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

B.Tech.(Electronics & Communication))Sem I

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
1.		Linear Algebra, Calculus & Solid Geometry	4	0	1	60	40	0	0	0	100	4	0	1	5
2.		Chemistry & Economics of Material Science	4	2	0	60	40	50	0	0	150	4	1	0	5
3.		Electronic Components & Devices	4	2	0	60	40	50	50	0	200	4	1	0	5
4.		Electrical Technology	4	2	0	60	40	25	0	0	125	4	1	0	5
5.		Computation & Programming Using C	4	2	0	60	40	50	25	0	175	4	1	0	5
	Total		**20**	**08**	**1**	**300**	**200**	**175**	**75**	**00**	**750**	**20**	**4**	**1**	**25**

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

B. Tech. (Electronics & Communication Engineering) Sem I **LINEAR ALGEBRA, CALCULUS AND SOLID GEOMETRY**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination(UE): 60 Marks	Credits : 04
Practical:--	Internal Assessment(IA): 40 Marks	
Tutorial: 01		Credit :01
	Total:100 Marks	Total Credits:05

Course Pre-requisites:	
The students should have knowledge of	
1	Basic algebra.
2	Ordinary derivative.
3	Plane geometry.

Course Objectives:	
1	Rank, consistency of system of equations and concepts of solid geometry.
2	Partial derivative and maxima, minima for several variable
3	Methods of curve tracing and multiple integrals

Course Outcomes: After learning this course students will be able to	
1	Apply &test rank of matrix for consistency of linear system.
2	Understand the partial derivative and apply to find errors and approximate values.
3	Test the functionality using Jacobian.
4	Trace curves of various types of mathematical functions.
5	Compute the coordinate system and apply it to locus problems.
6	Evaluate multiple integrals and apply it evaluate area and volume.

UNIT – I	**Linear Algebra: Matrices**	**(08Hours)**
	Rank, Normal form, System of Linear Equations, Linear Dependence and Independence, Linear and Orthogonal Transformations. Eigen values, Eigen Vectors, Cayley – Hamilton Theorem. Application to problems in Engineering.	
UNIT – II	**Partial Differentiation and its applications**	**(08Hours)**
	Functions of two or more variables, Partial derivatives,	

	Homogeneous functions, Euler's theorem, Total derivative, Change of variables, Errors and Approximations.	
UNIT -III	**Jacobian and Maxima and Minima Multivariable Calculus**	**(08Hours)**
	Partial derivative, Jacobians and their applications, Chain Rule, Functional Dependence. Maxima and Minima of Functions of two variables, Lagrange's method of undetermined multipliers.	
UNIT - IV	**Fourier series, Integral Calculus and Curve Tracing**	**(08 Hours)**
	Definition, Dirichlet's conditions, Fourier Series and Half Range Fourier Series, Harmonic Analysis, Differentiation Under the Integral Sign, Error functions. Tracing of Curves, Cartesian, Pola and Parametric Curves. Rectification of Curves.	
UNIT -V	**Solid Geometry**	**(08Hours)**
	Cartesian, Spherical Polar and Cylindrical Coordinate Systems. Sphere, Cone and Cylinder.	
UNIT - VI	**Multiple Integrals and their Application**	**(08 Hours)**
	Double and Triple integrations, Applications to Area, Volume, Mean and Root Mean Square Values	

Text Books:

1. .P. N. Wartikar and J. N. Wartikar, "Applied Mathematics" (Volumes I and II), 7th Ed., Pune Vidyarthi GrihaPrakashan, Pune, 2013.

References Books:

1. B. S. Grewal, "Higher Engineering Mathematics", 42th Ed., Khanna Publication, Delhi
2. B.V. Ramana, "Higher Engineering Mathematics", 6th Ed., Tata McGraw-Hill, New Delhi, 2008.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Ed., John Wiley & Sons, Inc., 2015.
4. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Ed., Cengage Learning, 2012.
5. Michael Greenberg,"Advanced Engineering Mathematics", 2nd Ed., Pearson Education, 1998.

Project based learning:

1. Find the eigen values and eigen vectors of any random matrix
2. Check the linear dependence / independence of vectors
3. Check the consistency and solve the linear equations
4. Solve the partial differential equations
5. Find the error using the concept of total derivative
6. Check the Functional Dependence using the concept of Jacobian

7. Find the derivatives of error functions
8. Find Maxima and Minima of functions of two variables
9. Use differentiation under the integral Sign to solve integrals
10. Trace the Cartesian curves
11. Trace the polar curves
12. Find the equation of sphere, cone and cylinder using the concept of solid geometry
13. Find root mean square values using integrals
14. Find the volume using triple integrals
15. Find the area using double integral

Students in a group of 3 to 4 shall complete any one project from the above list.

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B. Tech. (Electronics & Communication Engineering)Sem I **CHEMISTRY AND ECONOMICS OF MATERIAL SCIENCE**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination(UE): 60 Marks	Credits : 04
Practical:02	Internal Assessment(IA): 40 Marks	
Tutorial: --	TW:50 Marks	Credit: 01
	Total:150 Marks	Total Credits:05

Course Pre-requisites:	
The students should have knowledge of	
1	Structure property relationship, types of crystals, Capacitor, insulator, classification and properties of polymers, super capacitors , Green solvents

Course Objectives:	
1	To develop the interest among the students regarding chemistry and their applications in engineering.
2	To develop confidence among students about chemistry, how the knowledge of
3	The student should understand the concepts of chemistry to lay the groundwork for subsequent studies in the field such as E&C Engineering.

Course Outcomes: After learning this course students will be able to	
1	Describe the properties of materials and application of semiconductor electronics
2	The student will able to understand various structure of polymers and their effect on different properties of polymers.
3	Apply constitutive equations of composite materials and understand mechanical behavior at micro and macro levels.
4	To explain students the importance of economics and environmental issues in material science.
5	Design and develop sensors using optical methods with desired properties.
6	Identify the grand challenges of green chemistry and consider what it will take to resolve them.

UNIT – I	**Semi conductors, insulators and Superconductors**	**(08 Hours)**
	Semi conductivity in non-elemental materials, Preparations of semiconductors, Chalcogen photoconductors, photocopying process Introduction to Superconductors, types of Superconductors, Properties of superconductors, Applications of Superconductors, Electrical insulators or Dielectrics.	

UNIT – II	**Polymers for the Electronics Industry**	**(08 Hours)**
	Definition, Classification, Chain Architecture (Linear/Branched, Tacticity, Isomerism), homopolymers, copolymers, graft copolymers and their characteristic properties in reference to their applications. Conduction mechanism, Preparation of conductive polymers, Polyacetylene, Poly (p- phenlylene), Polyhetrocyclic systems, Polyaniline, Poly (Phenylene sulphide), Poly (1,6-heptadiyne), Applications, Photonic applications	
UNIT -III	**COMPOSITES**	**(08Hours)**
	Introduction of Composites, Classification of Composites, Organic Matrix Composites, Metal Matrix Composites (MMC), Ceramic Matrix Materials (CMM), Classification Based on Reinforcements, Fiber Reinforced Composites/Fibre Reinforced Polymer (FRP) Composites, Laminar Composites, Particulate Reinforced Composites (PRC), Classification Based on Reinforcements and Matrices, Classification Based On Matrices, Metal Matrix Composites (MMC), Advantages and Limitations of CompositesMaterials, Limitations of Composites	
UNIT -IV	**ECONOMICS OF ENGINEERING MATERIALS**	**(08 Hours)**
	Introduction, economic considerations, green design, environmental and societal considerations of materials recycling of metals and non-metals recycling issues, limits of recycling, life cycle analysis and its use in design.	
UNIT -V	**SENSORS**	**(08Hours)**
	MEMS, NEMS, Actuators, Biosensors, construction and working ofBiosensors and classification of Biosensors, Advantages of Biosensors, Biochips or Biological computers.	
UNIT -VI	**GREEN CHEMISTRY**	**(08 Hours)**
	Introduction, Twelve Principles of Green chemistry, numericals on atom economy,synthesis, adipic acid and indigo. Green solvents (ionic liquid supercritical CO2), and productsfrom natural materials.	
Term Work:		
The term work shall consist of record of minimum eight experiments.		
1. To determine strength of strong acid using pH meter		
2. Titration of a mixture of weak acid and strong base using		

conductometer
3. Preparation of polystyrene
4. To determine molecular weight of a polymer by viscosity measurement
5. To determine radius of macromolecule polystyrene/ polyvinyl alcohol by viscosity measurement.
6. Study of corrosion of metals in medium of different pH.
7. To determine pH of soil
8. To determine Acidity of soil
9. Determine the surface concentration of 1-butanol in aqueous solution.
10. Preparation of a conducting polymer.
11. Preparation of Urea-formaldehyde resins
12. To determine strength of strong acid using pH meter
Text Books
1.Bhal& Tuli, "Text book of Physical Chemistry (1995)", S. Chand & Company, New Delhi.
2.S. S. Dara , "A textbook of Engineering Chemistry", McGraw-Hill Publication, New Delhi.
Reference Books:
1. Jain P.C & Jain Monica , " Engineering Chemistry", Dhanpat Rai & Sons, Delhi, 1992.
2. O. G. Palanna , "Engineering Chemistry", Tata McGraw-Hill Publication, New Delhi..
3. F. A. Cotton and G. Wilkinson, "Advanced Inorganic Chemistry (6th edition)", John Wiley
4. P. Ghosh, " Polymer Science and technology (2nd Edition)" , Tata McGRAW Hill, 2008.
5. J.M.G.Cowie , "Polymers: Chemistry & Physics of Modern Materials (2nd edition)", Blackie Academic & Professional, 1994.
6. Shikha Agarwal , "Engineering Chemistry- Fundamentals and applications", Cambridge Publishers - 2015.
Project based learning:
1. To Prepare and for synthesis of the following polymers, a. Bakelite b. Polystyrene c. Epoxy Resin
2. Synthesis properties and applications of polymer.
3.To Prepare Glass Hybrid Fibres, Epoxy Composite material using Hand Layup Method
4 To Prepare Fibre Reinforced Composites.
5. To study - Bio diesel and Bio petrol & extraction process of Bio desial.
6. Effect of fertilizers in water
7. Preparation of Gold Nanoparticles Using Tea:
8. Determination of Mercury in Milk by Cold Vapor Atomic Fluorescence:
9. Nitration of Phenols Using $Cu(NO_3)_2$
10 Solvent less and One-Pot Synthesis of Cu(II) Phthalocyanine Complex:
11. Density Based Traffic Signal System using Microcontroller and IR Sensors
12 Solar Energy Measurement System using Microcontroller
13 To develop diagnostic biosensor.
14 Electrochemical 3D printing
15. Investigating cell mechanics with Fluid FM force spectroscopy.

Students in a group of 3 to 4 shall complete any one project from the above list.

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B. Tech. (Electronics & Communication Engineering)Sem I **ELECTRONIC COMPONENTS AND DEVICES**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination (UE): 60 Marks	Credits : 04
Practical:02	Internal Assessment(IA):40 Marks	
	TW : 50 Marks & Practical:50 Marks	Credits : 01
	Total Marks:200	Total Credits:05

Course Pre-requisites:	
The students should have knowledge of	
1	Class XII level Physics & Mathematics.

Course Objectives:	
1	To make the students gain the knowledge of basic electronic passive components**.**
2	To provide detailed description of PN junction behavior at the circuit level and its role in the operation of diodes as rectifiers, clippers and clampers
3	To provide a comprehensive study of bipolar junction transistor.
4	To learn and analyze transistor biasing circuits.
5	To observe characteristics and working of FET and MOSFET
6	To get familiarized with various optoelectronic devices.

Course Outcomes: After learning this course students will be able to	
1	Identify various Passive components.
2	Demonstrate knowledge of working of diode with applications such as rectifier, clipper and clamper.
3	Analyze the characteristics of BJTs in various configurations (CB, CE, and CC).
4	Design the biasing circuits like fixed bias and voltage divider bias.
5	Describe the operation of FET and MOSFET.
6	Demonstrate knowledge of working of optoelectronic devices.

UNIT – I	**Passive Components**	**(08 Hours)**
	Introduction to the concept of active and passive electronic components, Resistors: types of resistors, construction and applications, Capacitor: types of capacitors, construction and applications, Inductor: types of inductors, construction and applications.	
UNIT –II	**Diode and applications**	**(08 Hours)**
	Classification of material based on band gap theory, types of	

	semiconductors (p-type and n-type), PN junction Diode: basic structure and operating principle, current-voltage characteristic, Zener breakdown, Avalanche breakdown. Diode Applications: Rectifier circuits: Half-wave and full-wave rectifiers. Full wave Rectifier with capacitor filter. Diode as clipper: series and parallel forms of clipper circuits, biased clipper, Diode as a clamper.	
UNIT -III	**Bipolar Junction Transistor**	**(08 Hours)**
	Introduction to Bipolar Junction Transistors, it's construction and working mechanism, configuration of BJT in Common Base, Common Emitter and Common Collector configuration. Input–output characteristics in all three configurations with relevant V-I expressions and definitions of DC gains.	
UNIT -IV	**Transistor biasing and applications**	**(08 Hours)**
	Need of biasing, DC load line analysis, operating point, Thermal runaway. Requirements of a biasing circuit, Different biasing circuits: fixed bias, collector to base bias & voltage divider bias. Stability factor, General expression for stability factor, stability factor for biasing circuits, Transistor as an amplifier.	
UNIT -V	**FET & MOSFET**	**(08 Hours)**
	FET: Types of FET, JFET Structure, Construction and working mechanism of JFET, V-I characteristics and transfer characteristics, Parameters of JFET. MOSFET: Types of MOSFET, MOSFET Structure, Working of Depletion and Enhancement type MOSFETs, Drain and Transfer Characteristics of D-MOS andE-MOS.	
UNIT-VI	**Optoelectronic devices**	**(08 Hours)**
	Construction, V-I characteristics and applications of LED, LDR, Photodiode, Phototransistor, Photoconductive cell, Photovoltaic cell, optocoupler.	

Term Work:
The term work shall consist of record of minimum eight experiments.
1. To plot V-I characteristics of PN junction diode
2. To plot V-I characteristics of half wave rectifier
3. To plot V-I characteristics of Full wave rectifier using Capacitor filter.
4. To plot input-output characteristics of CE configuration of BJT.
5. To analyze biasing techniques of BJT: Fixed bias and voltage divider bias
6. To plot frequency response of single stage CE amplifier and find its bandwidth
7.To plot frequency response of single stage FET amplifier and find its bandwidth

8.To plot optical characteristics of LED and LDR
9.To plot optical characteristics of Photodiode and phototransistor
10.To plot transfer characteristics of Optocoupler
Text Books:
1.Robert Boylestad, Electronic Devices and Circuit Theory, Pearson Publication.
2**.** V.K.Mehta, Principles of Electronics, S Chand & Company Ltd. New Delhi.
3. Millman,Halkies, Electronic Devices and Circuits, TMH publication
Reference Books:
1. Thomas L. Floyd , "Electronic Devices", Pearson
2. Ben G. Streetman and Sanjay Banerjee, "Solid State Electronic Devices", Pearson Education India
3. Malvino, "Electronic Principle", McGraw Hill Education
4. Sedra& Smith, "Microelectronics Engineering", Oxford University Press
Project Based Learning:
Build the following circuits -
1. PN junction diode in forward and reverse biasing mode.
2. Conversion of AC to pulsating DC using half wave rectifier.
3. AC to DC converter using Full wave rectifier (Center tap Transformer)
4. AC to DC converter using Bridge Rectifier with capacitor filter
5. BJT in CE configuration.
6. Check stability of operating point using fixed bias method.
7. Check stability of operating point using Voltage divider bias method.
8. BJT Amplifier circuit.
9. FET Amplifier Circuit.
10. Optical characteristicsof LED and LDR.
11. Optical characteristicsof Photodiode and Phototransistor.
12. Characteristicsof optocoupler.
13. Zener diode in forward and reverse biasing mode.
14. BJTs as a digital switch
15. Automatic Street Light controller

Students in a group of 3 to 4 shall complete any one project from the above list.

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B. Tech. (Electronics & Communication Engineering)Sem I **ELECTRICAL TECHNOLOGY**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination(UE): 60 Marks	Credits : 04
Practical: 02	Internal Assessment(IA): 40 Marks	
Tutorial:--	TW: 25 Marks	Credit: 01
	Total Marks:125	Total credits:05

Course Pre-requisites:	
The Students should have knowledge of	
1	Basic physics.
2	Basic mathematics
Course Objectives:	
1	To study electrical circuit basics, network theorems, AC fundamentals, electrical machines, transformers, batteries, two port networks.
Course Outcomes: After learning this course students will be able to	
1	To find voltages and currents in a given network using various network reduction techniques and network theorems
2	To find parameters relating to a given series or a parallel resonant circuit.
3	Outline magnetic circuits and types of transformer.
4	Demonstrate AC and DC electrical machines.
5	Classify types of batteries.
6	To find any of the two port parameters of a given two port networks.

UNIT – I	**Introduction to Electrical Circuits and Network Theorems**	**(08 Hours)**
	Circuit concepts, Voltage and Current Sources, Independent and Dependent sources, Voltage-Current relationship for passive elements, Source Transformation and Source shifting techniques, Network Reduction techniques-Series, Parallel, Series-Parallel, Star-to-Delta, Delta-to-Star Transformations, Kirchhoff's Laws, Node and Mesh Analysis, Super node and Super mesh. Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power Transfer Theorem	
UNIT –II	**AC Fundamentals and circuits:**	**(08Hours)**

	AC Fundamentals: Sinusoidal, square and triangular waveforms – average and effective values, form and peak factors, concept of phasors, phasor representation of sinusoidally varying voltage and current. Analysis of series, parallel and series-parallel RLC Circuits: apparent, active & reactive powers, power factor, causes and problems of low power factor, power factor improvement; resonance in series and parallel circuits, bandwidth and quality factor (simple numerical problems)	
UNIT -III	**Magnetic circuits and Types of Transformer:**	
	Magnetic Circuit: Kirchhoff's laws for magnetic circuits. Magnetic circuit concepts, analogy between electric & magnetic circuits, magnetic circuits with DC and AC excitations, magnetic leakage, B-H curve, hysteresis and eddy current losses, magnetic circuit calculations, mutual coupling. Faradays law of electromagnetic induction, statically and dynamically induced emf, self-inductance, mutual inductance, coefficient of coupling. Single Phase Transformer: Principle of operation, construction, e .m.f. equation, voltage ratio, current ratio, KVArating ,determination of efficiency and regulation by direct load test, equivalent circuit, power losses,(simple numerical problems), introduction to auto transformer, Three phase transformer and its different winding connections..	**(08 Hours)**
UNIT -IV	**Electrical Machines: DC & AC:**	**(08 Hours)**
	Principles of electro mechanical energy conversion, DC machines: types, e. m. f. equation of generator and torque equation of motor, characteristics and applications of dc motors (simple numerical problems).Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications. Three Phase Induction Motor: types, Principle of operation, slip-torque characteristics, applications (numerical problems related to slip only).	
UNIT -V	**Batteries**	**(08 Hours)**
	Basic idea of primary and secondary cells, Construction, working principle and applications of Lead-Acid, Nickel Cadmium and Silver-Oxide batteries, Charging methods used for lead-acid battery (accumulator), Care and maintenance of lead-acid battery, Series and parallel connections of batteries, General idea of solar cells, solar panels and their applications, Introduction to maintenance free batteries, Safe disposal of Batteries; Fuel cell: Principle & Types of fuel cell.	
UNIT -VI	**Two Port Networks**	**(08 Hours)**

	Two port parameters: Z, Y, ABCD and H-parameters, Conditions for Reciprocity and Symmetry, Inter-relationship between two-port parameters, Interconnections between two port parameters.	

Term Work:
The term work shall consist of record of minimum eight experiments.
1. To verify Thevenin's, Norton's and Superposition Theorem.
2. To find Steady State response of RL,RC and RLC circuits
3. To find resonant frequencies of series and parallel circuit.
4. Load test on single phase transformer.
5. OS & SC test on single phase transformer to find efficiency and regulation
6. Load test on DC machine.
7. Speed control of DC motor
8. Study of different types of starters for DC & AC Machine
9. Testing and maintenance of batteries
10. To find Z and Y parameters of given two port networks.
11. To find H and ABCD parameters of given two port networks.
Text Books:
1. B. L. Theraja, 'A Textbook of Electrical Technology', Vol.1, S. Chand &Company Ltd. New Delhi.
2. V. K. Mehta, 'Basic Electrical Engineering', S Chand & Company Ltd. New Delhi.
3. I. J. Nagarath and Kothari, 'Theory and applications of Basic Electrical Engineering', Prentice Hall of India Pvt. Ltd.
4. D. Roy Choudhury, 'Network and Systems', New Age InternationalPublishers, Second Edition.
5. Ravish Singh, "Network analysis and Synthesis, M. Graw Hill Education (India) Private Limited.
Reference Books:
1. Edward Huges, 'Electrical Technology' Pearson
2. D. P. Kothari, J Nagarath, 'Basic Electrical Engineering'. TMC
3. M. E. Van Valkenburg, 'Network Analysis', PHI, 3rd Edition
Project based learning:
1. Design a small circuit to study superposition theorem.
2. Design small circuit to study Thevenin's Theorem.
3. Design Small circuit to study Norton's Theorem.
4. Design small circuit to study R-C series circuit.
5. Design small circuit to study R-L series circuit.
6. Design small circuit to study R-L-C series circuit.
7. Design of small R-L parallel circuit for study.
8. Design of small R-C parallel circuit for study.
9. Design of small R-L-C parallel circuit for study.
10. Design small two winding transformer.
11. Design small electromagnet.
12. Design of small chemical battery.
13. Design of small two port network for study of ABCD parameters.
14. Design of small electric circuit to study Kirchhoff's voltage laws.
15. Design of small electric circuit to study Kirchhoff's current laws

Students in a group of 3 to 4 shall complete any one project from the above list.

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B. Tech. (Electronics & Communication Engineering)Sem I **COMPUTATION AND PROGRAMMING USING C**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination(UE): 60 Marks	Credits: 04
Practical: 02	Internal Assessment(IA): 40 Marks	
Tutorial:--	TW : 50 Marks &Oral: 25 Marks	Credit: 01
	Total Marks:175 Marks	Total Credits:05

Course Pre-requisites:	
1	Students must possess knowledge about basic fundamentals of computer and professional Microsoft office development tools.

Course Objectives:	
The students should have knowledge of	
1	This course will introduce the concepts of C language software development and compiling tool. By the end of the course, student will be familiar with various fundamentals of C- language.

Course Outcomes: After learning this course students will be able to	
1	Understand the basic concept of C programming**.**
2	Write basic programs using conditional statement.
3	Use Array in programming.
4	Use Functions in programming.
5	Write basic programs using Pointers.
6	Write basic programs using structures.

UNIT – I	**Introduction:**	**(08 Hours)**
	Basic of C**:** Structure of a C program, identifiers, basic data types and sizes. Constants, variables, arithmetic, relational and logical operators , Managing input and output operations, Sample programs.	
UNIT – II	**Conditional Statements and Loops:**	**(08 Hours)**
	Decision making within a program, conditions, if statement, if-else statement, loops: while loop, do while, for loop. Nested loops, infinite loops, switch statement, sample programs.	

UNIT -III	**Arrays & Strings**	**(08 Hours)**
	Arrays - concepts, declaration, definition, accessing elements, storing elements, Strings and string manipulations, 1-D arrays, 2-D arrays and character arrays, string manipulations, Array applications: Matrix Operations.	
UNIT -IV	**Functions:**	**(08 Hours)**
	Basics, parameter passing, storage classes- extern, auto, register, static, scope rules, user defined functions, recursive functions, Recursive solutions for Fibonacci series, example c programs. Passing arrays & strings to functions.	
UNIT -V	**Pointers:**	**(08 Hours)**
	concepts, initialization of pointer variables, pointers and function arguments, passing by address, address arithmetic, Character pointers and functions, pointers to pointers, pointers and multidimensional arrays.	
UNIT -VI	**Structures and Linked list**	**(08 Hours)**
	Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typedef, bit-fields, program applications. Concept of linked lists, Types & Advantages linked list, creating a linked list, Inserting and deleting linked list, Applications of linked list	

Term Work:
The term work shall consist of record of minimum eight experiments.
1. Write a C program to take user Input and print it on the screen. a. Perform a C program to perform various mathematical and logical operations. b. Perform a C program to find whether the entered input number is Odd or Even.
2. Perform a C program to find out Prime numbers.
3. Write and perform C program to find out Fibonacci series.
4. Perform and write a C program to find out Armstrong number.
5. Perform a C programs to print different patterns.
6. Perform and write a C program to do factorial using recursion.
7. Perform a C program to sort the given array in Ascending & Descending order.
8. Perform C programs to perform various operations on 2-D arrays

9. Perform a C program to perform different operations on strings.
10. Use of Pointers a. Write a C program to swap numbers using pointers b. Write a C program to show the use of pointers in arrays. c. Write a C program to use functions using pointers.
11. Perform a C program to show the use of structure and linked list
12. Perform a C program to create student mark sheet using structures and linked list.
Text Books:
1. E Balagurusamy, "Programming in ANSIC",5th Edition-TMH
Reference Books:
1. Yashwant Kanitkar , "Let Us C",PBP
Project based learning:
1. Bank Management System
2. Diary management System
3. Calendar using C
4. Contact Management System
5. Library Management System
6. Snake Game
7. Bus Reservation system
8. Customer Billing system
9. Hospital Management system
10. Cyber management
11. Cricket score display
12. Employee management system
13. Pacman Game
14. Quiz game
15. Phone-book application
16. Election System
17. Flight ticket booking
18. Tourism Management system
19. Simple Result system
20. Stock Management system

Students in a group of 3 to 4 shall complete any one project from the above list.

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

B.Tech. (Electronics & Communication) Sem II

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
6		Integral Transforms & Vector Calculus	4	0	1	60	40	0	0	0	100	4	0	1	5
7		Wave Theory & Photonics	4	2	0	60	40	50	0	0	150	4	1	0	5
8		Electronic Communication	4	2	0	60	40	50	50	0	200	4	1	0	5
9		Computer Aided Graphics	4	2	0	60	40	25	0	0	125	4	1	0	5
10		Python Programming	4	2	0	60	40	50	25	0	175	4	1	0	5
	Total		**20**	**08**	**1**	**300**	**200**	**175**	**75**	**00**	**750**	**20**	**4**	**1**	**25**

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B. Tech. (Electronics & Communication Engineering)Sem II **INTEGRAL TRANSFORMS AND VECTORCALCULUS**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination(UE): 60 Marks	Credits : 04
Practical:--	Internal Assessment(IA): 40 Marks	
Tutorial: 01		Credit : 01
	Total Marks: 100 Marks	Total Credits: 05

Course Pre-requisites:	
The students should have knowledge of	
1	Integrals.
2	Fourier series.
3	Vector algebra.

Course Objectives:	
1	Methods to solve differential equations
2	Various techniques of integral transform.
3	line, surface and volume integrals.

Course Outcomes: After learning this course students will be able to	
1	Implement the methods for first order first degree differential equation.
2	Understand the modeling of physical systems and find the solutions.
3	Solve the nth order linear differential equation.
4	Compute the integral transform for various functions.
5	Apply the Laplace transform for solving differential equations
6	Understand vector calculus and apply it to evaluate line, surface and volume integrals.

UNIT – I	**Differential Equation**	**(08 Hours)**
	Formation of the ordinary differential equations(ODEs), Solution of an ordinary differential equation, Equations of the first order and first degree, Linear differential equation, Bernoulli's equation, Exact differential equations, Equations reducible to exact equations,	
UNIT – II	**Applications of Differential Equation**	**(08 Hours)**
	Applications of DE to Orthogonal Trajectories, Newton's Law of Cooling, Kirchoff's Law of Electrical Circuits, Motionunder	

	Gravity, Rectilinear Motion, Simple Harmonic Motion, One–Dimensional Conduction of Heat.	
UNIT - III	**Linear Differential Equations**	**(08 Hours)**
	Solution of nth order LDE with Constant Coefficients, Method of Variation of Parameters, Cauchy's &Legendre's DE, Solution of Simultaneous & Symmetric Simultaneous DE, Modeling of Electrical Circuits.	
UNIT - IV	**Z-transform**	**(08 Hours)**
	Fourier Transform (FT): Complex Exponential Form of Fourier series, Fourier Integral Theorem, Sine & Cosine Integrals, Fourier Transform, Fourier Sine and Cosine Transform and their Inverses. Introductory **Z-Transform (ZT)**: Definition, Standard Properties, ZT of Standard Sequences and their Inverses. Solution of Simple Difference Equations.	
UNIT -V	**Laplace Transform**	**(08**
	Definition of LT, Inverse LT. Properties & theorems. LT of standard functions. LT of some special functions viz., Periodic, Unit Step, Unit Impulse, ramp, jump, . Problems on finding LT& inverse LT. Applications of LT and Inverse LT for solving ordinary differential equations.	
UNIT - VI	**Vector Calculus**	**(08 Hours)**
	Physical Interpretation of Vector Differentiation, Vector Differential Operator, Gradient, Divergence and Curl, Directional Derivative, Solenoidal, Irrotational and Conservative Fields, Scalar Potential, Vector Identities. Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence Theorem, Stoke's Theorem, Applications to Problems in Electro-Magnetic Fields.	

Text Books:

2. P. N. Wartikar and J. N. Wartikar, "Applied Mathematics (Volumes I and II)", 7th Ed., Pune Vidyarthi GrihaPrakashan, Pune, 2013.

References Books:

1. B. S. Grewal, "Higher Engineering Mathematics", 42th Ed., Khanna Publication, Delhi
2. B.V. Ramana, "Higher Engineering Mathematics", 6th Ed., Tata McGraw-Hill, New Delhi, 2008.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Ed., John Wiley & Sons, Inc., 2015.

4. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Ed., Cengage Learning, 2012.
5. Michael Greenberg, "Advanced Engineering Mathematics", 2nd Ed., Pearson Education, 1998.
Project based learning:
1. Formation of differential equations
2. Evaluate the electric circuit problem using differential equations
3. Evaluate the heat conduction in 1-D using differential equations
4. Evaluate the rectilinear motion problem using differential equations
5. Evaluate the simple harmonic problem using differential equations
6. Obtain the solution of Simultaneous & Symmetric Simultaneous DE
7. Obtain the solution of Simple Difference Equations using Z-transforms
8. Find the Directional Derivatives
9. Find work done using Green's theorem
10. Find scalar potential using vectors
11. Evaluating integrals using Green's theorem, Gauss's and stoke's theorem
12. Use Laplace transform to solve differential equations
13. Use Laplace transform to solve integrals equations
14. Use Fourier transform to solve integrals
15. Applications of vector integration to solve problems in Electro-Magnetic Fields.
16. Find the conditions for Solenoidal and irrotational vector fields

Students in a group of 3 to 4 shall complete any one project from the above list.

Bharati Vidyapeeth
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B. Tech. (Electronics & Communication Engineering)Sem II **WAVE THEORY AND PHOTONICS**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination(UE): 60 Marks	Credits : 04
Practical:02	Internal Assessment(IA): 40 Marks	
Tutorial: --	TW:50 Marks	Credit: 01
	Total:150 Marks	Total Credits:05

Course Pre-requisites:	
The students should have knowledge of	
1	Students are expected to have a basic understanding of physics and calculus.

Course Objectives:	
1	To impart knowledge of basic concepts in physics relevant to engineering applications in a broader sense with a view to lay foundation for the Electronics and Communication Engineering.

Course Outcomes: After learning this course students will be able to	
1	Connect the problems associated with architectural acoustics and give their remedies. and use ultrasonic as a tool in industry for non-destructive testing.
2	Summarize and solve the engineering problems on Electromagnetism
3	Develop competency and understanding of the principles and applications of lasers and fiber optics.
4	Solve quantum physics problems to electronic phenomena and solid-state physics
5	Apply the properties of photon in communication engineering
6	Interpret the need, importance and scope of non-conventional and alternate energy resources.

UNIT – I	**Acoustics and Ultrasonics**	**(08 Hours)**
	Acoustics: Intensity, Loudness, Absorption coefficient and its determination, Reverberation and Reverberation time, Factors affecting acoustics of buildings and their remedies, Sources and impacts of noise, Sound level meter, Strategies on controlling noise pollution. Ultrasonic waves and properties, Methods of Ultrasonic production (Magnetostriction and Piezoelectric), Applications of Ultrasonics in Engineering and medicine.	

UNIT – II	**Electromagnetic Wave**	**(08 Hours)**
	Displacement current, Maxwell's equations (derivation), Wave equation for electromagnetic waves, Propagation in free space, Poynting theorem, Characteristic of Transverse electric and magnetic waves, Skin depth, Rectangular and circular waveguides.	
UNIT - III	**Lasers and Fibre Optics**	**(08 Hours)**
	Lasers introduction, Characteristics of Lasers, Einstein's coefficients and their relations, Lasing action, Working principle and components of CO_2 Laser, Nd -YAG Laser, Semiconductor diode Laser, Excimer Laser and Free electron Laser, Applications in remote sensing. Principle of Optical fiber, Acceptance angle and acceptance cone, Numerical aperture, V-number, Types of optical fibers (Material, Refractive index and mode), Photonic crystal fibers, Fiber optic communication, Fiber optic sensors.	
UNIT - IV	**Quantum Mechanics and Crystal Physics**	**(08 Hours)**
	Quantum mechanics: Inadequacies of Classical Mechanics, De Broglie hypothesis for matter waves, Heisenberg's uncertainty principle, Schrödinger's wave equation, Particle confinement in 1D box (Infinite Square well potential). Crystal Physics: Crystal directions, Planes and Miller indices, Symmetry elements, Quasi crystals, Diamond and HCP crystal structure, Packing factor, Reciprocal lattice, Diffraction of X-rays by crystal planes, Laue method and powder method	
UNIT -V	**Photonics**	**(08Hours)**
	Quantum properties of radiation and matter, Photon properties, Duality nature of electromagnetic radiation, Group/phase velocity and dispersion, matter and its interaction, light modulation, Coherence-different types, Two-beam interference and interferometry, multi-wave interference, Fabry-Perot interferometer, Fraunhofer diffraction, Fresnel diffraction, semiconductor junction characteristics, semiconductor light sources, semiconductor light detectors.	
UNIT - VI	**Green Energy Physics**	**(08 Hours)**
	Introduction to Green energy, Solar energy: Energy conversion by photovoltaic principle, Solar cells, Wind energy: Basic components and principle of wind energy conversion systems, Ocean energy: Wave energy, Wave energy conversion devices, Tidal energy, single and double basin tidal power plants, Ocean Thermal Electric	

	Conversion (OTEC), Geothermal energy: Geothermal sources (hydrothermal, geo-pressurized hot dry rocks, magma), Biomass: Biomass and biofuels, bio-energies from wastages, Fuel cells: H_2O_2, Futuristic Energy: Hydrogen, Methane Hydrates, Carbon capture and storage (CCS).	

Term Work:
The term work shall consist of record of minimum eight experiments.
1. To determine the velocity of sound
2. Measurement of average SPL across spherical wavefront and behavior with the distance
3. Expansion chamber muffler: investigation of muffler response as a filter in the low frequency approximation by determining insertion loss
4. Interference of sound using PC speakers
5. Determination of velocity of sound in liquid by ultrasonic interferometer
6. Ultrasonic probe - a study
7. Determination of divergence of a laser beam
8. Particle size by semiconductor laser
9. Determination of wavelength of laser by diffraction grating
10. Determination of Planck's Constant by photoelectric effect
11. To study Hall effect and determine the Hall voltage
12. Calculation of conductivity by four probe method
Text Books:
1.M N Avadhanulu, P G Kshirsagar and TVS Arun Murthy, "A Textbook of Engineering Physics" , S. Chand Publishing (2018)
2. R K Gaur and S L Gupta, " Engineering Physics" , Dhanpat Rai Publishing Co Pvt Ltd (2015)
3. Arthur Beiser**,** Shobhit Mahajan and S. Rai Choudhury**, "**Concepts of Modern Physics" , McGraw Hill Education (2017)
Reference Books:
1. Jearl Walker, David Halliday and Robert Resnick, "Fundamentals ofPhysics", John Wiley and Sons (2013)
2. Francis Jenkins and Harvey White, "Optics" , Tata Mcgraw Hill (2017)
3. John W. Jewett, "Principles of Physics" , Cengage publishing (2013)
4. C. Kittel , "Introduction to Solid State Physics", Wiley and Sons (2004)
5. H. V. Keer , "Principles of Solid State Physics", New Age International (1993)
6. B. B. Laud, "Laser and Non-Linear Optics" , New Age International Private Limited (2011)
7. Dr. S. K. Kulkarni , "Nanotechnology: Principles and Practice" , Capital Publishing Company (2014)
8.C.M. Srivastava and C. Srinivasan, "Science of Engineering Materials", New Age International Pvt. Ltd. (1997)
9. David R. Griffiths, "Introduction to Electrodynamics", Pearson (2013)
10. Boyle, "Renewable Energy: Power for a Sustainable Future", Oxford University Press (2012)
Project based learning:
1. Measurement and effect of environmental noise in the college
2. Construction and application of heat sensor in process control
3. Design and simulation of automatic solar powered time regulated water pumping
4. Solar technology: an alternative source of energy for national development

5. The study on the effect of length on the resistance of a copper wire (verification of ohms law r directly proportional to l)
6. Possible effects of electromagnetic fields (emf) on human health
7. The design and construction of the hearing aid device
8. Design and construction of digital distance measuring instrument
9. Design and construction of automatic bell ringer
10. Design and construction of sound or clap activated alarm
11. Electronic eye (Laser Security) as auto switch/security system
12. Determination of velocity of O-ray and E-ray in different double refracting materials
13. Quantum confinement effect in wide band semiconductors
14. Small wind turbines as a source of electricity
15. LiFi- wireless data transfer system using light

Students in a group of 3 to 4 shall complete any one project from the above list.

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B. Tech. (Electronics & Communication Engineering)Sem II **ELECTRONIC COMMUNICATION**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination (UE): 60 Marks	Credits : 04
Practical:02	Internal Assessment (IA): 40 Marks	
	TW: 50 Marks & Oral: 50 Marks	Credits : 01
	Total Marks:200 Marks	Total Credits:05

Course Pre-requisites:	
The students should have knowledge of	
1	Solid State Devices
2	Basic Physics
3	Basic Mathematics

Course Objectives:	
1	To introduce the concepts of analogue communication systems.
2	To equip students with various techniques related to analogue communication such as modulation, demodulation.
3	To study noise, transmission media etc.

Course Outcomes: After learning this course students will be able to	
1	Outline the basic concept of communication system, need of modulation, some Terminologies in communication systems.
2	Classify the transmission media used in communication system.
3	Outline the different modern communication systems.
4	Classify the different sources of noise.
5	Classify& compare the amplitude modulation & demodulation techniques.
6	Classify & compare the Angle modulation & demodulation techniques.

UNIT – I	**Fundamentals of Communication Engineering**	**(08 Hours)**
	Signals: Basics of signal representation & its analysis, Bandwidth of Signals, Signal Shapes in Communication, Electromagnetic spectrum & typical applications, System: Baseband Systems, Pass band Systems, Communication System: Block diagram of communication systems, Analog Versus Digital Communication System, Modulation and Demodulation in Communication System, Need of Modulation, Classification of modulation techniques, Terminologies in Communication Systems.	

UNIT – II	**Transmission Media and Propagation Mechanisms**	**(08 Hours)**
	Wired Media: Twisted Pair, Optical fiber: Structure of a Fiber Optic Cable, Propagation Modes of Fiber Optic Cable, Calculation of Number of Modes in a Fiber, Optical Fiber Index Profile, Optical Fiber's Numerical Aperture (NA), Wireless Media, Wireless Propagation: Ground Wave Propagation, Sky Wave Propagation, Propagation Mechanism.	
UNIT - III	**Modern Communication System** Introduction to modern communication system: Operation of communication system, need of modern communications. Communication Technologies: The Internet, Basics of Networks, Optical communication: Introduction to optical communication, Development in optical communication, Wireless communications: Introduction to wireless communication, Wireless communication technologies, Mobile cellular communications, Satellite Communications: Basic principle of operation of satellite communication, Satellite orbits, Introduction to Underwater Communication, Radar.	**(08 Hours)**
UNIT -IV	**Noise**	**(08 Hours)**
	Introduction, Sources of noise: External Noise, Internal Noise, Noise calculations(thermal noise),Noise figure: Signal to Noise ratio, definition of noise figure, Classification of noise figure, noise Figure from equivalent noise resistance, Noise Temperature.	
UNIT -V	**Amplitude Modulation & Demodulation**	**(08 Hours)**
	Amplitude Modulation: Introduction, Mathematical expression for AM, Modulation index, Frequency spectrum and bandwidth of AM, Time domain representation of AM Power relation in AM, Generation of AM signal: Double sideband full carrier (DSBFC), Double sideband suppressed carrier (DSBSC), SSB, Generation of SSB: Filter method, phase shift method, Third method, Block diagram & working principle of AM Transmitters, AM Receivers: Performance's characteristic of receivers, Tuned radio frequency (TRF) receiver, Super heterodyne receiver, Demodulation of AM Signal.	
UNIT -VI	**Angle Modulation& Demodulation**	**(08 Hours)**
	Introduction, Types of angle modulation techniques, Mathematical expression of FM, Modulation index for FM, Frequency spectrum and bandwidth of FM, Narrow band and wide band FM, Pre emphasis and de-emphasis, Generation of frequency modulation techniques: Direct method and indirect method, Pulse analog modulation techniques: Pulse Amplitude Modulation (PAM),Pulse	

	Width Modulation, Pulse Position Modulation, Demodulation of Pulse analog modulated signal, Comparison of AM, FM and PM, Block diagram & working principle of FM Transmitters, Block Diagram & working principle of FM receiver.	

Term Work:

The term work shall consist of record of minimum eight experiments.

12. Generate AM signals, study their time- and frequency-domain characteristics, and measure their modulation indices (Under modulation, Perfect modulation & Over modulation)
13. Demonstrate the modulation &demodulation process of DSB-SC.
14. Demonstrate the modulation &demodulation process of SSB-SC.
15. Generate &analyze frequency modulated signal &demodulate using FM demodulator.
16. Analysis of standard signals (square and triangular)and Modulated signals(all types of AM, FM) using spectrum analyzer.
17. Demonstrate the Pulse Amplitude Modulation & demodulation & their waveforms.
18. Demonstrate the Pulse Width Modulation & demodulation & their waveforms.
19. Demonstrate the Pulse Position Modulation & demodulation & their waveforms.
20. Examine the operation of PAM-TDM.
21. Study of Super heterodyne (AM) Receiver.

Textbooks:

1. S.Haykin , "Communication System" (IV Edition), John Wiley & Sons.
2. A.B. Carlson, " Communication Systems", McGraw-Hill.
3. B.Lathi , "Modern Analog And Digital Communication Systems", Oxford Univ.Press.
4. Taub &Schilling , "Communication Systems", TMH.
5. Kennedy, Davis , "Electronic Communication Systems", (4/e), McGraw Hill, Reprint 2008.
6. Djafar K. Mynbaev,Lowell L. Scheiner, "Essentials of modern communications" , Wiley.

Reference Books:

1. Matin, Mohammad Abdul , "Communication Systems for Electrical Engineers" , springer.

Project Based Learning:

1. Testing the connectivity of circuit using DMM.
2. Testing of devices using DMM.
3. Construct a circuit for sound amplifier.
4. Design of regulated power supply.
5. Construct a circuit for Analog signal multiplier using Op-amp.
6. Construct a circuit for Analog signal divider using Op-amp.
7. Construct a circuit for Walkie-talkie.
8. Construct a circuit for Wireless power transfer.
9. Construct a circuit for Crystal oscillator tester.
10. Construct a circuit for Mobile incoming call indicator.
11. Construct a circuit for FM transmitter.
12. Construct a circuit for AM Modulator.
13. Construct a circuit for PAM Modulator.
14. Construct a circuit for single transistor FM transmitter.

15. Construct a circuit for solar energy operated mobile charger.

Students in a group of 3 to 4 shall complete any one project from the above list.

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B. Tech. (Electronics & Communication Engineering)Sem II **COMPUTER AIDED GRAPHICS**		
TEACHINGSCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination(UE): 60 Marks	Credits : 04
Practical:02	Internal Assessment(IA): 40 Marks	
Tutorial: --	TW: 25 Marks	Credit: 01
	Total Marks:125 Marks	Total Credits:05

Course Pre-requisites:	
The students should have knowledge of	
1	Mathematics

Course Objectives:	
1	To understand the basic principles of engineering drawing and highlight the importance of Computer Aided Graphics in engineering.
2	To develop the graphical skills for communication of concepts & idea through technical drawings.

Course Outcomes: After learning this course students will be able to	
1	Understand the fundamental concepts of Drawing, different types of lines, curves and dimension technique with practical application.
2	Understand the concept of Orthographic projections and apply it to draw detail views by using 1st angle projection method.
3	Understand the concept of isometric projection and apply it to construct 3D view of a component.
4	Understand the concept of projections of Point, Line and plane; and apply to draw its projection by using 1st angle projection method and to locate its traces
5	Understand the concept of projections of different types of solids and apply to draw its projection by using 1st angle projection method.
6	Understand the concept of Development of Lateral surfaces; and apply to development of simple Solids.

UNIT – I	**Lines and Dimensioning in Engineering Drawing and Engineering Curves**	**(08 Hours)**
	Introduction to Engineering Drawing, Types of lines and Dimensioning, Layout and size of drawing sheets, Scales Engineering Curves-Ellipse drawing by Focus-Directrix Circle Method and Concentric Circle Method, Involutes of a circle, Cycloid, Archimedean Spiral, Helix on cone and Cylinder. Introduction to Auto CAD commands.	

UNIT – II	**Orthographic Projection**	**(08 Hours)**
	Basic principles of orthographic projection (First and Third angle method). Orthographic projection of objects by first angle projection method only. Procedure for preparing scaled drawing, sectional views and types of cutting planes and their representation, hatching of sections. (Also using AutoCAD commands)	
UNIT - III	**Isometric Projections**	**(08 Hours)**
	Isometric view, Isometric scale to draw Isometric projection, Non-Isometric lines, and construction of Isometric view from given orthographic views and to construct Isometric view. (Also using AutoCAD commands)	
UNIT - IV	**Projections of Points, Lines and Planes**	**(08 Hours)**
	Projections of points, projections of lines, lines inclined to one reference plane, Lines inclined to both reference planes. (Lines in First Quadrant Only), Traces of lines. **Projections of Planes-**projection of perpendicular and oblique planes (polygonal and circular surfaces), Obtaining true shape of plane surface. (Also using AutoCAD commands)	
UNIT -V	**Projection of Solids**	**(08 Hours)**
	Introduction of solids- Types of solids, Projection of solid inclined both references plane, Projection of common solids such as prism, pyramid, cylinder and cone. (Also using AutoCAD commands)	
UNIT - VI	**Development of Lateral Surfaces of Solids**	**(08 Hours)**
	Introduction to development of lateral surfaces and its Industrial application, draw the development of lateral surfaces of cone, pyramidandprism. (Also using AutoCAD commands)	
Term Work:		
The term work shall consist of record of minimum eight experiments.		
1. Types of lines, Dimensioning practice, free-hand lettering, 1nd and 3rd angle methods symbol		
2. Engineering curves.		

3. Orthographic Projections.
4. Isometric views.
5. Projections of Points, Lines and planes.
6. Projection of Solids.
7. Development of lateral surfaces
Text Books:
1. N. D. Bhatt , "Elementary Engineering Drawing", Charotar Publishing house, Anand India,
2. Munir Hamad ,"AutoCAD 2020 Beginning and Intermediate" , Mercury Learning & Information Publication, 2019.
3. Venugopal K ,"Engineering Drawing and Graphics",., New Age International publishers.
Reference Books:
1. K.L.Narayana& P. Kannaiah ,"Text Book on Engineering Drawing" , Scitech Publications, Chennai.
2. WarrenJ. Luzzader, "Fundamentals of Engineering Drawing", Prentice Hall of India, New Delhi,
3. M. B. Shah and B.C. Rana,"Engineering Drawing", 1st Ed, Pearson Education, 2005
4. P. J. Shah, "Engineering Drawing", C. Jamnadas and Co., 1stEdition,1988
5. P.S.Gill ,"Engineering Drawing(GeometricalDrawing)",10thEdition,S.K.KatariaandSons,2005
Project Based Learning
Following is the list topic for project based learning (Not Limited to) based on the syllabus contents:
To obtain industrial drawings to identify the types of lines, dimensioning methods and method of projection.
2. To develop the model/charts based on engineering curves.
3. To prepare model/chart for identification of engineering curves in nature for industrial, societal, etc application.
4. To demonstrate different methods of orthographic projection.
5. To demonstrate projection of Points.
6. To demonstrate projection of Lines.
7. To demonstrate projection of Planes.
8. To demonstrate projection of Solids.
9. To demonstrate developments of surfaces for solids.
10. To demonstrate industrial application of development of surfaces such as steam carrying pipes, Ducts of air conditioning systems, etc.
11. To demonstrate Isometric projection method through model of a cube.

Students in a group of 3 to 4 shall complete any one project from the above list

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B. Tech. (Electronics & Communication Engineering)Sem II **PYTHON PROGRAMMING**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination: 60 Marks	Credits : 04
Practical:02	Internal Assessment: 40 Marks	
Tutorial: --	TW: 50 Marks & Oral: 25 Marks	Credits: 01
	Total Marks:175 Marks	Total Credits:05

Course Pre-requisites:	
The students should have knowledge of	
1	Students should have basic knowledge of programming.

Course Objectives:	
1	This course will introduce the concepts of Python language software development tool. By the end of the course, student will be familiar with various fundamentals of Python language.

Course Outcomes: After learning this course students will be able to	
1	Understand the basic concept of Python programming.
2	Write basic programs using control statement.
3	Use exception handling.
4	Learn object oriented programming.
5	Write basic programs using arrays.
6	Use Python for simple applications.

UNIT – I	**Python Basics:**	**(08 Hours)**
	Python Introduction, Python Installation, Relational operators, Bitwise operators, Logical operators Python Data Types - Numbers (Integer, Floating Point, Complex Numbers), Strings Lists, Tuples, Dictionaries, List comprehensions, Python Control Statements	
UNIT – II	**Python Core:**	**(08 Hours)**
	Python Modules & Functions, Lambda, Scope, Python File Handling, Python Regular Expressions, Sequence Types, Input and output, Recursion, Flow Control, Immutable and Mutable Objects	
UNIT -	**Python Exception Handling:**	**(08**

III		**Hours)**
	Meaning of Exception, Exception Hierarchy Diagram, Types of Exception- Checked Exception, Unchecked Exception, Exception Handling -TRY, CATCH, FINALLY, Raising an Exception, User Defined Exceptions	
UNIT - IV	**OOPS, UML & OOAD:**	**(08 Hours)**
	Object Oriented Programming (OOPs) - Class & Object, Abstraction, Inheritance, Polymorphism, Encapsulation, Object Oriented (OO) Modelling, Object Oriented Analysis & Design (OOAD)	
UNIT -V	**PYTHON MULTI-THREADING:**	**(08 Hours)**
	Threads in Python (a) Kernel Threads(b) User Space Threads or User Threads, Advantages of Threading, Thread States: Life Cycle of a Thread, Thread & Threading Modules, Forking & Synchronizing Threads, Networking	
UNIT - VI	**Python Packages and Graphics:**	**(08 Hours)**
	Numpy: Introduction, datatypes, arrays, arrays manipulation, ploting , testing and debugging, Sharing Data using Sockets , pycharmin python ,Simple applications of python	

Term Work:
The term work shall consist of record of minimum eight experiments.
1. Evaluate any given expression involving arithmetic operators
2. Evaluate any given expression involving logical operators
3. Develop python functions to produce given patterns such as diamond, pyramid, triangles.
4. Usage of different functions present in “math” module
5. Write a function that takes two numbers as input parameters and returns their least common multiple.
6. Write a function that takes two numbers as input parameters and returns their greatestcommon divisor.
7. Write a function that returns the sum of the digits of a number, passed to it as an argument.
8. Write a program that takes a sentence as an input and displays the numbers of words inthe sentence.
9. Program to interchange first and last elements in a list
10. program to print even numbers in a list
11. Ways to sort list of dictionaries by values in Python – Using lambda function
12. Example using “matplotlib” module
13. Example using “NUMPY” module
14. Evaluate any given expression involving arithmetic operators
Text Books:

2. Sheetal Taneja,Naveen Kumar, “Python Programming,A modular approach”, Pearson publication
Reference Books:
1. Learning Python 5th Edition, Oreilly Publication.
2. Magnus Lie Hetland, “Beginning Python: From Novice to Professional”, Third Edition,Appress Publication
3. Allen Downey , Jeffrey Elkner , Chris Meyers, “Learning with Python”, DreamtechPublication.
4. Paul Berry , “Head-First Python: A Brain-Friendly Guide” (2nd Edition), O'Reilly Media
5. Magnus LieHetland , “Python Algorithms: Mastering Basic Algorithms in the Python Language”, Apress Pub.
Project Based Learning
1. Design and development of Mad Libs generator.
2. Design and development of electronic mail system (Read, write, send and delete operations).
3. Design and development of store billing system.
4. Design and development of typing speed check web application.
5. Design and development of windows application for music player.
6. Design and development of windows Quiz Application.
7. Design and development of web application for daily expense tracker.
8. Design and development of student portfolio management & CV generator system.
9. Design and development of windows based to do list or sticky notes.
10. Design and development of assignment plagiarism checker.

Students in a group of 3 to 4 shall complete any one project from the above list

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 III

Sr. No.	Course Code	NameofCourse	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
11		Probability & Statistics	4	0	1	60	40	0	0	0	100	4	0	1	5
12		Switching Theory & Logic Design	4	2	0	60	40	25	0	25	150	4	1	0	5
13		Analog Circuits & Applications	3	2	0	60	40	25	0	25	150	3	1	0	4
14		Signals & Systems	4	2	0	60	40	25	25	0	150	4	1	0	5
15		Process & Control System*	3	0	0	60	40	0	0	0	100	3	0	0	3
16		Vocational Course-I PCB Design & Assembly	0	2	0	0	0	25	25	0	50	0	1	0	1
17		Data Structures	0	2	0	0	0	25	0	0	25	0	1	0	1
18		Database Management System	0	2	0	0	0	25	0	0	25	0	1	0	1
	Total		**18**	**12**	**1**	**300**	**200**	**150**	**50**	**50**	**750**	**18**	**06**	**1**	**25**
	Social Activity- I**		-	-	-	-	-	-	-		-	-	-	-	2

*Industry Taught Course–I
**Addon course

Bharati Vidyapeeth
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College of Engineering, Pune

B. Tech. (Electronics & Communication Engineering) Sem III **PROBABILITY AND STATISTICS**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination(UE): 60 Marks	Credits : 04
Practical: --	Internal Assessment(IA): 40 Marks	
Tutorial: 01		Credit : 01
	Total: 100 Marks	Total Credits: 05

Course Pre-requisites:	
The students should have knowledge of	
1	Measures of central tendency, dispersion, skewness and kurtosis.

Course Objectives:	
1	To study probability distributions and testing of hypothesis.

Course Outcomes: After learning this course students will be able to	
1	Understand discrete and continuous probability distributions.
2	Identify standard probability distributions.
3	Apply bivariate distributions.
4	Apply sampling distributions.
5	Understand concept of point estimation and interval estimation.
6	Apply ANOVA for one way and two way distribution.

UNIT – I	**Probability and random variables**	**(08 Hours)**
	Concept of probability, Random Variables, Probability Distributions and Expectation: Concept of a random variable, discrete probability distributions, continuous probability distributions, joint probability distributions, mean, variance, covariance.	
UNIT -II	**Standard distributions**	**(08 Hours)**
	Gaussian, exponential, Rayleigh, uniform, Bernoulli, binominal, Poisson, Normal, hyper geometric, discrete uniform and conditional distributions, . Functions of a random variable.	
UNIT -III	**Joint Distributions**	**(08 Hours)**

	Joint, marginal and conditional distributions, product moments, independent of random variables, bivariate normal distribution.	
UNIT -IV	**Sampling Distributions**	**(08 Hours)**
	The central limit theorem, distributions of the sample mean and the sample variance for a normal population, Chi-square, t and F distributions.	
UNIT -V	**Estimation**	**(08Hours)**
	The methods of moments and the of maximum likelihood estimation, confidence intervals for the mean(s) and variance(s) of Normal populations.	
UNIT-VI	**Testing of Hypothesis**	**(08 Hours)**
	Null and Alternative hypotheses, the critical and acceptance regions, types of errors, power of the test, the most powerful test and Neyman-Pearson Fundamental Lemma, tests for one sample problems for normal populations, ANOVA I & ANOVA II.	

Text Books

1. Rohatgi, V K. and Saleh , A. K. Md. Ehsanes, "An Introduction to Probability and Statistics", (John Wiley and Sons) , (2^{nd} edition)
2. J.S. Milton & J.C. Arnold, “Introduction to Probability and Statistics” Tata McGrawHill Publication

References Books

1. H.J. Larson , “Introduction to Probability Theory and Statistical Inference” Wiley Publication.
2. S.M.Ross,“IntroductiontoProbabilityandStatisticsforEngineersandScientists” Academic Press.

Project Based Learning:

Students are expected prepare report on any one topic, write its definition,applications and illustrate with few examples. Also, write pseudo code/proof for it, wherever applicable.

1) Find the stability of the data using coefficient of variation
2) Use concept of correlation to find coefficient of correlation between different observations
3) Use Rank correlation to find correlation for qualitative data
4) Derive Spearman’s Rank correlation
5) Find the chance of happening particular event using Baye’s theorem
6) Use probability theory to estimate the life of electric equipments
7) Find the height, weight of the population using the example of normal distribution
8) Check the goodness of fit using chi-square distribution
9) Perform ANOVA for single way classification data
10) Perform ANOVA for two way classification data
11) simple regression model

12) Multiple regression model
13) Coefficient of variation
14) Joint and marginal probability distribution
15) Standard probability distributions

Students in a group of 3 to 4 shall complete any one project from the above list.

Bharati Vidyapeeth
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B. Tech. (Electronics & Communication Engineering) Sem III **SWITCHING THEORY AND LOGIC DESIGN**		
TEACHINGSCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination(UE): 60 Marks	Credits : 04
Practical: 02	Internal Assessment (IA): 40 Marks	
Tutorial: --	TW:25 Marks & Practical:25 Marks	Credit : 01
	Total: 150 Marks	Total Credits:05

Course Pre-requisites:	
The Students should have knowledge of	
1	Fundamentals of Number Systems
2	Knowledge of Boolean algebra laws.

Course Objectives:	
1	To familiarize with various number representations and conversion between different representation in digital electronic circuits.
2	To introduce the students to various logic gates, SOP, POS and their minimization techniques
3	To analyze logic processes and implementation of logical operations using combinational logic circuits.
4	To describe, analyze and design sequential circuits.

Course Outcomes: After learning this course students will be able to	
1	Represent numerical values in various number systems and perform number conversions between different number systems.
2	Apply knowledge of Boolean algebra and other minimization techniques for digital circuit design.
3	To differentiate between logic families TTL and CMOS.
4	Identify, formulate and solve a problem based on combinational circuits.
5	Analyze and design a simple sequential logic circuit.
6	Implement Digital circuits using VHDL systems

UNIT – I	**Number system & Codes:**	**(08 Hours)**
	Binary number base conversion decimal, octal, hexadecimal numbers,1's 2's Complement, signed binary numbers binary codes-BCD codes, Gray codes,Excess-3 code, ASCII code & codes for serial data transmission & storage	

	Logic Gates: Positive and Negative Logic, Various Logics Gates with IEEE/ANSI symbols, Boolean equations, truth table and IC Details. Universal Gates & Derived gates	
UNIT – II	**Boolean Algebra and Simplification Techniques:**	**(08 Hours)**
	De-Morgan's theorem – switching functions Introduction, Postulates and Theorems, Various types of Boolean expressions, Simplification Techniques-K-map up to 4 variables, Product of Sum simplification & Sum of product simplification, Don't care conditions, Quine Mc-Cluskey method	
UNIT - III	**Combinational Logic Circuits:**	**(08 Hours)**
	Combinational Circuits and its implementations, Arithmetic Circuits – Adders and Subtractors, BCD Adder, Look-Ahead Carry Generator, ALU, Multiplier, Magnitude comparator. Multiplexer, Encoders, Demultiplexers and Decoders, Parity Generation and Checking.	
UNIT - IV	**Sequential Logic Circuits:**	**(08 Hours)**
	R-S and D Flip-flop, Level Triggered and Edge-Triggered Flip-flops, J-K and T Flip-flop, Synchronous and Asynchronous Input, Flip-flop Timing Parameters, Application of Flip-flop. Ripple Counter, Synchronous Counter, Modulus Counter, Binary Ripple Counter, Synchronous Counters, UP/Down Counters, Decade and BCD Counters, Presettable Counters, Decoding Counter, Cascading Counter, Designing Counter with Arbitrary Sequences, Shift Register, Shift Register, Counters	
UNIT -V	**Programmable Logic Devices, Memory & Logic Families:**	**(08**
	Memories: ROM,PROM,EPROM Programmable Logic Devices(PLD):Programmable Logic Array(PLA),Programmable Array Logic(PAL) CPLD-FPGA Logic Families: Significance of families, Characteristic parameters, Types of Logic Families: TTL,ECL Comparison between various logic families Interfacing. between CMOS and TTL logic families	
UNIT - VI	**Introduction to VHDL:**	**(08 Hours)**
	Introduction to VLSI design flow (with reference to an EDA tool),sequential, data flow and structural modeling, functions, procedures, , data objects types, attributes, packages and configurations	
Term Work:		

The term work shall consist of record of minimum eight experiments.
1. Implementation of Boolean functions using logic gates.
2. Study of characteristics of typical 74 TTL / 74 CMOS family like: fan in, fan out standard load , noise margin & interfacing with other families
3. Half, Full Adder and subtractor using gates and IC's
4. Code conversion using digital IC's
5. Function implementation using Multiplexer and Demultiplexer
6. BCD Adder/Subtractor using IC7483.
7.Study of counters :Ripple , Synchronous , Ring , Johnson , Up-down counter and its application
8. Study of shift registers :Shift left , Shift right , parallelloading
9. To model 8:1 mux, 1:8 demux using VHDL.
10.Sequence generator using MS-JK flip flop IC's
Text Books:
1. R.P. Jain , "Modern digital electronics" , 3rdedition , 12th reprint TMH Publication, 2007
2**.** Anand Kumar 'Fundamentals of Digital Circuits'--. PHI
3. J. Bhaskar, "VHDL Primer", PHI, Third Edition (2009).
Reference Books:
1. J.F.Wakerly "Digital Design: Principles and Practices", 3rd edition, 4th reprint, Pearson Education, 2004.
2. A.P. Malvino, D.P. Leach 'Digital Principles & Applications'' –Vith Edition-Tata Mc Graw Hill, Publication
3. Morris Mano 'Digital Design'-- (Third Edition),.PHI
4. Thomas L Floyd & R.P Jain, "Digital Fundamentals" (Eight editions), Pearson
5. Stephen Brown &ZvonkoVranesic, "Fundamentals of Digital Logic Design with VHDL", Second Edition, TMH(2009).
Project based learning:
1. To demonstrate the use of NAND as Universal Gate
2. Electronic Eye using basic gates.
3. Light sensor switch circuit using JK-Flip-Flop
4. Morning sun alarm circuit using IC-4011(quad NAND gate)
5. To demonstrate the use of IC 555 as a Pulse Generator Circuit
6. Automatic switch off battery charger using IC 555
7. Fluid Level Control Using IC 4093
8. A pseudo-random number generator
9. 2-Bit-Parallel-or-Flash-Analog-to-Digital-Converter
10. DigitalBank Token Number Display
11. Digital Object Counter
12. Asynchronous-Modulo-16-Down-Counter
13. Analog-Signals-Multiplier
14. 4-line to 16-line decoder Circuit using 7442
15. Simple Electronic Toggle Switch Flip Flop Circuit Using IC 4017

Students in a group of 3 to 4 shall complete any one project from the above list.

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B. Tech. (Electronics & Communication Engineering) Sem III **ANALOG CIRCUITS AND APPLICATIONS**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03	End Semester Examination(UE): 60 Marks	Credits : 03
Practical: 02	Internal Assessment(IA): 40 Marks	
Tutorial: --	TW:25 Marks & Practical: 25 Marks	Credit: 01
	Total: 150 Marks	Total Credits:04

Course Pre-requisites:	
The Students should have knowledge of	
1	Electronic components and devices.

Course Objectives:	
1	To understand analysis of single stage and multistage transistor amplifier.
2	To give a practical approach of analysis of feedback amplifiers ,power amplifiers and oscillators
3	To understand analysis and design of voltage regulators.

Course Outcomes: After learning this course students will be able to	
1	Describe and demonstrate BJT single stage amplifier, its hybrid equivalent and hybrid models.
2	Analyze multistage amplifiers using BJT.
3	Analyze the importance of negative feedback in amplifiers.
4	Demonstrate and analyze power amplifier circuits in different modes of operation.
5	Design various oscillator circuits using BJT.
6	Design and analyze transistorized series and shunt voltage regulators.

UNIT – I	**Single stage Amplifiers**	**(06Hours)**
	Classification of Amplifiers – Distortion in Amplifiers, Analysis of CE, CC, and CB Configurations with simplified Hybrid Model, Analysis of CE amplifier with Emitter Resistance and Emitter follower, Miller'sTheorem and its dual, Design of Single Stage RC Coupled Amplifier using BJT.	

UNIT – II	**Multi Stage Amplifiers**	**(06Hours)**
	Need of Multistage amplifiers, Parameter evaluation such as Ri, Ro, Av, Ai & Bandwidth for general multi stage amplifier, Analysis & design at low frequency & mid frequency of direct coupled, RC coupled, transformer coupled (Two stage) amplifier, Darlington amplifier, cascode amplifier	
UNIT - III	**Feedback Amplifiers**	**(06Hours)**
	Concept of feedback, classification of amplifiers, Negative feedback topologies with their block diagram representation, Effect of negative feedback on Input impedance, Output impedance, Gain and Bandwidth with derivation, method of analysis of feedback amplifier, analysis of all feedback topologies.	
UNIT -IV	**Power Amplifiers**	**(06Hours)**
	classification of power amplifiers - Class A, Class B, Class C, and Class AB. Operation of - Class A with resistive load; Transformer coupled class A Amplifier; Class B Push – pull amplifier ; Class B Complementary symmetry amplifier. Efficiency analysis for Class A transformer coupledamplifier and Class B push – pull amplifier, cross over distortion in power amplifiers, harmonic analysis	
UNIT -V	**Oscillators**	**(06 Hours)**
	Positive feedback, Barkhausen criterion, Classification of oscillators, derivation and analysis of RC oscillators, Wien bridge Oscillators, LC Oscillators for frequency of oscillation, Tuned collector oscillator, Piezo-electric effect in crystalsand Crystal Oscillator	
UNIT -VI	**Regulator**	**(06Hours)**
	Block schematic of linear regulators, Performance parameters – Load and Line regulations, Ripple rejection, Output resistance Emitter follower regulator, Transistor series regulator, shunt regulator Study and design of regulators using IC's:78XX,79XX,723,LM317, Method of boosting output current using external series pass transistor. Protection circuits – Reverse polarity protection, over circuit, fold back current limiting, over voltage protection.	
Term Work:		
The term work shall consist of record of minimum eight experiments.		
1. Analysis of multistage LF amplifier, verification with theoretical values of A_{is}, A_{vs},		

R_i, R_o (overall) with square wave testing.
2. Input impedance improvement techniques for emitter follower.
3. Analysis of LF amplifier with negative feedback in Voltage series and current series topology.
4. Analysis of LF amplifier with negative feedback in Voltage shunt and current shunt topology.
5. Measurement of frequency of oscillations of RC Oscillators - phase shift and wien bridge
6. Measurement of frequency of oscillations of LC oscillators – Hartley, Colpitt
7. Biasing analysis of BJT power amplifier in class A, B, C.
8. Regulation characteristic of series and shunt regulators and calculation of S_v and R_o.
Text Books:
1. S. Salivahanan, Suresh Kumar Vallavaraj, "Electronic devices and circuits", Mc Graw Hill Publication
2. Robert Boylestad, "Electronic Devices and Circuit Theory", Pearson Publication
Reference Books:
1. Allen Mottershed , "Electronic Devices and Circuits", PHI Publication
2. J.B. Gupta , "Electronic Devices and Circuits", Kaison Educational Series
3. Raghbir Singh Khandpur, "Printed circuit boards: Design, fabrication, assembly and testing", 2006, ISBN 10:0071464204,McGraw Hill
Project Based Learning:
Build the following circuits -
1. A single stage common emitter amplifier.
2. RC coupled multistage amplifier.
3. Darlington amplifier.
4. Voltage shunt negative feedback amplifier.
5. Current shunt negative feedback amplifier.
6. Voltage series negative feedback amplifier.
7. Current series negative feedback amplifier.
8. Class A, B, C power amplifier.
9. RC phase shift oscillator using BJT.
10. Colpitt's oscillator using BJT.
11. Hartley oscillator using BJT.
12. Shunt voltage regulator using zener diode.
13. Series voltage regulator.
14. IC 723 as basic high/low voltage regulator with fold back current limiting.
15. Flashing LED using astable multi vibrator.

Students in a group of 3 to 4 shall complete any one project from the above list.

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B. Tech. (Electronics & Communication Engineering) Sem III **SIGNALS AND SYSTEMS**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination(UE): 60 Marks	Credits : 04
Practical: 02	Internal Assessment(IA): 40 Marks	
	TW:25 Marks & Oral:25 Marks	Credit : 01
	Total:150 Marks	Total Credits: 05

Course Pre-requisites:	
The students should have knowledge of	
1	Differential and Integral calculus
2	Vector algebra and algebra of complex numbers

Course Objectives:	
1	To understand the behavior of signals in time and frequency domain
2	To understand the characteristics of LTI systems
3	To analyze continuous and discrete time systems using different transform techniques.

Course Outcomes: After learning this course students will be able to	
1	Classify signals and perform operations on signals.
2	Analyze LTI systems using convolution.
3	Apply Fourier series and Fourier Transform for analysis of signals.
4	Analyze CT signals and systems using Laplace transform.
5	Apply Z-transform for the analysis of DT signals and systems.
6	Sample and reconstruct the signals using sampling technique.

UNIT –I	**Introduction and Classification of signals:**	**(08 Hours)**
	Signals and Systems definition, Types of signals, continuous time and Discrete time signal operations, Amplitude scaling, Time shifting, Time reversal, Time scaling, Mathematical operations additions, subtraction, multiplication of signals, Classification of signals according to their property, Periodic/Aperiodic, Even/Odd, Energy/Power/Causal/Non causal, Deterministic/Random signals	
UNIT –	**Time domain representation of LTI System:**	**(08**

II		**Hours)**
	Introduction to systems, Classification of systems according to their properties, Linear/Nonlinear, Static /Dynamic, Time Invariant/Time-variant, Causal/non causal, Stable/Unstable, Invertible/Non Invertible systems, LTI system: Causality, stability, step response, impulse response, Convolution Integral, convolution sum using graphical method properties and applications.	
UNIT-III	**Fourier Analysis of Signals:** Fourier Series: - Review of Fourier series of CT and DT signals and its properties (No derivation), Exponential and Trigonometric Fourier series of periodic signals, amplitude and phase spectra of periodic signals, Fourier Transform and its properties.	**(08 Hours)**
UNIT-IV	**Application of Laplace Transform in Signal processing:**	**(08 Hours)**
	Review of Bilateral and Unilateral Laplace Transform of signals, ROC and its properties. Laplace transforms of standard signals, Inverse Laplace Transform, Solution to differential equation, System transfer function and Response calculations, Poles and Zeros representation	
UNIT -V	**Z-transform**	**(08 Hours)**
	Z-transform, Region of convergence and its properties, Inverse z-transform, properties of z transform, relation between Z and Laplace Transform, Analysis and characterization of discrete time LTI systems using z-transform.	
UNIT-VI	**Sampling and Correlation:**	**(08 Hours)**
	Sampling theorem, sampling and reconstruction of signal from its samples using interpolation, Effect of under sampling, Correlation, Autocorrelation and cross-correlation of energy and power signals, properties of correlation functions, applications of Correlation, Energy Density Spectrum, Parsevals Theorem, Power Density Spectrum,	
Term work:		
1. Introduction to MATLAB and its basic functions.		
2. Generate Continuous and discrete time signals.		
3. Perform signal operations on Continuous and discrete time signals.		
4. Find even and odd part of the signal and sequence and find real and imaginary parts of signal.		
5. Compute linear convolution and convolution integral of sequences/signals.		
6. Compute Fourier Transform and Inverse Fourier Transform of a given signal		

/sequence and plot its Magnitude and Phase Spectra.
7. To compute and plot the impulse response and pole-zero diagram of transfer function using Laplace transform.
8. To compute and plot the impulse response and pole-zero diagram of transfer function using Z-transform.
9. Compute auto correlation and cross correlation between signals and sequences and verify its properties.
10. Verify sampling theorem and reconstruct the signal.
Text Books:
1. Oppenheim, Willsky, S.Hamid Nawab, "Signals and Systems", PHI, 2nd edition, 2002.
2. M.J. Roberts, "Signals and Systems", McGraw-Hill, 1st edition,2003.
3. B.P Lathi, "Principles of linear systems and signals", Oxford, 2nd edition,2009.
Reference Books:
1. Simon Haykin and Bary Van Veen, "Signals and Systems", Wiley- India Publications
2. Michal J. Roberts and Govind Sharma, "Signals and Systems", Tata Mc-Graw Hill Publications
Project Based Learning:
1. Generate basic signals using C / Python programming.
2. Perform multiple operations on signal using C or MATLAB.
3. Visualize signal/data in time and frequency domain using MATLAB.
4. Find the Trigonometric Fourier Series of a given Signal using C/Python/MATLAB.
5. Create Frame-Based Signals using MATLAB Simulink.
6. Create Multichannel Signals by combining single channel signals using Simulink.
7. Create Multichannel Signals by combining multichannel signals using Simulink.
8. Inspect sample and frame rate using Simulink.
9. Perform Linear Convolution of two sequences using SCILAB.
10. Represent, Play and plot audio signals with different sampling frequencies using MATLAB.
11. Study of Signal Processing Sound Effects: Introducing a delay, creating an echo effect by repeating the signal, time scaling, time reversal, volume scaling.
12. Create acoustic environment in Simulink.
13. Develop a Python application to generate digital signals.
14. Perform measurement using spectrum analyzer using MATLAB Simulink.
15. Filter the frames of noisy wave using MATLAB.

Students in a group of 3 to 4 shall complete any one project from the above list.

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B. Tech. (Electronics & Communication Engineering) Sem III **ITC-I: PROCESS AND CONTROL SYSTEM**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03	End Semester Examination(UE): 60 Marks	Credits : 03
Practical: --	Internal Assessment(IA): 40 Marks	
Tutorial: --		
	Total:100 Marks	Total Credits: 03

Course Pre-requisites:	
The Students should have knowledge of	
1	Basic knowledge of signals.
2	Basic mathematical tools like Laplace Transform.

Course Objectives:	
1	This course provide in depth knowledge of various control system.
2	It introduces the stability of system , transducers, DAS etc.

Course Outcomes: After learning this course students will be able to	
1	Identify various control systems and determine the 'transfer function' of System using block diagram reduction and Signal flow graph.
2	Determine the error in various control systems.
3	Evaluate the stability of a system using Routh's stability criteria, root locus, bode plot etc.
4	Illustrate different specifications of the system in frequency domain.
5	Measure non-electrical quantities such as displacement, temperature, angular speed etc using suitable transducer.
6	Compare various control actions such as Proportional (P), Integral (I), Derivative (D), PI, PID.

UNIT – I	**Control System Classification**	**(06Hours)**
	Open loop, closed loop, Feedback and Non-feedback Systems, continuous, discrete, linear and non-linear control systems. Transfer Function, Analysis of T.F. using Block diagram and signal flow graph.	
UNIT– II	**Time Domain Analysis**	**(06 Hours)**
	Transient and steady state responses of first and second order	

	systems, steady state errors, control of transient response, Basic control actions and their effects on transient and steady state responses.	
UNIT-III	**Stability**	**(06Hours)**
	Stability concepts, Routh Hurwitz criterion, Root loci, properties and construction of root loci, effects of adding of poles and zeros, root locus of conditionally stable systems.	
UNIT-IV	**Frequency Domain Analysis**	**(06Hours)**
	Bode plot, gain, magnitude and phase shift plots, frequency domain specifications, peak resonance and resonant frequency of a second order system, gain margin and phase margin, conditionally stable system.	
UNIT -V	**Transducers**	**(06Hours)**
	Classification of Transducers and its Characteristics. RTD, Thermocouple, Thermister, capacitive transducer, LVDT, strain gauge, Electromagnetic flow-meter, Piezoelectric Accelerometer, tacho-generators. Internet Things (IoT) for wireless sensor networks.	
UNIT -VI	**Controllers**	**(06Hours)**
	Control actions – On/Off Controller, Proportional Controller, Integral Controller, Derivative Controller, Proportional- Integral(PI) Controller, Proportional-Derivative(PD) Controller, PID Controller.	

Assignments:

It shall consist of record of minimum six assignments.

1. Transfer function of closed loop system.
2. Transient response specifications of second order system.
3. To draw Root Locus theoretically and verify it.
4. To draw Bode plot theoretically and verify it.
5. To study characteristics of temperature transducer.
6. To Study characteristics of LVDT for displacement measurement.
7. Study of Strain Guage.
8. Internet Things (IoT) for wireless sensor networks.
9. Study of Various Controllers.

Text Books:

1. A. K. Sawhney, “Electrical and Electronic Measurements and Instrumentation”, Dhanpt Rai and Co. Ltd

Reference Books:

1. J. Nagrath& M. Gopal, “Modern Control Engineering”, New Age International, New Delhi (Fifth Ediion)2007

2. H S Kalsi, “Electronic Instrumentation”, Tata McGraw-Hill.
3. Ogata, K., “Modern Control Engineering”, Prentice Hall, second edition, 1991

Project Based Learning:

1. Design of a Lead Compensator.
2. Design of a Lag Compensator.
3. Displacement measurement using “Linear Variable Differential Transformer”.
4. Design of Temperature control system using RTD.
5. Design of Temperature measurement system using thermocouple.
6. Design of Temperature control system Using Thermistor.
7. Design of Load Cell using Strain Guage.
8. Application Internet Things (IoT) using wireless sensor.
9. Transient response analysis for second order system.
10. Design and Simulation of Root Locus for given system.
11. Design and Simulation of Bode plot for given system.
12. Design of on-off controller.
13. Design of Proportional controller.
14. Design of Integral controller.
15. Design of Proportional-Integral controller.
16. Design of Proportional-Integral-Derivative controller.

Students in a group of 3 to 4 shall complete any one project from the above list.

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B. Tech. (Electronics & Communication Engineering) Sem III **VOCATIONAL COURSE-I** **PCB DESIGN & ASSEMBLY**		
TEACHINGSCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: --	End Semester Examination(UE): --	
Practical: 02	Internal Assessment(IA): --	
Tutorial: --	TW:25 Marks & Oral: 25 Marks	Credits : 01
	Total:50 Marks	Total Credits: 01

Course Pre-requisites:	
The Students should have knowledge of	
1	Basic knowledge of Electronic components.

Course Objectives:	
1	Become familiar with the simulation software.
2	This course provide in depth knowledge of PCB design.
3	It also introduces the PCB manufacturing.

Course Outcomes: After learning this course students will be able to	
1	Design electronic circuits, create a schematic, PCB layout.
2	Become proficient with software skills using EDA tool, for drawing electronic circuit Schematic and PCB Layout.
3	Fabricate a Prototype PCB using EDA tool.
4	Demonstrate the knowledge of selecting proper PCB primitives.
5	Use PCB design software for simple single sided PCB artwork design.
6	Identify and select appropriate soldering tools for the soldering job.

Unit-I	**Component Selection**	
	Principles and Process of Electronic Component Selection: **Electrical parameters, Mechanical parameters** . Performance, Quality**, Availability and price, PCB footprint with Dual -in-Line Package (DIP) and surface mount Packages.(SMP)/ SMD.**	
Unit-II	**Schematic design**	
	Electrical connection between different active and passive electrical components like resistors, capacitors, Integrated circuits IC. Connectivity and functionality between different components. Physical representation of all the electrical connections between active and passive components used in the schematic.	

Unit-III	**Circuit Design**	
	Design specification, Circuit Design theoretically and implementing on Breadboard, verification and testing.	
Unit-IV	**PCB Design**	
	Introduction to PCB Design using EDA tool. Design of single sided PCB, Design of Double sided PCB. Verification and testing. PCB Design Implementation with print-out or Gerber file.	
Unit-V	**PCB fabrication**	
	PCB Manufacturing Process Steps: Design and Output From File to Prototype machine/Film, Printing the Inner layers, Removing the Unwanted Copper, Layer Alignment and Optical Inspection, Layer-up and Bond, Drill, Plating and Copper Deposition, Outer Layer Imaging, Final Etching, Solder Mask Application, Surface Finishing, Electrical Test. PCB fabrication using Prototype machine/Chemical method.	
Unit-VI	**Soldering of Component**	
	Materials and Equipment: soldering iron, Rosin core solder, Sponge, Solder braid etc. PCB Protection Chemicals. Soldering and de-soldering of Components.	
PCB Plant Visit: At the end of course students should visit to PCB manufacturing company.		
Text Books:		
1. R.S. Khandpur**,** "Printed Circuit Boards: Design, Fabrication, and Assembly" ,McGraw-Hill Electronic Engineering		
2. Coombs Clyde, " Printed Circuits Handbook", McGraw-Hill Education		

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B. Tech. (Electronics & Communication Engineering) Sem III **DATA STRUCTURES**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory:--	End Semester Examination(UE): --	
Practical: 02	Internal Assessment(IA): --	
Tutorial: --	TW:25 Marks	Credits:01
	Total:25 Marks	Total Credits: 01

Course Pre-requisites:	
The Students should have knowledge of	
1	Knowledge of C programming
Course Objectives:	
1	This course provides in depth knowledge of the various types of data structures and various algorithms. Also it introduces the programming for linked list, stack, queues, graph and tree.
Course Outcomes: After learning this course students will be able to	
1	Write a program using data structure and its types.
2	Define various operations on linked and double linked lists.
3	Implement stacks and queues involving linked list.
4	Perform operations on a tree using linked lists.
5	Create a graph using adjacency list & traverse it using BFS & DPS methods.
6	Find the shortest path in each graph using algorithm.
Term Work:	
The term work shall consist of record of minimum eight experiments.	
1. Program to search for record from a given list of records stored in array using i) Linearsearch ii) Binarysearch	
2. Program to sort an array of names using i) Bubble sort ii) Insertionsort iii) Quicksort	
3. Program to implement following operation on singly linked list: i) Create ii) Delete iii) Insert iv) Display v) Search	

4. Program to add two polynomials using linked list.
5. Program to implement stack using: i) Array ii) Linked list
6. Program to convert an infix expression to postfix expression & evaluate the resultant expression.
7. Program to Implement Queue using: (i) Array (ii) linked list
8. Program to create a Binary search tree &Perform following primitive operation on it: i) Search ii) Delete iii) Traversals (inorder, pre-order, post-order-recursive) iv) Non-recursive in order traversal
9. Program to create a graph using adjacency list & traverse it using BFS & DPS methods
Text Books:
1. ISRD group ,“Data structure using C”,TMH.
2. Yashwant kanetkar “Data Structure through C” ,BPB Puplication.
Reference Books:
1. AM Tanenbaum, Y Langsam and MJ Augustein "Data structure using C”, Prentice Hall India.
2. Weiss, Mark Allen, “Data structure and Algorithm Analysis in C”, Addison Wesley.
3. Richard F Gilberg Behrouz A. Forouzan, Thomson ,“Data structure – A Pseudocode Approach with C”, Cengage Learning India
4. Yashwant Kanetkar ,“Let us C” ,BPB Publication

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B. Tech. (Electronics & Communication Engineering) Sem III **DATABASE MANAGEMENT SYSTEM**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory:--	End Semester Examination(UE): --	
Practical: 02	Internal Assessment(IA): --	
Tutorial: --	TW:25Marks	Credits:01
	Total:25 Marks	Total Credits: 01

Course Pre-requisites:	
The Students should have knowledge of	
1	Computational C.

Course Objectives:	
1	To explain basic database concepts, applications, data models, schemas and instances.
2	To demonstrate the use of constraints and relational algebra operations.
3	Describe the basics of SQL and construct queries using SQL.
4	To emphasize the importance of normalization in databases.
5	To facilitate students in Database design
6	To familiarize issues of concurrency control and transaction management

Course Outcomes: After learning this course students will be able to	
1	Apply the basic concepts of Database Systems and Applications.
2	Use the basics of SQL and construct queries using SQL in database creation and interaction
3	Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system
4	Analyze and Select storage and recovery techniques of database system.
5	Use Algorithms to solve scheduling conflict.
6	Apply Algorithms in distributed database.

Experiment List
1. Conceptual Designing using ER Diagrams (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.) Note: Student is required to submit a document by drawing ER Diagram to the Lab teacher.
2. Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, Represent attributes as columns, identifying keys) Note: Student is required to submit a document showing the database tables created from ER Model.
3. Normalization -To remove the redundancies and anomalies in the above relational tables, Normalize up to Third Normal Form

4. Creation of Tables using SQL- Overview of using SQL tool, Data types in SQL, Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables
5. Practicing DML commands- Insert, Select, Update, Delete
6. Practicing Queries using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION,
7. Practicing Sub queries (Nested, Correlated) and Joins (Inner, Outer and Equi)..
8. Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation and Dropping.
9. Practicing on Triggers - creation of trigger, Insertion using trigger, Deletion using trigger, Updating using trigger
10. Procedures- Creation of Stored Procedures, Execution of Procedure, and Modification of Procedure.
11. Cursors- Declaring Cursor, Opening Cursor, Fetching the data, closing the cursor.
Text/Reference Books:
1.Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0
2. Connally T, Begg C., "Database Systems", Pearson Education, ISBN 81
3. Pramod J. Sadalage and Martin Fowler, “NoSQL Distilled”, Addison Wesley, ISBN10: 0321826620, ISBN

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 IV

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
19		Digital Communication	3	2	0	60	40	25	25	0	150	3	1	0	4
20		Microcontroller & Applications	4	2	0	60	40	25	0	25	150	4	1	0	5
21		EM Waves & Propagation	4	0	1	60	40	0	0	0	100	4	0	1	5
22		Integrated Circuits & Amplifier Design	4	2	0	60	40	25	0	25	150	4	1	0	5
23		Essentials of Data Science*	3	0	0	60	40	0	0	0	100	3	0	0	3
24		Vocational Course-II Domestic Appliances & Maintenance	0	2	0	0	0	25	25	0	50	0	1	0	1
25		Java Programming	0	2	0	0	0	0	25	0	25	0	1	0	1
26		Linux Programming	0	2	0	0	0	25	0	0	25	0	1	0	1
		Total	**18**	**12**	**1**	**300**	**200**	**125**	**75**	**50**	**750**	**18**	**6**	**1**	**25**
		MOOC-I**	--	--	--	-	-	--		--	--	-	-	-	2

*Industry Taught Course–II
** Add on course

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College of Engineering, Pune

B. Tech. (Electronics & Communication Engineering) Sem IV **DIGITAL COMMUNICATION**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03	End Semester Examination(UE): 60 Marks	Credits : 03
Practical: 02	Internal Assessment (IA) :40Marks	
Tutorial: --	TW:25 Marks & Oral: 25 Marks	Credit: 01
	Total:150 Marks	Total Credits: 04

Course Pre-requisites:	
The Students should have knowledge of	
1	Electronic communication
2	Signals & Systems
3	Probability and Statistics

Course Objectives:	
1	To understand the building blocks of digital communication system.
2	To prepare mathematical background for communication signal analysis.
3	To understand the basics of baseband and pass band digital communication systems.
4	To acquire the knowledge of spread spectrum communication systems.

Course Outcomes: After learning this course students will be able to	
1	Apply different sampling techniques to convert analog signal into discrete sequence
2	Describe various CW modulation schemes
3	Learn the generation and detection of band pass modulation techniques
4	Identify the need of Multiplexing and Synchronization in digital communication and design Scrambler and Un-scrambler. Characterize, sketch various Line Codes
5	Evaluate probability of error in various digital modulation techniques
6	Describe the digital communication system with spread spectrum modulation

UNIT – I	**Pulse Modulation**	**(06 Hours)**
	Introduction to Digital Communication System, digital representation of analog signal, advantages of digital communication. Pulse Modulation, Sampling Theorem (time domain analysis) ideal sampling, Natural sampling, Flat top sampling, aliasing effect and aperture effect. Nyquist criteria, Pulse Amplitude Modulation (PAM), Pulse Width Modulation, Pulse Position Modulation, Their generation and Demodulation.	

UNIT – II	**Digital transmission of analog signals**	**(06 Hours)**
	Quantization–Uniform, Non-Uniform, Companding, A-Law, μ Law, Pulse code modulation Delta Modulation, Differential Pulse Code Modulation.	
UNIT -III	**Band pass Modulation Techniques**	**(06 Hours)**
	ASK, PSK, FSK, Binary Phase shift keying, Differential Phase shift keying, Differential encoded PSK, Quadrature PSK, M-ary PSK, Quadrature Amplitude shift keying (QASK), Binary frequency shift keying, Minimum shift keying (MSK), signal space representation and constellation diagram	
UNIT -IV	**Baseband Digital Transmission**	**(06 Hours)**
	Digital Multiplexing: Multiplexers and hierarchies, Data Multiplexers. Data formats and their spectra, synchronization: Bit Synchronization, Scramblers, Frame Synchronization. Inter-symbol Interference, Equalization.	
UNIT -V	**Baseband Receivers**	**(06 Hours)**
	Base band signal receiver, Probability of error, Optimum filter, White noise-Matched filter, probability of error of matched filter, correlation, FSK, PSK, non-coherent detection of FSK, DPSK, QPSK, Calculation of error probability for BPSK &BFSK, Signal space to calculate Pe.	
UNIT -VI	**Spread Spectrum Techniques**	**(06 Hours)**
	Introduction, Generation of PN Sequences and its properties, Direct Sequence Spread Spectrum Signals, Frequency Hopped Spread Spectrum Signals, Introduction to Multiple Access Techniques: CDMA, TDMA, FDMA.	

Term Work:

The term work shall consist of record of minimum eight experiments.

1. To verify the sampling theorem
2. To perform Pulse Code Modulation System (PCM) System
3. To analyze a Delta modulation system and interpret the modulated and demodulated waveforms
4. To analyze Adaptive Delta modulation system and interpret the modulated and demodulated waveforms
5. To analyze ASK (Amplitude Shift Keying) System with waveforms
6. To analyze PSK (Phase Shift Keying) System with waveforms
7. To analyze FSK (Frequency Shift Keying) System with waveforms
8. To analyze of Quadrature Phase Shift Keying (QPSK) with waveforms

9. To simulate any digital modulation scheme using MATLAB
10. To analyze waveforms of different Data Formats
Text Books :
1. Sklar, Bernard, "Digital Communications, Fundamentals & Applications," Second Edition, Prentice-Hall Inc., 2001.
2. Lathi B P, and Ding Z "Modern Digital and Analog Communication Systems," Fourth Edition, Oxford University Press.
3. Leon W. Couch, "Digital and Analog Communication Systems", Sixth Edition, Pearson Education, 2001.
Reference Books:
1. Haykin Simon, "Digital Communication Systems," Forth Edition, John Wiley and Sons, New Delhi.
2. Taub, D. Schlling, and G. Saha, "Principles of Communication Systems," Third Edition, Tata McGraw Hill.
3. John G. Proakis, "Digital Communication" ,Fifth Edition, Pearson Education.
Project Based Learning:
Implement following systems using matlab and simulink
1. Sampling of the given signal
2. Pulse Width Modulation generator
3. Pulse Position Modulation generator
4. Pulse Amplitude Modulation generator
5. Delta modulation system
6. Quantization of an audio signal
7. Pulse code modulation system
8. Frequency Shift Keying modulator
9. Amplitude Shift Keying modulator
10. Phase Shift Keying modulator
11. Quadrature Phase Shift Keying modulator
12. Unipolar RZ Line coding scheme
13. Bipolar RZ and NRZ line coding scheme
14. Random binary sequence generator
15. Generate the sound

Students in a group of 3 to 4 shall complete any one project from the above list.

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B. Tech. (Electronics & Communication Engineering) Sem IV **MICROCONTROLLER & APPLICATIONS**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination(UE): 60 Marks	Credits: 04
Practical: 02	Internal Assessment(IA): 40 Marks	
Tutorial: --	TW:25 Marks & Practical:25 Marks	Credit: 01
	Total:150 Marks	Total Credits: 05

Course Pre-requisites:	
The students should have knowledge of	
1	Basics of Digital Logic Design.
2	Basics of C programming
3	Basic of Microprocessor architecture.

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Course Objectives:	
1	To introduce the operation of micro-controllers.
2	To familiarize with the fundamentals of embedded system architecture, its basic hardware and software elements.
3	To understand the concept of AVR Controller
4	To introduce the AVR micro-controller with architecture and programming

Course Outcomes: After learning this course students will be able to	
1	Classify the memory devices, microcontrollers and their architecture.
2	Write the programs for 8051 microcontroller using mathematical, logical, data flow instructions.
3	Interface the external devices to 8051 microcontroller
4	Understand the architecture of AVR microcontroller
5	Implement the programs in C using AVR microcontroller
6	Distinguish different types of serial communication protocols

UNIT – I	**Review of Processor and Memory:**	**(08 Hours)**
	General-purpose processors, single-purpose processors, application specific processors, CISC and RISC processor architecture, memory devices, processor and memory selection for an embedded system, interfacing processor, memory and I/O devices, 8/16-bit microcontrollers.	
UNIT – II	**8 Bit Micro Controller 8051:**	**(08 Hours)**

	MCS 51 family architecture: Registers in MCS-51, Parallel I/O ports, Timers & Counters, Memory Organization, Pin Description, Instruction set, Addressing modes, Interrupts in MCS-51, Programming.	
UNIT- III	**8051 Serial Communication &Interfacing of 8051**	**(08 Hours)**
	Serial Communication of 8051: Basics, SBUF register, SCON and PCON registers, Modes of operation Simple program of serial communication. Interfacing of 8051 with devices: LED, LCD, keyboard, LM35 temperature sensor & A/D converter	
UNIT- IV	**Introduction to AVR microcontroller**	**(08 Hours)**
	Overview of AVR family, AVR Microcontroller architecture, status register, Special function registers, RAM, ROM & EEPROM space, On-Chip peripherals, ATmega32 pin configuration& function of each pin, Fuse bits of AVR**.**	
UNIT -V	**AVR programming in C**	**(08 Hours)**
	AVR Data types, AVR I/O port programming, Timer programming, Input capture and Wave Generator, PWM programming External Interrupt programming, ADC programming, EEPROM programming.	
UNIT- VI	**Serial communication protocols**	**(08 Hours)**
	UART protocol, I2C protocol, SPI protocol, Serial Port programming using polling and interrupt, I2C Programming, SPI Programming	

Term Work:

1.Addition / subtraction / multiplication / division of 8/16 bit data using 8051

2. Largest/smallest from a series using 8051.

3.Generate different waveforms: Sine, Square, Triangular, Ramp using DAC interface.

4.To write a C program to demonstrate LED using 8051 Micro-controller development kit.

5.To write a C program to demonstrate Seven Segment using 8051 Micro-controller development kit

6.To write a program to demonstrate Stepper Motor using 8051 Micro-controller development kit.

7.To write a program to demonstrate LCD using 8051 Micro-controller development kit.

8.Installation of AVR STUDIO and familiarization of ATMega32 AVR Development Board.

9.Stepper motor interfacing with ATMega32 in C with ATMega32.

10.Timer to generate accurate delay using Interrupt in C with ATMega32

11.Seven Segment Display interfacing with ATMega32 in C.
12.Timer to generate accurate delay using polling in C with ATMega32
13.16x2 LCD interfacing with ATMega32 in C.
15.Interfacing with ATMega32 in C using I2C protocol
16.On-chip ADC for interfacing analog sensors in C with ATMega32.
Textbooks:
1. Muhammad Ali Mazidi, Janice Gillespie Mazidi, "The 8051 Microcontroller and Embedded System" Pearson Education.
2. Dhananjay Gadre, "Programming and Customizing the AVR Microcontroller", McGraw Hill Education
Reference Books:
1. Kenneth J. Ayala, "The 8051 Micro-controller – Architecture, Programming & Applications", Second Edition Penram International & Thomson Asia
2. Rajkamal, "Embedded System-Architecture, Programming and Design", TMH Publications, Edition 2003
3. Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, " The AVR Microcontroller and Embedded Systems Using Assembly and C", Pearson Education
Project Based Learning:
Build the following circuits -
1. 8 Channel Quiz Buzzer Circuit using Microcontroller 8051/AVR
2. 8 Channel Quiz Buzzer Circuit using Microcontroller 8051/AVR
3. Automatic Railway Gate Controller with High Speed Alerting System using Micro-controller 8051/AVR
4. Bidirectional Visitor Counter using Microcontroller 8051/AVR
5. Celsius Scale Thermometer using Microcontroller 8051/AVR
6. Digital Tachometer using Microcontroller 8051/AVR
7. Density Based Traffic Signal System using Microcontroller 8051/AVR
8. Digital Temperature Sensor using Micro-controller 8051/AVR
9. Digital Voltmeter using Microcontroller 8051/AVR
10. Line Following Robotic Circuit using Microcontroller 8051/AVR
11. Password Based Door Lock System using Microcontroller 8051/AVR
12. RFID based Attendance System using Micro-controller 8051/AVR
13. Remote Control Circuit through RF using Microcontroller 8051/AVR
14. Street Lights that Glow on Detecting Vehicle Movement using Micro-controller 8051/AVR
15. Sun Tracking Solar Panel using Micro-controller 8051/AVR
16. Temperature Controlled DC Fan using Microcontroller 8051/AVR
17. Ultrasonic Rangefinder using Microcontroller 8051/AVR
18. Water Level Controller using Microcontroller 8051/AVR
19. Water Level Indicator using Micro-controller 8051/AVR
20. Temperature based Ceiling Fan Speed Control System (230V AC Motor) using Micro-controller 8051/AVR

Students in a group of 3 to 4 shall complete any one project from the above list.

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B. Tech. (Electronics & Communication Engineering) Sem IV **EM WAVES AND PROPAGATION**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination(UE): 60 Marks	Credits : 04
Practical: --	Internal Assessment(IA): 40 Marks	
Tutorial: 01		Credits : 01
	Total: 100 Marks	Total Credits: 05

Course Pre-requisites:	
The Students should have knowledge of	
1	Vector calculus and coordinate systems.
2	Curl, Divergence and Gradient.
3	Partial differential equations.

Course Objectives:	
1	Provide fundamentals of Static Electromagnetic Fields.
2	Explain basics of the vector Differential, Integral operators to Electromagnetic theory &
3	Electrostatic & Electromagnetic fields.
4	Define and derive different laws in Electrostatic & Electromagnetic fields.
5	Explain Maxwell's equations and concepts of transmission lines.
6	Analyze techniques for formulating and solving problems in Electrostatic &

Course Outcomes: After learning this course students will be able to	
1	Comprehend the fundamentals of Electrostatic and Electromagnetic fields..
2	Apply Gauss' law, Ampere's Law, Biot-Savart law, Faraday's law and laws related with steady magnetic field while solving problems in Electrostatic and Electromagnetic fields.
3	Develop field equations from understanding of Maxwell's Equations.
4	Extend the knowledge of basic properties of transmission lines to analyze Electromagnetic wave propagation in generic transmission line geometries
5	Demonstrate mathematical skills related with differential, integral and vector calculus.
6	Apply radiation principles and concept of Antennas

UNIT – I	**Static Electric Fields**	**(08 Hours)**
	Review of Co-ordinate systems, Coulomb's law, line, Surface& Volume Charge distribution. Electric Field Intensity, Electric Field	

	due to infinite line and surface charges, Electric Flux Density, Gauss law (differential and integral form) and its applications, Divergence Theorem, Electric Potential and gradient, Poisson's and Laplace Equations, Work done, Energy Density, Electric Dipole and moment. Polarization in Dielectrics, Boundary conditions for Dielectric and Dielectric, boundary conditions for Conductor and Dielectric, boundary conditions for Conductor and free space	
UNIT –II	**Static Magnetic Fields**	**(08 Hours)**
	Biot – Savart's law, Magnetic Field Intensity due to infinite and finite line. Ampere's Circuital Law in integral and differential form, Applications of Amperes Circuital law, Magnetic flux density, Stokes Theorem, vector magnetic potential, Magnetic Torque, moment and dipole, nature of magnetic material, magnetization, Magnetic boundary conditions.	
UNIT - III	**Time Varying Fields & Maxwell's Equations**	
	Faradays law of induced Emf, displacement current, Maxwell's Equations in point form & Integral form for various fields.	**(08 Hours)**
UNIT - IV	**Wave Propagation and Uniform Plane waves**	**(08 Hours)**
	Wave equations, wave propagation through different medium, wave propagation through free space , wave propagation through dielectric, wave propagation through conductors- skin depth, Poynting theorem, wave polarization, Reflection of plane wave from conducting medium, perfect dielectric., reflection of plane waves at normal incidence, reflection of plane waves atoblique incidence angles.	
UNIT -V	**Transmission Lines**	**(08 Hours)**
	Physical Description of Transmission line propagation, Transmission Line equations, Characteristic equation of infinite Transmission Line, Complex analysis of sinusoidal waves, Transmission lines equations & their solutions in phasor form, Uniform terminated 2 coefficient VSWR, smith chart (Numerical expected) and applications, transient analysis of transmission lines.	
UNIT -VI	**Waveguides & Antenna Fundamentals**	**(08 Hours)**
	Plane wave analysis of parallel-plate waveguide, rectangular waveguides, TE and TM modes, wave impedance, wave velocities, attenuation in waveguide, EMI/EMC concepts, basic radiation principles, Hertzian dipole, magnetic dipole, thin wire antennas, antenna specifications, antenna arrays.	

List of Tutorials:

1. Find the Electric field intensity and electric flux density at a given point due to following charge distributions. (In all coordinatesystems)
   - Pointcharges
   - Line charges (finite andinfinite)
   - Surface charges (finite andinfinite)
   - Mixed charges (Point charge, Line charge, Surfacecharge)
2. Application of Gauss'slaw
   - Given ρv(volume charge density) in a particular region, find $\bar{D}$ (electric flux density) using Law at the givenlocation.
   - Given ρS(surface charge density), find $\bar{D}$(electric flux density) using Gauss's Lawat the given location.
   - Given $\bar{D}$(electric flux density), find total charge enclosed by the surface (Q), (ρvvolume charge density) using Gauss's Law.(In all coordinatesystems)
3. Find the electrostatic fields (Tangential and Normal) at the boundarybetween,
   - Free space and dielectricmedium
   - Free space andconductor
   - Dielectric medium and conductor
   - Two dielectricmedia.
4. Find $\bar{H}$(Magnetic field intensity) and $\bar{B}$(Magnetic flux density) at a given pointdue to,
   - Infinitely long current carrying conductor
   - Finite current carrying conductor
   - Infinite conducting surface
   - Finite conducting surface
   - Different current carrying configurations (i.e. thin conductor, surface all together)
5. For the following current carrying configurations, find the $\bar{H}$(Magnetic field intensity) in a given region (or point) using Ampere's circuital law.
   - Infinitely long current carrying conductor
   - Infinite cylindrical surfaces of different radii all centered at the same axis.
   - Spherical surfaces of different radii all centered at a given point.
6. Given $\bar{H}$ (or $\bar{E}$) and the region properties (like ε, μ, σ etc.), find $\bar{B}$, $\bar{D}$ and $\bar{E}$ ($\bar{H}$) using Maxwell's equations. (In all coordinate systems).
7. Find attenuation constant, propagation constant, intrinsic impedance, values of E/H for different mediums like free space, conductors, and dielectrics.
8. Given the primary constants (R, L, G, C) along with the generator specifications and termination, find secondary constants (α, β, γ, Z0) and other parameters like Velocity, wavelength, received voltage, received power, reflection coefficient etc.
9. Problems on Impedance matching and design of stub matching using Smith Chart.
10. Find cut-off frequency or waveguide dimensions or phase velocity for rectangular waveguides.

Text Books:

1. A. Murthi," Electromagnetic fields", S. Chand.
2. Edminister J.A, "Electromagnetics", Tata McGraw-Hill.

Reference Books:

1. Hayt& Buck, “Engineering Electromagnetics”, 7th Edition, Tata McGraw-Hill
2. Kraus,Fleisch, “Electromagnetics with applications”, 5th Edition, McGraw Hill.
3. Jordan &Balmain, “Electromagnetic waves & radiating systems”, 2nd edition, PHI.
4. Matthew N.O. Sadiku, ”Principles of Electromagnetics”,6th edition, Oxford

Project Based Learning:

1. Plot Magnitude of a Vector & its Unit Vector MATLAB.
2. Simulate Coulomb Law on MATLAB &SCILAB.
3. Plot different charge distributions viz. line charge, volume charge, and surface charge in MATLAB.
4. Find & simulate Electric filed intensity & flux density for given charge distributions.
5. Verify & plot Divergence theorem with Gauss law in SCILAB & MATLAB.
6. Design a code in SCILAB for relation between E & V, Electric Dipole visualization and verify Poisson’s & Laplace’s Equations.
7. Design & Verify boundary conditions between Free space- conductor-Dielectric in SCILAB.
8. Simulate Biot-Savart’s Law, Magnetic field intensity for different current distributions in SCILAB & MATLAB.
9. Design & Verify Magnetic boundary conditions in SCILAB
10. Visualize & Simulate Maxwell’s Equations for Time varying Fields in MATLAB & SCILAB
11. Visualize EM waves & Uniform Plane waves formation in MATLAB
12. Visualize & Simulate behavior of EM waves in good conductors Lossy-Lossless dielectrics in MATLB & SCILAB.
13. Find out Transmission line parameters for given frequency in SCILAB, Visualize how standing waves generated & reflected on Transmission line in MATLAB
14. Visualize & plot SWR Circle, Impedance Matching, and reflection coefficient input impedance on SMITH CHART in MATLAB.
15. Visualize & plot Stub Matching problem of Transmission lines SMITH CHART in MATLAB.

Students in a group of 3 to 4 shall complete any one project from the above list.

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B. Tech. (Electronics & Communication Engineering) Sem IV **INTEGRATED CIRCUITS AND AMPLIFIER DESIGN**		
TEACHINGSCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination(UE): 60 Marks	Credits: 04
Practical: 02	Internal Assessment(IA): 40 Marks	
Tutorial: --	TW:25 Marks & Practical :25Marks	Credit: 01
	Total: 150 Marks	Total Credits: 05

Course Pre-requisites:	
The Students should have knowledge of	
1	Knowledge of KCL and KVL Law
2	Basic knowledge of Op-Amp and its configurations

Course Objectives:	
1	Familiar in the operational amplifier principle- analysis- design and application.
2	Gain knowledge on the linear and nonlinear applications of operational amplifiers.
3	Understand the theory and applications of Active filters and PLL.
4	Familiar in the ADC- DAC and its classifications.
5	Understand the few applications of specific ICs.

Course Outcomes: After learning this course students will be able to	
1	Differentiate IC and Discrete components, understand manufacturing process of IC and analyze how monolithic components are being developed.
2	Identify different configurations of op-amp analyze the parameters of op-amp and observe the frequency response of operational-amplifier
3	Understand & demonstrate different applications based on operational-amplifier.
4	Understand analog multiplier and PLL & demonstrate different applications based on it
5	Differentiate A/D and D/A converter, understand their types and analyze their applications
6	Demonstrate the applications of waveform generators, timers and voltage regulators

UNIT – I	**Basics of operational Amplifier**	**(08 Hours)**
	Block diagram representation of a typical op-amp, Differential amplifier, Schematic symbol for op-amp, Definition of integrated	

	circuits, Types of Integrated Circuits, Manufacturers, Designation for IC, IC package types, PIN identification & temp ranges, Ordering information, Characteristics of an op-amp, Internal &external offset voltage compensation, Frequency Response of an op-amp.	
UNIT –II	**Operational Amplifier – Linear circuits**	**(08 Hours)**
	Inverting amplifier, non-inverting amplifier, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Integrator, Differentiator, peak detector, clipper and clamper, Instrumentation amplifier using 1, 2 and 3 op-amps, Instrumentation amplifier using transducer bridge.	
UNIT -III	**Operational Amplifier - Non-linear circuits**	**(08 Hours)**
	Precision half wave rectifier & full wave rectifier, comparator, Schmitt trigger, window detector, log-antilog amplifier and its temperature compensation techniques, log ratio, sample and hold circuit.	
UNIT -IV	**Active filters and waveform generators**	**(08 Hours)**
	First and second order low pass Butterworth filters, first and second order high pass Butterworth filter, Band pass filter, Band reject filter, All-pass filter, notch filter, Square wave, Triangular wave, Saw tooth wave generator and study of function generator IC 8038	
UNIT -V	**Special function ICS**	**(08 Hours)**
	IC 555- as Monostable and Astable Multivibrators and its applications. IC 565- operating principle of Phase Locked Loop IC 565, Applications like Frequency multiplier, FSK and FM detector.	
UNIT -VI	**Interfacing circuits**	**(08 Hours)**
	V to I & I to V converter, D to A converter- Binary weighted resistors and R & 2R resistors, A to D Converter- Counter-ramp type, Successive approximation and Dual Slope.	

Term Work:
The term work shall consist of record of minimum eight experiments.
1. To design and setup an inverting amplifier circuit with OP AMP 741C for a gain of 10, plot the waveforms, observe the phase reversal, measure the gain.
2. To demonstrate the use of op-amp as Integrator and Differentiator and draw frequency response.
3. To demonstrate the use of op-amp as precision rectifier.
4. To design and setup a Schmitt trigger, plot the input output waveforms and measure

VUT and VLT.
5. Design and obtain the frequency response of second order Low Pass Filter (LPF) at a high frequency of 1KHz.
6. Design and obtain the frequency response of High Pass Filter (HPF) at a cut off frequency of 1KHz with pass band gain of 2.
7. To design and setup astable multivibrator using Op-amp 555, plot the waveforms and measure the frequency of oscillation
8. To obtain the output of voltage comparator and zero crossing detector.
9. Design instrumentation amplifier with the help of three Op-amps inverting amplifier and also implement Wheatstone bridge and balance for null condition. (Using VLabs)
10. To design and study the frequency response of Summing Inverting Amplifier circuit.(Using VLabs)
11. Design and simulate triangular/square waveform generator using IC 741.(using VLabs)
12. To construct and study the voltage to current convertor.
13. To construct and study digital to analog converter circuit.
Text Books:
1. Ramakant A. Gayakwad, OP-AMP and Linear ICs, Prentice Hall of India, 4th Edition,2010.
2. K. R. Botkar, Integrated Circuits, Khanna Publishers, 10th edition, 2010
Reference Books:
1. David A. Bell, "Operational Amplifiers and Linear ICs", Oxford publication,3rd edition,2011
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", Tata McGraw Hill, 3rd edition, 2008
3. D.Roy Choudhry, Shail Jain, Linear Integrated Circuits, New Age International Pvt.Ltd., 4th edition, 2010
Project Based Learning:
1. To design and setup a non-inverting amplifier circuit with OP AMP 741C for a gain of 10, plot the waveforms, observe the phase reversal, and measure the gain.
2. To demonstrate the use of op-amp as clipper circuit.
3. Design operational amplifier 741 tester which test op-amp 741 either is good or fault
4. Design and simulate Temperature to Voltage Converter Circuit.
5. To demonstrate the use of op-amp 741 as an Electronics Thermometer
6. IC 741 based circuit for dark Switch.
7. Hartley and Colpitts oscillator using op-amp
8. Notch filters using op-amp.
9. Water Level based Alarm Circuit (using IC 555- Astable Multivibrator).
10. Digital Stop Watch
11. FM Radio using PLL.
12. ICL7107 (A/D converter) based Digital Voltmeter.
13. Dimmer circuit for LED Lamp (using IC 555)
14. Electronic Letter Box.
15. 4-line to 16-line decoder Circuit using 7442

Students in a group of 3 to 4 shall complete any one project from the above list.

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B. Tech. (Electronics & Communication Engineering) Sem IV **ITC-II:ESSENTIALS OF DATA SCIENCE**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03	End Semester Examination(UE): 60 Marks	Credits : 03
Practical: --	Internal Assessment(IA): 40 Marks	
Tutorial: --		
	Total:100 Marks	Total Credits: 03

Course Pre-requisites:	
The Students should have knowledge of	
1	Python programming
2	Probability & Statistics

Course Objectives:	
1	Introduce R as a programming language
2	Introduce the mathematical foundations required for data science
3	Introduce the first level data science algorithms
4	Introduce a data analytics problem solving framework
5	Introduce a practical capstone case study

Course Outcomes: After learning this course students will be able to	
1	Describe a flow process for data science problems (Remembering)
2	Classify data science problems into standard typology (Comprehension)
3	Develop R codes for data science solutions (Application)
4	Correlate results to the solution approach followed (Analysis)
5	Assess the solution approach (Evaluation)
6	Construct use cases to validate approach and identify modifications required (Creating)

UNIT – I	**Introduction to Data Science**	**(06 Hours)**
	Data Science Fundamentals: Data, Data Science Process, Components of Data Science, Data Scientist roles and responsibilities, Introduction to R and R Studio, Variables and Data types in R, Data frames, Recasting and Joining of Data frames, Arithmetic, Logical and Matrix Operations in R, Advanced Programming in R : Functions, Data Visualization in R Basic Graphics.	

UNIT - II	**Linear Algebra & Statistical Modeling for Data Science**	**(06 Hours)**
	Linear Algebra for Data science, Solving Linear Equations, Linear Algebra - Distance, hyperplanes and half spaces, Eigen values, Eigenvectors, Statistical Modeling, Random Variables and Probability Mass/Density Functions, Sample Statistics, descriptive statistics, notion of probability, distributions, mean, variance, covariance, Hypotheses Testing, Type 1 and Type 2 errors. Testing for parameters of a normal distribution and for percentages based on a single sample and based on two samples. Introduction to the chi-squared test. The concept of p-value. Mean-squareestimation and Kalman filtering.	
UNIT - III	**Optimization for Data Science**	**(06 Hours)**
	Optimization for Data Science, Unconstrained Multivariate Optimization Gradient (Steepest) Descent (OR) Learning Rule, Multivariate Optimization With Equality Constraints, Solving Data Analysis Problems.	
UNIT - IV	**Regression and Classification**	**(06 Hours)**
	Predictive Modeling, Linear Regression, Model Assessment, Diagnostics to Improve Linear Model Fit, Simple Linear Regression Model Building and assessment, Multiple Linear Regression, The least squares error criterion. Relation to maximum likelihood, Analysis of Variance (ANOVA), Logistic Regression, Logistic Regression Implementation in R, Classification , Classification using logistic regression, K - Nearest Neighbors,K-Means Clustering, K - means Implementation in R , Dimension Reduction Techniques.	
UNIT – V	**Data Analysis and Visualization**	**(06 Hours)**
	Pandas and Numpy, Operating on Data in Pandas, Data modeling and transforming, dealing with null values, different data types, preparing data for the model, Visualization with Matplotlib, Seaborn, Data visualization using Power BI.	
UNIT - VI	**Machine Learning**	
	Introduction to Supervised and Unsupervised Learning, Clustering, Decision Trees, Random Forest, Time Series Forecasting: Introduction to Time Series, Correlation, Forecasting, Autoregressive models; Model Validation, Handling Unstructured Data, Neural networks, Support vector machine.	**(06 Hours)**
Text Books:		

1. Practical Statistics for Data Scientists by Peter Bruce, Andrew Bruce, O′Reilly Publication.
2. Introduction to Machine Learning with Python: A Guide for Data Scientists by Andreas C. Mueller, Sarah Guido, O′Reilly Publication.
Reference Books:
1. Mohammed J.Zaki , Wagner Meira, "Data Mining and Machine Learning: Fundamental Concepts and Algorithms", Jr,1st Edition. Cambridge University Press
2. Trevor Hastie Robert Tibshirani, " The Elements of Statistical Learning: Data Mining, Inference, and Prediction", Second Edition Springer Series in Statistics
3. Garrett Grolemund and Hadley Wickham, " R for Data Science", O'Reilly Pub.
Project Based Learning:
1. Detecting Fake News with Python Dataset/Package: news.csv
2. Real-time Lane Line Detection in Python
3. Sentiment Analysis Project in Rwith Dataset/Package: janeaustenR
4. Build an application to detect colors with Beginner Data Science Project – Color Detection with OpenCV
5. Build a chatbot using Python– Chatbot with NLTK &Keras
6. Design Gender and Age Detection with Data Sciencewith OpenCV
7. Design &buildMovie Recommendation System Project in R
8. Build an application for Customer Segmentation with Machine Learning(K-means Clustering) using R
9. Create a Spotify Music Analysis visualization using Python pandas
10. Create a Crypto currency Analysis visualization using Python pandas.
11. Build a Song recommendation model using Machine Learning.
12. Build a Book recommendation model using Machine Learning.
13. Uber Dataset Time Series Analysis / Uber Data Analysis in R
14. Implement an Email automation system using SQL & Python
15. Practically implement the Deep Learning Project with Source Code Handwritten Digit Recognition with CNN

Students in a group of 3 to 4 shall complete any one project from the above list.

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B. Tech. (Electronics & Communication Engineering) Sem IV **VOCATIONAL COURSE-II** **DOMESTIC APPLIANCES AND MAINTENANCE**		
TEACHINGSCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: --	End Semester Examination(UE): --	
Practical: 02	Internal Assessment(IA): --	
Tutorial: --	TW:25 Marks & Oral :25 Marks	Credits: 01
	Total: 50 Marks	Total Credits: 01

Course Pre-requisites:	
The Students should have knowledge of	
1	Basic Electronics

Course Objectives:	
1	To identify and rectify the faults in domestic appliances like Washing machine, Microwave oven, Mixer, Grinder and Electric kettle.

Course Outcomes: After learning this course students will be able to	
1	Identify and test passive and active electronics components & study of Multimeter
2	Troubleshoot the faults in power supply circuits.
3	Identify and test various mechanical and electrical modules of the washing machine.
4	Identify electronic parts/components/modules of the Microwave oven.
5	Identify and rectify the faults in mixer and grinder.
6	Identify and rectify the faults in electric kettle.

UNIT – I	**Basic Electronic components & Multi meter**	
	Different types of resistors, capacitors and inductors, Measurement of resistor using Color code, Measurement using LCR meter. Identify the power rating of components, Dismantle and identify the different parts of a relay, basics of Transformer, Multimeter.	
UNIT – II	**Power supply**	
	Testing of active components, Practice soldering and de-soldering techniques Assemble and test– half wave, full wave & bridge rectifier circuits with and without filter, different types of fixed positive and negative regulator ICs(78/79 series), Construct a fixed voltage regulator using 78xx/79xx series ICs, Variable voltage regulator using LM 723.	

UNIT - III	**Washing Machine**	
	Installation of front load washing machine Installation of top load washing machine, Identify the internal and external parts of semi-auto washing machine, Identify the internal and external parts of fully automatic washing machine, Operate semi–automatic washing machine, Operate fully–automatic washing machine, Rectify the fault leading to not working of control panel switches. Rectify the fault leading to not working of pulsator / agitator, Rectify the fault leading to spin drier not working, Rectify the fault leading to one side, rotation of motor. Rectify the fault leading to water inlet.	
UNIT - IV	**Microwave oven**	
	Internal and external parts of microwave oven. Identify the different touch pad controls their functions, Testing of high voltage diode. Identify the HV capacitor and discharge it. Rectify the fault leading to fuse blows off when cooking is initiated, Rectify the fault leading to not responding of touch switches(front panel). Rectify the fault leading to dead set. Rectify the fault leading to long cooking time. Precautions – importance of interlocking switch in performing maintenance.	
UNIT -V	**Mixer and Grinder**	
	Dismantle and identification of various parts, wiring, tracing of various controls, Electronic circuits in various types of Mixers/grinders, faults in various types of Mixers/grinders & rectification.	
UNIT - VI	**Electric Kettle**	
	Identify various components of Electric kettle, controls and trace the circuit and rectify the simulated faults	

List of Practicals:

Practical based on maintenance of appliances should be conducted

Text Books:

1. Shashi Bhushan Sinha, "Handbook of Repair and Maintenance of Domestic Electronics Appliances",January 2016, BPB Publications.

Reference Books:

1. Michael Jay Geier, "How to Diagnose and Fix Everything Electronic", Second Edition, Mc Graw Hill education.

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B. Tech. (Electronics & Communication Engineering) Sem IV **JAVA PROGRAMMING**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: --	End Semester Examination(UE): --	
Practical: 02	Internal Assessment(IA): --	
Tutorial: --	Oral: 25 Marks	Credits: 01
	Total: 25 Marks	Total Credits: 01

Course Pre-requisites:	
The Students should have knowledge of	
1	Fundamentals of computing

Course Objectives:	
1	To introduce object oriented programming concepts.
2	To develop programming ability by learning advanced coding techniques.

Course Outcomes: After learning this course students will be able to	
1	Demonstrate basic knowledge of object oriented programming concepts.
2	Write simple programs in Java.
3	Get the knowledge of interfaces, packages and different file handing operations.
4	Familiarize the concept of exception handling.
5	Conceptualize the technique of multithreading programming.
6	Apply Java for HTML and Applet applications.

Term Work:

The term work shall consist of record of minimum eight experiments.

1. Write a Java Program to demonstrate the use of OOP features.
2. Write a Java Program to display pattern (Triangle, Pyramid) using different loops.
3. Write a Java program to differentiate between method overloading and method overriding.
4. Implementation of different string functions by using switch case.
5. Write a Java program to understand the use of String buffer class.
6. Write a Java Program implement multiple inheritances by using Interface.
7. Write a Java program to implement the concept of package.
8. Write a Java program to implement concept of Exception Handling.
9. Write a Java Program to perform different file operations.

10. Write a program to implement multithreading.
11. Write a program to implement Frame and different graphics objects.
12. Write a program to implement Java Applet.
Text Books:
1. E Balagurusamy, " Programming with Java: A Primer, 3E", Tata McGraw Hill Publishing Company.
2. Herbert Schildt , "Java Complete Reference" , McGraw Hill Publishing Company
3. Deitel and Deitel , "Java: How to Program" , Deitel pub.
Reference Books:
1. Ivan Bayross, "Web Enabled Commercial Applications Development Using HTML, DHTML, JavaScript, Perl – CGI", BPB Publication.

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B. Tech. (Electronics & Communication Engineering) Sem IV **LINUX PROGRAMMING**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: --	End Semester Examination(UE): --	
Practical: 02	Internal Assessment(IA): --	
Tutorial: --	TW:25 Marks	Credits:01
	Total: 25 Marks	Total Credits: 01

Course Pre-requisites:	
The Students should have knowledge of	
1	Computational C.

Course Objectives:	
1	Make a Shell script executable. To demonstrate the use of constraints and relational algebra operations.
2	Execute programs written in C under UNIX environment
3	To use the following Bourne Shell commands: cat, grep, ls, more, ps, chmod, finger, ftp, etc. To facilitate students in Database design
4	Learn tracing mechanisms (for debugging), user variables, Bourne Shell variables, read-only variables, positional parameters, reading input to a Bourne Shell script, command substitution, comments..

Course Outcomes: After learning this course students will be able to	
1	To demonstrate the basic knowledge of Linux commands and file handling utilities by using Linux shell environment
2	To evaluate the concept of shell scripting programs by using an AWK and SED commands.
3	To create the directory, how to change and remove the directory.
4	To analyze the process of how the parent and child relationships
5	To understand the concept of client-server communication by using sockets.
6	Discuss shell programming in Linux operating system

Experiment List

1.
a) Study of Unix/Linux general purpose utility command listman, who, cat, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history, chmod, chown, finger, pwd, cal, logout,shutdown.
b) Study of vieditor.
c) Study of Bash shell, Bourne shell and C shell in Unix/Linux operatingsystem.
d) Study of Unix/Linux file system (treestructure).
e) Study of .bashrc, /etc/bashrc and Environment variables.

2. Write a C program that makes a copy of a file using standard I/O, and system calls

3. Write a C program to emulate the UNIX ls –l command.

4. Write a C program that illustrates how to execute two commands concurrently with a command pipe.
5. Ex: - ls –l |sort

6. Write a C program that illustrates two processes communicating using shared memory
7. Write C program to create a thread using pthreads library and let it run its function.
8. Write a C program to illustrate concurrent execution of threads using pthreads library.
9. Write a shell script that accept a file name starting and ending line numbers as arguments and display all the lines between given line no: Write a shell script that delete all lines containing a specified word
10. Write a shell script that displays a list of all the files in the current directory ; Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or a directory and reports accordingly. whenever the argument is a file or directory.
11. Write a java script to find the number of characters, words and lines in a file? linked list respectively. Write a C Program that makes a copy of a file using standard I/O and system calls? Implement in C the following Unix commands using system calls A) cat B)mv
12. Write a C program that illustrates how an orphan is created; Write a program that illustrates how to execute two commands concurrently with a command pipe.? Write C programs that illustrate communication between two unrelated processes using named pipe.
13. Write a client and server programs (using c)for interaction between server and client processes using Internet Domain sockets? Write a program to implement the shared memory. Write a client and server programs (using c)for interaction between server and client processes using Internet Domain sockets? . Write a C program that illustrates two processes.
Text Books:
1. Cristopher Negus, "Red Hat Linux Bibl"e, Wiley Dreamtech India 2005 edition.
2. Yeswant Kanethkar, "UNIX Shell Programming", First edition, BPB.
Reference Books:
1. Robert Love," Linux System Programming", O'Reilly, SPD.
2. W.R.Stevens," Advanced Programming in the Unix environment", 2nd Edition, Pearson Education.
3. W.R.Stevens , "Unix Network Programming",PHI.
4. Graham Glass, King Ables, "Unix for programmers and users", 3rd Edition, Pearson Education.

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

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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.
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
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.
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.

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

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
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.

Bharati Vidyapeeth
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College of Engineering, Pune

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	**Signaling 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:

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.

BharatiVidyapeeth
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College of Engineering, Pune

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	Analyze analog/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.

Bharati Vidyapeeth
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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
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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.

Bharati Vidyapeeth
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College of Engineering, Pune

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, Behavioral 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 behavior 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.

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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	Analyze 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 andnon-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 the wireless 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

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Faculty of Engineering and Technology
Programme: B. Tech. (Electronics & Communication) –CBCS 2021 Course

B. Tech. (Electronics & Communication) Sem VII

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
41		FTTH-Optical communication	3	2	0	60	40	25	25	0	150	3	1	0	4
42		Radar & Satellite Communication	4	0	1	60	40	0	0	0	100	4	0	1	5
43		AI and Data Mining*	4	2	0	60	40	50	0	0	150	4	1	0	5
44		Elective- I	3	2	0	60	40	00	50	0	150	3	1	0	4
45		Project Stage-I	0	2	0	0	0	50	50	0	100	0	3	0	3
46		Android App Development	0	2	0	0	0	50	0	0	50	0	1	0	1
47		Internship#	0	0	0	0	0	25	25	0	50	0	3	0	3
	Total		**14**	**10**	**1**	**240**	**160**	**200**	**150**	**0**	**750**	**14**	**10**	**1**	**25**

*Industry Taught Course- – V
Period- 60 days

Sr. No.	**Name of the Elective-I**
1	Augmented Reality & Virtual Reality
2	Data Centre Engineering
3	RF & Microwave Communication
4	Cyber Security & Forensics
5	Wireless Robots

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B. Tech. Electronics and Communication Engineering Sem VII **FTTH-OPTICAL COMMUNICATION**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/week	Examination (UE):60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	TW: 25 Marks, OR:25 Marks	Credits:01
	Total:150 Marks	**Total Credits:04**

Course Pre-requisites:	
The students should have knowledge of	
	Analog Circuits & Applications, Digital Communication, EM Waves & Propagation, Integrated Circuits& Amplifier Design.

Course Objectives:	
1	To understand the basic elements of optical fiber Communication & FTTH.
2	To enrich the knowledge about optical communication systems and networks
3	To learn about the various optical sources, detectors and transmission techniques,
4	To explore various idea about optical fiber measurements and various coupling techniques.
5.	To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM.

Course Outcomes: After learning this course students will be able to	
1	Identify and classify the structures of FTTH & Optical fiber.
2	Compare different optical sources and detectors and their principle.
3	Analyze the performance of various digital and analog fiber-optic access solutions.
4	Analyze various coupling losses and Design considerations of FTTH.
5	Compare the factors affecting the performance of different optical fibre communication systems.
6	Comprehend design, construction and testing of optical fiber communication system**.**

UNIT – I	**Introduction to FTTH-Optical Communication.**	**(06 Hrs)**
	Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication. FTTH, FTTH Components, optical fiber waveguides, Ray theory, Types of fiber, cutoff wavelength, mode filed diameter. Optical Fibers: fiber materials, photonic crystal, fiber optic cables specialty fibers.	
UNIT – II	**Optical Transmitter and Receiver**	**(06 Hrs)**
	Optical Transmitter Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Response time, double hetero junction structure, Photo diodes,	

	comparison of photo detectors**.** drive circuits for digital and analog transmission. **Optical Receivers** Photodetector types and performance characteristics, PiN photodiodes, Direct detection receivers, Coherent receivers, Advanced measurement techniques for optical fiber links.	
UNIT– III	**Analog and Digital Links**	**(06 Hrs)**
	Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, RF over fiber, key link parameters, Radio over fiber links, microwave photonics. Digital links – Introduction, point–to–point links, System considerations, link power budget, resistive budget, short wave length band, transmission distance for single mode fibers, Power penalties, nodal noise and chirping.	
UNIT– IV	**FTTH Technology and its network design**	**(06 Hrs)**
	FTTH technology & architectures, Passive Optical Network and types of splitting, GPON, EPON, Planning and Design issues, Link design and related considerations. ONT and its configurations, optical loss budget for a FTTx network, Testing FTTx Networks.	
UNIT – V	**Optical Components and Optical Networks:**	**(06 Hrs)**
	WDM concepts, overview of WDM operation principles, WDM standards, Types of Optical Amplifier and its applications, Amplifier Noise, Optical SNR, Raman Amplifier, Fiber optic splices, connectors & couplers & Coupling losses. Optical couplers, Isolators and Circulators. Network Concepts, network Topology, SONET/SDH.	
UNIT– VI	**Optical Fiber measurements and Applications**	**(06 Hrs)**
	Test Equipment, OTDR, Set ups for Measurement of Attenuation, Dispersion, NA and EYE pattern. Application in military, Industrial applications and applications in local area network.	

List of Practicals: The term work shall consist of record of minimum eight experiments
1. Optical Source Characteristics: Aim: To plot the electrical and optical characteristics of
different light sources.
2. Numerical Aperture of fiber: To estimate the numerical aperture of given fiber.
3. To measure the attenuation of given MMSI and SMSI fibers.
4. To measure the attenuation variation in length of optical cable.
5. To measure the attenuation due to bending of optical fiber.
4. Optical detector characteristics: To plot the frequency response of detectors with different
values of load resistor.
5. Fiber Bandwidth/Data rate: To estimate the bandwidth of given fiber.
6. Transmission of analog & Digital signal using a simple fiber optic link.
7. To test & study fiber optics connector & splicing of optical fibers
8. To perform Frequency modulation using optical fiber.

9. To perform PWM using optical fiber.
10. To find the optical power using “Optical Power Meter”.
11. To find the optical response using OTDR.
12. Determination of input, output and transfer characteristics of Optocoupler.

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:
1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

Text Books:

1. Gerd Keiser, “Optical Fiber Communications”, Tata McGraw Hill, Fourth Edition.
2. John M. Senior, “Optical Fiber Communications-Principles and Practice”, Prentice Hall of India, second Edition.
3. “Fiber to the Home: The New Empowerment”, Wiley Survival Guides in Engineering and Science Book

Reference Books:

1. Jasprit Singh, “Opto Electronics – As Introduction to materials and devices”, Tata McGraw-Hill International Edition.
2. Djafar K.Mynbaev and Lowell L.Scheiner, “Fiber optic communication Technology”, Pearson Education.
3. J.H. Franz and V. K. Jain, “Optical Communication - Components and systems”, Narosa Publishing house.
4. Bhattacharya, “Semiconductor Opto Electronic Devices”, PHI Learning, New Delhi.
5. Jim Hayes, “Fiber Optic Association Fiber to the Home-Handbook”

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 VII **RADAR AND SATELLITE COMMUNICATION**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04 Hrs/week	Examination (UE):60 Marks	Credits: 04
	Internal Assessment (IA): 40 Marks	
Tutorial: 01 Hr/week		Credit:01
	Total:100 Marks	**Total Credits:05**

Course Pre-requisites:

Basic Communication Engineering

Course Objectives:

1	To give the knowledge about satellite communication.
2	To introduce the concept radar communication.
3	To make the student aware of the function of satellite transmitter and receiver.
4	To impart the mathematical concepts & types of radar.

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

CO1	Learn the basics of satellite communication.
CO2	Comprehend subsystem for satellite Communication.
CO3	Describe the design of satellite link.
CO4	Categories the satellite navigations and GPS.
CO5	Interpret the working of the radar
CO6	Analyze the performance using the Radar Equations.

UNIT– I	**Introduction of Satellite Communication:**	**(08 Hrs)**
	A brief History of satellite communication, satellite frequency bands, satellite system, Application of satellite, orbital period and velocity, coverage and slant range, orbital perturbations, placement of satellite in geostationary orbit	
UNIT–II	**Satellite subsystems**:	**(08 Hrs)**
	Altitude and orbital control system, Telemetry Tracking and command system, Altitude control subsystem, power system, communication subsystem, Satellite antenna equipment.	
UNIT-III	**Satellite Link**:	**(08 Hrs)**
	Basic transmission theory, system noise temperature and G/T ratio, Basic link analysis, interference analysis, Design of satellite link for specified C/N Ratio, Link budget.	
UNIT–IV	**Earth Station Technology, Satellite Navigation and GPS:** Satellite transmitter, satellite receivers, satellite antenna, tracking system,	**(08 Hrs)**

	Radio and satellite navigations, GPS, position location principle, GPS receiver.	
UNIT–V	**Introduction of Radar**	**(08 Hrs)**
	Nature of RADAR, Maximum unambiguous range, Radar waveforms, simple form of radar equations, Radar block diagram, Radar frequencies and applications	
UNIT–VI	**Radar Equations and Types**:	**(08 Hrs)**
	Predications of radar performance, Minimum detectable signal, Receiver noise and SNR, Integration of Radar pulses, Radar cross section of target, transmitter power, system losses, Doppler effect	

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:

1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

Text Books:

1. Merrill I. skolnik "Introduction to radar system" third edition, Tata MGgraw Hill.
2. Dennis Roddy, "Satellite Communicatons" McGraw-Hill- 4th edition.
3. Giriraj Kumar Prajapati "Basic of RADAR and Its Applications in Wireless Communication" Scholar's Press.
4. Timothy Pratt , "Satellite communication", Wiley publication.
5. Dharma Raj Cheruku "Satellite Communication" I K International Publication House Pvt. Ltd.

Reference Books:

1. Bruce R. Elbert, "Introduction to satellite communication" Artech House.
2. Michal "Satellite Communication Engineering" , CRC press.

Project Based Learning:

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

Bharati Vidyapeeth
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B. Tech. Electronics & Communication Engineering SemVII **ITC-V:ARTIFICIAL INTELLIGENCE AND DATA MINING**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04 Hrs/week	Examination (UE): 60 Marks	Credits: 04
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	TW- 50 marks	Credit: 01
	Total:150 Marks	**Total Credits:05**

Course Pre-requisites:	
The students should have knowledge of	
1	Essentials of data science
2	Fuzzy Logic, Neural Networks, and Genetic Algorithms

Course Objectives:	
1	Introduce a relatively new computing paradigm for creating intelligent machines
2	Utilize data mining as a cutting-edge business intelligence tool.
3	Develop and apply critical thinking, problem solving and decision-making skills.
4	Describe and demonstrate basic data mining algorithms, methods, tools

Course Outcomes: After learning this course students will be able to	
CO1	Evaluate various problem-solving agents in AI
CO2	Design and analyze search techniques and game playing techniques
CO3	Implement the various expert systems in AI
CO4	Apply the basic concept of data mining and its functionality
CO5	Apply the concept of association rules, different techniques and implementation details
CO6	Design and implement the various the ML based algorithm.

UNIT – I	**Introduction to Artificial Intelligence**	**(05 Hrs)**
	AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.	
UNIT – II	**Search Techniques and Game Playing**	**(07 Hrs)**
	Defining The Problems as a state space search, Production Systems, Production Characteristics, Production System Characteristics, Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis. Game Playing-Adversial search, Games, mini-max algorithm, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.	

UNIT – III	**Expert System**	**(8 Hrs)**
	Introduction, Structure of expert systems, the human element in expert systems, problem areas addressed by expert systems, expert systems success factors, types of expert systems, Internet interacts web, knowledge engineering, methods, machine learning, intelligent agents, selecting an appropriate knowledge acquisition method, societal impacts reasoning in artificial intelligence, inference with rules, with frames: model based reasoning, case based reasoning, explanation & meta knowledge inference with uncertainty representing uncertainty	
UNIT – IV	**Introduction to Data mining**	**(08 Hrs)**
	Overview, Motivation (for Data Mining), Data Mining-Definition & Functionalities, Data Processing, Form of Data Preprocess-ing, Data Cleaning: Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer and Human inspection), Inconsistent Data, Data Integration and Transformation. Data Reduction: -Data Cube Aggregation, Data 35 Compression, Numerosity Reduction, Clustering, Discretization and Concept hierarchy generation.	
UNIT – V	**Data mining various aspects**	**(10 Hrs)**
	Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases. Measuring Central Tendency, Measuring Dispersion of Data, Graph Displays of Basic Statistical class Description, Mining Association Rules in Large Databases, mining Single-Dimensional Boolean Association rules from Transactional Databases– Apriori Algorithm, Mining, Multilevel Association rules from Transaction Databases and Mining Multi-Dimensional Association rules from Relational Databases.	
UNIT – VI	**Classification and Predictions**	**(10 Hrs)**
	What is Classification & Prediction, Issues regarding Classification and prediction, Decision tree, Bayesian Classification, Classification by Back propagation, Multilayer feed-forward Neural Network, Back propagation Algorithm, Classification methods K-nearest neighbor classifiers, Genetic Algorithm. Cluster Analysis: Data types in cluster analysis, Clustering methods, Partitioning methods. Hierarchical Clustering-CURE and Chameleon, Density Based Methods-DBSCAN, OPTICS, Grid Based Methods- STING, CLIQUE, Model Based Method – Statistical Approach, Neural Network approach, Outlier Analysis.	

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:

1. Internal Assessment (IA)(Unit Test, PBL)

2. End-term Examination (UE)

List of Experiments: The term work shall consist of record of minimum eight experiments

1. Write a program to implement Tic-Tac-Toe game problem
2. Write a program to implement BFS (for 8 puzzle problem or Water Jug problem or any AI search problem) .
3. Write a program to implement DFS (for 8 puzzle problem or Water Jug problem or any AI search problem)
4. Write a program to implement Single Player Game (Using Heuristic Function)
5. Write a program to implement Back propagation
6. Write a program to implement K-nearest neighbor classifiers
7. Write a program to implement Hierarchical Clustering
8. Write a program to implement Density Based Methods- DBSCAN
9. Write a program to implement Grid Based Method- STING
10. Write a program to implement Grid Based Method- CLIQUE
11. Write a program to implement Outlier Analysis
12. Write a program to implement Neural Network based approach

Text Books:

1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education
2. David Poole, Alan Mackworth, Randy Goebel" , Computational Intelligence: a logical approach", Oxford University Press.
3. H.Dunham,"Data Mining: Introductory and Advanced Topics" , Pearson Education.
4. J. Han and M. Kamber Morgan Kaufmann , "Data Mining Concepts and Techniques", 2006, ISBN 1-55860- 901-6
5. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining", Pearson Education (Addison Wesley), 0-321-32136-

Reference Books:

1. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education.
2. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.
3. Elaine Rich, Kevin Knight "Artificial Intelligence" -2nd Edition, Tata Mcgraw-Hill.
4. Jiawei Han, Micheline Kamber," Data Mining Concepts & Techniques" Elsevier.
5. Anand Rajaram, Jure Leskovec and Jeff Ullman, "Mining Massive data sets" , Cambridge University Press.

Project Based Learning:

Students are expected prepare report on any one topic related to this subject, write its definition, applications and illustrate with few examples. Also, write pseudo code/proof for it, wherever applicable. Use python for implementation

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B. Tech. Electronics & Communication Engineering Sem VII **ELECTIVE-I: AUGMENTED REALITY & VIRTUAL REALITY**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/week	Examination (UE): 60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	Oral :50 Marks	Credits:01
	Total:150 Marks	**Total Credits:04**

Course Pre-requisites:	
The students should have knowledge of	
	Computer Graphics
Course Objectives:	
1	To introduce AR VR technology, its principles and Human-Computer interaction techniques related to VR/AR.
2	To familiarize the student with various types of hardware and software in Virtual Reality systems.
3	To introduce Virtual/ reality and Augmented Reality to variety of applications.
Course Outcomes: After learning this course, students will be able to	
CO1	Describe how Virtual reality systems work and list the applications of VR.
CO2	Identify various geometric modelling techniques.
CO3	Comprehend the hardware and sensors used in Virtual Environment.
CO4	Understand the concepts of Augmented Reality and related technologies.
CO5	Apply various types of hardware and software in virtual reality systems.
CO6	Apply the acquired knowledge for analysis Virtual/Augmented Reality Applications

UNIT – I	**Introduction to Virtual Reality (VR)**	**(05 Hrs)**
	Virtual Reality and Virtual Environment, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR.	
UNIT–II	**Computer Graphics and Geometric Modelling**	**(08 Hrs)**
	The virtual world space, positioning the virtual observer, human vision, stereo perspective projection, colour theory, 2D to 3D conversion, 3D space curves, 3D boundary representation, Simple 3D modelling, Illumination models, Reflection models, Geometrical Transformations: Introduction, Frames of reference, Modelling transformations.	
UNIT-III	**Virtual Environment**	**(06 Hrs)**
	Input/output devices: Input (Tracker, Sensor, Digital gloves, movement capture, video-based Input, 3D Menus & 3D Scanner, etc.), Output	

	(Visual/Auditory/Haptic Devices) Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems, Animating the Virtual Environment	
UNIT–IV	**Introduction to Augmented Reality (AR)**	**(05 Hrs)**
	History of augmented reality, Technology and Features of Augmented Reality, AR Vs VR, Challenges with AR, AR systems and functionality, Augmented Reality Methods, Visualization Techniques for Augmented Reality, Enhancing interactivity in AR Environments.	
UNIT – V	**Development Tools and Frameworks**	**(06 Hrs)**
	Human factors: Introduction, the eye, the ear, the somatic senses Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML.	
UNIT–VI	**AR / VR Applications**	**(06 Hrs)**
	Applications of VR/AR in medical, manufacturing, education, entertainment, Science, game development, etc. future of VR/AR	

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:
1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

Textbooks:

1. Coiffet, P., Burdea, G. C., "Virtual Reality Technology," Wiley-IEEE Press.
2. Schmalstieg, D., Höllerer, T. "Augmented Reality: Principles & Practice," Pearson.
3. Norman, K., Kirakowski, J., "Wiley Handbook of Human Computer Interaction," Wiley-Blackwell.
4. John Vince, J., "Virtual Reality Systems", Pearson.

Reference Books:

1. Craig, A. B., "Understanding Augmented Reality, Concepts and Applications," Morgan Kaufmann.
2. Craig, A. B., Sherman, W. R., Will, J. D., "Developing Virtual Reality Applications, Foundations of Effective Design," Morgan Kaufmann.
3. Anand, R., "Augmented and Virtual Reality," Khanna Publishing House.
4. Fowler, A., "Beginning iOS AR Game Development: Developing Augmented Reality Apps with Unity and C#," Apress

List of Experiments:- The term work shall consist of record of minimum eight experiments

1. Installation of Unity and Visual Studio, setting up Unity for VR development.
2. Demonstration of the working of HTC Vive, Google Cardboard, Google daydream.
3. Develop a scene in Unity that includes a cube, plane and sphere

4. Apply transformations on the 3 game objects.
5. Add a video and audio source.
6. Develop a scene in Unity that includes a cube, plane and sphere.
7. Create a new material and texture separately for three Game objects. Change the colour, material and texture of each Game object separately in the scene.
8. Write a C# program in visual studio to change the colour and material/texture of the game objects dynamically on button click
9. Develop a scene in Unity that includes a sphere and plane. Apply Rigid body component, material and Box collider to the game Objects.
10. Write a C# program to grab and throw the sphere using VR controller.
11. Develop a simple UI (User interface) menu with images, canvas, sprites and button.
12. Write a C# program to interact with UI menu through VR trigger button such that on each successful trigger interaction displays a score on scene
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 VII **ELECTIVE-I: DATA CENTER ENGINEERING**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/week	Examination (UE): 60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	Oral :50 Marks	Credits: 01
	Total:150 Marks	**Total Credits:04**

Course Pre-requisites:	
The students should have knowledge of	
	Digital Communication, Computer Communication Networks
Course Objectives:	
1	To introduce the fundamental knowledge of data centers, architecture, software-defined networks (SDN) and virtualization technologies.
2	To familiarize the student with datacenter infrastructure, operations and management best practices.
3	To educate the student about networking in data center.
Course Outcomes: After learning this course, students will be able to	
CO1	Describe data centres , its types and priorities.
CO2	Classify the various types of data centers.
CO3	Understand the concept of network visualization
CO4	Identify the networking features in data center
CO5	Interpret the IT of data center
CO6	Justify the need of security systems in data center

UNIT – I	**Introduction to Data Center**	**(05 Hrs)**
	History of data centers & Engineering importance, evolving to modern facilities; Concepts of redundancy, availability & reliability; Data center types & sizes, Data Center Components, Data Center Key players, Tools and Techniques.	
UNIT–II	**Data Center Engineering Process & Classification**	**(08 Hrs)**

	Data Center Engineering Process: The Data Center EPS, Phased Process, Adaptive Need Conversion, Understanding Application, App Architecture, ETT, TPS, Load and Complexity Factor. **Data Center Classification:** Data Center Tiers and Classes, Data Center Grade Levels, Data Center Definitions and Options, The Infinity Paradigm Review, Standard Requirements, Designing with Limitations.	
UNIT-III	**Network Virtualization**	**(06 Hrs)**
	Network virtualization - Uses of Network virtualization in the Data Center - Network virtualization Models- Network Tunnels - Network virtualization solutions for the Data Center - Practical limits on the number of Virtual networks - Packet forwarding control protocol for Network virtualization.	
UNIT–IV	**Networking for a Data Center**	**(05 Hrs)**
	Data Center Telecommunications Cabling, Virtualization, Cloud, SDN, and Software-defined data center (SDDC) in Data Centers Data Center Layer 2 Interconnect - Overview of high availability clusters - Data center interconnect.	
UNIT – V	**Information Technology**	**(07 Hrs)**
	Load Balancing Types & Methods, 6-Pack Architecture, Firewalls and Intrusion Detection, Virtual Private Networks, VPN Protocols: IPsec, L2TP, PPTP, SSL, Virtualization Types & Methods, Cloud Infrastructure, OpenStack.	
UNIT–VI	**Data Center Safety & Security Systems**	**(05 Hrs)**
	Safety Principle , CCTV, DVR, NVR, etc., Access Control Systems, Mantraps & Airlocks, Tracking & Tracing, IT Security,	

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:
1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

Text Books:

1. Samee U Khan, Albert Y. Zomaya, "Handbook of data centers", Springer.
2. Hwaiyu Geng P.E, "Data Center Handbook: Plan, Design, Build, and Operations of a Smart Data Center", Wiley Publication.

Reference Books:

1. Mauricio Arregoces, : Data Center Fundamentals".
2. Lui zhang, Le chen, "Cloud Data Center Network Architectures and Technologies".

List of Assignments

Students are expected to submit eight assignments based on the above syllabus.

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 VII **ELECTIVE-I : RF & MICROWAVE COMMUNICATION**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/week	Examination (UE): 60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	Oral :50 Marks	Credit:1
	Total: 150 Marks	**Total Credits: 04**

Course Pre-requisites:	
The students should have knowledge of	
	Maxwells Equations, EM waves propagation, Transmission lines, Waveguides.
Course Objectives:	
1	To make the student learn RF circuit fundamentals for designing various circuit building blocks in a typical RF transceiver.
2	To lay the foundation for microwave engineering.
3	To introduce the applications of microwave engineering.
4	To make the student learn the microwave network analysis.
Course Outcomes: After learning this course, students will be able to	
CO1	Perceive the importance of RF amplifier & RF Oscillator designs
CO2	Design amplifier using appropriate components
CO3	Understand the working principles of all the microwave tubes
CO4	Identify the various microwave components.
CO5	Choose a suitable microwave tube and solid state device for a particular application.
CO6	Illustrate the microwave bench set up and conduct measurements of different parameters.

UNIT – I	**Introduction to RF**	**(06 Hrs)**
	Importance of RF Design, RF Behavior of Passive Components: High Frequency Resistors, High-Frequency Capacitors, High-Frequency Inductors. Chip Components and Circuit Board Considerations: Chip Resistors, Chip Capacitors, Surface-Mounted Inductors. RF Filter Design, Basic Resonator, Filter Realizations.	
UNIT–II	**RF Transistor Amplifier Design**	**(06 Hrs)**
	Characteristics of Amplifiers, Amplifier Power Relations, Constant Gain: Unilateral Design, Unilateral Figure of Merit, Bilateral Design, Operating and Available Power Gain Circles, Constant VSWR Circles, broadband, High Power and Multistage Amplifiers. RF Oscillators and Mixers, Oscillator Model, Feedback Oscillator Design, Quartz Oscillators. High Frequency Oscillator Configuration, Basic Characteristics of Mixers, Frequency Domain Considerations.	
UNIT-III	**Introduction to Microwaves engineering**	**(06 Hrs)**
	History of Microwaves, Microwave Frequency bands. Applications of Microwave. General solution for TEM, TE and TM waves, Parallel plate waveguide, and rectangular waveguide. Wave guide parameters. Introduction to coaxial line, rectangular waveguide cavity resonators, Circular waveguide cavity resonators	
UNIT–IV	**Microwave Components:**	**(06 Hrs)**
	Multi port junctions: Construction and operation of E-plane, H-plane, Magic Tee and Directional couplers. Ferrites components, Faraday rotation, Construction and operation of Gyrator, Isolator and Circulator, Impedance and Admittance matrices, Scattering Matrix: -Significance, formulation and properties. S-Matrix calculations for-2 port network junction, E plane, H-plane and E-H (Magic Tee) Tees, Directional coupler, Isolator and Circulator.	
UNIT – V	**Microwave Tubes:**	**(06 Hrs)**
	Limitations of conventional tubes, O and M type classification of microwave tube cavity, velocity modulation. O type tubes, Two cavity Klystron, Reflex Klystron: Construction and principle of operation, velocity modulation and bunching process, M-type tubes Magnetron: 8 cavity cylindrical travelling wave magnetron, hull cut-off condition, Slow	

	wave devices, Helix TWT: Construction and principle of operation, Applications.	
UNIT–VI	**Microwave Solid State Devices:**	**(06 Hrs)**
	Microwave bipolar transistor, FET, MESFET, Varactor Diode, PIN Diode, Shottky, Tunnel Diode, TEDs, Gunn Diodes, IMPATT diode and TRAPATT diode. Microwave Measurements: Measurement devices: Slotted line, Tunable detector, VSWR meter, Power Meter, Measurements: S-parameter, frequency, Power, attenuation, Phase shift, VSWR impedance, Q of cavity resonator measurement.	

Content Delivery Methods: Chalk & talk, Collaborative Learning,
Assessment Methods:
1. Continuous Assessment (Unit Test, PBL)
2. End-term Examination (UE)

Text Books:

1. M. Kulkarni, “Microwave and Radar engineering”, 3rd edition, Umesh Publications
2. M L Sisodia& GS Raghuvamshi, “Microwave Circuits and Passive Devices”Wiley.
3. M L Sisodia& G S Raghuvanshi, “Basic Microwave Techniques and Laboratory Manual”, New Age International (P) Limited, Publishers.

Reference Books:

1. RF Circuit Design Theory and Application, Reinhold Ludwig and Pavel Bretchko, Ed. 2004, Pearson Education Kaufmann.
2. Samuel Y. Liao, “Microwave Devices and Circuits”, 3rd edition, Pearson
3. David M. Pozar, “Microwave Engineering", Fourth edition, Wiley.

List of Experiments:

1. Frequency & Wavelength measurement of Klystron tube.
2. Study of directional Couplers, Isolators,
3. I-V characteristics of Gunn diode.
4. Microwave Frequency, S-parameter, power Measurement
5. Study of E-plane, H-plane tees.
6. Design of RF Oscillators & Mixer

7. Design of RF amplifier.
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 VII **ELECTIVE-I: CYBER SECURITY AND FORENSICS**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/week	End Semester Examination (ESE): 60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	OR: 50 Marks	Credit: 01
	Total:150 Marks	**Total Credits: 04**

Course Pre-requisites:	
The students should have knowledge of	
	Basic understanding of IT

Course Objectives:	
1	To introduce the foundations of Cyber security and threat landscape.
2	Familiarize the student with technical knowledge and abilities necessary for protecting and defending against cyber and computer crimes and vulnerabilities.
3	Develop skills to plan, execute, and monitor cyber security mechanisms of social media.
4	To expose students to e-commerce, digital payments and computer forensics
5	To create awareness among students effectively use Computer Forensics and data retrieval with responsibility.

Course Outcomes: After learning this course, students will be able to	
CO1	Understand the cyber security landscape.
CO2	Develop a deeper understanding and familiarity with various types of cyber and computer crimes and vulnerabilities.
CO3	Distinguish and review of the security aspects of social media platforms.
CO4	Analyze and evaluate the digital payment system security and remedial measures against digital payment frauds.
CO5	Define and cite appropriate instances for the application of computer forensics.
CO6	Identify the essential tools, and methodology of Computer Forensics and data retrieval.

UNIT – I	**Introduction to Cyber security**	**(06 Hrs)**
	Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.	

UNIT– II	**Cyber and computer crime**	**(06 Hrs)**
	Introduction to Digital Forensics, Definition and types of cybercrimes, electronic evidence and handling, electronic media, collection, searching and storage of electronic media, Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, financial frauds, social engineering attacks, malware and ransomware attacks, case study	
UNIT –III	**Social Media Overview and Security**	**(06 Hrs)**
	Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Case studies.	
UNIT –IV	**E - Commerce and Digital Payments**	**(06 Hrs)**
	Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), Aadhar enabled payments.	
UNIT – V	**Computer Forensics**	**(06 Hrs)**
	Definition and Cardinal Rules, Data Acquisition and Authentication Process, Windows Systems - FAT32 and NTFS, UNIX file Systems, mac file systems, computer artifacts, Internet Artifacts, OS Artifacts and their forensic applications.	
UNIT –VI	**Forensic tools and data retrieval**	**(06 Hrs)**
	Introduction to Forensic Tools, Usage of Slack space, tools for Disk Imaging, Data Recovery, Vulnerability Assessment Tools, Encase and FTK tools, Anti Forensics and probable counters, retrieving information, retrieving deleted data: desktops, laptops and mobiles, retrieving data from slack space, renamed file, ghosting, compressed files.	

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:

1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

List of Tutorials/Experiments: The students should perform a minimum of eight experiments

1. Checklist for reporting cyber crime at Cyber crime Police Station.
2. Reporting phishing emails.
3. Demonstration of email phishing attack and preventive measures.
4. Basic checklist, privacy and security settings for popular Social media platforms.
5. Reporting and redressal mechanism for violations and misuse of Social media platforms.
6. Setting and configuring two factor authentication in the Mobile phone.
7. Setting, configuring and managing three password policy in the computer (BIOS, Administrator and Standard User).
8. Security patch management and updates in Computer and Mobiles.

9. Retrieving information from Mobile phone.
10. Installation and configuration of FAT and NTFS file system
11. Artifacts identification
Text Books/ Reference Books:
1. Sumit Belapure and Nina Godbole , "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives" , Wiley India Pvt. Ltd.
2. Dorothy F. Denning, "Information Warfare and Security", Addison Wesley.
3. Henry A. Oliver, "Security in the Digital Age: Social Media Security Threats and Vulnerabilities , Create Space Independent Publishing Platform.
4. Natraj Venkataramanan and Ashwin Shriram, "Data Privacy Principles and Practice" , CRC Press.
5. W. KragBrothy, "Information Security Governance, Guidance for Information Security Managers" 1st Edition, Wiley Publication.
6. C. Altheide & H. Carvey, "Digital Forensics with Open-Source Tools",Syngress, 2011.
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 VII
ELECTIVE-I: WIRELESS ROBOTS

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/week	Examination (UE): 60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	Oral-50 Marks	Credit: 01
	Total:150 Marks	**Total Credits:04**

Course Pre-requisites:

Basic Communication Engineering, Control system engineering, Wireless communication mechanical and automobile Engineering

Course Objectives:

1	To introduce the concept of wireless locomotion
2	To familiarize the student with wireless robot kinematics and dynamics
3	To expose the localization and mapping techniques
4	To acquaint the student about motion control in wireless robots.

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

CO1	Describe working principle of advanced wireless robot.
CO2	Perceive the concept of kinematics & dynamics of wireless robots
CO3	Understand the localization & mapping parameters.
CO4	Explain the motion control involved in wireless robots
CO5	Classify the different types of robots.
CO6	Distinguish the performance of various robot applications.

UNIT – I	**Introduction To Wireless Robot**: Introduction to wireless robot and wireless manipulators, Principles of locomotion and types of locomotion, Types of wireless robots, ground robots (wheeled and legged robots), Aerial robots, underwater robots, water surface robots	**(06 Hrs)**
UNIT – II	**Kinematics and Dynamics:** Kinematics of wheeled wireless robots, degree of freedom and maneuverability, generalized wheel model,different wheel configuration, holonomicand nonholonomic robots, Dynamics of wireless robot. Lagrange -Euler and Netwon-Euler metods, Computer based dynamics simulation of different wheeled wireless robots	**(06 Hrs)**
UNIT –III	**Localization And Mapping:** Magnetic and optical position sensor, gyroscope, accelometer, magnetic compass, inclinometer, tactile and proximity sensor, ultrasound rangefinder, laser scanner, infrared rangefinder, visual and motion sensing	**(06 Hrs)**

	system, localization, Map based localization, Markov localization, Kalman filter localization, Error propagation model, Probabilistic map-based localization, Autonomous map building.	
UNIT– IV	**Motion Control**: Collision free planning and sensor-based obstacle avoidance, Motion controlling methods, Kinematics control, dynamics control and cascaded control	**(06 Hrs)**
UNIT –V	**Modern Wireless Robots**: Introduction, Swarm robots, cooperative robots, wireless manipulators, autonomous wireless robots	**(06 Hrs)**
UNIT –VI	**Classification and Application of Robots:** Classification of different types of robots, control related robots, wireless behind robots, automobile related to robots, communication related to robots and different application of different robots	**(06 Hrs)**

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:

1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

Text Books

1. Kelly, **"**Mobile robotics: Mathematics, Model, Methods**" ,** Cambridge University Press, USA**.**
2. Dudek, M Jenkin**, "**Computational principles of mobile robotics", Cambridge University, USA.

Reference Books:

1. Thrun, W. Burgard, D. Fox, Probabilistic robots, MIT Press , USA.
2. Siegwart, R.Hourbaksh and Scara Muzza, "Introduction to autonomous mobile robots", MIT press, USA.

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B. Tech. Electronics & Communication Engineering Sem VII **PROJECT STAGE-I**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
	Examination (UE): NA	
Practical: 02 Hrs/week	Internal Assessment (IA): -NA	
	TW :50 Marks OR:50 Marks	Credits:03
	Total:100 Marks	**Total Credits:03**

Course Objectives:	
1	To familiarize the students with the product development cycle.
2	To impart the importance of working as a team. .
3	To introduce the student to literature survey and documentation process.
4	To encourage the students to visualize & formulate a viable solution to practical engineering problems.

Course Outcomes: After learning this course, students will be able to	
CO1	Identify various technologies and fields for projects.
CO2	Understand the process to make reports and presentation.
CO3	Apply engineering knowledge to solve industrial problems.
CO4	Analyze ethical practices and tools used in different technologies for projects.
CO5	Justify the performance on parameters such as communication skills, technical knowledge.
CO6	Develop the skills to use software/hardware related to industrial projects

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B. Tech. Electronics & Communication Engineering Sem VII **ANDROID APPLICATION DEVELOPMENT**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
	Examination (UE): NA	
Practical: 02 Hrs/week	Internal Assessment (IA): -NA	
	TW :50 Marks	Credits:01
	Total:50 Marks	**Total Credits:01**

Course Pre-requisites:	
The students should have knowledge of	
1	Java programming

Course Objectives:	
1	To create robust mobile applications and learn how to integrate them with other services.
2	To Create intuitive, reliable mobile apps using android services and components.
3	To simulate and apply seamless user interface that works with different mobile screens.

Course Outcomes: After learning this course, students will be able to	
CO1	Understand how the process of developing software.
CO2	Install and configure Android application development tools
CO3	Design and develop user Interfaces for the Android platform.
CO4	Understand the basic concept such Drag and Drop.
CO5	Apply Java programming concepts to Android application development.
CO6	Create any application on the Android Platform.
***	**Tool required and use:** Java Programming

Unit-I	**Overview of Java:** What Are Variables? Basic Output in java, Basic Input, Comments in Java, Data Types, Type Conversion & Type Casting, Stack & Heap, Arrays	
Unit-II	**Android Basics**: Architecture, application components, resources, activities, services broadcast receivers, content, providers, fragments, intents/filters, Kotlin	
Unit- III	**Android User Interface Matching**: UI Layouts, UI Controls, event handling styles and themes, custom components,	
Unit- IV	**Android Advanced Concepts**:	

	Drag and Drop, Notifications, Location Based Services, Sending Email, Sending SMS, Phone Calls, Publication Android application.	
Unit-V	**Android applications-I:** Android - Alert Dialoges, animations. audio capture, audio manager, autocomplete, Bluetooth, camera, clipboard, custom fonts, data backup, developer tools, emulator, Facebook integration, gestures, Google maps, image effects, image switcher, JetPlayer, JSON parser, NFC guide, PHP/MySQL, ProgressBar , push notification, RenderScript, RSS reader, screencast, SDK manager, sensors, SIP protocol, spelling checker, SQLite database, support library, testing, text to speech, TextureView, twitter integration, UI design, UI patterns, UI testing, WebView layout, Wi-Fi, widgets, XML parsers.	
Unit-VI	**Android applications-II:** SDK manager, sensors, session management, shared preferences, SIP protocol, spelling checker, SQLite database, support library, testing, text to speech, TextureView, twitter integration, UI design, UI patterns, UI testing, WebView layout, Wi-Fi, widgets, XML parsers.	

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:

1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

Text Books:

1. Dawn Griffiths, "Head First Android Development: A Brain-Friendly Guide Paperback," Shroff/O'Reilly; Second edition.
2. Michael Burton, "Android App Development for Dummies, 3ed Paperback," Wiley; Third edition.

Reference Books:

1. William Stallings , "Wireless Communications & Networks," Second Edition, Pearson.
2. Asoke K Telukder, Roopa R Yavaga, "Mobile Computing Technology, Applications and service creation," TMH.
3. Android Application Development Black Book, Pradeep Kothari, dreamtech press.
4. Dr. Sunilkumar S. Manvi, Dr. Mahabaleshwar S.Kakkasageri, "Wireless and mobile networks", WILEY.
5. John Horton , "Android Programming with Kotlin for Beginners: Build Android apps starting from zero programming experience with the new Kotlin programming language", Packt Publishing; 1st edition.

List of Experiments:

1. Installation of Android studio
2. Development of Hello world application
2. Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button
3. Create a screen that has input boxes for User Name, Password, Address, Gender(radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner)

and a Submit button. On clicking the submit button, print all the data below the Submit Button (use any layout)
4. Design an android application to create page using Intent and one Button and pass the Values from one Activity to second Activity
5. Design an android application Send SMS using Intent
6. Design an android application Using Radiobuttons
7. Design an android application for menu.
8. Create a user registration application that stores the user details in a database table.

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B. Tech. Electronics & Communication Engineering Sem VII **INTERNSHIP**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
	Examination (UE): NA	
	Internal Assessment (IA): -NA	
	TW :25 Marks OR: 25 Marks	Credits:03
	Total:50 Marks	**Total Credits:03**

Course Objectives:	
1	To familiarize the students to industrial work processes.
2	To acquire practical knowledge and hands-on experience.
3	To work as an effective team member and solve managerial problems.
4	To introduce the student to work ethics in industry.

Course Outcomes: After learning this course, students will be able to	
CO1	Identify various technologies and fields for practical training to enhance employability skills.
CO2	Apply various skills such as time management, positive attitude and communication skills during the performance of the tasks.
CO3	Explore career alternatives prior to graduation.
CO4	Understand the ability to adapt with the latest changes in the technological world.

Internship Training:

Every student has to undergo training on site or in office of some company for a period of 60 days to get the exposure and practical experience. He/ She has to submit the detail report of training on the basis of which the term work and oral marks should be awarded**.**

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Faculty of Engineering and Technology
Programme: B. Tech. (Electronics & Communication) –CBCS 2021 Course

B. Tech. (Electronics & Communication) Sem VIII

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
48		Light Wave Communication	3	0	1	60	40	0	0	0	100	3	0	1	4
49		5G Architecture	4	2	0	60	40	50	0	0	150	4	1	0	5
50		Elective-II	3	2	0	60	40	0	25	0	125	3	1	0	4
51		Blockchain Technology*	4	2	0	60	40	0	50	0	150	4	1	0	5
52		Project Stage-II	0	4	0	0	0	100	100	0	200	0	6	0	6
53		Cloud Computing	0	2	0	0	0	25	0	0	25	0	1	0	1
	Total		**14**	**12**	**1**	**240**	**160**	**175**	**175**	**0**	**750**	**14**	**10**	**1**	**25**
	Research Paper Publication**		-	-	-	-	-	-	-	-	-	-	-	-	2

*Industry Taught Course – VI
** Add on course

Sr. No.	Name of the Elective-I
1	Smart Cities
2	Image Processing & Computer Vision
3	Biomedical Electronics
4	Software Defined Networks
5	Software Testing

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B. Tech. Electronics & Communication Engineering Sem VIII **LIGHTWAVE COMMUNICATION**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/week	Examination (UE):60 Marks	Credits: 03
Practical:00	Internal Assessment (IA): 40 Marks	
Tutorial:1 Hr/week		Credit:01
	Total:100 Marks	**Total Credits:04**

Course Pre-requisites:	
The students should have knowledge of	
	Basics of Communication, Optical Communication, Computer Networks
Course Objectives:	
1	To enable the student to understand the importance of the backbone infrastructure for our present and future communication needs.
2	To enable the student to understand the differences in the design of data plane and the control plane, the routing, switching and the resource allocation methods.
3	To expose the student to the advances in network control and management.
Course Outcomes: After learning this course students will be able to	
CO1	Apply knowledge of basic optical network elements for realizing lightwave network.
CO2	Identify and formulate different optical networking topologies
CO3	Design Optical Network Routing Algorithms.
CO4	Apply the basic Networking knowledge to realize any sort of end-to-end communication
CO5	Analyze the various design parameters of optical network.
CO6	Manage the optical networks in its configuration, fault and performance.

UNIT – I	**Introduction to WDM Network Elements**	**(06 Hrs)**
	Operational principle of WDM, WDM network elements: Switches, Wavelength Converters, Optical Line Terminals, Optical Line Amplifiers, WDM Point to Point link, Wavelength Add/Drop Multiplexers, Optical Cross connects.	
UNIT – II	**Optical Networks Architecture**	**(06 Hrs)**
	SONET/SDH, Computer Interconnects, MANS, Layered architecture for SONET and Second Generation Networks, Broadcast and Select Networks – Topologies for Broadcast Networks, Wavelength Routed Networks, Linear Lightwave Networks, Media-Access Control Protocols.	
UNIT–III	**Packet Switching and Access Networks**	**(06 Hrs)**

	Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronization, Broadcast OTDM networks, Switch-based networks. Access Networks – Network Architecture overview, Future Access Networks and OTDM networks.	
UNIT –IV	**Wavelength Routing Networks**	**(06 Hrs)**
	Optical layer, Node design, Network design and operation, routing and wavelength assignment architectural variations. Optical Network Routing Principles - Impairment Aware Routing Optical Circuit Switching, Optical Packet Switching Optical Burst Switching.	
UNIT – V	**Design of Optical Networks**	**(06 Hrs)**
	Core Optical Networks, Metro Optical networks, Access Optical Networks Wavelength Routing and Assignment, Traffic Grooming and Protection, Multilayer Network Structure Transmission system model, power penalty-transmitter, receiver optical amplifiers, crosstalk, dispersion, wavelength stabilization	
UNIT– VI	**Network Control and Management**	**(06 Hrs)**
	Control and management, Network management configuration management, Performance management, fault management. Network management functions, Optical safety.	

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:

1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

Text Books:

1. Kumar Sivarajan and Rajiv Ramaswamy, Morgan Kauffman, Optical Networks: A Practical Perspective, Elsevier Publication Elsevier India Pvt. Ltd, 3rd Edition, 2010.
2. Harry G. Parros, Communication Oriented Networks, Wiley
3. G. Agarwal, Fiber Optic Communication Systems, John Wiley and Sons, New York, 2014.

Reference Books:

1. C. Siva Ram Moorthy and Mohan Gurusamy, WDM Optical Networks: Concept, Design and Algorithms, Prentice Hall of India.
2. Biswajit Mukherjee, Optical Communication Networks, TMG.
3. Jane M. Simoons, Optical Network Design and Planning, Second Edition, Springer
4. John M. Senior, “Optical Fiber Communications Principles and Practice”, Prentice Hall.
5. Ulysees Black, Optical Networks, Pearson education.
6. Cvijetic, Ivan B. Djordjevic, Advanced Optical Communication Systems and Networks, Artech House Applied Photonics.

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.

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B. Tech. Electronics & Communication Engineering Sem VIII **5G ARCHITECTURE**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04 Hrs/week	Examination (UE): 60 Marks Internal Assessment (IA): 40 Marks	Credits: 04
Practical: 02 Hrs/week	TW:50 Marks	Credit:01
	Total:150 Marks	**Total Credits:05**

Course Pre-requisites:	
The students should have knowledge of	
1	Basic understanding of telecommunications.
2	Basic understanding of computer networks and wireless communications

Course Objectives:	
1	To introduce the student to 5G architecture.
2	To familiarize the student to various radio access technologies in 5G
3	To make the student learn the various cases of 5G communication

Course Outcomes: After learning this course students will be able to	
CO1	Design & simulate the use cases for 5G.
CO2	Draw and explain 5G architecture, its components and functional criteria.
CO3	Identify the 5G radio-access technologies.
CO4	Implement the 5G wireless propagation channel models and MIMO.
CO5	Evaluate device to device (D2D) and mmWave communication.
CO6	Design application of various 5 G wireless Technologies using WiFi, Zigbee and WiMax.

UNIT – I	**Introduction, 5G Use Cases and System Concept**	**(08 Hrs)**
	Industrial and technological revolution: Mobile communications generations: from 1G to 4G, IoT: relation to 5G. Standardization activities: ITU-R , 3GPP & IEEE Use cases and requirements: Use cases, Requirements and key performance indicators , 5G system concept, Extreme mobile broadband, Massive machine-type communication, Ultra-reliable machine-type communication, Dynamic radio access network , Lean system control plane, Localized contents and traffic flows, Spectrum toolbox, RF cell planning for 5G.	
UNIT –II	**The 5G architecture, Spectrum**	**(08 Hrs)**
	Introduction: NFV and SDN, Basics about RAN architecture, High-level requirements for the 5G architecture .Cell structure for 5G.	

	Functional architecture and 5G flexibility: Functional split criteria, Functional optimization for specific applications, Integration of LTE and new air interface to fulfill 5G requirements, 5G spectrum landscape and requirements, 5G spectrum technologies	
UNIT -III	**The 5G Radio-Access Technologies**	**(10 Hrs)**
	Access design principles for multi-user communications:- Orthogonal multiple-access systems, Capacity limits of multiple-access methods. Multi-carrier with filtering:- Filter-bank based multi-carrier, Universal filtered OFDM. Non-orthogonal schemes for efficient multiple access:- Sparse code multiple access (SCMA), Interleave division multiple access (IDMA). Radio access for dense deployments:- OFDM numerology for small-cell deployments.	
UNIT– IV	**The 5G wireless propagation channel models and Massive multiple-input multiple-output (MIMO) systems.**	**(08 Hrs)**
	Introduction, Modeling requirements and scenarios: Channel model requirements, Propagation scenarios**.** METIS channel models: Map-based model, Stochastic model. MIMO in LTE, Theoretical background: Single user MIMO, Multi-user MIMO. Pilot design for massive MIMO. Resource allocation and transceiver algorithms for massive MIMO. RF field measurement parameter for 5G.	
UNIT –V	**Enabling Technologies for 5G**	**(07 Hrs)**
	Device-to-device (D2D) communications from 4G to 5G. Radio resource management for mobile broadband D2D. Multi-hop D2D communications for proximity and emergency services. Multi-operator D2D communication, Milimeter wave Communication: Hardware technologies for mmW systems Antennas Beamforming architecture Deployment scenarios, Architecture and mobility.	
UNIT –VI	**5 G Wireless Technologies**	**(07 Hrs)**
	IEEE802Std: 802.11 (WiFi), 802.15.1 (Bluetooth), 802.15.4 (Zigbee), 802.16 (WiMax), BLE, 4G/5G: Frame Structures and applications.	

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:

1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

Text Books:

1. Andrea Goldsmith , "Wireless Communications ", Cambridge University Press, 2nd edition, March 3, 2020
2. Afif Osseiran & Jose F. Monserrat, "5G Mobile and Wireless Communications Technology", Cambridge University Press 2016

3.Sassan Ahmadi , "5G NR: Architecture, Technology, Implementation, and Operation of 3GPP New Radio Standards" , Elsevier-Science, 2019
Reference Books:
1. Erik Dahlman, Stefan Parkvall, Johan Skold, " 5G NR:The Next Generation Wireless Access Technology," Academic Press, 2018.
2. J. Rodriguez, "Fundamentals of 5G Mobile Networks," John Wiley & Sons, 2015
List of Experiments: The students must perform a minimum of eight experiments
1. 5G Communications Link Analysis with Ray Tracing using MATLAB
2. Wireless Connectivity in the 5G Era for WLAN using MATLAB
3. MIMO Wireless System Design for 5G using MATLAB
4. 5G Waveforms generation using MATLAB
5. 5G Beamforming Design
6. Numerology in 5G
7. Frame Structure of 5G technology
8. MIMO System Implementation with Perfect CSI
9. Recent developments in 5G
10. Case Study: Factors affecting deployment of 5G in Indian scenario
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.

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B. Tech. Electronics & Communication Engineering Sem VIII **ELECTIVE II: SMART CITIES**		
TEACHING SCHEME	**EXAMINATION SCHEME**	**CREDITS ALLOTTED**
Theory: 03 Hrs/Week	Examination (UE): 60 Marks Internal Assessment: 40 Marks	Credits: 03
Practical: 02 Hrs/Week	OR: 25 Marks	Credit:01
	Total:125 Marks	**Total Credits:04**

Course Pre-requisite:	
	Knowledge of IoT and Wireless protocols

Course Objectives :	
1.	To introduce the concept of smart city and challenges.
2.	To familiarize students with smart objects and devices.
3.	To introduce the wireless protocols needed for smart city.
4.	To familiarize students about the impact of ICT on quality life.

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

CO1	Summarize the philosophy of smart city and the challenges	
CO2	Apply the concept of IoT for smart systems.	
CO3	Classify the objects in IoT system.	
CO4	Explain the planning on interplay between the human and smart devices.	
CO5	Determine the wireless protocols needed for smart system.	
CO6	Paraphrase the impact of smart technologies on urbanization, human quality life and environment.	
Unit -I	**Smart City**	**(06 Hrs)**
	Necessity of SMART CITY The Smart City Philosophy, Development of Asian Cities, Megacities of India: Current Challenges, The India Story of Smart Cities, Conceptual Basis of a Smart City, Global Smart City Programs, Recommendations for Smart City Framework in GCC	

Unit -II	**IOT Applications in Smart City**	**(06 Hrs)**
	IoT applications in smart city: smart environment, smart streetlight and smart water management, smart waste management and smart energy management system.	
Unit- III	**Smart Objects**	**(06 Hrs)**
	Smart objects, Wired – Cables, hubs, etc., Wireless – RFID, WiFi, Bluetooth, etc. Different functional building blocks of IOT architecture	
Unit -IV	**Distributed Intelligence and Central Planning**	**(06 Hrs)**
	Central Planning on the Interplay between Humans and Smart Devices, BIM in smart cities, Artificial Intelligence (Machine Intelligence), Information Dynamics, Synergetic, Information Dynamics and Allometry in Smart Cities.	
Unit-V	**Wireless Protocols for Smart Cities**	**(06 Hrs)**
	Wireless Networking Basics, Wireless Networking Assumptions, Protocols: Message Queue Telemetry Protocol. RPL, REST, AMQP, CoAP	
Unit-VI	**ICT and Smart City**	**(06 Hrs)**
	Using technologies to improve the citizens quality of life, Smart city goals: The impact on citizens well-being and quality of life, Critical dimensions: Urbanization, local climate change, and energy poverty, Environmental issues: Role of local and global climate change.	

Content Delivery Methods: Chalk & talk, PowerPoint presentation

Assessment Methods:

1. Continuous Assessment (Unit Test, PBL, Attendance)
2. End-term Examination

Text Books:

1.	Olivier Hersent, David Boswarthick, and Omar Elloumi, "The Internet of Things: Key Applications and Protocols‖", Wiley Publications.
2.	Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.

References Books:

1.	Carlo Ratti and Matthew Claudel, "The City of Tomorrow: Sensors, Networks, Hackers, and the Future of Urban Life (The Future Series)", Yale University Press.
2.	Stephen Goldsmith, Susan Crawford, "The Responsive City: Engaging Communities Through Data-Smart Governance", 1st Edition Jossey Bass – Wiley.

3.	Michale Miller, “The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World”, Pearson Education.
List of Experiments: Case studies based on following:	
1.	Water waste management system.
2.	Smart street light management system.
3.	GIS based management Information System
4.	Smart RFID based traffic monitoring system.
5.	GIFT smart city
6.	Planning process for smart cities.
7.	Smart energy management system.
8.	Smart grid system
9.	Wireless protocols for Smart city
10.	Smart air quality monitoring system
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 VIII **ELECTIVE-II: IMAGE PROCESSING AND COMPUTER VISION**		
TEACHING SCHEME	**EXAMINATION SCHEME**	**CREDITS ALLOTTED**
Theory: 03 Hrs/week	End Semester Examination (ESE): 60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	OR: 25 Marks	Credit:01
	Total:125 Marks	**Total Credits:04**

Course Pre-requisites:	
The students should have the knowledge of	
1	Engineering Mathematics
2	Basics of Image processing

Course Objectives:	
1	To introduce the concepts of image processing and basic analytical methods to be used in image processing.
2	To familiarize students with image enhancement and restoration techniques.
3	To introduce different image segmentation techniques.
4	To make student aware of various techniques to implement computer vision algorithms efficiently.

Course Outcomes: After learning this course students will be able to	
CO1	Explain the fundamentals of digital image and its processing and perform image enhancement techniques.
CO2	Compare various geometric camera models and multiple view geometry.
CO3	Implement different feature extraction techniques for image analysis.
CO4	Apply the concept of Image segmentation.
CO5	Identify a suitable classifier to address a desired pattern recognition problem.
CO6	Apply three-dimensional image analysis techniques & motion analysis algorithms

UNIT – I	**Introduction to Image Processing**	**(05 Hrs)**
	Overview and State-of-the-art, Fundamentals of Image formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image enhancement, Restoration, Histogram processing	
UNIT – II	**Depth Estimation and Multi-camera views**	**(06 Hrs)**

	Perspective, Binocular stereopsis: Camera and Epipolar geometry; Homography, rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration	
UNIT –III	**Feature Extraction**	**(06 Hrs)**
	Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.	
UNIT –IV	**Image Segmentation**	**(05 Hrs)**
	Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.	
UNIT –V	**Pattern Analysis**	**(06Hrs)**
	Clustering: K-Means, Supervised, Un-supervised, Semi-supervised; Classifiers, Introduction to Bayes, KNN, ANN models.	
UNIT– VI	**Motion Analysis**	**(08 Hrs)**
	Background Subtraction and Modelling, Optical Flow, KLT, Spatio-Temporal analysis, Dynamic Stereo; Motion parameter estimation. Shape from X: Light at surfaces; Phong model; Reflectance map; Albedo estimation. Photometric stereo; Use of surface smoothness Constraint; Shape from texture, colour, motion and edges.	

Textbooks /Reference Books:

1. Rafael C. Gonzalez and R.E. Woods, "Digital Image Processing", Addison- Wesley.
2. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer-Verlag London Limited.
3. D.A. Forsyth, "Computer Vision: A modern approach", Pearson Education
4. Richard Hartely & Andrew Zisserman, "Multiple View Geometry in Computer vision", Second Edition, Cambridge University Press.
5. Milan Soanka, Vaclav Hlavac and Roger Boyle, "Digital Image Processing and Computer Vision", Cengage Learning.

List of Experiments: The students should perform a minimum of eight experiments

1. Perform basic Image Handling and Processing operations on the image.
2. Study of Geometric Transformation
3. Object detection in target domain using weakly supervised, semi supervised
4. Face recognition using face images obtained from internet.
5. Monocular 3D object detection for indoor objects.
6. Scene segmentation of indoor panorama
7. Joint Image Deblurring/Super-Resolution and Low-light Image Enhancement
8. Image to Image transformation (few samples) using VAE, GANs etc
9. Object-Goal Navigation task by learning from environment
10. Real (True) depth estimation from indoor scenes, given a model (DL tool) for virtual depth estimation

11. Project based on Computer Vision Applications
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.

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B. Tech. Electronics & Communication Engineering Sem VIII **ELECTIVE-II: BIOMEDICAL ELECTRONICS**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/week	Examination (UE):60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	OR: 25 Marks	Credit:01
	Total:125 Marks	**Total Credits:04**

Course Pre-requisites:	
The students should have knowledge of	
1	Electrodes, Sensors and transducers, Electronic Circuits and Applications

Course Objectives:	
1	To introduce various biopotentials, their measurements and interpretations associated with human body.
2	To familiarize the student with different medical equipment's.
3	To expose the student to clinical laboratory equipment's.
4	To imbibe the importance of patient's safety

Course Outcomes: After learning this course, students will be able to	
CO1	Classify systems in human body and identify bio-potentials
CO2	Correlate the parameters like B.P., ECG and PCG with the functioning of Heart.
CO3	Categorize life saving devices such as cardiac and respiratory equipment's.
CO4	Identify equipment's present in ICU/NICU.
CO5	Categorize blood tests and clinical laboratory instruments
CO6	Recognize surgical diathermy and radiology equipment's.

UNIT – I	**Human body & Origin of Bio-potentials**	**(06 Hrs)**
	Human body: cell structure, overview of different systems in the body: cardiovascular system, respiratory system, nervous system, musculoskeletal system, gastrointestinal system, endocrine system and lymphatic system, Origin of Bio-potentials: action potential, bio-potentials such as ECG, EEG, EMG.	
UNIT – II	**Electrocardiograph, Phonocardiograph and Blood pressure measurements**	**(06 Hrs)**
	Electrocardiography: ECG lead configurations, ECG machine, ECG electrodes, Phonocardiograph: heart sounds and heart murmurs, microphones used in Phonocardiograph, recording set up of PCG, Blood pressure measurement techniques: direct and indirect method, relationship between ECG, PCG and Blood pressure.	

UNIT - III	**Cardiac and Respiratory Equipment's**	**(06 Hrs)**
	Fibrillation, need of defibrillator, Types of defibrillator and electrodes, natural pacemaker, need of external pacemaker, types of pacemaker and batteries, mechanical ventilation, need of ventilator, ventilator block schematic and modes of ventilator, spirometry	
UNIT – IV	**ICU and NICU-Architecture and monitoring systems**	**(06 Hrs)**
	Architecture of ICU and NICU**,** patient monitoring system, central monitoring system**,** holter monitor, Basics of telemetry and Multi-channel telemetry, Baby incubator and Phototherapy unit	
UNIT – V	**Clinical Laboratory Instruments and hemodialysis**	**(06 Hrs)**
	Colorimeter, spectrophotometer, centrifuge, auto analyzer, blood cell counter, Basic principle of dialysis, Artificial kidney, different types of dialyzer membranes, typical setup of hemodialysis	
UNIT – VI	**Electrosurgical and Radiographic Instruments**	**(06 Hrs)**
	Basic principle of electro surgery, Electrosurgical unit, Basic principle and working of X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI) and Ultrasound, Digital X-Ray, Positron Emission Tomography (PET)	

Content Delivery Methods: Chalk & talk, Powerpoint presentation

Assessment Methods:

1. Continuous Assessment (Unit Test, PBL, Attendance)
2. End-term Examination

Text Book:

1. R. S. Khandpur, "Hand book of Biomedical Instrumentation", Tata McGraw Hill Publishing Company limited, New Delhi.
2. Leslie Cromwell, Fred J. Weibel, Erich A. Pfeiffer, "Biomedical Instrumentation and Measurements", Second Edition, PHI.

Reference Books:

1. John G. Webster, "Medical Instrumentation- Application and Design", Third Edition, John Wiely and Sons Inc., New York.
2. Joseph J. Carr & John M. Brown, "Introduction to Biomedical Equipment Technology", Forth Edition, PHI.
3. Richard Aston, "Principles of Biomedical Instrumentation and Measurement", Merrill Macmillan Publishing Company, New York.

List of Experiments:

1. Measurement of blood pressure using Sphygmomanometer.
2. Simulation of ECG waveform and heart rate measurement using ECG system.

3. Study of phonocardiograph for recognition of heart sound.
4. Detection of Apnea and Tachypnea using respiration rate simulator and monitor.
5. Detection of fibrillation condition and recovery using DC Defibrillator.
6. Observation and functioning of External Pacemaker over natural pacemaker.
7. To find out concentration of unknown samples uding Spectrophotometer.
8. Observation of cutting and coagulation operations using surgical diathermy unit.
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.

B. Tech. Electronics & Communication Engineering Sem VIII
ELECTIVE –II: SOFTWARE DEFINED NETWORKS

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 03 Hrs/week	Examination (UE):60 Marks	Credits: 03
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
	OR: 25 Marks	Credit:01
	Total:125 Marks	Total Credits:04

Course Pre-requisites:

The students should have knowledge of

1	Cellular Technology and 4G
2	Computer Communication Network

Course Objectives:

1	To introduce the fundamentals of software defined networks.
2	To understand the separation of the data plane and the control plane.
3	To enable the student to work on SDN Programming
4	To impart the knowledge about the security issues in SDN
5	To familiarize the applications of SDN

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

CO1	Understand the components of software defined networks
CO2	Use the various components of SDN.
CO3	Explain the use of SDN in the current networking scenario
CO4	Evaluate the various security aspects in SDN
CO5	Design and simulate various applications of SDN
CO6	Use SDN features in the future networking scenario

UNIT – I	**Introducing SDN**	**(06 Hrs)**
	SDN Origins and Evolution – Introduction – Need of SDN- Centralized and Distributed Control and Data Planes - The Genesis of SDN ,SDN APIs, Virtualization of Network Functions (VNF) and NFV, Open Virtual Networking (OVN), Open Network Operating Systems (ONOS)	
UNIT – II	**SDN Abstractions**	**(06 Hrs)**
	Working principle of SDn - The Openflow Protocol - SDN Controllers: Introduction - General Concepts - VMware - Nicira - VMware/Nicira - OpenFlow-Related - Mininet - NOX/POX - Trema - Ryu - Big Switch Networks/Floodlight - Layer 3 Centric - Plexxi - Cisco OnePK	
UNIT –III	**Programming SDN'S**	**(06 Hrs)**
	Network Programmability - Network Function Virtualization - NetAppDevelopment, Northbound / southbound interfaces ,Application	

	Programming Interface, Current Languages and Tools, Composition of SDNs,Network Slicing , Mininet Environment and Implementation	
UNIT –IV	**SDN Applications in Security**	**(06 Hrs)**
	Switching and Load Balancers, Firewall and Access Control, Use cases in Legacy Networks security, Security in modern networks – Cloud, Fog, IoT, 5G, , Solutions, Fault Tolerance Designs, Debugging and Trouble Shooting.	
UNIT –V	**SDN Applications and Use Cases**	**(06 Hrs)**
	SDN in the Data Center - SDN in Other Environments - SDN Applications - SDN Use Cases - The Open Network Operating System	
UNIT –VI	**SDN'S future and perspectives**	**(06 Hrs)**
	SDN Open Source - SDN Futures - Final Thoughts and Conclusions	

List of Experiments: : The term work shall consist of record of minimum eight experiments.

1. Setting up the Environment and Implementation of Controllers in Mininet 3
2. To create Custom Topologies in POX, ODL
3. To set ONOS
4. To implement Northbound Interfacing
5. To implement Southbound Interfacing
6. To implement ONOS deployment ONOS
7. ONOS deployment ONOS – OPNFV – SDN Application development
8. ONOS, Northbound – Southbound Interfacing, ONOS deployment ONOS – OPNFV – SDN Application development
9. To measure network performance in Mininet
10. Use case of SDN in Network Virtualization
11. Use case of SDN in Traffic Engineering WAN
12. Use case of SDN in Network Telemetry

Text Books:

1. Thomas D. Nadeau ,"SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies" ,Ken Gray Publisher: O'Reilly Media, August 2013.
2. Vivek Tiwari , "SDN and OpenFlow for Beginners", Amazon Digital Services, Inc., ASIN:, 2013.
3. Nunes, Bruno AA, et al. "A survey of software-defined networking: Past, present, and future of programmable networks." Communications Surveys & Tutorials, IEEE 16.3 (2014): 1617-1634.
4. Network Innovation through OpenFlow and SDN: Principles and Design, Edited by Fei Hu, CRC Press, ISBN-10: 1466572094, 2014.
5. Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud" – William Stallings.

6. Kreutz, Diego, et al. “Software-defined networking: A comprehensive survey.” Proceedings of the IEEE 103.1 (2015): 14-76.

Reference Books:

1. Paul Goransson and Chuck Black,”Software Defined Networks: A Comprehensive Approach”, Morgan Kaufmann Publications, 2014.
2. Lantz, Bob, Brandon Heller, and Nick McKeown. “A network in a laptop: rapid prototyping for software-defined networks.” Proceedings of the 9th ACM SIGCOMM Workshop on Hot Topics in Networks. ACM, 2010.
3. Siamak A zodolmolky, “Software Defined Networking with OpenFlow”, Packt Publishing, 2013.
4. Paul Goransson and Chuck Black, Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
5. Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks, OReilly Media, 2013.
6. Peterson, Cascone, O’Connor, Vachuska, and Davie.,”Software-Defined Networks: A Systems Approach ystems Approach LLC (Publisher),2022.

Project Based Learning:

Students are expected prepare report on any one topic related to this subject, write its definition, applications and illustrate with few examples.

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B. Tech. Electronics & Communication Engineering Sem VIII **ELECTIVE-II: SOFTWARE TESTING**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED**
Theory: 03 Hrs/week	Examination (UE): 60 Marks	Credits: 3
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
Tutorial: 00	Oral -25 Marks	Credit:1
	Total:125 Marks	**Total Credits:04**

Course Pre-requisite:	
The students should have knowledge of	
1	Knowledge of Software Engineering
2	Knowledge of UML
Course Objectives: -	
1	Familiarize the student with software testing, important concepts and the testing process
2	To make the student Learn about dynamic testing and Test case design techniques. How to do the testing after executing the program and how to design test cases with examples
3	To introduce the student to testing tools.
Course Outcomes: After learning the course, student will able to	
CO1	Perceive importance of testing techniques in software quality management and assurance
CO2	Categorize the different types of testing methodology.
CO3	Apply different testing methodologies used in industries for software testing
CO4	Identify various types of software risks and its impact on different software application.
CO5	Create test case Design scenarios for different application software s using various testing techniques.
CO6	Create test case execution scenarios for different application software s using various testing techniques.

Unit -I	**Introduction**	**(05 Hrs)**
	Software Testing, Importance of testing, Roles and Responsibilities, Testing Principles, Attributes of Good Test, V-Model, Test Case Generation, SDLC vs STLC, Software Testing Life Cycle-in detail.	
Unit -II	**Types of Testing:**	**(05 Hrs)**

	Testing Strategies: Unit Testing, Integration Testing, System Testing, Smoke, Regression Testing, Acceptance Testing. Clean Room Software Engineering. Functional/Non-functional Testing. Testing Tools, Categorization of testing methods: Manual Testing, Automation Testing and Automated Testing Vs. Manual Testing	
Unit-III	**Software Testing Methodologies:**	**(08 Hrs)**
	Validation & Verification, White/Glass Box Testing, Black Box Testing, Grey Box Testing, Statement Coverage Testing, Branch Coverage Testing, Path Coverage Testing, Conditional Coverage Testing, Loop Coverage Testing, Boundary Value Analysis, Equivalence Class Partition, State Based Testing, Cause Effective Graph, Decision Table, Use Case Testing, Exploratory testing and Testing Metrics, Testing GUI	
Unit -IV	**Software Testing Life Cycle:**	**(06 Hrs)**
	Requirements Analysis/Design, Traceability Matrix, Test Planning, Objective, Scope of Testing, Schedule, Approach, Roles & Responsibilities, Assumptions, Risks & Mitigations, Entry & Exit Criteria, Test Automation, Deliverables.	
Unit- V	**Test Cases Design:**	**(06 Hrs)**
	Write Test cases, Review Test cases, Test Cases Template, Types of Test Cases, Difference between Test Scenarios and Test Cases. Test Environment setup, Understand the SRS, Hardware and software requirements, Test Data.	
Unit-VI	**Test Execution:**	**(06 Hrs)**
	Execute test cases, Error/Defect Detecting and Reporting, DRE (Defect Removal Efficiency), Object, Types of Bugs, Art of Debugging, Debugging Approaches, Reporting the Bugs, Severity and priority, Test Closure, Criteria for test closure, Test summary report.	

Content Delivery Methods: Chalk & talk, PowerPoint presentation, Animations
Assessment Methods:
1. Continuous Assessment (Unit Test, PBL, Attendance)
2. End-term Examination

List of Experiments:

1	Implement all techniques of Black Box-Testing, White Box Testing taking your Mini Project as the Context System.
2	Write a program to find the roots of a quadratic equation and perform boundary valueanalysis
3	Write a program to find area of circle, square, triangle and rectangle and perform equivalence class testing.
4	Write a program to perform a raise to power b and perform decision table testing.
5	Write a program to compute previous date, given present date as input and perform decision table testing.
6	Write a program to read three sides of a triangle and determine whether they form scalene, isosceles or equivalent triangle and test it using cause – effect testing techniques.

7	Write a program to calculate total salary of an employee, given his salary. The slab is as follows HRA=30% of basic salary, DA=80% of basic salary, MA=100, TA=800, Income tax=700, Pf=780. Draw its path graph and finds its V(G) by all three methods.
8	Draw a DD path graph for the program written for experiment 6.
9	Write a program to read the marks of 10 students in 5 subjects calculate the average and assign grades. Now draw its graph matrix and find its V(G).
10	Perform Data Flow Testing on the program for quadratic equation program.
11	Case study on Testing Tool-QTP.
Text books	
1	Roger S.Pressman, "Software engineering- A practitioner's Approach", McGraw-Hill International Editions
2	Ian Sommerville, "Software Engineering", Pearson Education Asia
3	Boris Beizer , "Software Testing Techniques", 2nd edition, , 1990
Reference Books	
1	Srinivasan Desikan , "Software Testing: Principles and Practices", Dorling Kindersley (India).
2	Kshirasagar Naik and Priyadarshi Tripathy , "Software Testing and Quality Assurance: Theory and Practice", Wiley Publication.
3	Michael Haug and Eric W Olsen ,"Software Quality Approaches: Testing, Verification, and Validation: Software Best Practice" Springer.
	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 VIII **ITC-VI: BLOCKCHAIN TECHNOLOGY**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04 Hrs/week	Examination (UE): 60 Marks	Credits: 04
Practical: 02 Hrs/week	Internal Assessment (IA): 40 Marks	
Tutorial: 00	Oral :50 Marks	Credits:01
	Total:150 Marks	**Total Credits:05**

Course Pre-requisites:	
The students should have knowledge of	
	Expertise In Programming
	Basic Knowledge Of Computer Security
	Cryptography
	Networking
	Concurrent Or Parallel Programming
Course Objectives:	
1	To introduce the student to blockchain systems.
2	To make student learn about the securely interact with bitcoin and ethereum.
3	To make the student ro design, build, and deploy smart contracts and distributed applications.
4	To make the student to integrate ideas from blockchain technology into their own projects.
Course Outcomes: After learning this course, students will be able to	
1	Understand the design principles of Bitcoin and Ethereum
2	Describe Nakamoto consensus.
3	Explain the Simplified Payment Verification protocol.
4	List and describe differences between proof-of-work and proof-of-stake consensus.
5	Interact with a blockchain system by sending and reading transactions.
6	Design, build, and deploy a distributed application.

UNIT – I	**Introduction**	**(08 Hrs)**
	Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof	
UNIT–II	**Blockchain**	**(08 Hrs)**
	Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward,	

	Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain	
UNIT-III	**Distributed Consensus**	**(08 Hrs)**
	Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.	
UNIT–IV	**Cryptocurrency**	**(08 Hrs)**
	History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum -Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin	
UNIT – V	**Cryptocurrency Regulation**	**(08 Hrs)**
	Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy.	
UNIT–VI	**Cryptocurrency Applications**	**(08 Hrs)**
	Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain	

Content Delivery Methods: Chalk & talk, ICT Tools

Assessment Methods:

1. Internal Assessment (IA)(Unit Test, PBL)
2. End-term Examination (UE)

Text Books:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press (July 19, 2016).
2. Imran Bashir, "Mastering blockchain: Distributed Ledger Technology, Decentralization and Smart Contract Explained", Second Edition, Packt Publishing, 2018.

Reference Books:

1. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, "Blockchain Technology: Cryptocurrency and Applications", Oxford University Press, 2019.
2. Josh Thompson,"Blockchain:The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming", Create Space Independent Publishing platform 201

List of Experiments

1. Demonstration of Blockchain https://andersbrownworth.com/blockchain.
2. Installation of Ganache, Flask and Postman
3. Write a Simple Python program to create a Block class that contains index, timestamp, and previous hash. Connect the blocks to create a Blockchain.
4. Demo of Remix-Ethereum IDE https://remix.ethereum.org and Test Networks
5. Write a Simple Smart Contract for Bank with withdraw and deposit functionality.

6. Write a Smart Contract for storing and retrieving information of Degree.
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 VIII **PROJECT STAGE-II**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
	Examination (UE): NA	
Practical: 04 Hrs/week	Internal Assessment (IA): -NA	
	TW :100 Marks OR:100 Marks	Credits:06
	Total:200 Marks	**Total Credits:06**

Course Objectives:	
1	To familiarize the students with the product development cycle.
2	To impart the importance of working as a team. .
3	To introduce the student to literature survey and documentation process.
4	To encourage the students to visualize & formulate a viable solution to practical engineering problems.

Course Outcomes: After learning this course, students will be able to	
CO1	Identify various technologies and fields for projects.
CO2	Understand the process to make reports and presentation.
CO3	Apply engineering knowledge to solve industrial problems.
CO4	Analyze ethical practices and tools used in different technologies for projects.
CO5	Justify the performance on parameters such as communication skills, technical knowledge.
CO6	Generate project report and present it effectively.

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B. Tech. Electronics & Communication Engineering Sem. VIII

Cloud Computing

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: - VIII Semester	Examination (UE): -	Credits: 00
Practical:02	Internal Assessment (IA): -	
Tutorial: -	TW : 25 Marks	Credit:01
	Total:25 Marks	Total Credits:01

Course Pre-requisites:

The students should have knowledge of

1	Computer Networks, Basics of operating system (O.S.)

Course Objectives:

1	To learn and use version control systems.
2	To develop web applications in cloud.
3	To learn and work with virtual machine.
4	To design and develop a process involved in creating a cloud based application.
5	To understand the advanced technologies in cloud computing
6	To implement parallel programming using Hadoop.

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

1	Configure various virtualization tools such as virtual box, VMware workstation.
2	Design and deploy a web application in a PaaS environment.
3	Simulate a cloud environment to implement new schedulers.
4	Install a generic cloud environment as a private cloud.
5	Design a open source cloud.
6	Install and use Hadoop.

List of Experiments:

1. Use gcc to compile c-programs. Split the programs to different modules and create an application using make command.

2. Use version control systems command to clone, commit, push, fetch, pull, checkout, reset, and delete repositories.

3. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.

4. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.

5. Install Google App Engine. Create hello world app and other simple web applications using python/java.

6. Use GAE launcher to launch the web applications

7. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

8. Find a procedure to transfer the files from one virtual machine to another virtual machine.

9. Find a procedure to launch virtual machine using trystack (Online Openstack DemoVersion)

10. Install Hadoop single node cluster and run simple applications like wordcount.

Software requirement:

- **Open stack**
- **Hadoop**
- **Eucalyptus or Open Nebula or equivalent**

Text Book:

1. Cloud Computing: A Practical Approach forLearning and Implementation by A. Srinivasan, J.Suresh, Pearson**.**
2. Cloud Computing Bible by Barrie Sosinsky, Wiley Publishing.
3. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education

Reference Books:

1. Cloud Computing Black Book by Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Deven Shah, Dreamtech Press.
2. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej Goscinski, Wiley India.
3. To the cloud: cloud powering an Enterprise, Arora Pankaj, Tata Mc Graw Hill Education.
4. Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Kai Hwang, Morgan Kaufmann.

B. Tech. Electronics & Communication Engineering Sem VIII ADD ON COURSE: RESEARCH PAPER PUBLICATION		
TEACHING SCHEME:	**EXAMINATION SCHEME**	**CREDITS ALLOTTED:**
	Examination (UE): NA	
	Internal Assessment (IA): -NA	
		Total Credits:02

Course Objectives:	
1	To expose students to various types of research papers, paper writing tools, and plagiarism
2	Develop skills to write research papers using various tools.
3	To create awareness among students effectively choose journal metrics for manuscript submission

Course Outcomes: After learning this course, students will be able to	
CO1	Gain knowledge of various types of research papers
CO2	Choose various paper writing tools as per the need
CO3	Develop article writing skills
CO4	Apply skills to minimise plagairism
CO5	Effectively use journal maetrics for specific journal selection

Research Paper Publication:
Main objective of Research paper publication is to teach students how to do research and help them to acquire skills that students can use beyond the academic environment. Students should publish minimum one research paper in UGC care/Peer reviewed journal.