R19

B.Tech.
(ELECTRONICS AND COMMUNICATION ENGINEERING)

B.Tech. R19 CBCS Curriculum

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous, ISO 9001:2015 & QS I-Gauge Diamond Rated Institute, Accredited by NAAC with 'A++' Grade
NBA Accreditation for B.Tech. CE, EEE, ME, ECE, CSE, EIE, IT Programmes
Approved by AICTE, New Delhi, Affiliated to JNTUH, NIRF 113 Rank in Engineering Category
Recognized as "College with Potential for Excellence" by UGC
Vignana Jyothi Nagar, Pragathi Nagar, Nizampet (S.O), Hyderabad – 500 090, TS, India.
Telephone No: 040-2304 2758/59/60, Fax: 040-23042761
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VISION OF THE INSTITUTE

To be a World Class University providing value-based education, conducting interdisciplinary research in cutting edge technologies leading to sustainable development of the nation

MISSION OF THE INSTITUTE

- To produce technically competent and socially responsible engineers, managers and entrepreneurs, who will be future ready.

- To involve students and faculty in innovative research projects linked with industry, academic and research institutions in India and abroad.

- To use modern pedagogy for improving the teaching-learning process.

DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

B.TECH. (ECE)

VISION OF THE DEPARTMENT

A resource centre of academic excellence for imparting technical education with high pattern of discipline through dedicated staff which shall set global standards, making National and International students technologically superior and ethically strong, who in turn shall improve the quality of life.

MISSION OF THE DEPARTMENT

- To provide quality education in the domain of Electronics and Communication Engineering through effective learner centric process.
- To provide industry specific best of breed laboratory facilities beyond curriculum to promote diverse collaborative research for meeting the changing industrial and societal needs.

B.TECH.

(ELECTRONICS AND COMMUNICATION ENGINEERING)

B.TECH. (ECE)

PROGRAM EDUCATIONAL OBJECTIVES

PEO-I: Produce Electronics and Communication Engineering Professionals with a solid foundation in Mathematics, Science and Technology which is essential to solve engineering problems.

PEO-II: Train students in good scientific and engineering practices so that they comprehend, analyze, design, and create novel products and offer solutions for industry specific processes and real life problems.

PEO-III: Prepare students to adopt the learning culture needed for a successful professional career by encouraging them to acquire higher qualifications, take up research and keep abreast of latest technological developments.

PEO-IV: Inculcate organizing, managerial and entrepreneurship skills essential for professional growth.

PEO-V: Develop the consciousness among students towards moral values and professional ethics while developing innovative solutions to meet the societal needs.

B.TECH. (ECE)

PROGRAM OUTCOMES

PO-1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO-2: Problem analysis: Identify, formulate, review research literature, and analyze complexengineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO-3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO-4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO-5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO-6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO-7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO-9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO-10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO-11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO-12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

B.TECH. (ECE)

PROGRAM SPECIFIC OUTCOMES

PSO-1: Analyze, Design and Implement application specific Electronic systems for Analog and Digital domain, Communications, Signal and Analyze Image Processing Applications

PSO-2: Demonstrate the Computational and programming skills for problem solving

PSO-3: Identify and Apply Domain specific tools for Design, Analysis and Synthesis in the areas of VLSI and Embedded systems

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY HYDERABAD
B.TECH. I YEAR
(ELECTRONICS AND COMMUNICATION ENGINEERING)

I SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19BS1MT01	Calculus for Engineers	3	1	0	4	4
19BS1CH01	Engineering Chemistry	3	0	0	3	3
19HS1EN01	English	3	0	0	3	3
19ES1CS01	Programming through C	3	0	0	3	3
19ES1EE04	Circuit Theory	3	0	0	3	3
19BS2CH01	Engineering Chemistry Laboratory	0	0	2	2	1
19HS2EN01	English Language Communication Skills Laboratory	0	0	2	2	1
19ES2CS01	Programming through C Laboratory	0	0	2	2	1
19ES2ME01	Workshop Practices	1	0	2	3	2
Total		**16**	**1**	**8**	**25**	**21**
19MN6HS01	Induction Programme	-	-	-	-	-

II SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19BS1MT04	Linear Algebra and Advanced Calculus	3	0	0	3	3
19BS1PH02	Engineering Physics	3	0	0	3	3
19ES1IT01	Data Structures	3	0	0	3	3
19ES1EE06	Basic Electrical Engineering	3	1	0	4	4
19BS2PH02	Engineering Physics Laboratory	0	0	2	2	1
19ES2IT01	Data Structures Laboratory	0	0	2	2	1
19ES2EE04	Electrical Engineering Laboratory	0	0	2	2	1
19ES3ME02	Engineering Drawing	0	0	4	4	2
19PW4EC01	Design Sensitization	0	0	2	2	1
Total		**12**	**1**	**12**	**25**	**19**

L – Lecture T – Tutorial P – Practical D – Drawing

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY HYDERABAD
B.TECH. II YEAR
(ELECTRONICS AND COMMUNICATION ENGINEERING)

III SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19BS1MT08	Complex Analysis and Special Functions	3	0	0	3	3
19PC1EC01	Probability Theory and Stochastic Processes	3	1	0	4	4
19PC1EC02	Electronic Devices and Circuits	3	0	0	3	3
19PC1EC03	Digital System Design	3	0	0	3	3
19PC1EC04	Signals and Systems	3	0	0	3	3
19PC2EC01	Electronic Devices and Circuits Laboratory	0	0	3	3	1.5
19PC2EC02	Basic Simulation Laboratory	0	0	2	2	1
19PC2EC03	Digital System Design Laboratory	0	0	3	3	1.5
Total		**15**	**1**	**8**	**24**	**20**
19MN6HS03	Gender Sensitization	0	0	2	2	0

IV SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19PC1EE05	Control systems	3	0	0	3	3
19PC1EC05	Analog and Digital Communications	3	0	0	3	3
19PC1EC06	Analog Circuits	3	0	0	3	3
19PC1IT03	Computer Organisation	3	0	0	3	3
19PC1EC07	EM Waves and Transmission Lines	3	1	0	4	4
19PC2EC04	Analog and Digital Communication- Laboratory	0	0	3	3	1.5
19PC2EC05	Analog Circuits Laboratory	0	0	3	3	1.5
19PC2IT02	Python Programming Laboratory	0	0	2	2	1
Total		**15**	**1**	**8**	**24**	**20**

L – Lecture T – Tutorial P – Practical D – Drawing

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY HYDERABAD
B.TECH. III YEAR
(ELECTRONICS AND COMMUNICATIONS ENGINEERING)

V SEMESTER **R19**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
19PC1EC08	Antennas and Wave Propagation	3	0	0	3	3
19PC1EC09	Digital Signal Processing	3	1	0	4	4
19PC1EC10	Microprocessors and Microcontrollers	3	0	0	3	3
	Professional Elective – I					
19PE1EC01	Information theory and coding	3	0	0	3	3
19PC1EI07	Bio-Medical Instrumentation					
19PE1EC20	Sensors and Actuators					
19PE1MT01	Essential Mathematics for Machine Learning					
19PE1EC02	MOS Circuits					
	Open Elective – I	3	0	0	3	3
19PC2EC06	Digital Signal Processing Laboratory	0	0	3	3	1.5
19PC2EC07	Microprocessors and Microcontrollers Laboratory	0	0	3	3	1.5
19HS2EN05	Advanced English Communication Skills Laboratory	0	0	3	3	1
19PW4EC02	Internship	0	0	2	2	1
Total		**15**	**1**	**11**	**27**	**21**
19MN6HS02	Environmental Sciences	**2**	**0**	**0**	**2**	**0**

VI SEMESTER **R19**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
19PC1EC11	VLSI Design	3	1	0	4	4
19PC1EC12	Computer Networks and Systems Approach	3	0	0	3	3
19HS1MG02	Engineering Economics and Accountancy	3	0	0	3	3
	Professional Elective – II					
19PE1EC03	Mobile Communication and Protocols	3	0	0	3	3
19PE1EC04	Digital Image Processing					
19PE1EC05	Internet of Things					
19PE1CS10	Neural Networks and Deep Learning					
19PE1EC06	CPLD and FPGA Architecture					
	Open Elective – II	3	0	0	3	3
19PC2EC08	VLSI Design Laboratory	0	0	3	3	1.5
19PC2EC09	Computer Networks Laboratory	0	0	3	3	1.5
19PW4EC03	Design thinking	0	0	4	4	2
Total		**15**	**1**	**10**	**26**	**21**

L – Lecture T – Tutorial P – Practical

OE TRACKS BASED ON MEZZANINE TECHNOLOGIES:

OE TRACKS (Parent Department)	V SEMESTER	VI SEMESTER	VII SEMESTER	VIII SEMESTER
Smart Cities (CE)	Smart Cities Planning and Development **(19OE1CE01)**	Green Building Technology **(19OE1CE02)**	Smart Materials and Structures **(19OE1CE03)**	Intelligent Transportation System **(19OE1CE04)**
Waste Management (CE)	Solid Waste Management **(19OE1CE05)**	Hazardous Waste Management **(19OE1CE06)**	Waste to Energy **(19OE1CE07)**	Intelligent waste Management and Recycling System **(19OE1CE08)**
Green Energy (EEE)	Renewable Energy Sources **(19OE1EE01)**	Renewable Energy Technologies **(19OE1EE02)**	Energy Storage Technologies **(19OE1EE03)**	Energy Management and Conservation **(19OE1EE04)**
3D Printing & Design (ME)	Elements of CAD **(19OE1ME01)**	Introduction to 3D Printing **(19OE1ME02)**	3D Printing - Machines, Tooling and Systems **(19OE1ME03)**	Reverse Engineering **(19OE1ME04)**
Internet of Things (ECE)	Sensors Transducers and Actuators **(19OE1EC01)**	Introduction to Microcontrollers and Interfacing **(19OE1EC02)**	Fundamentals of Internet of Things **(19OE1EC03)**	Wireless Sensor Networks **(19OE1EC08)**
Augmented Reality (AR) / Virtual Reality (VR) (ECE)	Introduction to C Sharp **(19OE1EC04)**	Introduction to Signal Processing **(19OE1EC05)**	Introduction to Image and Video Processing **(19OE1EC06)**	Fundamentals of Augmented Reality and Virtual Reality **(19OE1EC07)**
Artificial Intelligence (CSE)	Mathematics for Artificial Intelligence **(19OE1MT01)**	Fundamentals of Artificial Intelligence **(19OE1CS01)**	Machine Learning Techniques **(19OE1CS02)**	Deep Learning **(19OE1CS03)**
Blockchain Technologies (CSE)	Fundamentals of Computer Networks **(19OE1CS04)** / Relational Data Base Management Systems **(19OE1CS08)**	Distributed Data Bases **(19OE1CS05)**	Cryptography and Network Security **(19OE1CS06)**	Blockchain Technology **(19OE1CS07)**
Robotics (EIE)	Fundamentals of Robotics **(19OE1EI01)**	Kinematics and Dynamics of Robots **(19OE1EI02)**	Drives and Control System for Robotics **(19OE1EI03)**	Robot Programming and Intelligent Control Systems **(19OE1EI04)**
Cyber Security (IT)	Fundamentals of Computer Networks **(19OE1CS04)** / Relational Data Base Management Systems **(19OE1CS08)**	Cryptography and Network Security **(19OE1CS06)**	Essentials of Cyber Security **(19OE1IT01)**	Computer Forensics **(19OE1IT02)**
Data Sciences / Big Data & Analytics (IT)	Statistical Methods for Data Science **(19OE1MT02)**	Computational Thinking using Python **(19OE1IT03)**	Fundamentals of Data Mining **(19OE1IT04)**	Data Analysis and Visualization **(19OE1IT05)**
Autonomous Vehicles (AME)	Principles of Automobile Engineering **(19OE1AE01)**	Modern Automotive Technologies **(19OE1AE02)**	Electric, Hybrid and Fuel Cell Vehicles **(19OE1AE03)**	Connected and Autonomous Vehicles **(19OE1AE04)**

GENERAL POOL OF OE COURSES:

OE TRACKS (Parent Departments)	COURSES
General-Computing (CSE / IT)	• Programming through Java **(19OE1IT06)** • Relational Data Base Management Systems **(19OE1CS08)** • Computational Thinking using Python **(19OE1IT03)** • Introduction to Data Analytics **(19OE1IT07)** • Fundamentals of Computer Algorithms **(19OE1CS11)**
General (H&S)	• Professional Ethics & Human Values (**19OE1HS01**) • Entrepreneurship (**19OE1HS02)** • Personality Development and Public Speaking (**19OE1HS03)** • Foreign Language-French (**19OE1HS04)**
General	• Smart Cities **(19OE1CE09)** • Trends in Energy Sources for Sustainable Development **(19OE1EE05)** • 3D Printing and Design **(19OE1ME05)** • Embedded Systems for IoT **(19OE1EC09)** • Artificial Intelligence - A Beginner's Guide **(19OE1CS09)** • Blockchain Technology Essentials **(19OE1CS10)** • Fundamentals of Robotics and Drones **(19OE1EI05)** • Fundamentals of Cyber Security **(19OE1IT08)** • Fundamentals of Data Science **(19OE1IT09)** • Introduction to Advanced Vehicle Technologies **(19OE1AE05)** • Introduction to Application Development with C# **(19OE1CS12)** • Introduction to Application Development with Java **(19OE1CS13)** • Introduction to Application Development with Python **(19OE1CS14)**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY HYDERABAD
B.TECH. IV YEAR
(ELECTRONICS AND COMMUNICATIONS ENGINEERING)

VII SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19HS1MG04	Principles of Management and organizational Behaviour	3	0	0	3	3
19PC1EC13	Microwave Engineering	3	0	0	3	3
	Professional Elective - III					
19PE1EC07	Fiber Optic Communication	3	0	0	3	3
19PE1EC08	Speech and Audio Processing					
19PC1IT04	Operating Systems					
19PE1EC21	Introduction to Machine Learning					
19PE1EC09	ASIC Design					
	Professional Elective - IV					
19PE1EC10	Satellite Communication	3	0	0	3	3
19PE1EC11	Software Defined Radio					
19PE1EC12	Embedded Systems					
19PE1CS21	Data Analytical Computing					
19PE1EC13	Verification and Scripting Languages for VLSI Design					
	Open Elective - III	3	0	0	3	3
19PC2EC10	Signal Processing and Communication Applications Laboratory	0	0	2	2	1
19PC2EC11	Microwave Engineering Laboratory	0	0	2	2	1
19PW4EC04	Mini-Project*	0	0	4	4	2
19PW4EC05	Major Project Phase - I	0	0	8	8	4
Total		**15**	**0**	**16**	**31**	**23**

*** Mini-Project to be pursued during summer vacation after VI semester and evaluated in VII semester**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY HYDERABAD
B.TECH. IV YEAR
(ELECTRONICS AND COMMUNICATIONS ENGINEERING)

VIII SEMESTER **R19**

<table>
<tr><th>Course Category</th><th>Title of the Course</th><th>L</th><th>T</th><th>P/D</th><th>Contact Hours/ Week</th><th>Credits</th></tr>
<tr><td></td><td colspan="6">Professional Elective – V</td></tr>
<tr><td>19PE1EC14</td><td>Advanced Communications</td><td rowspan="5">3</td><td rowspan="5">0</td><td rowspan="5">0</td><td rowspan="5">3</td><td rowspan="5">3</td></tr>
<tr><td>19PE1EI08</td><td>Biomedical Signal Processing</td></tr>
<tr><td>19PE1CS01</td><td>Mobile Computing</td></tr>
<tr><td>19PE1IT05</td><td>Cloud Computing</td></tr>
<tr><td>19PE1EC15</td><td>RF IC Design</td></tr>
<tr><td></td><td colspan="6">Professional Elective – VI</td></tr>
<tr><td>19PE1EC16</td><td>Radar Systems</td><td rowspan="5">3</td><td rowspan="5">0</td><td rowspan="5">0</td><td rowspan="5">3</td><td rowspan="5">3</td></tr>
<tr><td>19PE1EC17</td><td>Adaptive Signal Processing</td></tr>
<tr><td>19PE1EC18</td><td>Wireless Sensor Networks and protocols</td></tr>
<tr><td>19PE1CS17</td><td>Distributed Trust and Block chain Technologies</td></tr>
<tr><td>19PE1EC19</td><td>DSP Processors and Architectures</td></tr>
<tr><td></td><td>Open Elective – IV</td><td>3</td><td>0</td><td>0</td><td>3</td><td>3</td></tr>
<tr><td>19PW4EC06</td><td>Major Project Phase - II</td><td>0</td><td>0</td><td>12</td><td>12</td><td>6</td></tr>
<tr><td colspan="2">Total</td><td>09</td><td>0</td><td>12</td><td>21</td><td>15</td></tr>
</table>

L – Lecture T – Tutorial P – Practical D – Drawing

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Semester	L	T/P/D	C
	3	1	4

(19BS1MT01) CALCULUS FOR ENGINEERS

(Common to CE, EEE, ME, ECE, CSE, EIE, IT and AE)

COURSE PRE-REQUISITES: Differentiation, Integration

COURSE OBJECTIVES:

- To learn maximum and minimum value of a given function
- To learn Improper integrals using Beta and Gamma functions
- To learn methods of solving first order differential equations and learn about its applications to basic engineering problems
- To learn methods of solving higher order differential equations and learn about its applications to basic engineering problems
- To learn Laplace transforms of standard functions

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Solve problems involving Maxima and Minima
CO-2: Evaluate integrals using special functions
CO-3: Formulate and solve the problems of first and higher order differential equations
CO-4: Apply knowledge of differential equations to real world problems
CO-5: Use Laplace and Inverse Laplace transform as a tool to solve the problems.

UNIT-I:
Functions of Finite Variables: Limits, Continuity, Partial differentiation, partial derivatives of first and second order, Jacobian, Taylor's theorem of two variables (without proof). Maxima and Minima of two variables, Lagrange's method of undetermined Multipliers.

UNIT-II:
Improper Integrals: Definition of Improper Integrals, Beta functions: Properties and other forms of beta functions (statements only) and problems.
Gamma functions: Properties of Gamma functions (statements only), Relation between the Beta and Gamma functions (without proofs) and Evaluation of improper integrals using Beta and Gamma functions.

UNIT-III:
First Order, First Degree ODE and its Applications: Differential equations of first order and first degree - Exact differential equation, Linear and Bernoulli differential equation, Applications of differential equations of first order and first degree - Newton's law of cooling, Law of natural growth and decay, Orthogonal trajectories.

UNIT-IV:
Second and Higher Order ODE with Constant Coefficients: Second order linear differential equations with constant coefficients: Solution of Homogenous, non

homogeneous differential equations, Non-Homogeneous terms of the type e ^{ax} , sin (ax), cos (ax), polynomials in x, e ^{ax} V(x), x V(x).

UNIT-V:

Ordinary Differential Equations with Variable Coefficients: Method of variation of parameters; Equations reducible to linear ODE with constant Coefficients: Euler-Cauchy equation, Legendre's equation.

UNIT-VI:

Laplace Transforms: Laplace transforms, Existence condition, Laplace transform of Elementary functions, Properties of Laplace transforms (Without Proofs), Laplace transform of special functions (Unit step function, Dirac delta function and Periodic function). Inverse Laplace transform and its properties, Convolution theorem (without proof) ant its applications, Solving linear differential equations using Laplace transform.

TEXT BOOKS:

1. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, 5th Edition, Narosa Publishing House, 2016.
2. Higher Engineering Mathematics, B. V. Ramana, 33rd Reprint, McGraw Hill Education (India) private Limited, 2018.
3. Engineering Mathematics, N. P. Bali, 4th Edition, Laxmi Publications (P) Ltd., 2001.

REFERENCES:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley, 2011.
2. Advanced Engineering Mathematics, Peter 'O' Neil, 8th Edition, Cengage Learning, 2011.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19BS1CH01) ENGINEERING CHEMISTRY
(Common to CE, EEE, ECE and EIE)

COURSE PRE-REQUISITES: Basic knowledge of Mathematics and Chemistry

COURSE OBJECTIVES:
- To list out the importance of polymers, surfactants and lubricants in real world scenario
- To outline the features of conventional and non-conventional sources of energy
- To discuss the problems of corrosion on structures to interpret the need of alloys
- To emphasize the importance of nanomaterials, analytical techniques, environmental and green chemistry

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify & recognize the role of polymers, surfactants and lubricants in various fields
CO-2: Rationalize ideas about alternate sources of energy so as to reduce load on fossil fuels
CO-3: Summarise the effects of corrosion to indicate the use of alloys in various metallic structures
CO-4: Familiarize with the role of nanomaterials, environmental & green chemistry and assess the use of analytical techniques

UNIT-I:
Polymers: Polymers-Definition, types of polymerization-addition, condensation and copolymerization, Properties of polymers- crystallinity, melting point and glass transition, viscoelasticity, solubility of polymers. Fabrication of polymers (compression, extrusion, blowing and thermoforming). Synthesis, properties and uses of PET, PTFE, PMMA, polycarbonate, Bakelite and urea formaldehyde. Conducting polymers-definition, classification and applications. FRPs and their applications.

UNIT-II:
Surfactants: Definition, cleaning mechanism, types of surfactants, micelles, reverse micelles and critical micelle concentration.
Lubricants: Definition, types, mechanism of lubrication-thick film lubrication, thin film lubrication and extreme pressure lubrication. Additives and selection of lubricants. Properties-viscosity, cloud and pour point, flash and fire point, saponification number-definition and significance.

UNIT-III:
Energy Science:
Fuels: Definition, classification, characteristics of a good fuel. Coal-proximate & ultimate analysis-significance. Petroleum- refining, Cracking-definition, types of cracking, fluid-bed cracking, knocking, octane number, cetane number. Alternative and non-conventional sources of energy – solar, wind, geothermal, nuclear and biomass (advantages and disadvantages).

Battery Technology: Features of batteries, Rechargeable batteries- lithium ion and Zn-air batteries. Fuel cells-methanol-oxygen fuel cell.

UNIT-IV:

Corrosion: Introduction, causes and effects of corrosion, chemical and electrochemical corrosion and mechanism of corrosion. Types-differential aeration corrosion (Pitting and waterline corrosion), differential metal corrosion (Galvanic corrosion). Factors affecting corrosion-nature of metal (position, passivity, purity, areas of anode and cathode) & nature of environment (temperature, pH, humidity). Corrosion control methods-proper designing, cathodic protection, differences between galvanizing and tinning, paints-constituents and functions.

Alloys: Purpose of making alloys, classification of alloys, ferrous alloys ex: Steel, non-ferrous alloys ex: Cu, Al, Pb (features and applications).

UNIT-V:

Nanomaterials and Analytical Techniques: Nanomaterials: Definition, synthesis-top down and bottom up approaches. Properties and application of fullerenes and carbon nanotubes. Applications of nanomaterials in electronics, catalysis, telecommunication and medicine.

Analytical Techniques: Working principle and applications of pH-metry, conductometry, colorimetry, chromatography (TLC), Scanning tunneling microscope and atomic force microscope. Sensors: Lab-on-a-chip- features and applications.

UNIT-VI:

Environmental and Green Chemistry: Air, water and noise pollution: sources and effects, optimum levels of pollution. Solid waste management and e-waste: effects and management.

Green Chemistry- definition, principles and applications of green chemistry. Self healing materials-principle and applications.

TEXT BOOKS:

1. Engineering Chemistry, P. C Jain and M. Jain, 16th Edition, Dhanpat Rai Publications, New Delhi, 2016.
2. Engineering Chemistry, Prasanta Rath, B. Rama Devi, Ch. Venkata Ramana Reddy, Subhendu Chakroborty, 1st Edition, Cengage Publications, Delhi, 2019.
3. A Textbook of Engineering Chemistry, Shashi Chawla, 3rd Edition, Dhanpat Rai Publications, New Delhi, 2010.

REFERENCES:

1. Engineering Chemistry, S. S. Dara, 12th Edition, S. Chand & Company Ltd., New Delhi, 2010.
2. Engineering Chemistry, O. G. Palanna, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2009.
3. Engineering Chemistry, B. Sivasankar, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2009.
4. Introduction to Nanoscience, S. M. Lindsay, 2010.
5. Introduction to Environmental Science, Y. Anjaneyulu, BS Publications, Hyderabad, 2004.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19HS1EN01) ENGLISH

(Common to CE, EEE, ECE and EIE)

COURSE OBJECTIVES:

- To enhance their vocabulary through the use of affixes/stem and learn technical vocabulary in specialist fields
- To read and comprehend different kinds of texts (tone, tenor, sound, sense, diction, etc. - sub-skills)
- To write clear, concise, and correct sentences and paragraphs to produce appropriate technical prose
- To recognize and practice use the rhetorical elements necessary for the successful practice of scientific and technical communication

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Use vocabulary contextually and effectively
CO-2: Employ reading skills to comprehend different kinds of texts.(tone, tenor, sound, sense, diction, etc. - sub-skills)
CO-3: Apply principles of critical thinking, problem solving, for clarity, conciseness and accuracy of expression in academic and professional communication
CO-4: Demonstrate improved competence in Standard Written English, including grammar, sentence and paragraph structure, coherence, and use this knowledge to accurately communicate technical information
CO-5: Employ the appropriate rhetorical patterns of discourse in technical and business contexts for scientific and technical communication

UNIT-I:

1. Reading: On the Conduct of Life by William Hazlitt
2. Grammar: Prepositions
3. Vocabulary: Word Formation (Affixation, Compounding, Conversion, Blending, Borrowing)
4. Writing: Punctuation, Clauses and Sentences
5. Life Skills: Values and Ethics; 'If' by Rudyard Kipling

UNIT-II:

1. Reading: The Brook by Alfred Tennyson
2. Grammar: Articles
3. Vocabulary: Word Formation- (Prefixes, Suffixes, Root Words)
4. Writing: Principles of Good Writing-Coherence, Cohesion
5. Life Skills: Self Improvement; How I Became a Public Speaker by G.B. Shaw

UNIT-III:

1. Reading: The Death Trap by Saki
2. Grammar: Noun-Pronoun Agreement; Subject-Verb Agreement
3. Vocabulary: Collocation
4. Writing: Transitional Devices & Paragraph Writing; Writing Process

5. Life Skills: Time Management; On Saving Time by Seneca

UNIT-IV:

1. Reading: Chindu Yellamma
2. Grammar: Misplaced Modifiers
3. Vocabulary: Synonyms and Antonyms
4. Writing: Writing a Summary
5. Life Skills: Innovation; Muhammad Yunus

UNTI-V:

1. Reading: Politics and the English Language by George Orwell
2. Grammar: Cliches, Redundancies
3. Vocabulary: Common Abbreviations
4. Writing: Cause and Effect Paragraphs
5. Life Skills: Motivation; The Dancer with a White Parasol by Ranjana Dave

UNIT-VI:

Organizational Patterns for writing

1. Patterns of Writing: Comparison and Contrast
2. Patterns of Writing: Classification Paragraph
3. Patterns of Writing: Problem-Solution Pattern of writing

TEXT BOOKS:

1. Language and Life: A Skills Approach, Orient Black Swan, 2018 ed.

RECOMMENDED BOOKS:

1. Technical Communication, Raman, Meenakshi and Sharma, Sangeeta, 3rd Edition, O U P, 2015.
2. Communication Skills, Pushplata and Kumar Sanjay. O U P, 2015.
3. Longman Dictionary of Common Errors, Turton N.D., and Heaton J.B, 1991.
4. Practical English Usage, Swan, Michael. OUP, 1995.
5. Remedial English Grammar, Wood, F.T. Macmillan Publications, 2007.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19ES1CS01) PROGRAMMING THROUGH C
(Common to CE, EEE, ME, ECE, CSE, EIE, IT and AE)

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To relate basics of programming language constructs and problem solving techniques
- To classify and implement control structures and derived data types
- To analyze and develop effective modular programming
- To construct mathematical problems and real time applications using C language

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand fundamentals of computers and Illustrate the flowchart, algorithm, pseudo code for a given problem, develop programs using various datatypes and operators
CO-2: Develop conditional and iterative statements for a given problem
CO-3: Exercise on programs using arrays, pointers, dynamic memory management, structures and unions
CO-4: Develop solution for a given problem using modular approach and perform file handling

UNIT-I:
Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flow chart / Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, syntax and logical errors in compilation, object and executable code. Arithmetic expressions and precedence.

UNIT-II:
Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching Iteration and loops
Arrays (1-D, 2-D), Character arrays and Strings.

UNIT-III:
Basic Algorithms: Searching (Linear and Binary), basic sorting algorithms (bubble, insertion and selection), Pre-Processor directives.

UNIT-IV:
Functions: (Including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference.

Recursion: Recursion, as a different way of solving programs. Example programs, such as finding factorial, GCD, Fibonacci series, Ackerman function.

UNIT-V:

Structures & Unions: Defining structures and array of structures, Unions, Typedef, Bit-fields

Pointers: idea of pointers, defining pointers, use of pointers in self-referential structures, notation of linked list (no implementation), dynamic memory allocation.

UNIT-VI:

File Handling: Basic concepts, text files and binary files, file input/output operations, Error Handling in Files, random access of files, command line arguments.

TEXT BOOKS:

1. The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, Prentice Hall of India.
2. Schaum's Outline of Programming with C, Byron Gottfried, McGraw-Hill.

REFERENCES:

1. C: The Complete Reference, Herbert Schildt, IV Edition, McGraw-Hill.
2. Let Us C, Yashvant Kanetkar, BPB Publications.
3. Programming in ANSI C, E. Balaguruswamy, Tata McGraw-Hill.

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B.Tech. I Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19ES1EE04) CIRCUIT THEORY
(Common to EEE, ECE and EIE)

COURSE PRE-REQUISITES: Basic Mathematics

COURSE OBJECTIVES:
- To understand the basic concepts of circuit analysis
- To analyze single phase AC circuits and magnetic circuits
- To apply network theorems for circuit analysis
- To understand the graph theory for circuit analysis

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply basic network reduction techniques for analysis of electrical circuits
CO-2: Analyze AC circuits along with resonance and locus diagrams
CO-3: Appreciate the application of network theorems
CO-4: Analyze graph theory and apply topology solutions

UNIT-I:
Introduction to Electrical Circuits: Circuit Concept – Types of Elements-R-L-C parameters – Voltage and Current sources – Independent and dependent sources-Source transformation – Voltage – Current relationship for passive elements (for different input signals-square, ramp, saw tooth, triangular). Kirchhoff's laws – network reduction techniques – series, parallel, series parallel, star-to-delta or delta-to-star transformation.

UNIT-II:
Magnetic Circuits: Magnetic Circuits – Faraday's laws of electromagnetic induction – concept of self and mutual inductance – dot convention – coefficient of coupling – composite magnetic circuit - Analysis of series and parallel magnetic circuits

UNIT-III:
Single Phase A.C Circuits: R.M.S and Average values and form factor for different periodic wave forms, Steady state analysis of R, L and C (in series, parallel and series parallel combinations) with sinusoidal excitation – Concept of Reactance, Impedance, Susceptance and Admittance – Phase and Phase difference – concept of power factor, Real and Reactive powers –Complex and Polar forms of representation, Complex power.

UNIT-IV:
Locus Diagrams and Resonance: Locus diagrams – series R-L, R-C, R-L-C and parallel combination with variation of various parameters – Resonance: series and parallel circuits, concept of band width and Q factor.

UNIT-V:

Network Analysis and Network Theorems: Nodal analysis, Mesh analysis, Super Node and Super Mesh analysis of Networks with Independent and Dependent voltage and current sources.

Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Tellegen's, Millman's and Compensation theorems for D.C. and A.C. excitations.

UNIT-VI:

Network Topology: Definitions, Graph, Tree, Basic cut-set and Basic Tie-set matrices for planar networks -Duality and Dual networks.

TEXT BOOKS:

1. Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, 8th Edition McGraw Hill Company, 2013.
2. Circuit Theory, A. Chakrabarti, 6th Edition, Dhanpat Rai and Co., 2018.
3. Fundamentals of Electric Circuits, Charles K. Alexander, Mathew N. O. Sadiku, 3rd Edition, Tata McGraw Hill Company, 2019.

REFERENCES:

1. Network Analysis, M. E. Van Valkenburg, 3rd Edition, PHI, 2019.
2. Linear Circuit Analysis (Time Domain Phasor and Laplace Transform Approaches), Raymond A. Decarlo and Pen-min-lin, 2nd Edition, Oxford University Press, 2004.
3. Network Theory, N. C. Jagan and C. Lakshminarayana, 1st Edition, B. S. Publications, 2012.
4. Electrical Circuit Theory, K. Rajeswaran, Pearson Education, 2004.
5. Circuits and Networks Analysis and Synthesis, A. Sudhakar, Shyammohan S Palli, 5th Edition, Tata McGraw Hill Company, 2017.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Semester	L	T/P/D	C
	0	2	1

(19BS2CH01) ENGINEERING CHEMISTRY LABORATORY

(Common to CE, EEE, ECE and EIE)

COURSE PRE-REQUISITES: Basic knowledge of Volumetric Analysis and Mathematics

COURSE OBJECTIVES:

- To practically learn the preparation of standard solutions and estimate hardness & chloride content so as to check its suitability for various purposes
- To determine the rate constant of a reaction and check the variation of concentrations with respect to time
- To measure properties like adsorption, absorption of light, conductance, viscosity, pH and surface tension
- To synthesize a polymer and to separate a mixture of organic compounds by Thin Layer Chromatographic (TLC) technique

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Record the amount of hardness and chloride content in water and interpret the significance of its presence in water
CO-2: Analyze the influence of variation of concentration with time on rate constant
CO-3: Report and predict the significance of properties like absorption of light, adsorption, conductance, viscosity, pH and surface tension
CO-4: Demonstrate the technique of Thin Layer Chromatographic (TLC) and preparation of a polymer

LIST OF EXPERIMENTS:

1. Estimation of hardness of water by complexometric method using EDTA.
2. Determination of chloride content in the given sample water using Argentometric method.
3. Determination of the rate constant of hydrolysis of ester.
4. Estimation of copper present in the given solution by colorimetric method.
5. Conductometric titration of Acid vs Base.
6. Determination of viscosity of sample oil by Redwood Viscometer-I.
7. Determination of pH of various sample solutions by pH meter.
8. Titration of Acid vs Base using pH metric method.
9. Determination of surface tension of a liquid by drop method using Stalagmometer.
10. Determination of R_f value of organic compounds in a mixture by Thin Layer Chromatography.
11. Synthesis of a Polymer-Bakelite/Nylon.
12. Verification of Freundlich/Langmuir isotherm for adsorption of acetic acid on charcoal.

TEXT BOOKS:

1. Laboratory Manual on Engineering Chemistry, S. K. Bhasin and Sudha Rani, Dhanpat Rai Publications.

2. College Practical Chemistry, V. K. Ahluwalia, Sunitha Dhingra, Adargh Gulati, University Press Pvt. Ltd.
3. Practical Chemistry, O. P. Pandey, D. N. Bajpai, and Dr. S. Giri, S. Chand Publications.

REFERENCES:

1. Vogel's Text Book of Quantitative Chemical Analysis, G. N. Jeffery, J. Bassett, J. Mendham and R. C. Denny, Longmann, ELBS.
2. Advanced Practical Physical Chemistry, J. D. Yadav, Goel Publishing House.
3. Practical Physical Chemistry, B. D. Khosla, R. Chand and Sons.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester	**L**	**T/P/D**	**C**
	0	**2**	**1**

(19HS2EN01) ENGLISH LANGUAGE COMMUNICATION SKILLS LABORATORY
(Common to CE, EEE, ECE and EIE)

COURSE OBJECTIVES:
- To provide ample practice in LSRW skills and train the students in oral presentations, public speaking, role play and situational dialogue
- To provide practice in vocabulary usage, grammatical construction, structural patterns, and improve comprehension abilities in the students
- To train students to use neutral accent through phonetic sounds, symbols, stress and intonation
- To enable students to transfer information from verbal to graphic representation and vice versa
- To equip the learners to learn basic vocabulary of 3000 words (as identified in Oxford or Cambridge dictionary)

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Comprehend spoken and written discourse
CO-2: Speak fluently with neutral accent and exhibit interpersonal skills
CO-3: Write accurately, coherently and lucidly making appropriate use of words depending on context
CO-4: Introduce oneself to people and be able to speak extempore
CO-5: Learnt the basic vocabulary of 3000 words (as identified by oxford/Cambridge advanced learners dictionary)

UNIT-I:
1. Introduction of Self and others
2. Study & Referencing Skills

UNIT-II:
1. Role play-
   i) Expressing likes and dislikes;
   ii) Agreeing and disagreeing
   iii) Making requests (Using modals for polite requests)
   iv) Accepting and declining requests
2. Listening and note taking, Listening for details
3. Reading Skills – Skimming, Scanning, Intensive Reading and Extensive Reading

UNIT-III:
1. Extempore Speech: JAM
2. Accuracy in listening - Listening to discussion on specific issues
3. Pronunciation, Intonation, Stress and Rhythm

UNIT-IV:
1. Speaking Activity: Oral Presentation
2. Accuracy in listening- listening to discussion on specific issues

3. Reading Comprehension-Contextual Vocabulary

UNTI-V:

1. Speaking Activity: Book/Film Review
2. Reading Comprehension
3. Passive Voice-Constructing the impersonal passive

UNIT-VI:

1. Writing Skills: Information Transfer
2. Definition of a Technical Term
3. Description of a Mechanism/Process

RECOMMENDED BOOKS:

1. Practical English Usage, Swan, Michael. 4th Edition OUP, 2017.
2. Remedial English Grammar, F.T. Wood. BSC Publishers, 2014.
3. Exercises in Spoken English, Parts. I-III. CIEFL, Hyderabad. Oxford University Press, 1997.
4. Fowler's Modern English Usage, R.W. Burchfield OUP, Oxford, 2004.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Semester	**L**	**T/P/D**	**C**
	0	**2**	**1**

(19ES2CS01) PROGRAMMING THROUGH C LABORATORY
(Common to CE, EEE, ME, ECE, CSE, EIE, IT and AE)

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To gain a working knowledge of C programming to write modular, efficient and readable C programs by Identifying the structural elements and layout of C source code
- To declare and manipulate single and multi-dimensional arrays of the C data types and derived data types like structures, unions
- To use functions from the portable C library and to describe the techniques for creating program modules using functions and recursive functions
- To manipulate character strings in C programs. Utilize pointers to efficiently solve problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Use various data types for a specified problem
CO-2: Design, implement, debug a given problem using appropriate language constructs
CO-3: Implement programs using modular approach, file I/O
CO-4: Solve a given problem using C language

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

WEEK 1:
Familiarization with programming environment.

WEEK 2:
Simple computational problems using arithmetic expressions.

WEEK 3:
Problems involving if-then-else structures.

WEEK 4:
Iterative problems, sum of series.

WEEK 5:
1D Array manipulation.

WEEK 6:
Matrix problems, string operations.

WEEK 7:
Simple functions.

WEEK 8 AND WEEK 9:
Programming for solving searching and sorting techniques.

WEEK 10:
Recursive functions.

WEEK 11:
Pointers and structures.

WEEK 12:
File operations.

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B.Tech. I Semester	**L**	**T/P/D**	**C**
	1	**2**	**2**

(19ES2ME01) WORKSHOP PRACTICES

(Common to CE, EEE, ECE and EIE)

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To know the different popular manufacturing process
- To gain a good basic working knowledge required for the production of various engineering products
- To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field
- To identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Exposed to various types of manufacturing Process

CO-2: Fabricate/make components from wood, MS flat, GI Sheet etc. – hands on experience

CO-3: Exposed to manufacturing of machine components like fasteners, holes & threaded holes etc.

CO-4: Produce small devices / products /appliances by assembling different components

LECTURES & VIDEOS:

1. Manufacturing Methods - Casting, Forming, Machining, Joining, Advanced Manufacturing Methods
2. CNC Machining, Additive Manufacturing
3. Fitting Operations & Power Tools
4. Electrical & Electronics
5. Carpentry
6. Plastic Moulding, Glass Cutting
7. Welding (Arc Welding & Gas Welding), Brazing
8. Power Tools
9. Printed Circuit Boards

I. Carpentry

i. Cross lap joint
ii. Mortise & tenon joint

II. Fitting

i. Square fitting
ii. L-Fitting

III. Welding

i. Butt joint by arc welding
ii. Lap joint by arc welding

IV. Smithy

i. Making of Rectangular Tray from sheet metal.
ii. Making of U shaped component by black smithy

V. Electrical & Electronics

i. Single lamp connection & Stair case connection
ii. Translation of any tested / designed and tested circuits on a PCB.

VI. Machine Shop

i. Step turning on lathe
ii. Drilling & threading

TEXT BOOKS:

1. Workshop Manual, P. Kannaiah and K. L. Narayana, 3rd Edition, Scitech, 2015
2. Elements of Workshop Technology Vol.1 & 2, S. K. Hajra Choudhury, A. K. Hajra Choudhury and Nirjhar Roy, 13th Edition, Media Promoters & Publishers Pvt. Ltd., 2010.
3. Printed Circuit Boards - Design, Fabrication, Assembly and Testing, R. S. Khandpur, Tata McGraw-Hill Education, 2005.

REFERENCES:

1. Manufacturing Engineering and Technology, Serope Kalpakjian, Steven R. Schmid, 4th Edition, Pearson Education India Edition, 2002.
2. Manufacturing Technology-I, S. Gowri, P. Hariharan and A. Suresh Babu, Pearson Education, 2008.
3. Processes and Materials of Manufacture, Roy A. Lindberg, 4th Edition, Prentice Hall India, 1998.
4. Manufacturing Technology Vol-1 & 2, P. N. Rao, Tata McGraw-Hill House, 2017.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester	L	T/P/D	C
	3	0	3

(19BS1MT04) LINEAR ALGEBRA AND ADVANCED CALCULUS
(Common to CE, EEE, ME, ECE, CSE, EIE, IT and AE)

COURSE PRE-REQUISITES: Matrices, Differentiation, Integration

COURSE OBJECTIVES:
- To learn rank of the matrix and its application to consistency of system of linear equations
- To learn Eigen Values and Eigen Vectors
- To learn nature of Quadratic forms
- To learn evaluation of multiple integrals and their applications
- To learn basic properties of vector point function and their applications to line, surface and volume integrals

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Compute the rank of a matrix and analyze the solution of a system of linear equations
CO-2: Calculate Eigen values and Eigen vectors
CO-3: Reduce the quadratic form to its canonical form
CO-4: Evaluate areas & volumes using multiple integrals
CO-5: Transform line integral to surface and surface to volume integrals

UNIT-I:
Matrices: Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method; System of linear equations; Consistency of Homogeneous and Non-Homogeneous equations, LU Decomposition method.

UNIT-II:
Eigen Values and Eigen Vectors: Eigen values and Eigen vectors and their properties, Diagonalization of matrices; Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem.

UNIT-III:
Real & Complex Matrices, Quadratic forms: Types of Matrices, Symmetric; Hermitian; Skew-Symmetric; Skew-Hermitian; orthogonal matrices; Unitary Matrices and its properties; Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical form using Linear Transformation and Orthogonal Transformations.

UNIT-IV:
Multiple Integrals: Evaluation of Double Integrals (Cartesian and polar coordinates); change of order of integration (only Cartesian form), Change of variables (Cartesian to polar); Evaluation of Triple Integrals, Change of variables (Cartesian to Spherical and Cylindrical polar coordinates) for triple integrals. Applications: Areas (by double integrals) and volumes (by double integrals and triple integrals).

UNIT-V:

Vector Differential Calculus: Vector point functions and scalar point functions. Gradient and Directional derivatives, Divergence and Solenoidal vectors, Curl and Irrotational vectors, Scalar potential functions, Tangent plane and normal line. Vector Identities (without proofs).

UNIT-VI:

Vector Integral Calculus: Line, Surface and Volume Integrals and their problems. Green's theorem in a plane, Gauss-Divergence theorem and Stokes theorem (without proofs) and their problems.

TEXT BOOKS:

1. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, 5th Edition, Narosa Publishing House, 2016.
2. Higher Engineering Mathematics, B. V. Ramana, 33rd Reprint, McGraw Hill Education (India) private Limited, 2018.
3. Engineering Mathematics, N. P. Bali, 4th Edition, Laxmi Publications (P) Ltd., 2001.

REFERENCES:

1. Linear Algebra and its Applications, Gilbert Strang, 4th Edition, Cengage Learning, 2014.
2. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley, 2011.
3. Linear Algebra: A Modern Introduction, D. Poole, 4th Edition, Cengage Learning, 2017.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester	L	T/P/D	C
	3	0	3

(19BS1PH02) ENGINEERING PHYSICS

(Common to EEE, ECE and EIE)

COURSE PRE-REQUISITES: 10+2 Physics

COURSE OBJECTIVES:

- To analyze various phenomena of light- Interference and diffraction
- To apply the basic principles of LASER to various laser systems and optical fibers
- To explain the basic concepts in quantum physics required to deal with behavior of particle
- To interpret behavior of an electron in a periodic potential in crystal
- To explain various types of semiconductors and semiconductor materials

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Extend the importance of Interference in thin films, Fraunhofer diffraction
CO-2: Explain the lasing action of various laser sources and optical fiber materials
CO-3: Apply quantum mechanics to behavior of a particle
CO-4: Classify solids based on band gap
CO-5: Analyse formation of PN junction and importance of semiconductor materials

UNIT-I:
Wave Optics: Superposition Principle, Coherence, Interference of light by wave front splitting and amplitude splitting; Interference in thin films by reflection, Newton's rings experiment by reflection- Calculation of wavelength, Farunhofer diffraction (qualitative treatment) from a single slit, Double slit diffraction, Diffraction grating and a circular aperture .

UNIT-II:
Lasers: Introduction, Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Meta Stable State, Population Inversion, Lasing Action, Einstein's Coefficients and relation between them, Ruby Laser, Helium-Neon Laser, Semiconductor Laser, Application of Lasers in Science, Engineering and Medicine, Propagation of LASER through Optical Fiber- Total Internal Reflection.

UNIT-III:
Principles of Quantum Mechanics: Introduction to Quantum Mechanics, Waves and particles, de Broglie hypothesis, Matter waves, Davisson and Germer experiment, Heisenberg's uncertainty principle, Schrodinger Time independent Wave Equation, Physical significance of wave function, Particle in one dimensional infinite potential box.

UNIT-IV:
Band Theory of Solids: Free electron theory of metals (Drude and Lorentz theory), Electrical conductivity and Ohm's law, Bloch's theorem for particles in a periodic potential, Kronig-Penney model (Qualitative only), E-K diagram and origin of energy

bands. Types of electronic materials: metals, semiconductors, and insulators, Effective mass of an electron.

UNIT-V:

Semiconductors: Intrinsic semiconductors- Carrier concentration, dependence of Fermi level on carrier-concentration and temperature, Extrinsic Semiconductors (Qualitative), Continuity equation-Carrier generation and recombination, Carrier transport: diffusion and drift currents, Hall Effect, Hall Experiment, Measurement of Hall mobility, Resistivity, carrier density using Hall effect.

UNIT-VI:

Engineered Semiconductor Materials: Direct and Indirect band gap semiconductors, Formation of p -n junction, Energy diagram of diode, V-I characteristics of p-n junction diode, Working principle of LED, Working principle and V-I characteristics of Solar Cell – Parameters (short circuit current and open circuit voltage) extraction from I-V characteristics.

TEXT BOOKS:

1. Physics, Halliday, Resnick and Krane, 5th Edition, John Wiley & Sons, 2014.
2. Engineering Physics, R. K. Gaur and S. L. Gupta, 8th Edition, Dhanpat Rai and Sons, 2011.
3. Introduction to Semiconductor Materials and Devices, M. S. Tyagi, 3rd Edition, Wiley India, 2014.

REFERENCES:

1. A Textbook of Engineering Physics, M. N. Avadhanulu and P. G. Kshirsagar, 4th Edition, S. Chand, 2014.
2. Optics, A. Ghatak, 2nd Edition, McGraw Hill Education, 2014.
3. Introduction to Solid State Physics, Charles Kittel, 8th Edition, John Wiley & Sons, 2014.
4. Engineering Physics, B. K. Pandey and S. Chaturvedi, 5th Edition, Cengage Learning, 2015.
5. Concepts of Modern Physics, Arthur Beiser, 6th Edition, McGraw Hill Inc, 2016.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19ES1IT01) DATA STRUCTURES
(Common to ECE, CSE and IT)

COURSE OBJECTIVES:
- To introduce various searching and sorting techniques
- To demonstrate operations of linear and non-linear data structure
- To develop an application using suitable data structure

COURSE OUTCOMES: After completion of course, the student should be able to
CO-1: Understand basic concepts of data structures and analyse computation complexity
CO-2: Apply linear data structures to implement various sorting, searching techniques
CO-3: Apply various operations of linear and non-linear data structures
CO-4: Analyze appropriate and efficient data structure to implement a given problem

UNIT-I:
Introduction to Data Structures: Abstract Data Types (ADT), Asymptotic Notations. Time- Space trade off. Searching: Linear Search and Binary Search Techniques and their time complexities.
Linear Data Structures: Stacks - ADT Stack and its operations: Applications of Stacks: Recursion, Expression Conversion and evaluation.

UNIT-II:
Linear Data Structures: Queues - ADT queue, Types of Queue: Linear Queue, Circular Queue, Double ended queue, operations on each types of Queues

UNIT-III:
Linked Lists: Singly linked lists: Representation in memory, Operations: Traversing, Searching, insertion, Deletion from linked list; Linked representation of Stack and Queue.
Doubly linked List, Circular Linked Lists: All operations

UNIT-IV:
Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Binary Search Tree, AVL Tree; Tree Operations on each of the trees and their algorithms with time complexities.
B-Trees: Definition, Operations.

UNIT-V:
Priority Queue: Definition, Operations and their time complexities.
Sorting: Objective and properties of different sorting algorithms: Quick Sort, Heap Sort, Merge Sort; Radix sort

UNIT-VI:

Dictionaries: Definition, ADT, Linear List representation, operations- insertion, deletion and searching, Hash Table representation, Hash function-Division Method, Collision Resolution Techniques-Separate Chaining, open addressing-linear probing, quadratic probing, double hashing, Rehashing.

Graphs: Graph terminology –Representation of graphs –Graph Traversal: BFS (breadth first search) –DFS (depth first search) –Minimum Spanning Tree.

TEXT BOOKS:

1. Fundamental of Data Structure, Horowitz and Sahani, Galgotia Publication.
2. Data Structure, Lipschutz, Schaum Series.

REFERENCES:

1. Algorithms, Data Structures, and Problem Solving with C++, Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company.
2. How to Solve it by Computer, 2nd Impression by R.G. Dromey, Pearson Education.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester

	L	T/P/D	C
	3	1	4

(19ES1EE06) BASIC ELECTRICAL ENGINEERING
(Common to ECE and EIE)

COURSE PRE-REQUISITES: Circuit Theory, Calculus for Engineers

COURSE OBJECTIVES:
- To know about performance of DC machines
- To understand the operation of transformers and AC machines
- To analyze transient response of circuits with dc excitation
- To understand two port network parameters, filters and attenuators

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Appreciate the working of DC machines
CO-2: Understand the operation of transformers and AC machines
CO-3: Analyze transient response of circuits
CO-4: Evaluate two port parameters and design simple filters

UNIT-I:
DC Generators: Principles of Operation of DC Generator, construction, EMF equation, Types of Generators, Magnetization, Internal and external Characteristics of DC Generators.
DC Motors: DC Motors, Types of Dc Motors, Characteristics of Dc Motors, Losses and Efficiency, Swinburne's Test, Brake test on DC shunt motor, Speed Control of Dc Shunt Motor- Flux and Armature Voltage control methods.

UNIT-II:
Transformers: Principle of Operation of Single Phase transformer, Types, Constructional Features, Phasor Diagram on No Load and Load, Equivalent Circuit, Losses, Efficiency and Regulation of Transformer, OC and SC Tests, Predetermination of Efficiency and Regulation, Simple Problems

UNIT-III:
Three Phase Induction Motor: Principle of operation -types, torque-Slip characteristics, power flow diagram.
Alternators: Principle of operation –Types - EMF Equation- Predetermination of regulation by Synchronous Impedance Method- OC and SC tests.

UNIT-IV:
Transient Analysis (First and Second Order Circuits): Transient Response of RL, RC and RLC Circuits for DC excitations, Initial Conditions, Solution using Differential Equations approach and Laplace Transform Method.

UNIT-V:
Two Port Networks: Impedance Parameters, Admittance Parameters, Hybrid Parameters, Transmission (ABCD) Parameters, Conversion of one Parameter to another, Conditions for Reciprocity and Symmetry, Interconnection of Two Port

networks in Series, Parallel and Cascaded configurations, Image Parameters, Illustrative problems.

UNIT-VI:

Filters and Attenuators: Classification of Filters, Classification of Pass band and Stop band, Characteristic Impedance in the Pass and Stop Bands, Constant-k and m-derived filters-Low Pass Filter and High Pass Filters, Band Pass filter and Band Elimination filters (qualitative treatment only), Attenuators-symmetrical and asymmetrical(qualitative treatment only).

TEXT BOOKS:

1. Principles of Electrical Engineering, A. Sudhakar, Shyammohan S. Palli, 8th Edition, TMH Publications, 2011.
2. Introduction to Electrical Engineering, M. S. Naidu and S. Kamakshaiah, TMH Publications, 2017.
3. Network Analysis and Synthesis, C. L. Wadhwa, 3rd Edition, New Age International Publishers, 2018.

REFERENCES:

1. Engineering Network Analysis and Filter Design, Gopal G. Bhise, Prem R. Chadha & Durgesh C. Kulshreshtha Gopal, 1st Edition, Umesh Publication, 1999.
2. Engineering Circuit Analysis, W. H. Hayt, J. E. Kemmerly and S. M. Durbin, 8th Edition, Mc Graw Hill Company, 2013.
3. Circuit Theory, A. Chakrabarti, 6th Edition, Dhanpat Rai and Co, 2018.
4. Network Analysis, N. C. Jagan and C. Lakshmi Narayana, 1st Edition, B. S. Publications, 2012.
5. Circuits and Networks Analysis and Synthesis, A. Sudhakar, Shyammohan S. Palli, 5th Edition, Tata McGraw Hill Company, 2010.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester	**L**	**T/P/D**	**C**
	0	**2**	**1**

(19BS2PH02) ENGINEERING PHYSICS LABORATORY

(Common to EEE, ECE and EIE)

COURSE OBJECTIVES:

- To practically learn interaction of light with matter through physical phenomena like interference, diffraction and dispersion
- To understand the periodic motion and formation of standing waves and know the characteristics of the capacitors and resistors
- To study semiconductor devices
- To experience resonance phenomena
- To compare the experimental results with the class room learning

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Demonstrate the optical phenomena with formation of Newton Rings, pure spectrum through prism and to evaluate grating parameters

CO-2: Illustrate charging & discharging of a capacitor

CO-3: Asses the various characteristics of semiconductor devices

CO-4: Realize tangent law of magnetism and resonance phenomenon in Melde's and Sonometer experiment

CO-5: Correlate the experimental results with the class room learning

LIST OF EXPERIMENTS:

1. **Spectrometer:** To determine the dispersive power of given prism using spectrometer
2. **Diffraction Grating:** To determine the wavelength of given laser and grating parameters
3. **Diffraction at Single Slit:** To determine the width of given wire.
4. **Newton's Rings Experiment:** To determine the radius of curvature of given plano convex lens
5. **RC Circuit:** To determine the time constant of RC circuit
6. **Optical Fiber:** To determine Numerical aperture and Acceptance angle of a given optical fiber cable.
7. **Energy Band Gap of Semiconductor:** To determine Energy band gap of a semiconductor diode
8. **Light Emitting Diode:** To study the V-I characteristics of LED
9. **Solar Cell:** To study the V-I characteristics of Solar cell
10. **AC Frequency by Sonometer**: To measure frequency of AC mains
11. **Stewart Gee's Experiment:** To verify Biot - Savart's law
12. **Melde's Experiment:** To determine the frequency of electrical vibrator using resonance phenomenon

REFERENCES:

1. Engineering Physics Laboratory Manual/Observation, Faculty of Physics, VNRVJIET.

2. Laboratory Manual of Engineering Physics, Y. Aparna & K. Venkateswara Rao, VGS Publications.
3. Engineering Physics Practicals, B. Srinivasa Rao, Keshava Vamsi Krishna and K. S. Rudramamba, Second Edition, Laxmi Publications Pvt. Ltd., University Science Press.

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B.Tech. II Semester	**L**	**T/P/D**	**C**
	0	**2**	**1**

(19ES2IT01) DATA STRUCTURES LABORATORY
(Common to ECE, CSE and IT)

COURSE OBJECTIVES:

- **Impart** the basic concepts of data structures and algorithms
- **Learn** the concepts about searching and sorting
- **Understand** the basic concepts about stacks, queues, lists
- **Know** the concepts of trees and graphs

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Implement all operations on different linear data structures
CO-2: Develop all operations on different Non- linear data structures
CO-3: Apply various searching and sorting techniques
CO-4: Use appropriate data structure for any given problem

LIST OF EXPERIMENTS:

WEEK 1:
Implement Stack using Array

WEEK 2:
a) Program to convert infix expression to postfix expression.
b) Program to postfix evaluation.

WEEK 3:
Implement the following
a) Linear Queue using Array b) Circular Queue using Array

WEEK 4:
Implement Dequeue using Array

WEEK 5:
Implement Single Linked List operations

WEEK 6:
Implement following
a) Circular Linked List Operations b) Double Linked List Operations

WEEK 7:
Implement following
a) Stack using Linked List b) Queue using Linked List

WEEK 8:
Implement BST operations

WEEK 9:
Implement B Tree operations -

WEEK 10:
Implement following sorting techniques
a) Merge b) Heap c) Radix d) Quick

WEEK 11:
Implement following Hashing Techniques
a) Separate Chaining b) Linear Probing

WEEK 12:
Implement following Graph traversals
a) BFS b) DFS

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester	**L**	**T/P/D**	**C**
	0	**2**	**1**

(19ES2EE04) ELECTRICAL ENGINEERING LABORATORY
(Common to ECE and EIE)

COURSE PRE-REQUISITES: Circuit Theory

COURSE OBJECTIVES:
- To understand the construction of electrical equipment
- To apply different circuit reduction techniques using theorems
- To analyze the transient and steady state behavior of the RLC networks
- To practice the techniques to control and assess electrical machines

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify different parts of electrical equipment and appreciate their purpose
CO-2: Apply different network theorems to solve complex electrical circuits
CO-3: Analyze the transient and steady state behavior of the RLC networks
CO-4: Realize the compatibility of electrical machines in different engineering fields
CO-5: Control different electrical machines and evaluate their performance

LIST OF EXPERIMENTS:

1. Verification of superposition and reciprocity theorems.
2. Verification of maximum power transfer theorem.
3. Experimental determination of Thevenin's and Norton's equivalent circuits and verification by direct test.
4. Analysis of series RL, RC and RLC circuits.
5. Series resonant frequency, bandwidth and Q-factor determination for RLC network.
6. Time response of RC and RL circuits.
7. Two port network parameters –Z and Y-parameters.
8. Load test on 1- φ transformer.
9. Speed control of DC shunt motor.
10. Torque-Speed characteristics of separately excited DC motor.
11. Brake test on 3- φ Induction motor.
12. Control of synchronous generator voltage through its field excitation.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester	**L**	**T/P/D**	**C**
	0	**4**	**2**

(19ES3ME02) ENGINEERING DRAWING
(Common to EEE, ECE and EIE)

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To know the conventions used in Engineering Drawing and comprehend the tools to be used in AutoCAD software
- To understand the importance of engineering scales and curves
- To learn to use the orthographic projections for points, lines, planes and solids in different positions
- To understand the development of sections and isometric projections
- To create simple solid models of various domain applications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the concepts of engineering curves in construction using AutoCAD
CO-2: Solve the problem of projections of points, lines, planes and solids in different positions using AutoCAD
CO-3: Solve the problems of Projections of solids and its positions using AutoCAD
CO-4: Solve the problems on Isometric Projections and its conversions using AutoCAD

Introduction to AutoCAD Software:
The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line, The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.

UNIT-I:
Introduction to Engineering Drawing:
Principles of Engineering drawing and their significance, Conventions, Drawing Instruments
Engineering Curves: Construction of Ellipse, Parabola and Hyperbola – General and Special methods; Cycloidal curves- Epicycloids and Hypocycloids.

UNIT-II:
Orthographic Projections, Projections of Points & Straight Lines: Principles of Orthographic Projections – Conventions; Projections of Points in all positions; Projections of lines inclined to both the planes

UNIT-III:
Projections of Planes: Projections of Planes- Surface Inclined to both the Planes

UNIT-IV:
Projections of Regular Solids: Projections of Regular Solids inclined to both the Planes – Prisms, Pyramids, Cylinder and Cone

UNIT-V:

Isometric Projections: Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and Compound Solids

UNIT-VI:

Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions

Introduction to Solid Modelling: Creation of simple solid models relevant to the domain.

TEXT BOOKS:

1. Engineering Drawing, N. D. Bhatt, 53^{rd} Edition, Charotar Publishing House, 2016.
2. Textbook on Engineering Drawing, K. L. Narayana & P. Kannaiah, Scitech Publishers, 2010.
3. Engineering Drawing and Computer Graphics, M. B. Shah & B. C. Rana, Pearson Education, 2010.

REFERENCES:

1. Mastering AutoCAD 2019 and AutoCAD LT 2019, George Omura and Brian C. Benton (Auto CAD 2019), 1^{st} Edition, John Wiley & Sons, Indianapolis, Indiana.
2. AutoCAD Software Theory and User Manuals

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B.Tech. II Semester	**L**	**T/P/D**	**C**
	0	**2**	**1**

(19PW4EC01) DESIGN SENSITISATION

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To create awareness of design among students of engineering
- To teach a systematic approach to identifying and defining a problem before brainstorming for a solution
- To instill a sense of significance towards applying creativity to product and service design
- To motivate students to apply design thinking while implementing a project focusing on local or global societal problems

COURSE OUTCOMES: After completion of this course, the student should be able to

CO-1: Identify design principles from an engineering perspective
CO-2: Cultivate sensitivity towards design aspects of Activities, Environments, Interactions, Objects, and Users (A-E-I-O-U) in daily life
CO-3: Validate problem statements through user empathisation with societal and environmental consciousness
CO-4: Devise visual design and documentation to communicate more effectively
CO-5: Develop project management skills in a multidisciplinary environment

STUDENTS' RESPONSIBILITIES:

1. Forming diverse teams of 3–5 members each to work collaboratively throughout the semester.
2. Proactively engaging to observe the objects and interactions in their daily life and society from a design perspective.
3. Identifying general societal and social problems that may be effectively addressed using design thinking principles
4. Presenting and reporting the tasks to the concerned faculty members using their creative communication and people skills.

MODULE-1: Design Overview and Motivation

Design is Everywhere – Various perspectives including history; Design Vocabulary; Design in Indian Context; Art and Design; Importance of Design in Career

MODULE-2: Understanding Design

Design Engineering vs. Engineering Design; Good and Bad Design — Case Studies
Introduction to the Design Double Diamond: Discover-Define-Develop-Deliver; Importance of user-centricity for design

MODULE-3: Doing Design: Discover Phase

Looking for problems: SDGs; Identifying Stakeholders and Defining User Personas; User Empathisation and Tools; Data collection from users and for users: Surveys, Questionnaires, Statistics, Interactions

Need Analysis: Types of Users, Types of Needs; Market Size; Value Proposition to the Users; Identifying Addressable Needs and Touchpoints; Data Validation; Structuring Need Statements

MODULE-4: Designing Customer Service Experience

Enhancing Customer Experience in Services through Innovation and Design Thinking; Service Development Process and Case Studies; Service Experience Cycle and Case Studies

MODULE-5: Communication Skills for Design

Communicating using various media to express an idea in print, electronic, mobile, web, and social media: Visuals, Text, Voice and Audio, Infographics

General Guidelines for a Good Presentation: Target Audience, Slideshow Templates, Appropriate Visual Elements and Aesthetics, Typography, Presentation Styles, Guidelines

General Guidelines for a Good Report: Documentation Classification, Standards, Styles, and Templates

MODULE-6: Sustainable Design Approaches

Concern for Environment and Sustainability in Design, Case Studies to understand good Design For Environment (DFE) Decisions; Design Considerations in the five stages of the Product Life Cycle

TEXT BOOKS:

1. Tim Brown, "Change by Design", Harper Business, 2012 (ISBN: 978-0062337382)
2. Donald A. Norman, "The Design of Everyday Things", MIT Press, 2013 (ISBN: 978-0262525671)
3. Daniel Ling, "Complete Design Thinking Guide for Successful Professionals", CreateSpace Independent Publishing, 2015 (ISBN: 978-1514202739)

REFERENCES:

1. Bruno Munari, "Design As Art", Penguin UK, 2009 (ISBN: 978-0141035819)
2. Tom Kelly, Jonathan Littman, "The Art of Innovation", HarperCollins Business, 2002 (ISBN: 978-0007102938)
3. Thomas Lockwood, "Design Thinking: Integrating Innovation, Customer Experience, and Brand Value", Allworth Press, 2009 (ISBN: 978-1581156683)
4. Joost Groot Kromelink, "Responsible Innovation: Ethics, Safety and Technology", 2nd ed., TU Delft, Faculty of Technology, Policy and Management, 2019 (e-Book ISBN: 978-9463662024)
5. Jimmy Jain, "Design Thinking for Startups: A Handbook for Readers and Workbook for Practitioners", Notion Press, 2018 (ISBN: 978-1642495034)
6. Beverly Rudkin Ingle, "Design Thinking for Entrepreneurs and Small Businesses: Putting the Power of Design to Work", A Press, 2013 (ISBN: 978-1430261810)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19BS1MT08) COMPLEX ANALYSIS AND SPECIAL FUNCTIONS
(Common to ECE & EIE)

COURRSE PREREQUISITES: Integral and Differential Calculus

COURSE OBJECTIVES: To Learn
- Analytic function and their properties
- Concept of complex integration
- Classifications of Singular points and residues
- The notion of Conformal mapping
- The ways of finding the solutions of Bessel and Legendre equations

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply Cauchy-Riemann equations to study analyticity of functions
CO-2: Evaluate contour integrals using Cauchy's integral theorems
CO-3: Evaluate contour integrals using residue theorem
CO-4: Analyze the image of the given curve under the given transformation
CO-5: Solve ordinary differential equations using the notion of Bessel's equations

UNIT – I:
Functions of Complex Variables: Functions of a complex variable, Continuity, Differentiability, Analyticity, Singular point, Cauchy-Riemann equations in Cartesian and polar coordinates, Harmonic and conjugate harmonic functions, Milne – Thompson method. Analyticity of Exponential, trigonometric, hyperbolic functions and their properties.

UNIT – II:
Integration of Complex Function, Power Series: Line integral, evaluation along a path and by indefinite integration. Cauchy's integral theorem, Cauchy's integral formula. Expansion of Taylor's series and Laurent series (without proofs).

UNIT – III:
Residues and Real Integrals: Classifications of singular points: Isolated singular point, removable, pole of order m, essential singularity. Residues – Evaluation of residue by formulae, Residue theorem, Evaluation of real integrals (applications).

UNIT – IV:
Conformal Mapping: Definition of Conformal mapping, transformation of e z , log(z), z2 , Sin z, cos z, z + a/z. Basic transformations-Translation, rotation, inversion. Bilinear transformation - fixed point, cross ratio, properties, invariance of circles, determination of bilinear transformation mapping three given points to three assigned points.

UNIT – V:
Special functions- Bessel function: Bessel functions, Recurrence relations, properties. Generating function and Orthogonal properties.

UNIT – VI:

Special functions- Legendre function: Legendre polynomials, Properties, Rodrigue's formula, Recurrence relations Generating function, and Orthogonal properties.

TEXT BOOKS:

1. Higher Engineering Mathematics-B.S.Grewal, Khanna publishers, 36th Edition-2010
2. Higher Engineering Mathematics – B.V. Ramana; Publisher:Tata McGraw Hil, New Delhi,11th Reprint-2010
3. Complex Variables & Its Applications- Churchill and Brown, (1996), International Edition, McGraw Hill

REFERENCES:

1. Advanced Engineering Mathematics-Erwin Kreyszig, 9th Edition, Publisher: John Wiley
2. Advanced Engineering Mathematics – Peter 'O' Neil, publisher: Cengage Learning

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester	**L**	**T/P/D**	**C**
	3	**1**	**4**

(19PC1EC01) PROBABILITY THEORY AND STOCHASTIC PROCESSES

COURSE PRE-REQUISITES: Calculus for Engineers (19BS1MT01), Linear Algebra and Advanced Calculus (19BS1MT04)

COURSE OBJECTIVES:
- To introduce elementary probability theory as a basis for understanding random signals and random process
- To apply statistical methods on random signals and processes
- To utilize the random signals and systems in communications and signal processing
- To introduce the concepts of internal noise and external noise with reference to a communication system
- To characterize and quantify the channel in terms of coding and capacity

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the fundamentals of probability theory and solve real time probabilistic problems
CO-2: Evaluate and apply the statistical properties on random signals and processes
CO-3: Determine the spectral and temporal characteristics of Random processes
CO-4: Understand the response of linear time Invariant system for a random processes
CO-5: Analyse the noise characteristics of communication channel

UNIT – I:
Overview of Probability Theory: Definitions, scope and history, sets, sample space and events, axioms of probability, discrete, continuous and conditional probabilities, independence, total probability, Baye's rule and applications.
The Random Variable: Introduction, review of probability theory - conditional probability and Baye's theorem, definition of a random variable, conditions for a function to be a random variable, discrete, continuous and mixed random variables, distribution and density functions and its properties, conditional distribution and density and its properties, Binomial, Poisson, Uniform, Gaussian, Exponential and Rayleigh distributions.

UNIT – II:
Operations on Single Random Variable: Expected value of a random variable, function of a random variable, moments about the origin, central moments, variance and skew, characteristic function, moment generating function, Transformations of a random variable: monotonic and non–monotonic transformations for a random variable.

UNIT – III:
Multiple Random Variables: Joint distribution and density functions and its properties, Marginal distribution and density functions, Joint conditional distribution and density,

Statistical independence, Sum of two random variables, Sum of several random variables, Central Limit Theorem.

Operations on Multiple Random Variables: Joint moments about the origin, Joint central moments, Joint characteristic functions, Jointly Gaussian random variables: Two random variables case, N-random variables case, properties of Gaussian random variables.

UNIT – IV:

Random Processes–Temporal Characteristics: Concept of random process, Classification of processes, Deterministic and nondeterministic processes, Distribution and density functions, Concept of stationarity and statistical independence, First-order stationary processes, Second-order and Wide-sense stationarity, N^{th}-order and Strict-sense stationarity, Time averages and ergodicity, Autocorrelation function and its properties, Cross-correlation function and its properties, Covariance functions.

Random Signal Response of Linear Systems: System response – convolution, mean and mean-squared value of system response, autocorrelation function of response, Cross-Correlation functions of input and output.

UNIT – V:

Random Processes – Spectral Characteristics: The power density spectrum: Properties, relationship between power density spectrum and Autocorrelation function, Cross-power density spectrum and its properties, Relationship between cross-power density spectrum and cross-correlation function.

Spectral Characteristics of System Response: Power density spectrum of response, Cross power density spectrums of input and output.

UNIT – VI:

Modelling of Noise Sources: Resistive (Thermal) noise source, Arbitrary noise sources, Effective noise temperature, Average noise figure, Average noise figure of cascaded networks.

Introduction to Information Theory: Entropy, Information rate, Source coding: Huffman coding, Shannon-Fano coding, Mutual information, Channel capacity of discrete channel, Shannon-Hartley law, Trade-off between bandwidth and SNR.

TEXT BOOKS:

1. Probability, Random Variables & Random Signal Principles by Peyton Z. Peebles, TMH, 4th Edition, 2017
2. Modern Digital and Analog Communication Systems by B.P. Lathi, Zhi Ding, Oxford University Press, 4th Edition, 2011

REFERENCES:

1. Probability, Random Variables and Stochastic Processes by Athanasios Papoulis, S. Unnikrishna Pillai, 4th Edition, PHI, 2002
2. Probability and Random Processes with Applications to Signal Processing by Henry Stark and John W. Woods, 3rd Edition, Pearson Education, 2013
3. Statistical Theory of Communication by S.P. Eugene Xavier, 1st Edition, New Age International, 1997

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1EC02) ELECTRONIC DEVICES AND CIRCUITS
(Common to ECE, EIE & EEE)

COURSE PRE-REQUISITES: Engineering Physics (19BS1PH02)

COURSE OBJECTIVES:

- To understand the construction, principle of operation and characteristics of various semiconductor devices
- To study the applications of various semiconductor devices
- To have the familiarity with small signal model of semiconductor devices
- To understand the concepts of feedback in amplifiers and Oscillators

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the principle of operation and substantiate the applications of various Semiconductor devices
CO-2: Appreciate the need for biasing and stabilization
CO-3: Design the application specific circuits using basic active and passive components
CO-4: Explain the necessity of feedback in amplifiers and Oscillators

UNIT – I:
PN-Junction Diode and Applications: Review of p-n Junction as a Diode, Diode Equation, Volt-Ampere Characteristics, Temperature dependence of V-I characteristics, Ideal and Practical Diode Equivalent Circuits, Transition and Diffusion Capacitances, Breakdown Mechanisms in Semi-Conductor Diodes, Zener Diode and its Characteristics.
Half wave Rectifier, Full wave rectifier, Bridge Rectifier, Harmonic components in a Rectifier Circuit, Capacitor filters, π- section filters, Zener diode as Voltage Regulator.

UNIT – II:
Bipolar Junction Transistor, Biasing and Stabilization: Bipolar Junction Transistor (BJT), Transistor Current Components, Transistor Construction, BJT Operation, Common Base, Common Emitter and Common Collector Configurations, Limits of operation, BJT as an Amplifier, BJT Specifications. DC and AC Load lines, Quiescent operating point, Need for Biasing, Analysis of Fixed Bias, Collector Feedback Bias, Emitter Feedback Bias, Collector-Emitter Feedback Bias, Voltage Divider Bias, Bias Stability, Stabilization Factors, Stabilization against variations in VBE, β and ICO, Thermal Runaway, Thermal Stability and Compensation Techniques

UNIT – III:
Field Effect Transistor, Biasing: Construction and operation of Junction Field Effect Transistor (JFET), Volt-Ampere characteristics- Drain and Transfer Characteristics, FET as Voltage Variable Resistor, FET Biasing, Construction and operation of MOSFET, MOSFET characteristics in Enhancement and Depletion modes.

UNIT – IV:

Small signal low frequency Amplifiers:

BJT Amplifiers: Small signal low frequency transistor amplifier circuits: h-parameter representation and analysis of single stage CE, CC, CB amplifiers - Computation of Voltage gain, Current gain, Input impedance and Output impedance, Comparison of CB, CE, CC amplifiers.

JFET Amplifiers: JFET Small Signal Model, FET Common Source Amplifier, Common Drain Amplifier.

UNIT – V:

Feedback Amplifiers and Oscillators: Concept of feedback, Types of feedback, general characteristics of negative feedback amplifiers, voltage series, voltage shunt, current series and current shunt feedback configurations and their analysis(BJT version), Illustrative problems.

Classification of oscillators, Conditions for oscillations, RC phase shift oscillator, Generalized analysis of LC oscillators – Hartley and Colpitts oscillators, piezoelectric crystal oscillator, Stability of oscillators.

UNIT – VI:

Special Purpose Semiconductor Devices: Tunnel Diode, Varactor Diode, Photo Diode, Photo Transistor, UJT, LED, SCR

TEXT BOOKS:

1. Electronic Devices and Circuits – J.Millman, C.Halkias, and Satyabrata Jit, 4th Edition, Tata McGraw Hill, 2015
2. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, 11th Edition, Pearson/Prentice Hall, 2016

REFERENCES:

1. Integrated Electronics - J.Millman ,C.Halkias, and Chetan D Parikh, 2nd Edition, Tata McGraw Hill, 2010
2. Electronic Devices and Circuits – T.F. Bogart Jr., J.S.Beasley and G.Rico, 6th Edition, Pearson Education, 2004
3. Microelectronic Circuits- Adel S. Sedra and Kenneth C. Smith 7th Edition, Oxford, 2014

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1EC03) DIGITAL SYSTEM DESIGN
(Common to ECE, EEE & EIE)

COURSE PRE-REQUISITE: Linear Algebra and Advanced Calculus (19BS1MT04)

COURSE OBJECTIVES:
- To understand and analyze the logic families
- To understand the different ways of number representation and simplification of Boolean functions with reference to digital circuit design
- To understand the design principles of combinational and sequential circuits
- To understand the role of state machine in digital system designs
- To introduce the principles involved in implementing a digital system using PLDs

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify suitable logic family for the implementation of digital ICs
CO-2: Apply the fundamental concepts of digital logic in the design of digital system
CO-3: Analyze and design combinational and sequential logic building blocks of a digital system
CO-4: Apply state machines in the design of digital systems
CO-5: Implement digital systems using various programmable logic devices

UNTI – I:
Digital Logic Families: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing
Number Systems and codes: Number Systems, Representation of unsigned and Signed Numbers – Binary Arithmetic, Binary Codes, Code Conversions

UNIT – II:
Switching Functions and Logic Simplification: Boolean Algebra postulates and theorems, Algebraic Simplification, Digital logic gates, Multilevel NAND/NOR realizations, Boolean function representations: Canonical and Standard forms, Karnaugh map up to 5 variables, Don't care combinations.

UNIT – III:
Combinational Circuits: Half Adder, Full Adder, Ripple Carry Adder, Half Subtractor, Full Subtractor, Binary Adder/Subtractor, BCD adder, 4-bit Magnitude Comparator, Encoder, Priority Encoder, Decoder, Multiplexer, De- Multiplexer, Barrel shifter.

UNIT – IV:
Sequential Circuits: Classification of sequential circuits, Latches and Flip Flops, SR, JK,D, T and Master-Slave JK Flip Flops, Flip-Flop Conversions, Ripple and Synchronous Counters, Shift Registers, Sequence generator and sequence detector, Introduction to Finite State Machines(Mealy and Moore).

UNIT – V:
Algorithmic State Machine Charts: Introduction to ASM charts, system Design using data path and control subsystems, ASM charts for Binary Multiplier and Dice Game Controller.

UNIT – VI:

Programmable Logic Devices: Logic implementation using Programmable Logic Devices (PLDs): Read Only Memory (ROM), Programmable Logic Array (PLA), Programmable Array Logic (PAL).

Basic architectures of CPLD and FPGA, FPGA Programming Technologies: SRAM, Antifuse, EPROM

TEXT BOOKS:

1. Digital Design – Morris Mano, 3rd Edition, PHI, 2006
2. Modern digital Electronics- R P Jain, 4th Edition, Tata McGraw Hill, 2009
3. Digital Fundamentals-Floyd and Jain, 8th Edition, Pearson Education, 2009

REFERENCES:

1. Digital Systems- Ronald J Tocci, Neal S Widmer, Gregory L Moss, 10th Edition, Pearson Education, 2009
2. Digital Principles and Applications- Donald P Leach, Albert Paul Malvino and Goutam Saha, 8th Edition, McGraw Hill, 2014
3. Fundamentals of logic design - Charles H. Roth Larry L. Kinney, 7th Edition, Cengage, 2015

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1EC04) SIGNALS AND SYSTEMS
(Common to ECE & EIE)

COURSE PRE-REQUISITES: Calculus for Engineers (19BS1MT01), Linear Algebra and Advanced Calculus (19BS1MT04)

COURSE OBJECTIVES:

- To understand various fundamental characteristics of signals and systems
- To study the importance of transform domain
- To analyze and design various systems
- To study the effects of sampling
- To understand Laplace and Z-transforms their properties for analysis of signals and systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Classify the signals and implement various operations on signals
CO-2: Analyze the spectral characteristics of signals and systems
CO-3: Understand the conditions for physical realizability of a system
CO-4: Identify the significance of sampling types and applications of correlation functions
CO-5: Discover the significance of LT, ZT and their relation

UNIT – I:
Representation of Signals: Continuous time and Discrete Time signals, Classification of Signals – Periodic and aperiodic, even and odd, energy and power signals, deterministic and random signals, causal and non-causal signals, complex exponential and sinusoidal signals. Concepts of standard signals. Various operations on Signals.

UNIT – II:
Signal Analysis: Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Closed or complete set of orthogonal functions.
Fourier Series Representation of Periodic Signals: Dirichlet conditions, Representation of Continuous time periodic signals using Trigonometric and Exponential Fourier series, Complex Fourier spectrum, Gibb's Phenomenon.

UNIT – III:
Fourier Transform: Fourier transform from Fourier series, Fourier transform of standard signals and periodic signals, properties of Fourier transform with proof, Inverse Fourier Transform.
Laplace Transform: Concept of Region Of Convergence (ROC) for Laplace transform, Properties of ROC, Inverse Laplace Transform, Relation between Laplace Transform and Fourier transform of a signal. Introduction to Hilbert Transform and its properties.

UNIT – IV:

Signal Transmission through Linear Systems: Classification of Continuous time and discrete time Systems, impulse response, Response of a linear system, Transfer function and Filter characteristics of an LTI system, Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Paley -Wiener criterion for physical realization.

UNIT – V:

Convolution and Correlation of Signals: Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Properties of Convolution, Concepts of correlation, properties of correlation. Relation between convolution and correlation, Detection of periodic signals in the presence of noise by correlation.

Sampling Theorem: Representation of continuous time signals by its samples - Sampling theorem – Reconstruction of a Signal from its samples, aliasing – discrete time processing of continuous time signals, sampling of band pass signals.

UNIT – VI:

Z –Transform: Basic principles of z-transform, region of convergence, properties of ROC, Properties of z-transform with proofs, Poles and Zeros. Inverse z-transform – Power series method, Residue Theorem method, Convolution Method and Partial fraction expansion method.

TEXT BOOKS:

1. Signals, Systems and Communications - B.P. Lathi, BS Publications, 2009
2. Signals and Systems – Alan V.Oppenheim, Alan S.Willsky and S.Hamid Nawab, 2nd Edition, PHI ,1997

REFERENCES:

1. Signals and Systems- A.Anand Kumar, 2nd Edition, PHI, 2012
2. Signals and Systems -Simon Haykin and Barry Van Veen, 2nd Edition, John Wiley, 1998

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester	L	T/P/D	C
	0	3	1.5

(19PC2EC01) ELECTRONIC DEVICES AND CIRCUITS LABORATORY
(Common to ECE & EEE)

COURSE PRE-REQUISITES: Engineering Physics (19BS1PH02)

COURSE OBJECTIVES:
- To identify various active and passive components
- To understand the functionality of various measuring instruments
- To know the characteristics of various active devices
- To verify the applications of semiconductor devices and circuits

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the specifications of various devices and measuring equipment
CO-2: Analyze the characteristics of various semiconductor devices
CO-3: Appreciate the effect of feedback on the systems' performance
CO-4: Implement the applications using electronic devices

Part A: (Only for viva-voce Examination)
ELECTRONIC WORKSHOP PRACTICE (in 2 lab sessions):
1. Identification, Specification, testing of R,L,C components (color codes),Potentiometer (SPDT, DPDT and DIP), Coils, Gang Condensers, Relays, Bread Board, PCB.
2. Identification, Specification, testing of Active devices: Diodes, BJT, Low power JFET, MOSFET, Power Transistors, LED, LCD, SCR, and UJT.
3. Study and operation of:
   a) Multimeters (Analog and Digital)
   b) Function Generator
   c) Regulated Power Supplies
   d) CRO

Part B:
1. V-I characteristics of PN junction diode under forward and reverse bias.
2. V-I characteristics of Zener diode and voltage regulator using Zener Diode.
3. Full wave Rectifier without filter and with π filter: Computation of Ripple factor and Regulation efficiency
4. Input and Output characteristics of CE transistor configuration: computation of h-parameters.
5. Input and Output characteristics of CB transistor configuration: computation of h-parameters.
6. Characteristics of FET under CS configuration.
7. Frequency response of CE Amplifier.
8. Frequency response of CS Amplifier.
9. Frequency response of Voltage series feedback amplifier.
10. RC phase shift Oscillator using transistors.
11. Colpitt's Oscillator using transistors.
12. Characteristics of UJT

Experiments over and above curriculum:

1. UJT Relaxation Oscillator.
2. Transistor as a switch

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester	**L**	**T/P/D**	**C**
	0	**2**	**1**

(19PC2EC02) BASIC SIMULATION LABORATORY

COURSE PRE-REQUISITES: Calculus for Engineers (19BS1MT01), Linear Algebra and Advanced Calculus (19BS1MT04)

COURSE OBJECTIVES: Using simulation tool

- To understand the simulation of generation of Various (Continuous/Discrete) signals
- To study various arithmetic operations on signals and various transforms applied for signals
- To understand the characteristics of LTI system and to find its response for various excitations
- To study about the mathematical tools for signal estimation in the presence of noise

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Synthesize the given waveform using standard test signals and sequences and to find the symmetry of the signal
CO-2: Classify the given system based on its characteristics
CO-3: Analyze the effect of various transformations applied on independent and dependent variables of signals
CO-4: Determine the spectral and temporal characteristics of random processes

The experiments are to be software simulated using suitable software.

1. Basic Operations on Matrices
2. Generation of various signals and sequences (Periodic and Aperiodic), such as unit Impulse, step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc and random signals.
3. Operations on signals and sequences such as Addition, Multiplication, Scaling, Shifting, Folding. Computation of Energy and Average Power.
4. Finding the Even and Odd parts of Signal / Sequence and Real and imaginary parts of Signal.
5. Convolution between (i) Signals (ii) Sequences.
6. Auto Correlation and Cross Correlation of (i) Signals (ii) Sequences.
7. Computation of Unit sample, Unit step and sinusoidal responses of the given LTI system and Verifying its Physical realizability and stability properties.
8. Verification of Linearity and Time Invariance Properties of a given Continuous/Discrete System.
9. Verification of Gibb's Phenomenon.
10. Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.
11. Verification of Sampling Theorem.
12. Verifying the applications of Correlation:
    i. Estimating the period of a periodic signal masked by noise
    ii. Removal of Noise from the combination of signal and noise
13. Generation of Gaussian noise (Real and Complex), Computation of its mean, M.S. Value and its Skew, Kurtosis and PSD, Probability Distribution Function.

14. Checking a Random Process for Stationary in Wide sense.

Experiments over and above the curriculum:
1. Verification of the properties of FS and FT.
2. Verification of Wiener-Khinchine relation.

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B.Tech. III Semester	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

(19PC2EC03) DIGITAL SYSTEM DESIGN LABORATORY
(Common to ECE & EEE)

COURSE OBJECTIVES:

- To get familiarity with functionalities of IC's through hardware simulation
- To learn Verilog Hardware Description Language
- To model, and simulate digital circuits using hardware description languages and CAD tools
- To learn writing test-benches for functional verification of the relatively complex digital system

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Verify the functionality of various Digital ICs
CO-2: Apply hardware description languages for designing and functional verification of combinational circuits
CO-3: Design and verify the functionality of sequential circuits using Verilog HDL
CO-4: Design various state machines and applications using Verilog HDL

LIST OF EXPERIMENTS:
A study on Classification and basic information of Integrated Circuits (ICs).
Part-1: To Verify the Functionality of the following 74 Series ICs.

1. 3- 8 Decoder – 74LS138.
2. 8X1 Multiplexer– 74151 and 2X4 De-multiplexer- 74155.
3. 4-bit COMPARATOR -74LS85.
4. D-Flip- Flop – (74LS74) and JK Master-Slave Flip- Flop (74LS73).
5. Decade Counter (74LS90) and UP-DOWN Counter (74LS192).
6. Universal Shift registers – 74LS194/195.

Part-2: Design and simulate the following Circuits:

1. Logic Gates.
2. Adders and Subtractors
3. Code converters
4. Multiplexer and De-multiplexer.
5. Encoder and Decoder.
6. Parity generator and checker
7. Flip Flops using Truth table and FSM
8. Shift Registers
9. Synchronous & Asynchronous counters
10. Sequence Detector.

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B.Tech. III Semester	**L**	**T/P/D**	**C**
	0	**2**	**0**

(19MN6HS03) GENDER SENSITIZATION

COURSE DESCRIPTION:
This course offers an introduction to Gender Studies, an interdisciplinary field that asks critical questions about the meanings of sex and gender in society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary. It draws on multiple disciplines – such as literature, history, economics, psychology, sociology, philosophy, political science, anthropology and media studies – to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with race, class, caste, nationality and other social identities. This course also seeks to build an understanding and initiate and strengthen programmes combating gender-based violence and discrimination. The course also features a number of exercises and reflective activities designed to examine the concepts of gender, gender-based violence, sexuality, and rights. It will further explore the impact of gender-based violence on education, health and development

ACTIVITIES:
Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments.

COURSE OBJECTIVES:
- To sensitize students on issues of gender in contemporary India
- To provide a critical perspective on the socialization of men and women
- To expose the students to debates on the politics and economics of work
- To enable students to reflect critically on gender violence
- To expose students to more egalitarian interactions between men and women

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand important issues related to gender in contemporary India
CO-2: Attain a finer grasp of how gender discrimination works in our society and how to counter it
CO-3: Acquire insight into the gendered division of labour and its relation to politics and economics
CO-4: Respond to put an end to gender violence
CO-5: Equipped to work with the other gender treating them as equals

MODULE 1: Introduction to Gender
- Definition of Gender
- Basic Gender Concepts and Terminology
- Exploring Attitudes towards Gender
- Social Construction of Gender

MODULE 2: Gender Roles and Relations
- Types of Gender Roles

 Gender Roles and Relationships Matrix
 Gender-based Division and Valuation of Labour

MODULE 3: Gender Development Issues
 Identifying Gender Issues
 Gender Sensitive Language
 Gender, Governance and Sustainable Development
 Gender and Human Rights
 Gender and Mainstreaming

MODULE 4: Gender-based Violence
 The concept of violence
 Types of Gender-based violence
 The relationship between gender, development and violence
 Gender-based violence from a human rights perspective

MODULE 5: Gender and Culture
 Gender and Film
 Gender and Electronic Media
 Gender and Advertisement
 Gender and Popular Literature

MODULE 6: Gender and Studies
 Knowledge: Through the Lens of Gender Point of View, Gender and the Structure of Knowledge
 Whose History: Questions for Historians and Others, Reclaiming a Past, Writing Other Histories

TEXT BOOK:
1. Towards a World of Equals: A Bilingual Textbook on Gender, A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu, Telugu Akademi, Telangana Government, 2015.

REFERENCES:

1. Sen, Amartya. More than One Million Women are Missing. New York Review of Books 37.20 (20 December 1990). Print. 'We Were Making History...' Life Stories of Women in the Telangana People's Struggle. New Delhi: Kali for Women, 1989.
2. Tripti Lahiri. By the Numbers: Where Indian Women Work. Women's Studies Journal (14 November 2012) Available online at: http://blogs.wsj.com/India real time/2012/11/14/by-the-numbers-where-India-women-work/>
3. Abdulali Sohaila I Fought For My Life ...and Won. Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/
4. K. Kapadia. The Violence of Development: the Politics of Identity, Gender and Social Inequalities in India. London: Zed Books, 2002
5. T. Banuri and M. Mahmood, Just Development: Beyond Adjustment with a Human Face, Karachi: Oxford University Press, 1997

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1EE05) CONTROL SYSTEMS
(Common to ECE and EIE)

COURSE PREREQUISITES: Ordinary Differential Equations and Laplace Transform

COURSE OBJECTIVES:

- To understand the different ways of system representations-Transfer function representation, state space representation and to assess the system's dynamic response
- To assess the system performance using time domain analysis and methods for improving it
- To assess the system performance using frequency domain analysis and techniques for improving the performance
- To design various controllers and compensators to improve system performance

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the system's steady state and transient performance
CO-2: Evaluate the effects of feedback on system performance
CO-3: Obtain the transfer function/ state space models
CO-4: Design suitable controller and compensator for the improvement of system performance

UNIT – I:
Introduction to control problem: Open-Loop and Closed-loop systems, benefits of Feedback. Mathematical models of physical systems. Transfer function models of linear time-invariant systems –RLC Circuits, DC and AC servo motors. Block diagram algebra and Signal Flow Graphs.

UNIT- II:
Time Response Analysis: Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorems. Design specifications for second-order systems based on the time-response.

UNIT – III:
Stability and Root Locus: Concept of Stability, Routh-Hurwitz Criterion, Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

UNIT – IV:
Frequency-response analysis: Relationship between time and frequency response. Bode plots- transfer function from bode plot-phase and gain margins- stability analysis. Polar and Nyquist plots, Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margins.

UNIT – V:
Introduction to Controller Design: Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems.

Root-loci method of feedback controller design- Application of Proportional, Integral and Derivative Controllers. Design specifications in frequency- domain. Frequency-domain methods of design- Lead and Lag compensators.

UNIT – VI:

State space Analysis: Concepts of state variables. State space model - RLC circuits and DC motors. State Transition Matrix and its properties- Transformations: State space to Transfer function and vice versa. Eigenvalues and Stability Analysis. Concept of controllability and observability.

TEXT BOOKS:

1. Control Systems Engineering, by I. J. Nagrath and M. Gopal, New Age International,2009
2. Modern Control Engineering, by K. Ogata, Prentice Hall, 1991

REFERENCES:

1. Modern Control Systems, by Richard C. Dorf and Robert H. Bishop
2. Automatic Control System, by B. C. Kuo, Prentice Hall, 1995
3. Control Systems: Principles and Design, by M. Gopal, McGraw Hill Education, 1997

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1EC05) ANALOG AND DIGITAL COMMUNICATIONS

COURSE PRE-REQUISITES: Signals and Systems(19PC1EC04), Probability Theory and Stochastic Process (19PC1EC01)

COURSE OBJECTIVES: Providing the ability

- To understand the principles of various Analog and Digital modulation and demodulation Techniques
- To analyze the noise performance of Analog Modulation systems
- To Understand the concepts of Pulse Analog and digital modulation
- To Study the concepts of base band transmission
- To understand the principle of Uncertainty of an event and relating it to a communication system

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Appreciate the difference between Analog and Digital communication systems

CO-2: Differentiate and explain about baseband Transmission and pass band transmission of information

CO-3: Understand the effect of filter characteristics of a communication channel on the transmitted signal

CO-4: Analyze and compare various Modulation schemes with reference to their Noise performance

CO-5: Explain the practical significance of codes in communication

UNIT – I:

Amplitude Modulation: Need for modulation, Amplitude Modulation - Time and frequency domain representation, single tone modulation, power relations in AM waves, Generation of AM waves – Square-Law modulator, Switching modulator, Detection of AM Waves – Square-Law Demodulator, Envelope detector, DSB-SC modulation - time and frequency domain representation, Generation of DSB-SC Waves - Balanced Modulators, Coherent detection of DSB-SC Waves, COSTAS Loop.

SSB modulation -time and frequency domain representation, Generation of SSB waves - Frequency discrimination and Phase discrimination methods, Demodulation of SSB Waves, Vestigial side band modulation – Time and frequency domain representation, Noise in AM, DSB and SSB Systems.

UNIT – II:

Angle Modulation: Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave using Bessel functions, Narrow band FM, Wide band FM, Power in NBFM and WBFM, Transmission bandwidth of FM Wave. Generation of FM Waves - Armstrong Method, Detection of FM Waves - Balanced slope detector, Phase locked loop, Comparison of FM and AM.

Noise in Angle Modulation System, Threshold effect in Angle Modulation System. Pre-emphasis and De-emphasis.

UNIT – III:

Receivers: Radio Receiver - Receiver Types - Tuned radio frequency receiver, Super heterodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, Image frequency, AGC, Amplitude limiting, FM Receiver, Comparison with AM Receiver.

Pulse Modulation: Types of Pulse modulation – Generation and Detection of PAM, PWM and PPM.

UNIT – IV:

Pulse Code Modulation: PCM Generation and Reconstruction, Quantization Noise Power, Non-Uniform Quantization and Companding, DPCM, Adaptive DPCM, DM and Adaptive DM, Noise in DM, Comparison of FDM and TDM.

Various Line Coding Formats: Unipolar, Polar, Bi-polar, Power Spectral Density of various line coding formats, Inter Symbol Interference, Nyquist Criterion to reduce ISI.

UNIT – V:

Digital Modulation Techniques: ASK- Modulator, Coherent ASK Detector, FSK-Modulator, Non-Coherent FSK Detector, BPSK- Modulator, Coherent BPSK Detection. Differential PSK, Principles of QPSK and QAM.

Baseband Transmission and Optimal Reception of Digital Signal: A Baseband Signal Receiver, Probability of Error, Optimum Receiver, Matched filter, Coherent Reception. Probability error of ASK, FSK, PSK.

UNIT – VI:

Error Correcting Codes

Linear Block Codes: Linear Codes, Decoding, Constructing Hamming Codes.

Cyclic Codes: Systematic Cyclic Codes, Generator Polynomial and Generator Matrix of Cyclic codes, Cyclic code generation, Decoding, Cyclic Redundancy Check (CRC) codes for Error Detection.

TEXT BOOKS:

1. Principles of Communication Systems – H.Taub, D.L.Schilling, Goutham Saha, Mc Graw Hill, 4th Edition, 2013
2. Modern Digital and Analog Communication Systems – B.P.Lathi, Zhi Ding, Oxford University Press, 4th Edition, 2011

REFERENCES:

1. Communication Systems –Simon Haykin, Michael Moher, Wiley, 4th Edition, 2009
2. Digital and Analog Communication Systems-K.Sam Shanmugam, Wiley Student Edition, 2006

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1EC06) ANALOG CIRCUITS
(Common to ECE & EEE)

COURSE PRE-REQUISITES: Electronic Devices and Circuits (19PC1EC02)

COURSE OBJECTIVES:
- To understand the principle of Multi stage Amplification
- To understand the principle of large signal amplification
- To learn about process of wave shaping circuit
- To study the applications of Operational Amplifier
- To study the IC versions of various waveform generators

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze and Compute the parameters of single and multistage Amplifiers
CO-2: Design various large signal and tuned amplifiers
CO-3: Design the wave shaping circuit for a specified output
CO-4: Understand the characteristics of an Operational Amplifier
CO-5: Design various applications using linear integrated circuits

UNIT – I:
Frequency Response of BJT Amplifiers: Analysis at low and high frequencies, Effect of coupling and bypass capacitors, Miller's Theorem.
Transistor at high frequency: Hybrid-π Common Emitter transistor model, CE short circuit gain, CE current gain with resistive load, Single stage CE transistor amplifier response at high frequencies.

UNIT – II:
Multistage Amplifiers: Introduction, Methods of inter-stage coupling, Frequency response and Analysis of multistage amplifiers, n-stage cascaded amplifier, CE-CC Amplifier, Darlington Pair.
MOS Amplifiers: **MOS Small signal Model, Common source amplifier with Resistive load, Diode connected load, and current source load, Source follower, Cascode Amplifiers.**

UNIT – III:
Large Signal Amplifiers: Class-A Power Amplifier- Series fed and Transformer coupled, Conversion Efficiency, Class B Power Amplifier- Push Pull and Complimentary Symmetry configurations, Conversion Efficiency, Cross Over Distortion, Principle of operation of Class AB and Class C Amplifiers.
Tuned Amplifiers: Classification, Single Tuned Amplifiers – Q-factor, frequency response of tuned amplifiers, Concept of stagger tuning and synchronous tuning.

UNIT – IV:
Linear Wave Shaping: High pass, Low pass RC circuits and their response for sinusoidal, step, pulse, square inputs. RC network as a differentiator and integrator, Attenuators.

Non-Linear Wave Shaping: Diode clippers, clipping at two independent levels, Transfer characteristics of clippers, Clamping operation, clamping circuits, Clamping circuit theorem.

UNIT – V:

Linear Integrated Circuits: Classification, basic information of Op-amp, ideal and practical Op-amp, internal circuits, Op-amp DC and AC characteristics, modes of operation-inverting, non-inverting, and differential.

OP-AMP Applications: Basic applications of Op-amp, Instrumentation amplifier, ac amplifier, V to I and I to V converters, Sample and Hold circuits, Differentiators, Integrators, Comparators.

UNIT – VI:

Data Converters and Waveform Generators: D-A and A- D Converters: weighted resistor DAC, R-2R ladder DAC, Different types of ADCs- Successive approximation ADC and Dual slope ADC, Parallel comparator.

555 Timer and PLL: Introduction to 555 timer, functional diagram, Mono-stable, Astable and Schmitt Trigger operations, PLL – operation and application.

TEXT BOOKS:

1. Integrated Electronics - J.Millman ,C.Halkias, and Chetan D Parikh, Tata McGraw Hill ,2nd Edition ,2017
2. Pulse, Digital and Switching Waveforms J. Millman ,H. Taub and Suryaprakash Rao M, 3rd Edition McGraw-Hill, 2017
3. Op-Amps and Linear Integrated Circuits – Ramakanth A. Gayakwad, 4th Edition, PHI, 2015

REFERENCES:

1. Electronic Circuit Analysis - S. Salivahanan, N. Suresh Kumar, Tata McGraw-Hill Education, 4th Edition, 2017
2. Pulse and Digital Circuits – K Venkata Rao, K Rama Sudha, G. Manmadha Rao, Pearson Education India, 1st Edition, 2010
3. Linear Integrated Circuits –D. Roy Choudhary, Shail.B.Jain, New Age International, 5th Edition, 2018

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Semester	L	T/P/D	C
	3	0	3

(19PC1IT03) COMPUTER ORGANIZATION
(COMMON TO ECE, CSE & IT)

COURSE OBJECTIVES:

- To describe the functional blocks of a computer to interpret the instructions and various addressing modes for the execution of instruction cycle
- To perform Arithmetic micro operations on integers and floating-point numbers
- To analyze the cost performance and design trade-offs in designing and constructing a computer processor including memory
- To discuss the different ways of communicating with I/O devices & interfaces and the design techniques to enhance the performance using pipelining, parallelism

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Interpret the functional architecture of computing systems
CO-2: Explore memory, control and I/O functions
CO-3: Impart the knowledge on micro programming
CO-4: Analyze instruction level parallelism, Concepts of advanced pipeline techniques

UNIT – I:
Functional Blocks of a Computer: CPU, memory, input-output subsystem, control unit. Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.
Case study – Instruction set of some common CPUs

UNIT – II:
Data Representation: Signed number representation, fixed and floating point representations, character representation.
Computer Arithmetic: Integer Addition and Subtraction - Ripple carry adder, carry look- ahead adder. Multiplication – Shift-and add, Booth multiplier, carry save multiplier. Division – Restoring and non-restoring techniques, floating point arithmetic.

UNIT – III:
Microprogrammed Control: Control memory, address sequencing, micro program example, and design of control unit, hardwired control, and micro programmed control.

UNIT – IV:
Memory System Design: Semiconductor memory technologies. SRAM vs DRAM.
Memory Organization: Memory interleaving, concepts of hierarchical memory organization, cache memory, cache size vs block size, mapping functions, replacement algorithms, write policies, virtual memory, secondary storage.

UNIT – V:
Peripheral Devices and their Characteristics: Input-output subsystems, I/O device interface, I/O transfers, - program controlled, Interrupt driven and DMA, privileged and non –privileged instructions, software interrupts and exceptions. Programs and

processes – role of interrupts in process state transitions, I/O device interfaces – SCSI, USB.

UNIT – VI:

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction pipe line, RISC pipeline Vector Processing, Array Processors

TEXT BOOKS:

1. "Computer Organization and Design: The Hardware/Software Interfaces", 5^{th} Edition by David A. Patterson and John L. Hennessy, Elsevier
2. "Computer Organization and Embedded Systems", 6^{th} Edition by Carl Hamacher, McGraw Hill Higher Education

REFERENCES:

1. Computer System Architecture, by M. Morris Mano, 3^{rd} Edition
2. Computer Architecture and Organization, by John P. Hayes, 3^{rd} Edition, WCB/McGraw-Hill
3. Computer Organization and Architecture: Designing for Performance, by William Stallings, 10^{th} Edition, Pearson Education
4. Computer System Design and Architecture, by Vincent P. Heuring and Harry F. Jordan, 2^{nd} Edition Pearson Education

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	3	**1**	**4**

(19PC1EC07) EM WAVES AND TRANSMISSION LINES

COURSE PRE-REQUISITES: Engineering Physics (19BS1PH02)

COURSE OBJECTIVES:
- To provide the basic concepts of Electric and Magnetic fields
- To understand the Maxwell's equations and applying boundary conditions to the different material interfaces
- To conceptualize the wave propagation characteristics for different media
- To learn the basic parameters of Transmission lines

COURSE OUTCOMES: After Completion of the course the student should be able to
CO-1: Understand the basic concepts of Electric and Magnetic fields
CO-2: Solve equations of EM fields using Maxwell's equations
CO-3: Evaluate and analyze propagation characteristics of electromagnetic waves
CO-4: Find the parameters of transmission lines

UNIT – I:
Electrostatics: Introduction to Vector Calculus and Coordinate Systems, Coulomb's law, Electric filed intensity, fields due to different charge distributions, Electric flux density, Gauss law and applications, Electric potential, Relations between E and V, Maxwell's two equations for electro static fields, energy density, Convection and Conduction currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics , Continuity equation, Relaxation time, Poisson's and Laplace equations, Capacitance –parallel plate, coaxial, spherical capacitors, illustrative problems.

UNIT – II:
Magneto Statics: Biot – Savart's law, Ampere's circuit law and applications, Magnetic flux density, Magnetic scalar and vector potentials, Forces due to Magnetic fields, Amperes Force law, Inductances and Magnetic energy, illustrative problems.

UNIT – III:
Maxwell's Equations: Maxwell's Equations (Time Varying Fields) Faraday's law and Transformer emf, inconsistency of the Amperes law and displacement current density, Maxwell's equations in differential forms, integral forms and word statements, conditions at a boundary surface: Dielectric - Dielectric and Dielectric - conductor interfaces – illustrative problems.

UNIT – IV:
EM wave Characteristics – I: Wave equations for conducting and perfect dielectric media. Uniform plane waves – definitions, all relations between E and H, sinusoidal variations, wave propagation in loss less and conducting media, conductors and Dielectrics characterization, wave propagation in good conductors and good dielectrics, polarization, illustrative problems.

UNIT – V:

EM Waves characteristics – II: Reflection and refraction of plane waves – normal and oblique incidences for both perfect conductor and perfect dielectrics, Brewster angle, Critical angle and Total internal reflection, Surface Impedance, skin depth, Poynting vector and Poynting theorem – applications, power loss in a plane conductor, illustrative problems.

UNIT – VI:

Transmission Lines: Types, parameters, Transmission line equations, primary and secondary constants, Expressions for characteristic impedance, propagation constant, phase and group velocities, infinite line concepts, Loss loss/ low loss characterization, Distortion – condition for distortion less and minimum attenuation, Loading, Types of loading. Input impedance relations, SC and OC lines, reflection coefficient, VSWR, UHF lines as circuit elements,
□/4, □/2, □/8 lines - impedance Transformations, Significance of Zmin and Zmax, Smith chart configuration and applications, single and double stub matching, illustrative problems.

TEXT BOOKS:

1. Elements of Electromagnetics – Matthew N.O.Sadiku, Oxford Univ.Press, 6th Edition, 2012
2. Electromagnetic Waves and Radiating Systems- E.C. Jordan and K.G.Balmain, PHI, 2nd Edition, 2000

REFERENCES:

1. Engineering Electromagnetics - William H.Hayt jr and John A. Buck,TMH, 7th Edition, 2006
2. Networks Lines and Fields - John D Ryder, PHI, 2nd Edition, 1999
3. Engineering Electromagnetics –Nathan Ida, Springer, 1st Edition, 2000

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Semester	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

(19PC2EC04) ANALOG AND DIGITAL COMMUNICATIONS LABORATORY

COURSE PRE-REQUISITES: Signals and Systems (19PC1EC04)

COURSE OBJECTIVES:

- To introduce the principles of various Analog and Digital Modulation Methods and the study of their spectral characteristics
- To introduce practical implementation of discretization process of a continuous and analog signal
- To understand the principles of channel coding

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Generate AM and FM signals and evaluate their performance
CO-2: Perform signal sampling by determining the sampling rates for baseband signals and reconstruct the signals
CO-3: Generate digital modulation signals and perform their demodulation
CO-4: Encode and decode Linear block codes

List of Experiments: The experiments to be simulated using suitable software. Minimum 6 experiments are to be implemented in hardware.

1. Amplitude Modulation, Demodulation
2. Frequency Modulation, Demodulation
3. SSB system and synchronous detection
4. Sampling of a continuous and analog signal & Reconstruction
5. Generation & Demodulation of PCM/DM
6. Generation & Demodulation of ASK and FSK
7. Generation and Demodulation of BPSK
8. Generation and Demodulation of DPSK
9. Costa's receiver and AGC system
10. M-ary PSK systems
11. Computation of a channel capacity of binary channels
12. BER comparison of different modulation schemes in AWGN channel

Experiments over and above the curriculum:

Simulation of

i. Modulation and Demodulation of Analog QAM
ii. Encoding and Decoding of Linear Block codes.

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

(19PC2EC05) ANALOG CIRCUITS LABORATORY

COURSE PRE-REQUISITES: Electronic Devices and Circuits (19PC1EC02)

COURSE OBJECTIVES:
- To explain the operation, design and Analysis of multistage amplifiers using BJT
- To understand the operation of power amplifiers and their efficiency
- To understand the operation of wave shaping circuits
- To understand the operation of IC 741 and its applications
- To understand the working principle of 555 timer

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Design and analyze multi-stage amplifier circuits
CO-2: Design Linear and Non-linear Waveshaping circuits
CO-3: Analyze and design application specific circuits using Op.Amp IC 741
CO-4: Design applications using IC 555 Timer

PART - A
Design and simulation of the following circuits using simulation software and implementation through hardware.
1. Common Emitter Amplifier
2. MOSFET- CS amplifier
3. Two stage RC coupled BJT Amplifier
4. Darlington amplifier.
5. Class B Complementary Symmetry Amplifier.

PART – B: Implement the following
1. Linear Waves shaping - RC high pass and low Pass circuits
2. Non-linear wave shaping–Clippers
3. Non-linear wave shaping–Clampers
4. Adder, Subtractor, Comparator, Integrator and Differentiator using IC 741 OP-AMP.
5. Square Wave Generator and Triangular Wave Generator using OP- AMP.
6. R-2R ladder D-A Converter
7. Monostable and Astable Multivibrator.using 555 timer
8. Schmitt Trigger circuits using IC 741 & IC 555.

Experiments over and above the curriculum:
1. Sweep generator
2. Active first order LPF, HPF using OP-AMP

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B.Tech. IV Semester – CSE, IT & ECE	**L**	**T/P/D**	**C**
	0	**2**	**1**

(19PC2IT02) PYTHON PROGRAMMING LABORATORY

COURSE PRE-REQUISITES: Programming through C (19ES1CS01)

COURSE OBJECTIVES:
- To install and run the Python interpreter
- To learn control structures
- To Understand Lists, Dictionaries in python
- To Handle Strings and Files in Python

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Develop the application specific codes using python
CO-2: Understand Strings, Lists, Tuples and Dictionaries in Python
CO-3: Verify programs using modular approach, file I/O, Python standard library
CO-4: Implement Digital Systems using Python

Exercise 1 Basics
Running instructions in Interactive interpreter and a Python Script
Write a program to purposefully raise Indentation Error and correct it

Exercise 2 Operations
Write a program to compute GCD of two numbers by taking input from the user
Write a program add.py that takes 2 numbers as command line arguments and prints its sum.

Exercise - 3 Control Flow
Write a Program for checking whether the given number is even number or not.
Write a program using for loop that loops over a sequence.
Python Program to Print the Fibonacci sequence using while loop
Python program to print all prime numbers in a given interval (use break)

Exercise – 4 Lists
Find mean, median, mode for the given set of numbers in a list.
Write a program to convert a list and tuple into arrays.
Write a program to find common values between two arrays.

Exercise – 5 Dictionary
Write a program to count the numbers of characters in the string and store them in a dictionary data structure
Write a program combine_lists into a dictionary.

Exercise – 6 Strings
Write a program to check whether a string starts with specified characters.
Write a program to check whether a string is palindrome or not

Exercise -7 Strings Continued
Python program to split and join a string

Python Program to Sort Words in Alphabetic Order

Exercise - 8 Files
Write a program to print each line of a file in reverse order.
Write a program to compute the number of characters, words and lines in a file.
Write a program to count frequency of characters in a given file.

Exercise - 9 Functions
Simple Calculator program by making use of functions
Find the factorial of a number using recursion
Write a function dups to find all duplicates in the list.
Write a function unique to find all the unique elements of a list.

Exercise - 10 Functions - Problem Solving
Write a function cumulative_ product to compute cumulative product of a list of numbers.
Write a function reverse to print the given list in the reverse order.
Write function to compute GCD, LCM of two numbers

Exercise- 11 Multi-D Lists
Write a program that defines a matrix and prints
Write a program to perform addition of two square matrices
Write a program to perform multiplication of two square matrices

Exercise - 12 - Modules
a) Install Num Pypackage with pip and explore it.

Exercise - 13
Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR
Write a program to implement Half Adder, Full Adder, and Parallel Adder

TEXT BOOKS:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Learning Python, Mark Lutz, Orielly

REFERENCES:

1. Think Python, Allen Downey, Green Tea Press
2. Core Python Programming, W.Chun, Pearson
3. Introduction to Python, Kenneth A. Lambert, Cengage

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B.Tech. V Semester	L	T/P/D	C
	3	0	3

(19PC1EC08) ANTENNAS AND WAVE PROPAGATION

COURSE PRE-REQUISITES: EM Waves and Transmission Lines (19PC1EC07)

COURSE OBJECTIVES:
- To know about the Antenna specifications and Operation
- To analyze the fields associated with various types of antennas along with emphasis on their applications
- To know the measurement techniques involved in measuring antenna parameters
- To understand the concepts of radio wave propagation in the atmosphere

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Describe the basic parameters and analyze the fields radiated by various types of antennas
CO-2: Measure antenna parameters critical for evaluating its performance
CO-3: Interpret the performance characteristics of Array Antennas
CO-4: Compare the intricacies involved in various modes of wave propagation

UNIT – I:
Antenna Fundamentals: Introduction, Radiation Mechanism – single wire, 2 wires, dipoles, Current Distribution on a thin wire antenna. Antenna Parameters - Radiation Patterns, Patterns in Principal Planes, Main Lobe and Side Lobes, Beam width, Polarization, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Antenna Apertures, Aperture Efficiency, Effective Height, Antenna properties based on Reciprocity theorem, illustrated Problems.
Antenna Measurements – Patterns Required, Set Up, Distance Criterion, Directivity and Gain Measurements (Comparison, Absolute and 3-Antenna Methods).

UNIT – II:
Thin Linear Wire Antennas: Retarded Potentials, Evaluation of Field Components, Radiation from Small Electric Dipole, Power Radiated, Alternating current element, Half wave Dipole and Quarter wave Monopole- Current Distributions, Radiation Resistance, Beam width, Directivity, Effective Area and Effective height. Thin Linear Center-fed Antennas of different lengths, Loop Antennas: Introduction, Comparison of loop antennas with dipole.

UNIT – III:
Antenna Arrays: Two element arrays - different cases, Principle of Pattern Multiplication - 4-element and 8-element array, N-element Uniform Linear Arrays - Broadside, Endfire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison, Concept of Scanning Arrays, Directivity Relations (qualitative treatment), Binomial Arrays, Effects of Uniform and Non-uniform Amplitude Distributions, Design Relations, Arrays with Parasitic Elements, Yagi - Uda Arrays, Folded Dipoles and their characteristics.

Non-Resonant Radiators: Microstrip Antennas - Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry and Parameters, Impact of different parameters on characteristics.

UNIT – IV:
VHF, UHF and Microwave Antennas
Broadband Antennas: Helical Antennas – Significance, Geometry, basic properties, design considerations for monofilar helical antennas in Axial mode and Normal modes (qualitative treatment).
Reflector Antennas: Flat Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, characteristics, types of feeds, F/D Ratio, Spill over, Back Lobes, Aperture blocking, off-set Feeds, Cassegrain Feeds, Horn Antennas – Types, Optimum Horns, Design Characteristics of Pyramidal Horns, Lens Antennas – Geometry, Features, Fermatt's principle, Dielectric Lenses and Zoning, Applications.

UNIT – V:
Wave Propagation: Concepts of Propagation – frequency ranges and types of propagations, Ground Wave Propagation – Characteristics, Parameters, Wave Tilt, Flat and Spherical earth considerations, Sky wave propagation – Formation of Ionospheric layers and their characteristics, Mechanism of Reflection and Refraction, Critical frequency, MUF and skip distance – Calculations for flat and spherical earth cases, Optimum frequency, LUHF, Virtual height, Ionospheric abnormalities, Ionospheric absorption.

UNIT – VI:
Space Wave Propagation: Fundamental equation for Free-Space propagation, Basic transmission loss calculations, Space wave propagation – Mechanism, LOS and Radio Horizon. Tropospheric Wave Propagation – Radius of Curvature of path, Effective Earth's Radius, Effect of Earth's Curvature, Field Strength calculations, M-curves and Duct Propagation, Tropospheric Scattering.

TEXT BOOKS:
1. Antennas for All Applications – John D. Kraus and Ronald J. Marhefka, TMH, 3rd Edition, 2003
2. Antenna Theory - C.A. Balanis, John Wiley and Sons, 2nd Edition, 2016

REFERENCES:
1. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K. G. Balmain, PHI, 2nd Edition, 2000
2. Transmission and Propagation – E.V.D. Glazier and H.R.L. Lamont, The Services Text Book of Radio, vol. 5, Standard Publishers Distributors, Delhi
3. Electronic and Radio Engineering – F.E. Terman, McGraw-Hill, 4th Edition, 1955

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B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**1**	**4**

(19PC1EC09) DIGITAL SIGNAL PROCESSING
(Common to ECE & EIE)

COURSE PRE-REQUISITES: Signals and Systems

COURSE OBJECTIVES:

- To know the characteristics of discrete time signals and systems
- To analyze and process signals using various transform techniques
- To understand various factors involved in design of digital filters and role of Multi rate Signal Processing
- To understand the effects of finite word length implementation

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze and process signals in the time-domain and transform domain
CO-2: Design of digital filters for various applications
CO-3: Design of multirate systems (ECE)
CO-4: Analyze the significance of finite word length effects

UNIT – I:
Introduction: Introduction to Digital Signal Processing, Applications of Z-Transforms: Solution of Linear Constant Coefficient Difference equations (LCCD), Block diagram representation of LCCD equations. System function, Frequency domain representation of discrete time signals and systems.
Discrete Fourier Series: DFS representation of periodic sequences, Relation between Z- transform and DFS.

UNIT – II:
Discrete Fourier Transforms: Properties of DFT, linear convolution of sequences using DFT, Computation of DFT.
Fast Fourier Transforms: Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

UNIT – III:
IIR Digital Filters: Analog filter approximations- Butterworth and Chebyshev, comparison of Butterworth and Chebyshev filters. Design of IIR Digital filters from analog filters, Step and Impulse invariance transformation techniques, Bilinear transformation method. Spectral transformations (Analog to Analog).
Realization of IIR Filters: Direct, Canonic, Cascade, Parallel, Lattice and Ladder forms.

UNIT – IV:
FIR Digital Filters: Characteristics of linear phase FIR filters and its frequency response. Comparison of IIR and FIR filters.
Design of FIR filters: Fourier Method, Frequency Sampling method and windowing methods: Rectangular window, Hanning window, Hamming window, Bartlett window and Kaiser window.

Realization of FIR Filters: Direct form, cascade realization and Linear phase Realization.

UNIT – V:

Multirate Digital Signal Processing: Introduction, Down sampling, Decimation, Up sampling, Interpolation, sampling rate conversion, Implementation of sampling rate conversion, Applications of Multirate Signal Processing.

UNIT – VI:

Finite Word Length Effects: Limit cycles, Overflow oscillations, Round-off noise in IIR digital filters, Computational output round off noise, Methods to prevent overflow.

TEXT BOOKS:

1. Digital Signal Processing: Principles, Algorithms and Applications, John G. Proakis, D.G. Manolakis, 4th Edition, Pearson/PHI, 2009
2. Discrete Time Signal Processing, A.V. Oppenheim and R.W. Schaffer, PHI, 2009

REFERENCES:

1. Digital Signal Processing – A Pratical Approach, Emmanuel C. Ifeacher, Barrie. W. Jervis, 2nd Edition, Pearson Education, 2009
2. Digital Signal Processing - Fundamentals and Applications, Li Tan, Elsevier, 2008
3. Fundamentals of Digital signal Processing using MatLab, Robert J. Schilling, Sandra L. Harris, Thomson, 2007
4. Digital Signal Processing, S. Salivahanan, A. Vallavaraj, C. Gnanapriya, TMH, 2009
5. Fundamentals of Digital Signal Processing, Loney Ludeman, John Wiley, 2009

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B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1EC10) MICROPROCESSORS AND MICROCONTROLLERS
(Common to ECE, EEE & EIE)

COURSE PRE-REQUISITES: Digital System Design, Computer Organization

COURSE OBJECTIVES:
- To understand architectures of various microprocessors and microcontrollers
- To understand basic programming concepts and software development tools
- To learn interfacing techniques necessary for designing processor/ controller based real time systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the evolution and architectures of 8086 & ARM Cortex-M3
CO-2: Analyse and understand the instruction set of 8086 & ARM Cortex-M3
CO-3: Understand the exception, interrupts and interrupt handling schemes
CO-4: Analyse and interface various peripherals for the design of processor/ controller-based systems

UNIT – I:
Introduction to 8086 Microprocessor
Architecture of 8086 Microprocessor: Introduction to microprocessor family, Microprocessors Vs Microcontrollers, 8086 Internal Architecture, Addressing modes
Instruction Set: Data transfer instructions, String instructions, Logical instructions, Arithmetic instructions, Control transfer instructions, Process control instructions.

UNIT – II:
Hardware & Software details of 8086 Microprocessor
Programming 8086 Microprocessor: Assembler directives, Procedures and Macros, Simple assembly language programs
Operating Modes: Basic 8086 Configurations - Minimum mode and Maximum mode, System bus timing - Timing diagrams for minimum mode and maximum mode systems.

UNIT – III:
IO Interfaces
Parallel I/O Interface: Parallel I/O Interface 8255A - Internal block diagram and System connections, Operational modes and initialization, Interfacing with 8086, Interfacing Analog to Digital Converters (ADCs) and Digital to Analog Converters (DACs) with 8086
Serial I/O Interface: Serial data communication, Serial data transmission methods and standards - RS-232C, Intel 8251A- USART architecture and interfacing with 8086.

UNIT – IV:
ARM Processors
Introduction to ARM Processors: ARM Cortex-M3 Processor, Background of ARM and ARM Architecture - Architecture Versions, Processor Naming, Instruction Set Development, Thumb-2 Technology and Instruction Set Architecture, Applications
ARM Cortex-M3 Organization: ARM Cortex-M3 Block diagram, Bus Interfaces, Core Registers, Special Registers, Operation Modes, Nested Vectored Interrupt Controller, Exceptions and Interrupts, Memory map, Stack implementation, Two-Stack Model, Reset Sequence

UNIT – V:
ARM Cortex-M3 Instruction Set and Memory System
Instruction Sets: ARM Cortex-M3 16-bit and 32-bit Instruction Set, Unified Assembler Language, Data Processing Instructions, Branch Instructions, Load and Store Instructions
Memory System: Memory Maps, Memory Access Attributes, Default Memory Access Permissions, Bit-Band Operations, Unaligned Transfers, Exclusive accesses, Pipeline

UNIT – VI:
ARM Cortex-M3 Firmware Development Ecosystem
Cortex-M3 Programming:
Overview, Typical Development Flow, C Programming for Cortex-M3, Using C and Assembly, CMSIS (Cortex Microcontroller Software Interface Standard) -Organization of CMSIS, Benefits of CMSIS.
Exception Programming: Using Interrupts, Exception/Interrupt Handlers, Software Interrupts, Vector Table Relocation

TEXT BOOKS:

1. Microprocessors and Interfacing, Douglas V. Hall, 2nd Edition, TMH, 1999
2. The Definitive Guide to the ARM Cortex-M3, Joseph Yiu, 2nd Edition, Elsevier Inc 2010

REFERENCES:

1. Advanced microprocessors and Peripherals – A.K.Ray and K.M.Bhurchandi, TMH, 2000
2. Microcomputer Systems - The 8086/8088 Family Architecture, Programming and Design, Y.Liu and G.A. Gibson, 2nd Edition, PHI
3. Embedded Systems with ARM Cortex-M Microcontroller in Assembly Language and C, 3rd Edition, July 2017

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B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PE1EC01) INFORMATION THEORY AND CODING

COURSE PRE-REQUISITES: Probability Theory & Stochastic Processes

COURSE OBJECTIVES:
- To introduce the concept of information content of a message /source
- To differentiate between the information content available with the source and the information gained by the observer
- To differentiate between source coding and channel coding
- To introduce the principles of Error detection and Error correction

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Calculate the information content and classify various communication channels based on their performance
CO-2: Construct the efficient source code words for discrete memory less sources
CO-3: Differentiate between Groups and Fields and to perform Modulo-N arithmetic
CO-4: Comprehend the properties of various error control codes, compute the error detection and correction capabilities

UNIT – I:
Information Theory: Introduction , Information content of a message ,Average information content of a Source-Entropy, and its properties , Measure of Information for Two Dimensional(Source-Sink) case ,Bounds on Joint Entropy, Relation between Marginal, conditional and Joint Entropies Mutual Information , Properties of Mutual Information, Channel Capacity, Mathematical Modeling of Various Communication Channels and computation of their capacity, Information Theory for Continuous Random Variables - Entropy of Continuous Source ,condition for Maximum Entropy of a Continuous Source, Capacity of a Band-limited Additive White Gaussian Noise(AWGN) Channel . Capacity of a Channel with infinite bandwidth: Exchange between Bandwidth and Signal to Noise ratio.

UNIT – II:
Source Coding: Introduction, Shanon's Source Coding Theorem, Code Efficiency, Classification of Various Source Coding Schemes: Fixed Length Source Codes ,Variable length Source Codes : Distinct Codes ,Prefix free codes ,Uniquely Decipherable codes , Instantaneous Codes, Kraft's Inequality Bounds on Source Code word length, Requirements of Efficient variable length source code words, Entropy Coding Shanon- Fano Encoding ,Huffman Encoding ,Non Uniqueness of Huffman Coding , r-ary Huffman Source Coding ,Source Extension .

UNIT – III:
Introduction to Linear Algebra: Groups, Fields, Binary Filed Arithmetic, construction of Galois Fields GF($2m$), Basic properties of Galois Field GF($2m$), Computations using Galois Field GF($2m$) Arithmetic, Vector spaces of a Field, Matrices over GF($2m$).

UNIT – IV:

Block Codes: Introduction, Modulo-N arithmetic, Single Parity check codes, Product codes, Repetition codes, Minimum Distance of Block Codes, Soft Decision and Hard Decision decoding, Matrix representation of Block Codes, Systematic and Non-Systematic Block codes, Standard Array, Error Syndromes, Error Detection and correction, Shortened and extended Linear codes.

UNIT – V:

Cyclic Codes: Algebraic structure of Cyclic codes- Generator polynomials, parity check polynomials, Encoding and Decoding of Cyclic Codes, Binary Cyclic code properties, Encoding in systematic form, Linear feedback shift registers, Polynomial division register, Registers for encoding, decoding, error detection and error correction, Shortened cyclic codes, Expurgated cyclic codes.

UNIT – VI:

Convolutional codes: Introduction, Encoding of Convolutional codes-Generator Matrices and Generator Polynomials, Systematic, Non-systematic and catastrophic convolutional codes, Graphical representation, Distance properties, Sequential decoding and Maximum likelihood decoding of Convolutional codes.

TEXT BOOKS:

1. Modern Analog and Digital Communication Systems, B.P. Lathi, Zhi Ding, International 4th Edition, Oxford University Press, 2010
2. Error Control Coding, Shu Lin, Daniel J. Costello, Jr., 2nd Edition, Pearson Education India, 2010

REFERENCES:

1. Digital Communication-Fundamentals and Applications, Bernard Sklar, 2nd Edition, Pearson Education,
2. Theory and Problems of Analog and Digital Communications, Hwei P. Hsu,
3. Schaum's Outline Series, McGraw Hill international Edition
4. Introduction to Error Control Codes, Salvatore Gravano, Oxford University press, South Asia Edition, 2014

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B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1EI07) BIO-MEDICAL INSTRUMENTATION
(Common to EIE & ECE)

COURSE OBJECTIVES:

- To identify significant biological variables at cellular level and ways to acquire different bio-signals
- To elucidate the methods to monitor the activity of the heart, brain, eyes and muscles
- To introduce therapeutic equipment for intensive and critical care
- To outline medical imaging techniques and equipment for certain diagnosis and therapies

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand biosystems and medical systems from an engineering perspective
CO-2: Identify the techniques to acquire record and primarily understand physiological activity of the human body through cell potential, ECG, EEG, BP and blood flow measurement and EMG
CO-3: Understand the working of various medical instruments and critical care equipment
CO-4: Know the imaging techniques including CT, PET, SPECT and MRI used in diagnosis of various medical conditions

UNIT – I:
Bio Potential Signals and Electrodes: Bio-signals and their characteristics, Organization of cell, Nernst equation of membrane, Resting and Action potentials. Bio-amplifiers, characteristics of medical instruments, problems encountered with measurements from living systems.

UNIT – II:
Bio-potential Electrodes: Body surface recording electrodes, Internal electrodes, micro electrodes. Bio-chemical transducers – reference electrode, the pH electrodes, Blood gas electrodes.

UNIT – III:
Cardiovascular Instrumentation: Heart and cardiovascular system Heart electrical activity, blood pressure and heart sounds. Cardiovascular measurements electro cardiography – electro cardiogram, ECG Amplifier, Electrodes and leads, ECG recorder principles. Types of ECG recorders. Principles of blood pressure and blood flow measurement.

UNIT – IV:
Neurological Instrumentation: Neuronal communication, electro encepherogram (EEG), EEG Measurements EEG electrode-placement system, interpretation of EEG, EEG system Block diagram, preamplifiers and amplifiers EMG block diagram and Stimulators.

UNIT – V:

Equipment for Critical Care: Therapeutic equipment - Pacemaker, Defibrillator, Shortwave diathermy, Hemodialysis machine. Respiratory Instrumentation - Mechanism of respiration, Spirometry, Pneumotachograph, Ventilators.

UNIT – VI:

Principles of Medical Imaging: Radiography, computed Radiography, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear Medicine, Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET), Ultrasonography, Introduction to Telemedicine.

TEXT BOOKS:

1. Handbook of Biomedical Instrumentation, R.S. Khandpur, McGraw-Hill, 2003
2. Medical Instrumentation, Application and Design, John G. Webster, John Wiley

REFERENCES:

1. Biomedical Instrumentation and Measurements, Leslie Cromwell, F.J. Weibell, E. A. Pfeiffer, PHI
2. Principles of Applied Biomedical Instrumentation, L.A. Geoddes and L.E. Baker, John Wiley and Sons
3. Introduction to Biomedical Equipment Technology, Joseph Carr and Brown

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B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PE1EC20) SENSORS AND ACTUATORS

COURSE OBJECTIVES:

- To expose the students to various sensors and transducers for measuring mechanical quantities
- To make the students familiar with the specifications of sensors and transducers
- To make the students identify for various sensors and transducers for various applications
- To expose the students to various actuators

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Familiar with classification and characteristics of various sensors and transducers

CO-2: Familiar with the principle and working of various sensors and transducers

CO-3: Familiar with the principle and working of various Actuatots

CO-4: Select proper transducer / sensor/Actuator for a specific measurement application

UNIT – I:

Sensors & Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization. Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges, Inductive Sensors- Sensitivity and Linearity of the Sensor, Types- Capacitive Sensors, Electrostatic Transducer, Force/Stress Sensors using Quartz Resonators, Ultrasonic Sensors.

UNIT – II:

Thermal Sensors: Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index Thermo-sensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermo-EMF Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermo-electric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors.

UNIT – III:

Magnetic Sensors: Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto-resistive Sensing, Semiconductor Magneto-resistors, Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement

Transducers, Synchros, Synchroresolvers, Eddy Current Sensors, Electromagnetic Flowmeter, Switching Magnetic Sensors, SQUID Sensors.

UNIT – IV:

Radiation Sensors: Introduction – Basic Characteristics – Types of Photosensistors/Photo detectors– X-ray and Nuclear Radiation Sensors– Fiber Optic Sensors. Electro Analytical Sensors: Introduction – The Electrochemical Cell – The Cell

Potential – Standard Hydrogen Electrode (SHE) – Liquid Junction and Other Potentials – Polarization – Concentration Polarization— Reference Electrodes – Sensor Electrodes – Electro ceramics in Gas Media.

UNIT – V:

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation. Sensors Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring.

UNIT – VI:

Actuators: Pneumatic and Hydraulic Actuation Systems- Actuation systems, Pneumatic and hydraulic systems, Directional Control valves, Pressure control valves, Cylinders, Servo and proportional control valves, Process control valves, Rotary actuators, Mechanical Actuation Systems Types of motion, Kinematic chains, Cams, Gears, Ratchet and pawl, Belt and chain drives, Bearings, Mechanical aspects of motor selection, Electrical Actuation Systems, Electrical systems, Mechanical switches, Solid-state switches, Solenoids, D.C. Motors, A.C. Motors, Stepper motors.

TEXT BOOKS:

1. Sensors and Transducers, D. Patranabis, PHI Learning Private Limited
2. Mechatronics, W. Bolton, Pearson Education Limited

REFERENCES:

1. Sensors and Actuators, Patranabis, 2nd Edition, PHI, 2013

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PE1MT01) ESSENTIAL MATHEMATICS FOR MACHINE LEARNING

COURSE PRE-REQUISITES: Basic Calculus and Matrix Algebra

COURSE OBJECTIVES: Important classes of spaces which apply to data and operations on them: Vector Spaces, Metric Spaces, Normed spaces, and Inner Product Spaces

- Matrix theory and application to find the matrix function. Methods of computing and using Eigen values and Eigen vectors
- To use Calculus to build approximations to functions
- To minimizing a cost function and Optimization techniques
- Tools for modeling and dealing with uncertainty -Theory of probability, its application for small and large samples

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Organize, present and interpret statistical data, both numerically and graphically
CO-2: Analyze and interpret statistical data using appropriate probability distributions, e.g. binomial and normal
CO-3: Recognize the role of and application of probability theory, descriptive and inferential statistics in machine learning

UNIT – I:
Linear Algebra – I: Vector Spaces, Linear Maps, Metric Spaces, Normed Spaces, Inner Product spaces, Vectors and linear combinations; Rank of a matrix; Gaussian elimination; LU Decomposition Vector space; Dimension; Basis; Orthogonality; Projections; Gram-Schmidt orthogonalization and QR decomposition.

UNIT - II:
Linear Algebra – II: Eigen values and Eigenvectors; Positive definite matrices; Linear transformations, Singular Value Decomposition and Principal Component Analysis

UNIT-III:
Calculus: Extrema, Gradient, The Jacobian, The Hessian, Matrix Calculus- Inferring from the matrix of functions.

UNIT-IV:
Optimization: Optimization Using Gradient Descent, Constrained optimization using Lagrange multipliers, Convex Optimization

UNIT-V:
Probability: Probabilities and Random Variables, Probability distributions- Joint, Marginal and Conditional, Bayes theorem, Learning as Bayesian Inference, Basics of probabilistic modeling and inference, Functions of random variables, Moment Generating function, Entropy

UNIT-VI:

Statistical Methods: Random Sample, Inferential Statistics, Linear and Multiple Linear Regression, Logistic regression, Estimation of parameters, Linear Discriminant Analysis –

Estimating linear discriminant functions and their properties, Principal Component analysis – algorithm for conducting Principal Component Analysis, a comparison of Classification methods, Demonstrations of Clustering, Classifications using R (Using UCI depository)

TEXT BOOKS:

1. Applied Statistics and Probability for Engineers, Douglas C. Montgomery, George C. Runger, 6th Edition, John Wiley & Sons Inc., 2008
2. An Introduction to Multivariate Analysis, T.W. Anderson, John Wiley & Sons, Inc., New York, 2003
3. An Introduction to Applied Probability, Ian F. Blake, John Wiley & Sons, Inc., New York, 1979

REFERENCES:

1. Advanced Engineering Mathematics, Peter V. O'Neil, 7th Edition,
2. Advanced Engineering Mathematics, Michael. D. Greenberg, 2nd Edition
3. Introduction to Linear Algebra, 5th Edition, Gilbert Strang
4. Introduction to Linear Regression Analysis, D.C. Montgomery and E.A. Peck, Wiley Series in Probability and Statistics, 5th Edition, 2012
5. Mathematics for Machine Learning, Garrett Thomas - https://gwthomas.github.io/docs/math4ml.pdf

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B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PE1EC02) MOS CIRCUITS

COURSE PRE-REQUISITES: Electronic Devices and Circuits, Analog Circuits

COURSE OBJECTIVES:
- To learn the MOS device physics
- To know the design procedure of various analog application of MOSFET
- To know the design procedure of various digital application of MOSFET
- To understand the concepts semiconductor memories

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the operation and sizing issues of MOSFET
CO-2: Design basic analog applications of MOSFET
CO-3: Design basic digital applications of MOSFET
CO-4: Conceptualize the memory classification and designing of memory circuits

UNIT – I:
Basic MOS Device Physics: MOSFET as a switch, MOS I vs V Characteristics, second-order effects, MOS device models-MOS device capacitances, MOS small signal-model, Scaling and Short channel effects.

UNIT – II:
MOS Single Stage Amplifiers: Common source amplifier with different loads, source follower, Common gate amplifier, Cascode Amplifier, Folded cascade amplifier, Frequency Response of Amplifiers - CG, CS, and CD amplifiers.

UNIT – III:
Analog MOS Sub-Circuits: Current Mirrors- Basic current mirrors, Active current mirrors. Differential Amplifiers: Single-ended and Differential operation, Basic Differential pair, Common Mode Response, Differential pair with MOS Loads.

UNIT – IV:
Operational Amplifiers: One-stage Op-Amp, Two-stage Op-Amp, Precision Rectification, ADC, and DAC.
Sampling Circuits using NMOS, PMOS, CMOS Switches, and Switch capacitor circuit, Switched capacitor integrator.

UNIT – V:
MOS Inverters: Introduction, The static CMOS Inverter an intuitive Perspective, Static and Dynamic behaviour of CMOS Inverter, Noise margins, switching characteristics, calculation of delay times, effect of load on switching characteristics and driving large loads, logical effort of paths.

UNIT – VI:
Memory and Array Subsystems: Types of memory, ROM Organization, RAM organization, DRAM Types and Operation, refresh operation, SRAM types and operation, FLASH Memory.

TEXT BOOKS:

1. Design of Analog CMOS Integrated Circuits, Behzad Razavi, TMH Edition, 2016
2. Digital Integrated Circuits, Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, 2nd Edition, Pearson Education, 2016

REFERENCES:

1. CMOS Analog Circuit Design, Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010
2. Analog Integrated Circuit Design, David A. Johns, Ken Martin, Wiley Student Edn, 2013
3. CMOS: Circuit Design, Layout and Simulation, Baker, Li and Boyce, PHI, 2012
4. Principles of CMOS VLSI Design, Neil H.E Weste and Kamran Eshraghian, 2nd Edition, Addition Wesley, 1998

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B.Tech. V Semester	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

(19PC2EC06) DIGITAL SIGNAL PROCESSING LABORATORY

COURSE PRE-REQUISITES: Signal and Systems

COURSE OBJECTIVES: Simulation and implementation on DSP processor

- To verify properties of a discrete system
- To learn various transforms on digital signals
- To understand the design of digital filters
- To verify basic properties of multirate systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the effect of various transformations on discrete signals
CO-2: Design digital filters for the given specifications
CO-3: Design multi rate signal processing of signals through systems
CO-4: Implement real-time applications

The following experiments are to be performed using appropriate Software At least 3 experiments are to be implemented using model based design

1. Circular Convolution
2. Discrete Fourier Transform / Inverse Discrete Fourier Transform
3. Power Density Spectrum
4. Implementation of Filters using IIR
5. Implementation of Filters using FIR
6. Generation of Sinusoidal signal through filtering
7. Generation of DTMF Signals
8. Implementation of Decimation and Interpolation processes, I/D sampling Rate Converters.

The following Experiments are to be performed using Code Composer Studio

a) Introduction To Code Composer Studio
b) Procedure to Work On CCS

1. To Verify Linear Convolution.
2. To Verify Circular Convolution.
3. Real-time Implementation of FIR (Low Pass/High Pass) using Rectangular, Triangular, Hanning, Kaiser windowing techniques.
4. Real-time Implementation of IIR Filter (Low Pass and High pass).
5. To find the FFT of given 1-D signal.
6. To compute Power Density Spectrum (PDS) of a sequence and signal.
7. Real-time audio applications such as audio effects, Interpolation, Decimation effects.

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B.Tech. V Semester	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

(19PC2EC07) MICROPROCESSORS AND MICROCONTROLLERS LABORATORY
(Common to ECE, EEE & EIE)

COURSE PRE-REQUISITES: Digital System Design

COURSE OBJECTIVES:
- To provide practical knowledge on programming 8086/8051 to perform various operations
- Interface various I/O devices to 8086/8051
- Design and develop digital systems for embedded applications and know the process to meet desired needs within realistic constraints

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Write programs for 8086/ARM architectures to carry out various operations
CO-2: Apply the knowledge of interfacing techniques to design processor based systems
CO-3: Apply the knowledge of interfacing techniques to design controller-based systems

Part A
Experiments on 8086 microprocessor
1. Programs for 16-bit arithmetic operations using Various Addressing Modes.
2. Program for sorting an array for 8086.
3. Program for searching for a number or character in a string for 8086.
4. Program for string manipulations for 8086
5. Program to define and call a subroutine which calculates the average of three numbers.
   a) Interfacing ADC to 8086.
   b) Interfacing DAC to 8086
   c) Interfacing stepper motor to 8086.

Part B
Experiments on ARM development boards
1. Programs to perform arithmetic operations
2. Control ON/OFF of LEDs using switches involving delays.
3. Controlling an LED using switch by polling method/Interrupt method
4. Implementation of PWM to change duty cycle.
5. Communication through UART.

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B.Tech. V Semester	**L**	**T/P/D**	**C**
	0	**2**	**1**

(19HS2EN05) ADVANCED ENGLISH COMMUNICATION SKILLS LABORATORY
(Common to all branches)

COURSE OBJECTIVES:

- To enable students to understand the principles and process of Technical Writing
- To train students to write technical documents such as Applications, Resumes, SOPs, Proposals and Technical Reports
- To train students to speak accurately and fluently for participation in Presentations, Group Discussions and interviews.
- To train students in soft skills to make them effective individuals

COURSE OUTCOMES: After completion of the course the student should be able to :

CO-1: Summarize and synthesize information and produce technical writing that is required in academics as well as in the engineering profession

CO-2: Employ principles of TW and writing process to produce technical documents such as cover letters, resume, SOP, Project Proposals and Technical Reports

CO-3: Actively participate in group discussions/interviews and prepare & deliver effective presentations

CO-4: Become an effective individual through goal setting & Career Planning & function effectively in multi-disciplinary and heterogeneous teams through the knowledge of teamwork, Inter-personal relationships, conflict management and leadership quality

UNIT – I:

The Concept of Technical Communication:

1. Understanding the concept of Technical Communication
2. Technical Writing (TW)- Definition, Principles and Processes
3. Summarizing and Synthesizing
4. Editing

UNIT – II:

Application Writing:

1. Formal Letters (Indian and Western styles); Cover Letter
2. Resumé and SoP Writing
3. E-Correspondence and Netiquette

UNIT – III:

Presentation Skills:

1. SWOC Analysis
2. Self -Introduction
3. Oral Presentations
4. Powerpoint Presentations

UNIT – IV:

Report Writing:

1. Technical Report —Categories, Formats, Styles and Types
2. Proposal Writing
3. Writing Agenda & Minutes

UNIT – V:

Employability Skills-1:

1. Self Assessment; Values & Beliefs; Self Esteem
2. Nonverbal Communication
3. Group Discussions

UNIT – VI:

Employability Skills-2:

1. Personal goal setting & Career Planning
2. Interview Skills – Face to Face
3. Interview Skills – Telephonic / Video

TEXT BOOKS:

1. Technical Writing Essentials, Suzan Last, University of Victoria, 2019 (Technical Writing Essentials by Suzan Last is licensed under a Creative Commons Attribution 4.0 International License)
2. Technical Communication: A Practical Approach, William S. Pfeiffer, 7th Edition, Longman, 2012
3. Reports In Paul V. Anderson's Technical Communication: A Reader-Centered Approach, Anderson, Paul V. 5th Edition, Boston Heinle 2003

REFERENCES:

1. "Communication in the workplace: What can NC State students expect?" J. Swartz, S. Pigg, J. Larsen, J. Helo Gonzalez, R. De Haas, and E. Wagner, Professional Writing Program, North Carolina State University, 2018 [Online] Available:https://docs.google.com/document/d/1pMpVbDRWIN6HssQQQ4MeQ6U-oB-sGUrtRswD7feuRB0/edit ↵
2. Technical Communication, Burnett, Rebecca, 5th Edition, Heinle 2001
3. Technical Writing Process and Product, Gerson Sharon J. and Steven Gerson: 3rd Edition, New Jersey: Prentice Hall 1999
4. Technical Communication: Situations and Strategies, Markel, Mike, 8th Edition 2006-2007
5. https://kupdf.net/download/learner-english-pdf 1pdf_59beb5ec08bbc55c18686ee6_pdf

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B.Tech. V Semester	**L**	**T/P/D**	**C**
	0	**2**	**1**

(19PW4EC02) INTERNSHIP

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Gain exposure to the current technological developments relevant to the subject area of training
CO-2: Apply the technical knowledge in real industrial situations
CO-3: Promote academic, professional and/or personal development
CO-4: Demonstrate effective communication skills through oral presentation
CO-5: Engage in effective written communication through internship report

COURSE OUTLINE:

- A student shall take up 01 credit summer internship in an industry/research organization/institution during the summer vacation after fourth semester (II year II semester) of the B.Tech. programme.
- Internship shall be carried out for a minimum period of 02 weeks and maximum of 04 weeks.
- Evaluation of the Internship shall be done by a review committee consisting of the Head of the Department, faculty supervisor and a senior faculty member of the department. A student shall submit a detailed report regarding the internship and present it before the review committee for evaluation.

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B.Tech. V Semester	L	T/P/D	C
	0	2	0

(19MN6HS02) ENVIRONMENTAL SCIENCE

COURSE PREREQUISITES: Basic knowledge of environmental issues

COURSE DESCRIPTION:
Environmental science is the study of patterns and processes in the natural world and their modification by human activity. We as human beings are not an entity, separate from the environment around us, rather we are a constituent seamlessly integrated and co-exist with the environment around us. To understand current environmental problems, we need to consider physical, biological and chemical processes that are often the basis of those problems. The course requires the students to identify and analyse natural and human- made environmental problems, evaluate the relative risks associated with these problems, and examine alternative solutions for resolving or preventing them. This course will survey some of the many environmental science topics at an introductory level, ultimately considering the sustainability of human activities on the planet. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa.

COURSE OBJECTIVES:
- To recognize the impacts of human interventions towards environment
- To list out the benefits in creating a sustainable environment
- To sketch out various activities in achieving a cleaner environment
- To emphasize the role of an individual for a better planet to live

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain a variety of experiences & acquire a basic knowledge about the environment & its allied problems
CO-2: Interpret the key components in safe guarding the environment
CO-3: Appraise the quality of environment in order to create a healthy atmosphere
CO-4: Familiarize with the individual responsibilities towards green revolution

MODULE 1: INTRODUCTION
Environmental Science: Introduction, Definition, scope and importance.

MODULE 2: AWARENESS ACTIVITIES
Small group meetings about:
- Water management
- Projects Vs Environment
- Generation of less waste
- Promotion of recycle use
- Impact of Science & Technology on Environment
- Avoiding electronic waste

MODULE 3: SLOGAN AND POSTER MAKING EVENT
- Food waste management

- Rain water harvesting
- Climate change
- Green Power
- Water conservation
- Green at work
- Role of IT in environment and human health
- Sustainable development

MODULE 4: EXPERT LECTURES ON ENVIRONMENTAL SCIENCE
- Environmental Impact Assessment
- Industrial waste treatment
- Organic farming/Vertical gardens/Hydroponics

MODULE 5: CLEANLINESS DRIVE
- Indoor air pollution
- Vehicular pollution
- VISUAL pollution
- Waste management at home
- Composting
- Plastic recycling

MODULE 6: CASE STUDIES
- HPCL disaster in Vizag
- Oleum gas leak in Delhi
- Mathura Refinery & Taj Mahal
- Conservation of Hussain Sagar lake
- The Cleanliest city of India-Surat
- Green Buildings in India
- KBR park in Hyderabad (Environmental protection Vs Development)
- Fluorosis
- Ecotourism & its impacts

TEXT BOOKS:

1. Environmental Studies for UG Courses, Erach Bharucha, UGC Publications, Delhi, 2004
2. Textbook of Environmental Studies, Deeksha Dave, S. S. Katewa, Cengage Delmar Learning India Pvt., 2012

REFERENCES:

1. Introduction to Environmental Science, Y. Anjaneyulu, BS Publications, 2004
2. Environmental Studies by Anubha Kaushik & C. P. Kaushik, 4th Edition, New Age International Publishers

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VI Semester	**L**	**T/P/D**	**C**
	3	**1**	**4**

(19PC1EC11) VLSI DESIGN

COURSE PRE-REQUISITES: Electronic Devices and Circuits (19PC1EC02), Digital System Design (19PC1EC03)

COURSE OBJECTIVES:
- To learn the fabrication process of Integrated Circuit and electrical properties of MOSFET
- To study the concepts of stick diagrams and layouts with the knowledge of MOS layers
- To understand the concept of scaling and its effects
- To learn the design of digital systems using subsystem design approach

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand IC Fabrication process steps required for various MOS circuits
CO-2: Know the various electrical properties of MOS transistors
CO-3: Design the digital circuits using various logic styles
CO-4: Implement subsystems with different technologies

UNIT – I:
Introduction to MOS Technology: Introduction to Integrated Circuit Technology, The Integrated Circuit Era, MOS and Related Technology, Basic MOS Transistors, Operation of Enhancement and Depletion Mode Transistors, Fabrication Process : Silicon Wafer Preparation, Epitaxial Growth, Oxidation, Photolithography, Diffusion, Ion implantation, Metallization, Assembly Processing and Packaging, Encapsulation, nMOS and pMOS fabrication, CMOS fabrication using p-Well, n-Well and Twin Tub processes, BiCMOS technology and its fabrication.

UNIT – II:
Basic Electrical Properties of MOS and BiCMOS Circuits: Ids versus Vds relationship, MOS transistor threshold voltage, Transconductance and Output conductance, figure of merit, nMOS inverter, Alternate forms of pull-ups, pull-up to pull-down ratio for nMOS inverter driven by another nMOS inverter, pull-up to pull-down ratio for nMOS inverter driven through one or more pass transistors, CMOS Inverter and its static characteristics, BiCMOS inverters, Latch-up in CMOS circuits.

UNIT – III:
VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams- nMOS and CMOS design styles, Design Rules and Layouts - nMOS Lambda based design rules, Contact cuts, CMOS Lambda based design rules, Layout Diagram for nMOS and CMOS inverters.
Scaling of MOS circuits - Scaling models and scaling factors, scaling factors for device parameters, Limitations of scaling.

UNIT – IV:

Basic Circuit Concepts: Sheet Resistance and its concept applied to MOS transistors and inverters, Area Capacitance of layers and its calculations, delay unit, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Choice of layers.

Combinational MOS Logic Circuits: Primitive CMOS logic gates - NOR and NAND gate, Realizing Boolean expressions using nMOS and CMOS gates, Stick diagrams and layouts for basic logic gates, CMOS full adder, Designing of logic circuits using Pass Transistor Logic (PTL) and CMOS transmission gates.

UNIT – V:

Dynamic Logic Circuits: Basic principle of pass transistor, Voltage Bootstrapping, Synchronous dynamic circuit techniques, Dynamic CMOS circuit techniques, High performance dynamic CMOS Circuits - Domino CMOS Logic.

Sequential MOS Logic Circuits: Behavior of bi-stable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D-latch and edge triggered flip flop.

UNIT – VI:

Subsystem Design: Parity generator, Multiplexer, Dynamic shift register, ALU subsystem, Serial-Parallel multiplier, Comparator, Up/Down Counter.

Trends in MOS Technology: Introduction to CNTFET, FinFET and multi-gate FET, GNRFET.

TEXT BOOKS:

1. Essentials of VLSI Circuits and Systems, Kamran Eshraghian, Dougles and A. Pucknell, PHI Edition, 2005
2. CMOS Digital Integrated Circuits Analysis and Design, Sung-Mo Kang, Yusuf Leblebici, 4th Edition, TMH, 2019

REFERENCES:

1. CMOS VLSI Design – A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, Pearson, 4th Edition, 2015
2. Introduction to VLSI Systems: A Logic, Circuit and System Perspective, Ming-BO Lin, CRC Press, 2011
3. Modern VLSI Design-IP-Based Design, Wayne Wolf, 4th Edition, Prentice Hall, 2015

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B.Tech. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1EC12) COMPUTER NETWORKS AND SYSTEMS APPROACH
(Common to ECE & EIE)

COURSE PRE-REQUISITES: Analog and Digital Communications

COURSE OBJECTIVES:
- To understand the division of network functionalities into layers
- To be familiar with the components required to build different types of networks
- To be exposed to the required functionality at each layer
- To learn the flow control and congestion control algorithms

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify the components required to build different types of networks
CO-2: Choose the required functionality at each layer for given application
CO-3: Implement functionality solution at each layer
CO-4: Trace the flow of information from one node to another node in the network

UNIT – I:
Data Communications: Networks – Components and Categories – Direction of Data flow – Types of Connections – Topologies – Layering and Protocols – Transmission media – Multiplexing.

UNIT – II:
Link Layer: Link layer Services – Framing – Error Detection – Flow control – Noiseless Channels – Noisy Channels – HDLC – Point to Point Protocols.

UNIT – III:
Media Access Control Layer: Media access control – Wireless LANs – IEEE 802.11 – ALOHA – CSMA/CD – Random access – Controlled access – Channelization – Switching

UNIT – IV:
Internetworking and Routing: Basic Internetworking (IP, CIDR, ARP, ICMP) – Routing (RIP, OSPF, metrics) – Global Internet (Areas, BGP, IPv6), Multicast Addresses – Multicast Routing (DVMRP, PIM).

UNIT – V:
Transport Layer: Overview of Transport layer – UDP – Reliable byte stream (TCP) – Connection management – Flow control – Retransmission – TCP Congestion control – Congestion avoidance – QoS – Application requirements – QoS Techniques.

UNIT – VI:
Application Layer: Traditional applications – Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP.

TEXT BOOKS:

1. Data Communication and Networking, Behrouz A. Forouzan, 5th Edition, Tata McGraw – Hill, 2013
2. Computer Networks: A Systems Approach, Larry L. Peterson, Bruce S. Davie, 5th Edition, Morgan Kaufmann Publishers, 2011

REFERENCES:

1. Computer Networking – A Top-Down Approach Featuring the Internet, James F. Kurose, Keith W. Ross, 7th Edition, Pearson Education, 2017
2. Computer and Communication Networks, Nader. F. Mir, 2nd Edition, Pearson Prentice Hall Publishers, 2014
3. Computer Networks: An Open-Source Approach, Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, Mc Graw Hill Publisher, 2012
4. Computer Networks, Andrew S Tanenbaum, 5th Edition, Pearson Education/PHI 2011

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B.Tech. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19HS1MG02) ENGINEERING ECONOMICS AND ACCOUNTANCY
(Common to all branches)

COURSE OBJECTIVES:

- To explain the basic nature of pure economics and to analyse certain concepts of both Micro & Macro Economics and to know the role of managerial economics in solving problems of business enterprises
- To understand different forms of organizing private-sector and public-sector business enterprises and problems which have been encountered by public enterprises in India
- To describe each stage of product life cycle with the help different costs and their role in maintaining optimum cost of production and overall profitability by considering different market competitions
- To analyse the process involved in preparation of project proposals, to estimate capital required to commence and carry-on business projects, to know the various sources of mobilizing required amount of capital and to evaluate investment opportunities
- To apply the basic accounting concepts & conventions and to analyse financial position of business enterprise

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Perform decision making function effectively in an uncertain framework by applying the concepts of economics, manage demand efficiently and plan future course of action
CO-2: Select suitable form of business organization which meets the requirements of business
CO-3: Fix the right price which can best meet the pre-determined objectives of the business under different market conditions
CO-4: Identify the best source of mobilising capital, select most profitable investment opportunity, carry out & evaluate benefit/cost, life-cycle and Break-even analysis on one or more economic alternatives
CO-5: Prepare book of accounts and understand overall position of the business enterprise, therefore, take appropriate measures to improve the situation

UNIT – I:
Introduction to Economics: Definition, nature, scope and types of Economics. Concepts of Macro-Economics: Gross Domestic Product (GDP), Gross National Product (GNP), National Income (NI) & Rate of Inflation.
Managerial Economics: Definition, nature, scope & significance. Elements of Managerial Economics: Demand Analysis, Law of Demand, Elasticity of Demand and Demand Forecasting.

UNIT – II:
Private Sector Business Enterprises: (i) Sole Proprietorship - Definition, features, merits, limitations & suitability. (ii) Partnership - Definition, Partnership Act, features, types, merits, limitations, suitability. (iii) Joint-Stock Company - Definition, Companies Act, features, types, merits, limitations, suitability.

Public Sector Business Enterprises: Definition, features, objectives, merits, problems.

UNIT – III:

Market Structures: Definition & common features of market and classifications of markets. Evaluation of market structures-Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly.

Product Life-Cycle and Pricing: Definition, various stages of PLC, and Life-Cycle Costs; objectives and methods of pricing.

Introduction to Financial Accounting: Definition, basic principles and double-entry book-keeping, practice of accounting process-Journal, ledger, trial balance and final accounts (simple problems)

UNIT – IV:

Financial Analysis through Ratios: Meaning, computation of ratios

(i) Liquidity Ratios: Current Ratio and Quick Ratio,

(ii) Solvency Ratios: Interest Coverage Ratio and Debt- Equity Ratio,

(iii) Activity Ratios: Stock/Inventory Turnover Ratio and Debt Turnover Ratio,

(iv) Profitability Ratios: Gross Profit Ratio, Net Profit Ratio & Earning Per Share (EPS) Ratio.

UNIT – V:

Management Accounting: Definition & nature of Management Accounting. Capital: Types of capital, factors influencing capital requirements, sources of mobilising Fixed and Working Capital.

UNIT -VI:

Cost Accounting: Definition, Types of costs – Opportunity cost, Explicit/Out-of-Pocket cost, Implicit/Imputed cost, Fixed cost, Variable cost, Semi-Variable cost, Differential cost, Sunk cost, Total cost, Average cost & Marginal cost. Break-Even/Cost-Volume-Profit (CVP) Analysis (Simple Problems).

TEXT BOOKS:

1. Managerial Economics and Financial Analysis, Aryasri, Tata McGraw Hill, 2009
2. Managerial Economics, Varshney & Maheswari, Sultan Chand, 2009
3. Principles of Marketing: A South Asian Perspective, Kotler Philip, Gary Armstrong, Prafulla Y. Agnihotri, and Eshan ul Haque, 2010, 13th Edition, Pearson Education/ Prentice Hall of India

REFERENCES:

1. Indian Economy, Misra S. K. and Puri, Himalaya Publishers
2. Textbook of Business Economics, Pareek Saroj, Sunrise Publishers
3. Financial Accounting for Management: An Analytical Perspective, Ambrish Gupta, Pearson Education
4. Managerial Economics, H. Craig Peterson & W. Cris Lewis, Prentice Hall of India
5. Guide to Proposal Writing, Jane C. Geever & Patricia McNeill, Foundation Centre

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VI Semester	L	T/P/D	C
	3	0	3

(19PE1EC03) MOBILE COMMUNICATION AND PROTOCOLS

COURSE PRE-REQUISITES: Analog Digital Communications

COURSE OBJECTIVES:
- To learn the basics of mobile telecommunication system
- To understand Wireless LAN, Bluetooth and WiFi Technologies
- To be familiar with the network protocol stack
- To be exposed to Ad-Hoc networks

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the basics of mobile telecommunication system
CO-2: Differentiate various generations of wireless networks
CO-3: Analyze the architecture of Wireless LAN technologies
CO-4: Design the architecture of WAP & WML

UNIT – I:
Introduction to Mobile Communication: Evolution of Mobile Radio Communication, Examples of Wireless Communication Systems, Trends in cellular radio & Personal Communication. Modern Wireless Communication System: Second Generation (2G) and Third Generation (3G) cellular networks.

UNIT – II:
Cellular Concepts: Introduction, Frequency reuse, Channel Assignment, Handoff, Interference & System capacity, Trunking & Grade of Service, Improving coverage & capacity.

UNIT – III:
Mobile Telecommunication System: GSM – Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS (general packet radio service)- UMTS(Universal mobile telecommunication systems)- Architecture.

UNIT – IV:
Wireless Networks: Wireless LANs and PANs – IEEE 802.11 Standard – Architecture – Services – Blue Tooth- Wi-Fi – WiMAX.

UNIT – V:
Mobile Network Layer: Mobile IP, DHCP(Dynamic host configuration protocol), AdHoc networks, Proactive and Reactive Routing Protocols, Vehicular Ad Hoc networks (VANET), MANET Vs VANET.

UNIT – VI:
Mobile Transport and Application Layer: Mobile TCP, WAP (Wireless Application Protocol)- Architecture, WDP(Wireless Datagram Protocol), WTLS(Wireless Transport Layer Security), WTP(Wireless Transaction Protocol), WSP(Wireless Session Protocol),

WAE(Wireless Application Environment), WTA(Wireless Telephony Applications) Architecture, WML(Wireless Markup Language).

TEXT BOOKS:

1. Mobile Communications, Jochen Schiller, 2nd Edition, PHI, 2014
2. Wireless Communications Principles & Practice, Theodore S Rappaport, 2nd Edition, Pearson Education, 2010

REFERENCES:

1. Fundamentals of Mobile Computing, Prasant Kumar Pattnaik, Rajib Mall, PHI Learning Pvt. Ltd., New Delhi, 2012
2. Introduction to Wireless and Mobile Systems, Dharma Prakash Agarval, Qing and An Zeng, Thomson Asia Pvt. Ltd., 2005
3. Principles of Mobile Computing - II, Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, Springer, 2003
4. Mobile Cellular Telecommunications - Analog and Digital Systems, William C.Y. Lee, 2nd Edition, Tata Mc Graw Hill Edition ,2006
5. AdHoc Mobile Wireless Networks, C.K. Toh, 1st Edition, Pearson Education, 2002

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B.Tech. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PE1EC04) DIGITAL IMAGE PROCESSING

COURSE PRE-REQUISITES: Digital Signal Processing

COURSE OBJECTIVES:
- To introduce fundamentals of digital image processing and study image transforms
- To learn enhancement & restoration techniques in spatial and frequency domains
- To study and compare various image compression image segmentation and Morphological algorithms
- To understand image analysis methods

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the basic principles of digital image processing and perform image transforms
CO-2: Understand and perform basic image processing methods such as Image filtering operations, Image enhancement and restoration
CO-3: Analyze and compare various image compression image segmentation and Morphological techniques and their applications
CO-4: Design and implement various algorithms for image analysis

UNIT – I:
Fundamentals of Image Processing: Digital Image Fundamentals, Basic steps of Image Processing System, Sampling and Quantization of an image, relationship between pixels, Imaging Geometry.
Image Transforms: 2 D- Discrete Fourier Transform, Discrete Cosine Transform (DCT), Haar Transform, Hadmard Transform, Hotelling Transform and slant transform.

UNIT – II:
Image Enhancement: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters.
Frequency Domain Methods: Basics of filtering in frequency domain, Image smoothing, Image sharpening, Selective filtering.

UNIT – III:
Image Segmentation: Segmentation concepts, Point, Line and Edge Detection, Edge Linking using Hough Transform, Thresholding, Region Based segmentation.
Wavelet Based Image Processing: Introduction to wavelet Transform, Continuous wavelet Transform, Discrete wavelet Transform, Filter banks, Wavelet based image segmentation.

UNIT – IV:
Image Compression: Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compression models - Lossy and Lossless, Huffman coding, Arithmetic coding, LZW coding, Run length coding, Bit plane coding, Transform coding, Predictive coding, JPEG Standards.

UNIT – V:

Image Restoration: Image Restoration Degradation model, Algebraic approach to restoration, Inverse Filtering, Least Mean square filters.

Morphological Image Processing: Dilation and Erosion, Opening and closing, The Hit or Miss Transformation, Morphological algorithms.

UNIT – VI:

Representation and Description: Boundary following, chain codes, polygonal approximation using minimum - perimeter polygons, boundary segments, skeleton, simple boundary descriptors, shape number, simple regional descriptors.

TEXT BOOKS:

1. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, 4th Edition, Pearson, 2018
2. Digital Image Processing, S. Jayaraman, S. Esakkirajan, T. Veerakumar, 5th Edition, TMH, 2015

REFERENCES:

1. Digital Image Processing, William K. Pratt, 3rd Edition, John Willey, 2007
2. Fundamentals of Digital Image Processing, A.K. Jain, 3rd Edition, PHI, 1989
3. Digital Image Processing using MATLAB, Rafael C. Gonzalez, Richard E. Woods and Steven L. Edding 2nd Edition, TMH, 2010
4. Digital Image Processing and Computer Vision, Sonka, Hlavac, Boyl, Cengage Learning, 2008
5. Introduction to Image Processing and Analysis, John C. Russ, J. Christian Russ, CRC Press, 2008

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B.Tech. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PE1EC05) INTERNET OF THINGS
(Common to ECE, EIE, CSE & IT)

COURSE PRE-REQUISITES: Microprocessors and Microcontrollers(19PC1EC10), Sensors and Actuators (19PE1EC20)

COURSE OBJECTIVES:
- To understand the concepts of Internet of Things
- To explore the various IoT Platforms and protocols
- To implement the web-based services on IoT devices
- To design an IoT application

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the use of Devices, Gateways and Data Management in IoT
CO-2: Analyze various protocols for IoT
CO-3: Familiarize various IoT Development frameworks
CO-4: Develop various applications in IoT

UNIT – I:
Introduction: Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Deployment Templates.

UNIT – II:
IoT Protocols: Message Queuing Telemetry Transport (MQTT), Secure Message Queuing Telemetry Transport (SMQTT), Constrained Application Protocol (CoAP), Extensible Messaging and Presence Protocol (XMPP), Advanced Message Queuing Protocol (AMQP).

UNIT – III:
Connectivity Technologies: IEEE802.15.4, Zigbee, 6LOWPAN, Wireless HART, Z-Wave, ISA 100, Bluetooth, NFC, RFID, LoRa and LoRaWAN

UNIT – IV:
IoT Physical Devices and Endpoints: Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

UNIT – V:
IoT Platforms: Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API, Web Services for IoT.

UNIT – VI:
Domain Specific IoT Applications: Introduction, home automation, smart cities, environment, energy, retail, logistics, agriculture, industry, Health and Lifestyle.

Design Methodology for Home Automation and Weather Monitoring.

TEXT BOOKS:

1. Internet of Things: A Hands-on Approach, Vijay Madisetti, Arshdeep Bahga
2. The Internet of Things – Key Applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi, Wiley, 2012
3. The Internet of Things in the Cloud: A Middleware Perspective, Honbo Zhou, CRC Press, 2012

REFERENCES:

1. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers
2. Building the Internet of Things, Sara Cordoba, Wimer Hazenberg, Menno Huisman BIS Publishers, 2011
3. Designing the Internet of Things, Adrian Mcewen, Hakin Cassimally, 2015

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B.Tech. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PE1CS10) NEURAL NETWORKS AND DEEP LEARNING

COURSE OBJECTIVES:
- To introduce to the basic concepts of neural networks
- To identify and analyze the various types of neural networks and models of neuron and apply accordingly
- To introduce the concept of deep learning and its types
- To explore the concepts of applications of deep learning

COURSE OUTCOMES: After Completion of the course the student should be able to
CO-1: Analyze and apply the basic the concepts of neural networks
CO-2: Analyze various types of neural networks and use various activation functions to solve complex problems
CO-3: Relate the concept of deep learning and its architecture
CO-4: Design and carry out empirical analysis for various types of applications of deep learning systems

UNIT – I:
Introduction to Neural Networks: Characteristics of Neural Networks, Historical Development of Neural Networks Principles, Artificial Neural Networks: Terminology, Models of Neuron, Topology, Basic Learning Laws**.**

UNIT – II:
Training Neural Network: Risk minimization, loss function, back propagation, regularization, model selection, and optimization.

UNIT – III:
Feed Forward Neural Networks: Introduction, Analysis of Pattern Association Networks, Analysis of Pattern Classification Networks, Analysis of Pattern Storage Networks. Analysis of Pattern Mapping Networks.

UNIT – IV:
Feedback Neural Networks: Introduction, Analysis of Pattern Storage Networks. Competitive Learning Neural Networks
Introduction, Analysis of Pattern Clustering Networks, Analysis of Feature
Mapping Networks, Associative Memory.

UNIT – V:
Fundamentals of Deep Learning: Defining Deep Learning, Common architectural principles of Deep Networks, Building Blocks of Deep Networks, and Major architectures of Deep Networks.

UNIT – VI:
Convolution Neural Networks: The convolution operation, pooling, Recurrent neural networks, Introduction to Auto encoders and decoders
Applications of deep learning: Computer vision, Speech Recognition, Natural Processing.

TEXT BOOKS:

1. Neural Networks by Simon Haykin PHI
2. Artificial Neural Networks B. Yagna Narayana, PHI, (Chapter 1,2 and 3)
3. Deep Learning: A Practitioner's Approach by Josh Patterson, Adam Gibson

REFERENCES:

1. Deep learning, Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville An MIT Press book in preparation, 2015 -http://www.deeplearningbook.org/
2. Deep learning (Adaptive computation &Machine learning) by Ian Good Fellow, Yoshua Bengio, AranCourville
3. Fundamentals of Neural Networks: Architectures, Algorithms and Applications, by Fausett
4. Neural Networks and Deep Learning, Michael Nielsen, Determination Press, 2015

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B.Tech. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PE1EC06) CPLD AND FPGA ARCHITECTURE

COURSE PRE-REQUISITES: Digital System Design

COURSE OBJECTIVES:
- To introduce digital design concepts through various Programmable Logic Devices
- To understand the CPLD and FPGA architectures in detail
- To analyse the physical design cycle in FPGA
- To know the various applications of CPLD and FPGAs

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Design digital applications using PLDs
CO-2: Analyze the architectural features of CPLDs, FPGAs
CO-3: Analyse Physical Design cycle for FPGA
CO-4: Implementation of various applications using FPGA

UNIT – I:
Introduction to Programmable Logic Devices: Programmable logic devices (PLD), Simple Programmable Logic Devices (SPLD) – Read Only Memories, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL): Registered PALs, Configurable PALS, Digital design using PLDs.

UNIT – II:
Complex Programmable Logic Devices: Features and applications of complex programmable logic devices, Altera Max - 7000 series and Altera FLEX logic- 10K series CPLD, Xilinx Cool Runner XCR3064XL CPLD, CPLD Implementation of a parallel adder with accumulation.

UNIT – III:
Field Programmable Gate Arrays: Features and applications of FPGAs, advantages and disadvantages of FPGA, architecture of FPGA, technology trends, programming technologies, commercially Available FPGAs.

UNIT – IV:
SRAM Field Programmable Gate Arrays: SRAM Programming Technology, SRAM Programmable FPGAs: Xilinx XC4000, Spartan-3 FPGA Architectures.
Anti-Fuse Programmed FPGAs: Anti-fuse Programming technology, The Actel ACT1, ACT2 and ACT3 architectures.

UNIT – V:
Physical Design Implementation on FPGAs: FPGA Design flow, Physical Design cycle for FPGAs, Partitioning, Routing-non-segmented, segmented and staggered models.

UNIT – VI:
Design Applications: General design issues, Counter design using FPGA, Designing Adders and Accumulators with the ACT Architecture, A Fast Video Controller.

TEXT BOOKS:

1. Fundamentals of Logic Design, Charles H. Roth Jr, 5^{th} Edition, Cengage Learning, 2004
2. Field Programmable Gate Array Technology, Stephen M. Trimberger, Springer International Edition, 1994

REFERENCES:

1. Algorithms for VLSI Physical Design Automation, Naveed Sherwani, 3^{rd} Edition, Springer International Edition, 2005
2. Field-Programmable Gate Arrays, Stephen D. Brown, Springer, 1992

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B.Tech. VI Semester	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

(19PC2EC08) VLSI DESIGN LABORATORY

COURSE PRE-REQUISITES: Digital Logic Design, HDL Programming Knowledge

COURSE OBJECTIVES:
- To implement the digital systems using FPGA
- To design (Schematic/SPICE Model) CMOS Digital/Analog circuits using CAD Tools
- To optimize the CMOS circuit design according to user constraints

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Implement the Digital Design application using FPGA
CO-2: Develop the circuit level designs as per the circuit Specifications
CO-3: Analyse the various performance parameters for the Systems

Implement the following using FPGAs
1. Arithmetic Logic Unit
2. Traffic Light Controller

Design (Schematic/SPICE Model), Verify, Simulate and Perform DC and Transient analysis of the following:
1. NMOS and PMOS Transfer Characteristics
2. Logic Gates
3. Boolean Function using NMOS and CMOS Logic
4. Adder/Subtractor
5. Multiplexer/Demultiplexer
6. Comparator
7. Latch and flip-flops
8. SRAM Memory Cell
9. Up/Down Counters.
10. Shift Registers.

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B.Tech. VI Semester	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

(19PC2EC09) COMPUTER NETWORKS LABORATORY

COURSE PRE-REQUISITES: Analog and Digital Communication

COURSE OBJECTIVES:
- To learn and understand various error correction and detection mechanisms
- To examine basic networking commands and networking

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand fundamental underlying principles of computer networking
CO-2: Analyze performance of various communication protocols
CO-3: Compare routing algorithms
CO-4: Acquire the required skill to design computer networks

LIST OF EXPERIMENTS:

1. Study of different types of network cables and practically implement the cross-wired cable and straight through cable using clamping tool.
2. Study of Network Devices in detail.
3. Implement the data link layer framing methods such as character stuffing and bit stuffing in Python/C language.
4. Study of Network IP.
5. Connect the computers in Local Area Network.
6. Study of basic network command and network configuration commands.
7. Configure Bus, Ring network topologies.
8. Configure Star, Mesh network topologies.
9. Configure a Network using Distance Vector Routing protocol.
10. Configure Network using Link State Vector Routing protocol.
11. Configure Network using TCP Protocol.
12. Configure Network using UDP Protocol.

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B.Tech. VI Semester	**L**	**T/P/D**	**C**
	0	**4**	**2**

(19PW4EC03) DESIGN THINKING

COURSE OBJECTIVES:

- To inculcate core design principles and applied creativity to develop innovative strategies that better connect engineers with their end users
- To build mindset leading to flow of creative ideas, validating those ideas and prioritizing the best ones
- To incorporate tools that designers need to take a design project from inspiration and insights to ideation and implementation
- To instil full scope of organizational innovation and strategy through knowledge, insight and analytical skills

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Use design thinking and hypothesis-driven innovation processes to develop viable solutions to user challenges
CO-2: Use multiple brainstorming techniques to find innovative solutions
CO-3: Develop and test a business model or business case to support the viability of the solution
CO-4: Prototype a solution to a user challenge
CO-5: Investigate the cultural, emotional, technological and business factors relevant to developing new product or service design concept

Module 1: Revisiting Design Thinking
Creative thinking as basis of innovation; Empathy process for deep understanding of challenge with practical ingenuity; Making sense of observations and insights; Defining a point of view and context
Design thinking skills for Problem Discovery, Definition, and Ideation – Identifying problems in daily lives and in the world at large, Understanding user and customer perspectives, Thinking from the problem before thinking of a solution

Module 2: Ideation Process
Clear Articulation of problem statement with focus on latent needs; Brainstorming potential solutions; Ideation methods with case-study based approach to using Systematic Inventive Thinking (SIT) Methods such as Addition, Subtraction, Multiplication, Division and Task Unification
Strategic Innovation for competition in future: Linear Innovation vs. non-linear innovation, Understanding and identifying weak signals, 3-box thinking, 3-Box framework and Box-3 ideation

Module 3: Designing Customer Experience
Understanding Innovation through Design Thinking; Enhancing Customer Experience; Service Design and Development Process and Case Studies; Service Experience Cycle and Case Studies

Module 4: Sustainable Design Approaches
Concern for Environment and Sustainability in Design, Case Studies to understand good Design For Environment (DFE) Decisions; Design Considerations in the five stages of the Product Life Cycle

Module 5: Integrative Engineering Design Solutions
Identifying and resolving issues with working in diverse teams, Modularising, prototype building by different engineering disciplines within the team, validated learning with accessible metrics

Module 6: Capstone Project (Interdisciplinary)
Applying Design Thinking Principles and Methods for Ideation and Prototyping, Testing Solution, Refining Solution, and Taking the Solution to the Users

TEXT BOOKS:

1. 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization, Vijay Kumar, John Wiley & Sons, ISBN: 978-1118083468, 2012
2. Living with Complexity, Donald A Norman, MIT Press, ISBN: 978-0262528948, 2016
3. Design Thinking for Entrepreneurs and Small Businesses: Putting the Power of Design to Work, Beverly Rudkin Ingle, A Press, ISBN: 978-1430261810, 2013

REFERENCES:

1. Emotionally Durable Design: Objects, Experiences and Empathy, Jonathan Chapman, 2nd Edition, Routledge, ISBN: 978-0415732161, 2015
2. Innovation Design: How Any Organization Can Leverage Design Thinking to Produce Change, Drive New Ideas, and Deliver Meaningful Solutions, Thomas Lockwood, Edgar Papke, New Page Books, ISBN: 978-1632651167, 2017
3. Design Thinking Business Analysis: Business Concept Mapping Applied, Thomas Frisendal, Springer, ISBN: 978-3642434822, 2012
4. Chapter 1: A Simple Framework for Leading Innovation, The Three Box Solution, HBR Press, 2016
5. Design a Better Business: New Tools, Skills and Mindset for Strategy and Innovation, Patrick Van Der Pijl, Justin Lokitz, Lisa Kay Solomon, Erik van der Pluijm, Maarten van Lieshout, Wiley, ISBN: 978-8126565085, 2016

OPEN ELECTIVE COURSES

SMART CITIES

SMART CITIES

In the twenty-first century, engineers are being tasked with solving ever more complex and subtle societal challenges – from climate change to unprecedented urbanisation that is materially affecting the lives of many urban populations. As engineers become ever more interdisciplinary and the boundaries of disciplines soften, they need to reflect as a community as to the appropriateness of the engineering paradigm to address these needs. Currently the engineering community is pointing to the digital technologies and the ‘smart city’ as a deliverer of efficiency and resilience without fully acknowledging the intricate socio-political context in which it is situated.

The domain of EIE was developed to modernise and automate these operations using the technological advancements in the realm of electronics. Even outside the industry, common household appliances — such as washing machine, air-conditioner, geyser, and microwave oven — cannot attract customers without features such as auto cut-off after certain time or temperature, which is again an example of instrumentation. The field of Instrumentation Engineering is also core to the recent advances such as smart home appliances, smart cities and automobiles. It is thus not far from the truth to claim that the fourth industrial revolution.

The world population is continuously growing and reached a significant evolution of the society, where the number of people living in cities surpassed the number of people in rural areas. This puts national and local governments under pressure because the limited resources, such as water, electricity, and transports, must thus be optimized to cover the needs of the citizens. Therefore, different tools, from sensors to processes, service, and artificial intelligence, are used to coordinate the usage of infrastructures and assets of the cities to build the so-called smart cities.

Different definitions and theoretical models of smart cities are given in literature. However, smart city can usually be modelled by a layered architecture, where communication and networking layer plays a central role. In fact, smart city applications lay on collecting field data from different infrastructures and assets, processing these data, taking some intelligent control actions, and sharing information in a secure way. Thus, a two-way reliable communications layer is the basis of smart cities. This chapter introduces the basic concepts of this field and focuses on the role of communication technologies in smart cities. Potential technologies for smart cities are discussed, especially the recent wireless technologies adapted to smart city requirements.

What is the concept of a smart city?

There is no universally accepted definition for a smart city because people can interpret different meanings for it. Hence, it means different things to different people. Here, you will get a basic definition that captures the essence of what a smart city is and what it does. While the concept varies from area to area depending on the resources, the basic idea behind it remains the same. A smart city aims to bring various components together to live harmoniously and attempts to do with the least environmental damage or impact. In other words, a smart city is a place with high standards of living, which survives and thrives on eco-friendly means.

The size and amenities within a smart city vary according to geography, resources available, geopolitical scenario and investment received.
Growth in Global population continues to drive citizens from rural areas to cities. With rapid expansion of urban areas, cities need to become intelligent to handle this large scale urbanization. This is driving city operators to look at smarter ways to manage complexities, increase efficiencies and improve quality of life. Today we need cities that monitor& integrate infrastructure to better optimize resources while maximizing service to its citizens. So to meet all the needs we need our cities to be smarter which brings a concept "**Smart cities**" Smart cities optimize the use of technology in the design & operation of infrastructure and buildings in such a way which meets the current and future needs of their citizens. To be truly smart they also require consideration of governance &growth, urban development and infrastructure, the environment & natural resources, society and community.
Smart city programs provide a range of technologies that can be applied to solve infrastructure problems associated with ageing infrastructure and increasing demands. The potential for infrastructure and urban improvement remains unrealized, however, due to technical, financial, and social constraints and criticisms that limit the implementation of smart cities concepts for infrastructure management. The discussion presented here provides a review of smart technologies including sensors, crowdsourcing and citizen science, actuators, data transmission, Internet of Things, big data analytics, data visualization, and blockchain, which can be used for infrastructure management. Smart infrastructure programs are reviewed to explore how enabling technologies have been applied across civil engineering domains, including transportation systems, water systems, air quality, energy infrastructure, solid waste management, construction engineering and management, structures, and geotechnical systems.
Making cities "smarter" by efficient management of resources and infrastructure, greener environment, and smart governance resulting in a better quality of living of its citizens. This can be enabled by the effective use of information and communication technologies (ICTs) tools, which have the ability to provide eco-friendly and economically viable solutions for cities.
Setting up a smart city is more than improving the old system with technology by simply adding sensors, remote supervision, and control to essential city services. It should be a complete shift of a paradigm in daily life when using new technologies, especially new ICT leading to smart outcomes.

Smart solutions

Another important feature of smart cities is that they will provide smart solutions to modern problems. These include:

- Public information systems
- Redressal of grievances
- Electronic service delivery
- Maximum engagement of citizens
- Reduced energy and fuel usage
- Reduces the development of wastes

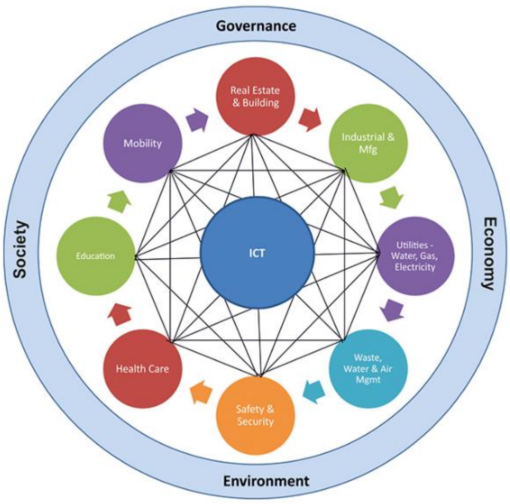
- Smart water monitoring
- Treatment of wastewater
- Sustainable monitoring water quality
- Maximum utilization of renewable energy sources
- Usage of green building techniques
- Smart parking to reduce clutter
- Intelligent traffic management system.

Advantages of a smart cities,

1. Promotion of mixed land usage resulting in higher efficiency and reduced wastage of land.
2. Expanded housing opportunities.
3. Reduced congestion, air pollution and resource depletion.
4. Helps to boost local economies by promoting localized trade and interactions.
5. Efficient use of public transport to reduce fuel wastage.
6. Safe and secure localities.
7. Preservation of open spaces.
8. Reduction in urban heating.
9. Promotion of transit-oriented development.
10. Making governance more people-friendly and cost-effective.

Here's a look at some projects that have taken inspiration from the concepts used for the design of smart cities. These projects will help you build energy-efficient systems that will help heal the world.

1. **Home Automation using IoT**
2. **Smart Irrigation System**
3. **Smart Building using IoT**
4. **Smart Energy Meter using GSM**
5. **Solar and Smart Energy Systems**
6. **Smart Water Monitoring**
7. **Automated Street Lighting**
8. **Automated Railway Crossing**
9. **Intelligent Transportation Systems**
10. **Smart Sewage Maintenance Systems.**



To develop new smart cities and to transform our cities into smart cities the engineers in particular are stepping up as leaders.

Civil & Environmental Engineers are working to harness the potential of latest technologies and data for our urban infrastructure, which is among the most complex system in the world. They provide sustainable, resilient and advanced means of transportation system, green building, better water management system and better waste management system. This not only develop physical infrastructure but also develop institutional & social infrastructure that enable our societies to function. Modelling these systems of systems will require managing data at an unprecedented scale.

To support them Computer and **Electronics & Communication Engineers** help in creating future cities that are digital, build and operate cities ICT landscape across application and infrastructure like IOT (Internet of Things), e-payment, e-market, the latest communication devices etc which is leveraging next generation technologies. They create a platform for conveyance of different city services, leverage big data analytics to manage city performance and proactive crisis management.

Electrical Engineers developing new renewable source of energy to meet ever increasing power demands. They also develop methods of effective power transmission with minimum losses which is more economical and safer. They also work on developing microchips to micro sensors which are helping in making our households, institution efficient and safer.

Conclusion

It is clear that dreaming of a smart city without active contribution of engineers is a myth. So, there will always be demand of Engineers and because of which even after crises in the placement scenario still the maximum science students choose Engineering as their first career choice in hope of a better future.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CE01) SMART CITIES PLANNING AND DEVELOPMENT

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To Introduce students on smart city basic concepts, global standards and Indian context of smart cities
- To understand smart community, smart transportation and smart buildings
- To understand Energy demand, Green approach to meet Energy demand and their capacities
- To identify Smart Transportation Technologies in cities and concepts towards smart city

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Recognize smart city concepts and their international and national standards
CO-2: Recognize smart community, transportation and building concepts
CO-3: Develop and calibrate energy demand and their capacity limits
CO-4: Predict the various smart urban transportation systems and the transition from existing city towards a smart city

UNIT – I:
Introduction to Smart Urban Infrastructures and Smart Cities: Introduction to City Planning - Understanding Smart Cities - Dimensions of Smart Cities - Global Experience of Smart Cities – Global Standards and Performance Benchmarks, Practice Codes -Indian scenario - India "100 Smart Cities" Policy and Mission.

UNIT – II:
Smart Cities Planning and Development: Introduction to Smart Community - Smart community concepts: Concept of Smart Community - Smart Transportation - Smart Building and Home Device - Smart Health - Smart Government - Smart Energy and Water – Cyber Security, Safety, and Privacy - Internet of Things, Blockchain, Artificial Intelligence, Alternate Reality, Virtual Reality.

UNIT – III
Smart Urban Energy Systems – I: Conventional vs. Smart, City components, Energy demand, Green approach to meet Energy demand, Index of Indian cities towards smartness – A statistical analysis -Meeting energy demand through direct and indirect solar resources - Efficiency of indirect solar resources and its utility, Capacity limit for the indirect solar resources - Effectiveness in responsive environment in smart city; Smart communication using green resources.

UNIT – IV:

Smart Urban Energy Systems – II: Introduction to PV technology - PV of various scale for smart city applications - Energy efficiency - Policies of Solar PV in smart domains (RPO, REC, Carbon credit, etc.) Definition, Structure of Smart Grid- Indian Perspective- Advantage & limitation.

UNIT – V:

Smart Urban Transportation Systems: Smart Transportation Technologies - Driverless and connected vehicles - Ride sharing solutions - The "improve" pathway - The "shift" pathway – Smart Roads and Pavement systems.

UNIT – VI:

Towards Smart Cities: The transition of legacy cities to Smart -. Right transition process - The benefit of citizens, cities to adopt effective management and governance approaches - Factors in the transition phase of legacy cities to smart cities and their managerial implications.

TEXT BOOKS:

1. Internet of Things in Smart Technologies for Sustainable Urban Development, G. R. Kanagachidambaresan, R. Maheswar, V. Manikandan, K. Ramakrishnan, Springer, 2020
2. Society 5.0: A People-centric Super-smart Society, Hitachi-UTokyo Laboratory (H-UTokyo Lab), Springer, 2020
3. The Routledge Companion to Smart Cities, Katharine S. Willis, Alessandro Aurigi, Routledge International Handbooks, 2020

REFERENCES:

1. Smart Cities in Asia: Governing Development in the Era of Hyper-Connectivity Yu-min Joo, Yu-Min Joo, Teck-Boon Tan, Edward Elgar Pub, 2020
2. Urban Systems Design: Creating Sustainable Smart Cities in the Internet of Things Era, Yoshiki Yamagata, Perry P. J. Yang, Elsevier, 2020
3. Smart Cities and Artificial Intelligence: Convergent Systems for Planning, Design, and Operations, Christopher Grant Kirwan, Zhiyong Fu, Elsevier, 2020

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CE02) GREEN BUILDING TECHNOLOGY

COURSE PRE-REQUISITES: Smart Cities Planning and Development

COURSE OBJECTIVES:

- To expose the students to green buildings, their features and importance in the present context of sustainable development
- To introduce various sustainable building materials for green buildings
- To acquire knowledge on various design concepts and construction aspects of green buildings
- To learn the various policies and incentives for green buildings and also different green building rating systems and codes

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Explain the importance, features and requisites of a green building

CO-2: Identify suitable sustainable building materials for construction of green building

CO-3: Plan and design various systems for green buildings

CO-4: Explain various codal provisions of green buildings and accordingly rate a building

UNIT – I:

Introduction: Definition of Green Buildings - Typical features of green buildings - Benefits of Green Buildings - Green Building Materials and Equipment in India - Key Requisites for Constructing a Green Building - Important Sustainable features for Green Building - Climate responsive buildings - Carbon footprint and eco footprints of buildings.

UNIT – II:

Green Building Materials: Introduction to sustainable building materials – Sustainable Concrete – Partial replacements in concrete - Natural building materials - Bio materials - Mycelium - Engineered Wood - Structural insulated panels (SIPs) - Natural Fiber - Nontoxic materials: low VOC paints, organic paints, coating and adhesives - Use of waste materials such as paper, Cellulose, glass bottles, tires, shipping containers - Use of industrial waste such as fly-ash, bags, building demolition waste.

UNIT – III:

Design of Green Buildings: Indoor environmental quality requirement and management: Thermal comfort - HVAC - Visual perception - Illumination requirement - Auditory requirement – Energy Efficiency - Lighting and day lighting - Steady and non-steady heat transfer through the glazed window and the wall – Indoor air quality - Local climatic conditions – temperature, humidity, wind speed and direction.

UNIT – IV:

Construction of Green Buildings: IoT Integrated Automated Building Systems - Synthetic Roof Underlayment - Green Roofs - Grid Hybrid System - Passive Solar - Greywater Plumbing Systems - Electrochromic Glass - Solar Thermal Cladding - Structural 3D Printing - Self-healing Concrete - Bird Friendly Design - Landscaping for Parking Lot Runoff - Composting Toilets - Proactive Maintenance - Green Cleaning.

UNIT – V:

Green Building Policies and Incentives: Green products and material certification - parameters making products green - products transparency movement - Cradle to cradle certification - Product emission testing - Carbon trust - carbon credit - returns on investments - savings Policies towards electrical power in India – Case study - Tax credits & Grants - Green construction guide.

UNIT – VI:

Green Building Rating Systems and Codes: Green building rating systems: BREAM, LEED and GRIHA, ISO 14020 – Green building codes: ECBC and NBC 2016 - Green materials: Standard specifications – Case Studies: Dockland Building in Hamburg, SOKA Building in Wiesbaden, KSK Tuebingen, Nycomed, Constance, DR Byen, Copenhagen.

TEXT BOOKS:

1. Green Building Handbook, Tom Woolley and Sam Kimings, 2009
2. Sustainable Construction: Green Building Design and Delivery, Charles J. Kibert, 2012

REFERENCES:

1. Green Building Fundamentals, Mike Montoya, Pearson, USA, 2010
2. Sustainable Construction - Green Building Design and Delivery, Charles J. Kibert, John Wiley & Sons, New York, 2008
3. Sustainable Construction and Design, Regina Leffers, Pearson / Prentice Hall, USA, 2009
4. Introduction to Environmental Economics, Nick Hanley, Jason, F. Shogren and Ben White, Oxford University Press, 2001

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VII Semester	L	T/P/D	C
	3	0	3

(19OE1CE03) SMART MATERIALS AND STRUCTURES

COURSE PRE-REQUISITES: Smart Cities Planning and Development, Green Building Technology

COURSE OBJECTIVES:
- To introduce the students to various smart materials and their working principles
- To acquire knowledge on different measuring techniques
- To learn about various smart sensors, actuators and their application in structural health monitoring
- To acquire knowledge on different smart composite materials and their modelling concepts
- To learn about the data acquisition and processing and their application in engineering domain

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the different smart materials and their principles
CO-2: Explain and understand different measuring techniques
CO-3: Identify suitable smart sensors and actuators for a specific engineering application
CO-4: Gain the knowledge on data acquisition and processing and advantages in smart materials and smart structures

UNIT – I:
Introduction: Introduction to Smart Materials and Structures – Instrumented structures functions and response – Sensing systems – Self -diagnosis – Signal processing consideration – Actuation systems and effectors.

UNIT – II:
Measuring Techniques: Measuring techniques: Strain Measuring Techniques using Electrical strain gauges, Types – Resistance – Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells – Temperature Compensation – Strain Rosettes.

UNIT – III:
Sensors: Sensing Technology – Types of Sensors – Physical Measurement using Piezo Electric Strain measurement – Inductively Read Transducers – LVDT – Fiber optic Techniques- Absorptive chemical sensors – Spectroscopes – Fibre Optic Chemical Sensing Systems and Distributed measurement, Application of Smart Sensors for Structural Health Monitoring (SHM), System Identification using Smart Sensors

UNIT – IV:

Actuators: Actuator Techniques – Actuator and actuator materials – Piezoelectric and Electrostrictive Material – Magneto structure Material – Shape Memory Alloys – Electro rheological fluids – Electromagnetic actuation – Role of actuators and Actuator Materials - IPMC and Polymeric Actuators, Shape Memory Actuators

UNIT-V:

Signal Processing and Control Systems: Data Acquisition and Processing – Signal Processing and Control for Smart Structures – Sensors as Geometrical Processors – Signal Processing – Control System – Linear and Non-Linear

UNIT –VI:

Advances in Smart Structures & Materials: Self-Sensing Piezoelectric Transducers, Energy Harvesting Materials, Autophagous Materials, Self Healing Polymers, Intelligent System Design, Emergent System Design

TEXT BOOKS:

1. Smart Materials and Structures, Gandhi M. V. and Thompson B. S., Chapman & Hall, Madras, 1992
2. Dynamics and Control of Structures, Meirovitch L., John Wiley, 1992

REFERENCES:

1. Smart Structures: Analysis and Design, A. V. Srinivasan, D. Michael McFarland, Cambridge University Press, 2009
2. Smart Materials and Technologies: For the Architecture and Design Professions, Michelle Addington and Daniel L. Schodek, Routledge 2004
3. Smart Structures and Materials, Brian Culshaw, Artech House – Borton, London, 1996

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VIII Semester	L	T/P/D	C
	3	0	3

(19OE1CE04) INTELLIGENT TRANSPORTATION SYSTEM

COURSE PRE-REQUISITES: Smart Cities Planning and Development, Green Building Technology, Smart Materials and Structures

COURSE OBJECTIVES:

- To understand ITS architecture and standards
- To apply appropriate ITS technology depending upon site specific conditions
- To design and implement ITS components
- To understand concept and application of Automated Highway Systems

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Differentiate different ITS user Services

CO-2: Apply ITS for road user safety

CO-3: Interpret importance of AHS in ITS

CO-4: Extend future research and special project

UNIT – I:

Introduction To ITS: System Architecture, Standards, Database – Tracking Database – Commercial Vehicle Operations – Intelligent Vehicle Initiative - Metropolitan ITS – Rural ITS – ITS for Rail network.

UNIT – II:

ITS Travel Management: Autonomous Route Guidance System – Infrastructure based systems – Telecommunications – Vehicle – Roadside communication – Vehicle Positioning System – Electronic Toll Collection – Electronic Car Parking

UNIT – III:

ITS Designs: Modeling and Simulation Techniques - Peer – to – Peer Program – ITS for Road Network – System Design – Mobile Navigation Assistant – Traffic Information Center – Public Safety Program.

UNIT – IV:

Introduction to Automated Highway Systems: Evolution of AHS and Current Vehicle Trends - Vehicles in Platoons – Aerodynamic Benefits - Integration of Automated Highway Systems – System Configurations - Step by Step to an Automated Highway System.

UNIT – V:

Evaluation and Assessment of AHS: Spacing and Capacity for Different AHS Concepts – Communication Technologies for AHS - The Effects of AHS on the Environment – Regional Mobility - Impact Assessment of Highway Automation.

UNIT – VI:

Implementation of ITS: ITS programs globally- overview of ITS in developed countries and developing countries – ITS at Toll Plazas – Parking lots – Highways.

TEXT BOOKS:

1. Intelligent Transport Systems Handbook: Recommendations for World Road Association (PIARC), Kan Paul Chen, John Miles, 2000
2. Intelligent Transport Systems – Cases and Policies, Roger R. Stough, Edward Elgar, 2001
3. Intermodal Freight Transport, David Lowe, Elsevier Butterworth-Heinemann Publishers, 2005

REFERENCES:

1. Positioning Systems in Intelligent Transportation Systems, Chris Drane and Chris Rizos, Artech House Publishers, London, 2000
2. Perspectives on Intelligent Transport Systems, Joseph M. Sussman, Springer Publishers, 2000
3. Intelligent Transport System, Intelligent Transportation Primer, Washington, US, 2001

WASTE MANAGEMENT

WASTE MANAGEMENT

The courses such as solid waste management (SWM), hazardous waste management (HWM), waste to energy (WTE) and intelligent waste management and recycling system (IWM&RS) are the courses available in the waste management track stream which having a potential syllabus content to meet out the industrial and research needs.

Solid waste management is an interesting track course which actual highlights the day-to-day problems where everybody is facing due to the improper management of industrial, domestic and household waste. Further, the enthusiastic aspects involved in the track courses such as: awareness on its impact over on environment, formal or scientific way of handling and management of waste and disposal scenarios.

In hazardous waste management course, handling and management of nuclear waste at national and international level have been highlighted. Further, the content enlightens about the legal process of state, central and industrial responses toward any emergency situations arise by hazardous waste. Finally, it deals about natural resource damage assessment and restoration.

Waste to energy is a pioneering course available in the track; it is one of the interesting and mindboggling course in the track which highlights the importance of converting the waste materials into wealth. It gives enough space to understand the basic process technologies in a theoretical and industrial way such as: thermal, chemical and biological conversion process. From the above, biological conversion process is in its embryonic state and having potential to expands its technological wings in the near future and having enormous scope of industrial applications where students can be benefited. Finally, conversion devices is an innovative module have been framed to explore the young minds in the line of designing and creating a demand based conversion device products which even lays an entrepreneurial pathway to them.

First of its kind, even at both international and national level a dedicated and extensive course for intelligent waste management and recycling system have been framed with conventional and advanced modules. It is really an interesting course where a student can apply his/her innovative creations to solve the existing and futuristic problems in a smart way with the help of smart tools. Optimistic modules such as: life cycle assessment and carbon-footprint-based IWMS, principles of systems engineering and regulatory frameworks have been incorporated to meet out the international requirements.

In the pathway of exploring the fundamentals and basic knowledges about the course, the six units of all the courses have been formulated keeping in the mind that the students can be able to competitive among the international community at the end of semester. In this context, comprehensive theoretical and industrial processes have been incorporated in each and every module of courses. Further, it is highly believed that the framed syllabus modules having 100% industrial applications which can make the students to feel motivated, satisfied and confidence to compete with the international community.

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B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CE05) SOLID WASTE MANAGEMENT

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand the concepts of solid waste management
- To remember the characteristics of solid waste and source reduction techniques
- To acquire the knowledge & skills in the collection, storage, transport and engineering principles of solid waste
- To remember and understand the treatment, disposal and recycling and various laws and regulation of solid waste management

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply the fundamental concepts of solid waste management

CO-2: Apply the acquired knowledge to resolve the practical problems on source reduction

CO-3: Apply the knowledge on collection, storage, transport and waste processing of solid waste in real time situation

CO-4: Impart the gained knowledge and skills and various laws & regulations on treatment of SW in real time societal problems

UNIT – I:

Sources and Classification: Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management – Elements of integrated waste management and roles of stakeholders - Financing and Public Private Participation for waste management- Integrated solid waste management.

UNIT – II:

Waste Characterization and Source Reduction: Waste generation rates and variation - Composition, physical, chemical and biological properties of solid wastes – Hazardous Characteristics – TCLP tests – waste sampling and characterization plan - Source reduction of wastes –Waste exchange - Extended producer responsibility - Recycling and reuse.

UNIT – III:

Storage, Collection and Transport of Wastes: Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations Optimizing waste allocation– compatibility, storage, labeling and handling of hazardous wastes – hazardous waste manifests and transport.

UNIT – IV:

Waste Processing Technologies: Objectives of waste processing – material separation and processing technologies – biological and chemical conversion technologies – methods and controls of Composting - thermal conversion technologies and energy recovery – incineration – solidification and stabilization of hazardous wastes- treatment of biomedical wastes - Health considerations in the context of operation of facilities.

UNIT – V:

Waste Disposal: Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – Rehabilitation of open dumps-remediation of contaminated sites.

UNIT – VI:

Regulatory Frameworks: Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, nuclear wastes - lead acid batteries, electronic wastes, plastics waste, bio-medical waste, construction and demolition waste and fly ash waste.

TEXT BOOKS:

1. Integrated Solid Waste Management, George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, McGraw Hill International Edition, New York, 1993
2. CPHEEO, Manual on Municipal Solid Waste Management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2014

REFERENCES:

1. Handbook of Solid Waste Management, Frank Kreith, George Tchobanoglous, McGraw Hill, 2002
2. Waste Management Practices, John Pitchtel, CRC Press, Taylor and Francis Group, 2014
3. Municipal Solid Waste Management, Processing, Energy Recovery, Global Examples, P. Jayarama Reddy, BS Publications, CRC Press, Taylor and Francis Group, 2011
4. GoI, Ministry of Environment and Forest and Climate Change, Various Recent Laws and Rules of Solid Waste Management

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VI Semester	L	T/P/D	C
	3	0	3

(19OE1CE06) HAZARDOUS WASTE MANAGEMENT

COURSE PRE-REQUISITES: Solid Waste Management

COURSE OBJECTIVES:

- To understand the concepts of hazardous waste management
- To understand the principle of waste characterization, storage, transport and processing
- To understand the principles of nuclear waste and Hazardous Management (HM) and emergency Response
- To understand the principle and process of landfills and natural resource Damage Assessment & Restoration

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply the fundamental concepts of hazardous waste management

CO-2: Apply the knowledge to resolve the problems on storage, transport and processing

CO-3: Apply the knowledge to resolve the practical problems on nuclear waste and HM & emergency response

CO-4: Impart the gained knowledge and skills to resolve the practical problems on landfills and natural resource damage assessment & restoration on field

UNIT – I:

Introduction: Need for hazardous waste management – Sources of hazardous wastes – Effects on community – terminology and classification – Storage and collection of hazardous wastes – Problems in developing countries – Protection of public health and the environment.

UNIT – II:

Waste Characterization, Storage, Transport and Processing: Hazardous Waste Characterization and Definable Properties - Analytical– Analytical methods – Hazardous waste inventory- Source reduction of hazardous wastes - Handling and storage of Hazardous wastes –Waste Compatibility Chart – Hazardous Waste Transport- Manifest system – Transboundary movement of wastes – Basal Convention – Hazardous waste treatment technologies – Physical, chemical and thermal treatment of hazardous waste – Solidification – Chemical fixation – Encapsulation – Incineration.

UNIT – III:

Nuclear Waste: Characteristics – Types – Nuclear waste – Uranium mining and processing – Power reactors – Refinery and fuel fabrication wastes – spent fuel – Management of nuclear wastes – Decommissioning of Nuclear power reactors – Health and environmental effects.

UNIT – IV:

Management of Hazardous Wastes: Identifying a hazardous waste – methods – Quantities of hazardous waste generated – Components of a hazardous waste management plan – Hazardous waste minimization – Disposal practices in Indian Industries – Future challenges - Emergency Response - National Response Team and Regional Response Teams; National Contingency Plan and Regional Contingency Plans; National Response Center; State, Local and Industry Response Systems.

UNIT – V:

Secure Landfills: Hazardous waste landfills – Site selections – landfill design and operation – Regulatory aspects – Liner System- Liners: clay, geomembrane, HDPE, geonet, geotextile – Cover system- Leachate Collection and Management – Environmental Monitoring System- Landfill Closure and post closure care - Underground Injection Wells.

UNIT – VI:

Natural Resource Damage Assessment and Restoration: Natural Resource Damage Assessment Laws and Regulations - Central and State government agencies - Damage Assessment and Restoration Procedures - Groundwater Hydrology and Contamination Processes - Groundwater Contamination Detection, Analysis and Monitoring - Overview of CERCLA - Remedial Action Process and RCRA Correction Action Program - Preliminary Assessments and Site Inspections - Hazard Ranking System - National Priorities List - State Priorities List - Remedial Investigations and Feasibility Studies - Records of Decision and the Administrative Process - Remedial Design - Remedial Action - NPL Deletion Process.

TEXT BOOKS:

1. Hazardous Waste Management, Charles A. Wentz., 2nd Edition, McGraw Hill International, 1995
2. Standard Handbook of Hazardous Waste Treatment and Disposal, Harry M. Freeman, McGraw Hill, 1997

REFERENCES:

1. Hazardous Waste (Management and Transboundary Movement) Rules, Ministry of Environment and Forests, Government of India, New Delhi
2. Guidelines and Criteria for Hazardous Waste Landfills and Hazardous Waste Treatment Disposal Facilities, Central Pollution Control Board, New Delhi, 2010
3. Hazardous Waste Management, Anjaneyulu
4. Hazardous Waste Management, M. LaGrega and others, McGraw-Hill Publication

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CE07) WASTE TO ENERGY

COURSE PRE-REQUISITES: Solid Waste Management, Hazardous Waste Management

COURSE OBJECTIVES:
- To understand the concepts of energy from waste
- To understand the principle and process of thermal conversion technology (TCT)
- To understand the principle and process of chemical and biological conversion technology (CCT & BCT)
- To understand the principles and processes of biomass energy technology (BET) and conversion process and devices (P&D) for solid wastes

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the fundamental concepts of energy from waste
CO-2: Apply the acquired knowledge to resolve the practical problems on TCT
CO-3: Apply the knowledge to resolve the practical problems on CCT and BCT
CO-4: Impart the gained knowledge and skills to resolve the practical problems on BET and P&D

UNIT – I:
Introduction to Energy from Waste: Classification of waste as fuel – agro based, forest residue, industrial waste, MSW – conversion devices – incinerators, gasifiers, digesters, Environmental monitoring system for land fill gases, Environmental impacts; Measures to mitigate environmental effects due to incineration.

UNIT – II:
Thermal Conversion Technologies: Fundamentals of thermal processing – combustion system – pyrolysis system – gasification system – environmental control system – energy recovery system – incineration.

UNIT – III:
Chemical Conversion Technologies: Acid & Alkaline hydrolysis – hydrogenation; solvent extraction of hydrocarbons; solvolysis of wood; biocrude; biodiesel production via chemical process; catalytic distillation; transesterification methods; Fischer-Tropsch diesel: chemicals from biomass - various chemical conversion processes for oil, gas, cellulose acetate.

UNIT – IV:
Biological Conversion Technologies: Nutritional requirement for microbial growth – types of microbial metabolism – types of microorganisms – environmental requirements – aerobic biological transformation – anaerobic biological transformation – aerobic composting – low solid anaerobic digestion – high solid

anaerobic digestion – development of anaerobic digestion processes and technologies for treatment of the organic fraction of MSW – Biodegradation and biodegradability of substrate; biochemistry and process parameters of biomethanation - other biological transformation processes.

UNIT – V:

Biomass Energy Technologies: Biomass energy resources – types and potential; Energy crops - Biomass characterization (proximate and ultimate analysis); Biomass pyrolysis and gasification; Biofuels – biodiesel, bioethanol, Biobutanol; Algae and biofuels; Pellets and bricks of biomass; Biomass as boiler fuel; Social, economic and ecological implications of biomass energy.

UNIT – VI:

Conversion Devices: Combustors (Spreader Stokes, Moving grate type, fluidized bed), gasifier, digesters. Briqueting technology: Production of RDF and briquetted fuel. Properties of fuels derived from waste to energy technology: Producer gas, Biogas, Ethanol and Briquettes – conversion process with basic device formulation for agricultural residues and wastes including animal wastes; industrial wastes; municipal solid wastes; E-waste; Bio-medical waste; C&D waste; plastic waste and batteries waste.

TEXT BOOKS:

1. Integrated Solid Waste Management, George Tchobanoglous, Hilary Theisen and Samuel A., Vigil, Mc-Graw Hill International Edition, New York, 1993
2. Energy from Waste - An Evaluation of Conversion Technologies, C. Parker and T. Roberts (Ed.), Elsevier Applied Science, London, 1985

REFERENCES:

1. Introduction to Biomass Energy Conversion, Capareda S., CRC Press, 2013
2. Thermo-chemical Processing of Biomass: Conversion into Fuels, Chemicals and Power, Brown R. C. and Stevens C., Wiley and Sons, 2011
3. Biomass Conversion Processes for Energy and Fuels, Sofer, Samir S. (Ed.), Zaborsky, R. (Ed.), New York, Plenum Press, 1981
4. Energy Recovery from Municipal Solid Waste Thermal Conversion Technologies, P. Jayarama Reddy, CRC Press, Taylor & Francis Group, London, UK, 2016

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CE08) INTELLIGENT WASTE MANAGEMENT SYSTEM AND RECYCLING SYSTEM

COURSE PRE-REQUISITES: Solid Waste Management, Hazardous Waste Management, Waste to Energy

COURSE OBJECTIVES:

- To understand the concepts of Solid waste
- To understand the principle and process of IWMS Tools
- To understand the applications of IoT, ML, DL, BC and LCA & Carbon Foot Print (CFP) based SWM
- To understand the principles of Process Systems Engineering (PSE) and various laws and regulation of SWM

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply the fundamental concepts of Solid waste

CO-2: Apply the knowledge to resolve the practical problems with the help of IWMS Tools

CO-3: Apply the knowledge of IoT, ML, DL, BC and LCA & CFP to resolve the practical problems in SWM

CO-4: Impart the PSE knowledge and various laws and regulation to resolve the practical problems in SWM

UNIT – I:

Introduction to Solid Waste: Sources, Generation, Classification and Types of Solid Waste – Biomedical Waste – E-Waste – Construction and Demolition Waste – Plastic Waste – Batteries Waste – Hazardous Waste - Waste Management Through Waste Hierarchy: Reduce, Reuse, Recycle, Recover, and Disposal - Waste Operational Units: Equipment and Facilities: Collection and Transportation - Mechanical Treatment - Biological Treatment - Thermal Treatment – Disposal.

UNIT – II:

Introduction to IWMS Tools: Introduction – Need of the IWMS – functional elements of IWMS – Ultrasonic Sensor, Arduino Board, GSM Module, Bread Board, Power Supply (Battery) – Jump Wires - Navigation system – Cloud Services - Zero Waste Principle.

UNIT – III:

Applications in Intelligent Waste Management System: Introductory Applications of IoT, Machine Learning, Deep Learning and Block Chain Technology in Waste Characterization and Source Reduction, Storage, Collection and Transport of Wastes, Waste Processing Technologies and Waste Disposal.

UNIT – IV:

Life Cycle Assessment and Carbon-Footprint-Based IWMS: Phases of Life Cycle Assessment: Goal and Scope Definition - Life Cycle Inventory - Life Cycle Impact Assessment – Interpretation - LCA Waste Management Software - Umberto Software - SimaPro Software - LCA Assessment Methodology: Life Cycle Inventory Analysis - Life Cycle Impact Assessment – Interpretation - Sensitivity Analysis - Carbon-Footprint-Based SWM - The Global-Warming Potential Impact - GHG Accounting - GWP Assessment for Solid Waste Management.

UNIT – V:

Principles of Systems Engineering: Systems Engineering Principles and Tools for SWM - Planning Regional Material Recovery Facilities - Optimal Planning for Solid Waste Collection, Recycling, and Vehicle Routing - Multiattribute Decision Making with Sustainability Considerations - Decision Analysis for Optimal Balance between Solid Waste Incineration and Recycling Programs - Environmental Informatics for Integrated Solid Waste Management - Future Perspectives.

UNIT – VI:

Regulatory Frameworks: Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, nuclear wastes - lead acid batteries, electronic wastes, plastics waste, bio-medical waste, construction and demolition waste and fly ash waste.

TEXT BOOKS:

1. Sustainable Solid Waste Management - A Systems Engineering Approach, Ni-Bin Chang and Ana Pires, IEEE & John Wiley & Sons, Inc., Hoboken, New Jersey, 2015
2. Integrated Solid Waste Management, George Tchobanoglous, Hilary Theisen and Samuel A., Vigil, McGraw Hill International Edition, New York, 1993

REFERENCES:

1. Manual on Municipal Solid Waste Management, CPHEEO, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2014
2. Smart Waste Management-Nutshell, Vishal Gupta, Amazon.com Services LLC, September 11, 2017
3. Recyclable Household Waste Management System for Smart Home in IOT, Manpreet Kaur & Dr. Kamaljit Singh Saini, Independently Published, June 12, 2018
4. GoI, Ministry of Environment and Forest and Climate Change, Various Recent Laws and Rules of Solid Waste Management

GREEN ENERGY

1. RENEWABLE ENERGY SOURCES

What we are studying?

The climate landscape is changing rapidly, and new technologies and solutions keep arising to respond to global and local challenges.

Renewable energy sources course makes you discover how Solar Thermal Energy conversion system works. It makes you understand how a Solar Photo voltaic generation system generates electricity. Scope of the course also includes wind energy generation. It also navigates you through Biomass and geo thermal energy generation systems.

Job opportunities:

When it comes to the hottest and most buzzing careers in the 21st century, the majority of people think of hardcore technical domains such as data science, machine learning & artificial intelligence. Few people might also come up with biotechnology (or biosciences). But, quite often people forget about one of the dark horses – the Renewable Energy sector. Even Bill Gates lobbied for the Energy sector as one of the top three career choices for making an impactful career.

Reference:

https://www.stoodnt.com/blog/careers-in-renewable-energy-job-opportunities-fields-of-study-and-top-universities/

2. RENEWABLE ENERGY TECHNOLOGIES

Within Crisis, there are seeds of opportunity..! We are at the wedge of fossil fuel end. After few years you can witness fuel crisis all over the world, as an engineer one must aware of the solution. To design sustainable systems those last for decades, one must use renewable energy as main or auxiliary source of energy. The application may be electrical or mechanical or chemical, one must convert energy from renewable source into electricity for ease of use.

Renewable Energy Technologies course will introduce you to Different types of Solar PV systems and their characteristics. Students will know the functionality of Power Converters such as Inverters etc., through block diagram approach. Fuel cell technology, which is one of the solutions for energy crisis will be discussed in detail. Course will conclude by discussing impact of PV panel production on environment and disposal of it.

Job Opportunities:

Green jobs in the renewable energy sector are expected to touch new figures with 6 digit monthly income. Following link may describe the interesting interdisciplinary careers for budding engineers.

Reference:

https://www.businessinsider.in/slideshows/miscellaneous/21-high-paying-careers-for-people-who-want-to-save-the-planet-and-also-have-job-security/slidelist/70677782.cms#slideid=70677804

3. ENERGY STORAGE TECHNOLOGIES

Battery technology is an essential skill for every engineer in present scenario. Course on energy storage technologies will enable student to, Design storage system Residential loads integrated to Renewable and storage systems for Electric Vehicles. It will make student to understand various electrochemical storages such as Lead acid, Li Ion cell etc. and their characteristics. The course enables student to compare non-electric, electric storage systems and analyze application of them to various domains.

Job opportunities:

Upon successful completion of course student will enhance the chances of getting into EV industry , which almost open fact. Job Profiles include

i. Battery algorithms engineer
ii. Battery management engineer
iii. Battery modeling expert
iv. Design engineer – EV

4. ENERGY MANAGEMENT AND CONSERVATION

Energy Management And Conservation course is mainly intended to monitor Energy consumption of industries and to manage energy systems. This course also deals with methods of improving efficiency of electric machinery and to design a good illumination system. It also teaches student calculate pay back periods for energy saving equipment.

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B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1EE01) RENEWABLE ENERGY SOURCES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the role of solar power
- To know components of PV system conversion
- To learn Operation of windmills
- To understand the principle operation of biomass and geo thermal energy systems

COURSE OUT COMES: After completion of the course, the student should be able to
CO-1: Understand Solar Thermal Energy conversion systems
CO-2: Understand Solar Photo voltaic systems
CO-3: Analyze wind energy conversion system
CO-4: Understand the principle operation of Biomass and geo thermal energy systems

UNIT – I:
Principles of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, The apparent motion of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sunshine, solar radiation data.

UNIT – II:
Solar Thermal Energy Conversion:
Solar Heating: Some basic calculations, The performance of solar heating devices, Evaluation of sunlight received by a collector, Flat solar panels - Different technologies of thermal solar collectors-Evaluation of the performance of solar collectors- Selective coatings for collectors and glazing, Solar heating systems - Individual and collective solar water heaters- Combined solar systems for the heating of buildings
Power Stations: Concentric Solar Power Plants- Concentrating systems- Components for production of heat and conversion into electricity

UNIT – III:
Solar PV Conversion: The PV Cell-Crystalline Solar cells-Thin film solar cell, Module, Array, Equivalent Electrical circuit, Open circuit voltage and Short circuit current, I-V, P-V Corves, Array design- Sun angle- effect of Temperature-Sun tracking, PV system components

UNIT – IV:
Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria, Maximum power Tracking of wind mills, and peak power operation Site selection of Wind mills, working Induction generator (Principle only)

UNIT – V:

Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.

UNIT – VI:

Geothermal & Ocean Energy: Resources, types of wells, methods of harnessing the energy (brief discussion) potential in India. OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

TEXT BOOKS:

1. Non-Conventional Energy Sources, G. D. Rai, Khanna Publishers
2. Renewable Energies, John Claude Sabbonedere, ISTE & John Wiley Publishers, 2007
3. Renewable Energy Resources, Twidell & Wier, CRC Press (Taylor & Francis), 2016

REFERENCE:

1. Wind & Solar Power Systems, Mukund R. Patel, CRC Press, 2003

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B.Tech. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1EE02) RENEWABLE ENERGY TECHNOLOGIES

COURSE PRE-REQUISITES: Renewable Energy Sources

COURSE OBJECTIVES:
- To provide necessary knowledge about the modeling, design and analysis of various PV systems
- To show that PV is an economically viable, environmentally sustainable alternative to the world's energy supplies
- To understand the power conditioning of PV and WEC system's power output

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Model, analyze and design various photovoltaic systems
CO-2: Know the feasibility of PV systems as an alternative to the fossil fuels
CO-3: Design efficient stand alone and grid connected PV and WEC power systems

UNIT – I:
Behavior of Solar Cells-Basic Structure and Characteristics: Types - equivalent circuit- modeling of solar cells including the effects of temperature, irradiation and series/shunt resistances on the open-circuit voltage and short-circuit current-Solar cell arrays- PV modules-PV generators- shadow effects and bypass diodes- hot spot problem in a PV module and safe operating area.

UNIT – II:
Types of PV Systems: Grid connected PV systems- Net-metering- Estimation of actual AC output power from PV systems
Stand-alone system- Approach to designing an off-grid PV system with battery- with battery and diesel generator- Stand-alone solar water pumping system- Sizing/designing PV water pumping system- Problems

UNIT – III:
Power Converters for PV and Wind: Basic switching devices, AC-DC Rectifier, DC-AC inverter (Basic operation), DC-DC converter - Buck, Boost converters Basic operation, Battery charger (Basic operation), grid interface requirements in Renewable energy integration

UNIT – IV:
Maximum Power Point Tracking: Various Sources of Losses is PV system, Charge Control in Battery Backed PV Systems, Maximum Power Point Tracking (MPPT)- Role of DC-DC converter in MPP tracking- Perturb and Observe Method-pseudo program for P&O method, Advanced Issues & Algorithms- search steps-variable step size algorithm.

UNIT – V:
Fuel Cell Technology: History of Fuel cells, Fuel Cell Vehicle Emissions, Hydrogen safety factors, Principle of Operation- Fuel cell Model- cell voltage, Power and

efficiency of fuel cell, Various types of fuel cells, Various storage systems for Hydrogen, Applications

UNIT – VI:

Solar Thermal Electricity Generation: Sterling Engine, Solar Pond, Solar Chimney

Solar PV System Environment Impact: Potential Hazards in production of PV cell, Energy payback and CO2 emission of PV systems, Procedure for decommissioning of PV plant, Future Trends of Wind Energy system

TEXT BOOKS:

1. Handbook of Renewable Energy Technology, Ahmed F. Zobaa, World Scientific Publishing Company, 2011
2. Wind and Solar Power Systems Design, Analysis, and Operation, Patel M. R., 2^{nd} Edition, CRC Press, New York, 2005
3. Practical Handbook of Photovoltaics - Fundamentals and Applications, Augustin McEvoy, Tom Markvart, T. Markvart, L. Castaner, Elsevier Science, 2003

REFERENCE:

1. Electric Powertrain - Energy Systems, Power Electronics & Drives for Hybrid, Electric & Fuel Cell Vehicles, Goodarzi, Gordon A., Hayes, John G, John Wiley & Sons, 2018

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1EE03) ENERGY STORAGE TECHNOLOGIES

COURSE PRE-REQUISITES: Renewable Energy Sources, Renewable Energy Technologies

COURSE OBJECTIVES:

- To understand Techno economic analysis of various storage systems
- To know Feasibility of different storage technologies
- To learn operation of several electrochemical storage systems
- To understand Functionality of non-electric storage systems

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Design storage system Residential loads integrated to Renewable and storage systems for Electric Vehicles

CO-2: Understand various electrochemical storage system

CO-3: Understand terminology and characteristics of Electro chemical systems

CO-4: Compare non-electric and electric storage system

CO-5: Analyze application of storage systems to various domains

UNIT – I:

Techno-economic Analysis of Various Energy Storage Technologies: Electrical Energy Storage (EES)-Definition-Role, Energy storage components, Applications and Technical support, Financial Benefits of EES, Techno economic analysis, Classification of Energy Storage systems, Comparison

UNIT – II:

Estimation of Energy Storage and Feasibility Analysis: Background-Solar Power-Wind Power (Brief discussion), Estimation-daily residential load-daily available solar energy-daily available wind energy-Importance, Estimation of Storage sizing- Steps for Storage sizing- Grid connected residential PV-grid connected residential Wind-hybrid system, Feasibility analysis of Storage systems- Various Terms involved- Case study of comparison between Off grid and grid connected systems

UNIT – III:

Electro Chemical Storage: Standard Batteries- Lead Acid- VRLA - Ni-cd, Modern Batteries- Ni MH- Li Ion, Flow Batteries – Br2 Zn-Vanadium Redox, Battery composition, construction, Principle of operation, Types, Advantages and disadvantages to above batteries.

UNIT – IV:

Terminology & Characteristics: Battery Terminology, Capacities, Definitions of various characteristics, Different States of charge-DOD-SOC-SOE-SOH-SOF, Resistance, Battery Design, Battery Charging, Charge Regulators, Battery Management, General Equivalent Electrical Circuit, Performance Characteristics

UNIT – V:

Non-Electric Storage Technologies: Flywheel, Energy Relations, Flywheel System Components, Benefits of Flywheel over Battery, Superconducting Magnet Energy Storage, Compressed Air Energy storage, Overview Thermal Energy Storage. Capacitor bank storage, Comparison of storage Technologies

UNIT –VI:

Applications: Domains of applications of Energy storage- Starter-Traction-stationary-mobile or nomadic, Review of storage requirements, Storage for Electric Vehicle application, Storage for hybrid vehicle-Regenerative Braking-Super capacitor-hybrid capacitor

TEXT BOOKS:

1. Energy Storage Technologies and Applications, Ahmed Faheem Zobaa, InTech Publishers, 2013
2. Lithium Batteries and Other Electrochemical Storage Systems, Christian Glaize, Sylvie Geniès, ISTE & John Wiley, 2013
3. Wind and Solar Power Systems, Mukund R. Patel, 2nd Edition, CRC Press, 2006

REFERENCES:

1. Rechargeable Batteries Applications Handbook, EDN Series for Design Engineers, Elsevier

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B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1EE04) ENERGY MANAGEMENT AND CONSERVATION

COURSE PRE-REQUISITES: Renewable Energy sources, Renewable Energy Technologies, Energy Storage Technologies

COURSE OBJECTIVES:

- To understand the necessity of conservation of Energy
- To Know the methods of Energy management
- To identity the factors to increase the efficiency of electrical equipment
- To know the benefits of carrying out energy Audits

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: To conduct Energy Audit of industries
CO-2: To manage energy Systems
CO-3: To specify the methods of improving efficiency of electric motor
CO-4: To improve power factor and to design a good illumination system
CO-5: To calculate pay back periods for energy saving equipment

UNIT – I:
Basic Principles of Energy Audit: Energy audit- definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit

UNIT – II:
Energy Management: Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting- Energy manager, Qualities and functions, language, Questionnaire - check list for top management

UNIT – III:
Energy Efficient Motors: Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed, variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit

UNIT – IV:
Power Factor Improvement, Lighting and Energy Instruments: Power factor – methods of improvement, location of capacitors, p.f with non-linear loads, effect of harmonics on p.f., p.f motor controllers – simple problems
Lighting Energy Audit and Energy Instruments: Good lighting system design and practice, lighting control, lighting energy audit - Energy Instruments- watt meter, data loggers, thermocouples, pyrometers, flux meters, tongue testers, application of PLC's

UNIT – V:

Economic Aspects and Analysis: Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis.

UNIT – VI:

Analysis of Energy Efficient Motor: Energy efficient motors- calculation of simple payback method, net present worth method- Power factor correction, lighting - Applications of life cycle costing analysis, return on investment.

TEXT BOOKS:

1. Energy Management, W. R. Murphy & G. Mckay, Butterworth-Heinemann Publications
2. Energy Management, Paul o' Callaghan, 1st Edition, McGraw Hill Book Company, 1998

REFERENCES:

1. Energy Efficient Electric Motors, John C. Andreas, 2nd Edition, Marcel Dekker Inc. Ltd., 1995
2. Energy Management Handbook, W. C. Turner, John Wiley and Sons
3. Energy Management and Good Lighting Practice: Fuel Efficiency Booklet12-EEO

3D PRINTING AND DESIGN

3D PRINTING AND DESIGN

3D Printing is a process for making a physical object from a three-dimensional digital model by laying down many successive thin layers of a material. It brings a digital CAD model into its physical form by adding layer by layer of materials. Thus called 'Additive Manufacturing'. It is the opposite of subtractive manufacturing i.e., removing material from an object using a mechanical machine. It enables to produce complex shapes using less material than traditional manufacturing methods. There are several different techniques to 3D print an object. It saves time through prototyping and is also responsible for manufacturing impossible shapes. Due to these, it has many applications in different fields like consumer products (eyewear, footwear, design, furniture, industrial products (manufacturing tools, prototypes, functional end-use parts, dental products, prosthetics, architectural scale models, reconstructing fossils, replicating ancient artefacts, reconstructing evidence in forensic pathology etc.

3D printing has good prospects from career perspective. Various positions that could be available are CAD designers, engineers, technical developers, software developers, electronics engineers, etc.

This OE track consists of 04 courses and is designed with an objective to provide an overview of all the constituents of 3D Printing starting from elements of CAD that are needed to create CAD models, followed by basics of 3D Printing required for setting the parameters, then the machines and tools used in 3D Printing for thorough understanding of systems and processes and finally the reverse engineering of 3D printing models from actual objects.

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B.Tech. V Semester	L	T/P/D	C
	3	0	3

(19OE1ME01) ELEMENTS OF CAD

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand the basics of CAD and devices used
- To know the various types of modeling used in CAD
- To appreciate the concept of feature-based modeling and geometric transformations
- To comprehend the assembly modeling procedure and data exchange formats

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Know the fundamentals of CAD and devices used
CO-2: Identify the types of CAD modeling techniques and utilize them
CO-3: Evaluate the objects or models using geometric transformations and manipulations
CO-4: Perform the assembly modeling and asses the various data exchange formats

UNIT – I:
Fundamentals of CAD: Introduction to Computer Aided Design (CAD), Design process, Application of computers for Design and Manufacturing, Benefits of CAD, Brief overview of computer peripherals for CAD.

UNIT – II:
Geometric Modeling: Introduction to Geometric Model, Types of modeling, Curve representation
Wireframe Modeling: Introduction, advantages, limitations and applications, Wire frame entities-analytic and synthetic, Basic definitions of Cubic, Bezier and B-spline curves

UNIT – III:
Surface Modeling: Introduction, advantages, limitations and applications, surface entities, Basic definitions of analytic surfaces - planar surface, ruled surface, tabulated cylinder, surface of revolution; Basic definitions of synthetic surfaces - Bezier surface, B-spline surface

UNIT – IV:
Solid Modeling: Introduction, advantages, limitations and applications, Solid Entities, Solid Representation schemes – Boundary Representation (B-Rep) scheme, Constructive Solid Geometry (CSG) scheme.
Feature-based Modeling: Introduction, Feature entities, Feature representation, 3D Sketching, Parameter, Relations and Constraints

UNIT – V:
Geometric Transformations: Introduction to 2D & 3D transformations, Brief treatment on Translation, Scaling, Reflection and Rotation using Homogeneous and concatenated transformations

Manipulations: Displaying, Segmentation, Trimming, Intersection, Projection

UNIT – VI:

Assembly Modeling: Introduction, Assembly modeling, Assembly Tree, Mating Conditions, Bottom-up and Top-down approach

Product Data Exchange: Introduction, Graphics Standards, Types of translators, Importance of formats in 3D Printing, Data exchange formats - IGES, STEP and STL

TEXT BOOKS:

1. CAD/CAM Theory and Practice, Ibrahim Zeid, Tata McGraw Hill
2. Mastering CAD/CAM, Ibrahim Zeid, Tata McGraw Hill
3. CAD/CAM-Computer Aided Design and Manufacturing, Mikell P. Groover, E. W. Zimmers, Pearson Education/Prentice Hall

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B.Tech. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1ME02) INTRODUCTION TO 3D PRINTING

COURSE PRE-REQUISITES: Elements of CAD

COURSE OBJECTIVES:
- To understand the need of 3D Printing
- To understand about the process chain involved in 3D Printing
- To know about the two-dimensional layer by layer techniques, solid based systems & 3D Printing data exchange formats
- To know the post processing methods involved in 3D Printing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize the importance of 3D Printing
CO-2: Explain the process chain involved in 3D Printing
CO-3: Explain about two-dimensional layer-by-layer techniques, solid based systems and 3D printing data exchange formats
CO-4: Apply the knowledge gained in the post-processing methods

UNIT – I:
Introduction to 3D Printing: Introduction to 3D Printing, 3D Printing evolution, Classification of 3D Printing, Distinction between 3D Printing & CNC Machining, Advantages of 3D Printing

UNIT – II:
Generalized 3D Printing Process Chain: Process chain, Materials for 3D Printing, Design for 3D Printing and Overview of Medical Modeling & Reverse Engineering.

UNIT – III:
Two-Dimensional Layer-By-Layer Techniques: Stereolithography (SL), Selective Laser Sintering (SLS), Selective Powder Building (SPB), Advantages and Applications.

UNIT – IV:
Solid Based Systems: Introduction, basic principles, Fused Deposition Modeling, Multi-Jet Modeling, Laminated Object Manufacturing (LOM), Advantages and Applications.

UNIT – V:
3D Printing Data Exchange Formats: STL Format, STL File Problems, Brief Overview of other translations like IGES File, HP/GL File and CT data only.

UNIT – VI:

Post-Processing: Introduction, Support Material Removal, Surface Texture Improvements, Accuracy Improvements, Aesthetic Improvements.

TEXT BOOKS:

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W Rosen, Brent Stucker, Springer, 2010
2. Rapid Prototyping: Principles & Applications, Chuaa Chee Kai, Leong Kah Fai, World Scientific, 2010

REFERENCES:

1. Rapid Prototyping: Theory and Practice, Ali K. Karmani, Emand Abouel Nasr, Springer, 2006
2. Understanding Additive Manufacture: Rapid Prototyping, Rapid Tooling and Rapid Manufacture, Andreas Gebhardt, Hanser Publishers, 2013
3. Rapid Manufacturing: Advanced Research in Virtual and Rapid Prototyping, Hopkinson, N. Haque, and Dickens, Taylor and Francis, 2007

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1ME03) 3D PRINTING-MACHINES, TOOLING AND SYSTEMS

COURSE PRE-REQUISITES: Elements of CAD, Introduction to 3D Printing

COURSE OBJECTIVES:
- To understand the need of prototyping
- To understand about the liquid and solid based 3D printing systems
- To know about the liquid-based 3D printing systems & rapid tooling
- To know the applications of 3D Printing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize the importance of 3D Printing
CO-2: Explain the process involved in liquid and solid based 3D printing systems
CO-3: Explain about the liquid-based 3D printing systems and rapid tooling
CO-4: Adapt the knowledge gained in applications of 3D Printing

UNIT – I:
Introduction: Prototype Fundamentals, Types of Prototypes, Roles of Prototypes, Phases of Development Leading to Rapid Prototyping, Fundamentals of Rapid Prototyping.

UNIT – II:
Liquid Based 3D Printing Systems: Introduction, Principles, Processes and Applications of Solid Ground Curing, Material Jetting & Binder Jetting

UNIT – III:
Solid Based 3D Printing Systems: Introduction, Principles, Processes and Applications of Fused Deposition Modelling (FDM), Paper Lamination Technology (PLT) and Laminated Object Manufacturing (LOM)

UNIT – IV:
Laser Based 3D Printing Systems: Selective Laser Sintering (SLS)-Principle, Process and Applications, Three-Dimensional Printing- Principle, Process and Applications, Laser Engineered Net Shaping (LENS)- Principle, Process and Applications

UNIT – V:
Rapid Tooling: Introduction and need for Rapid Tooling, Overview of Indirect and Direct Processes, Applications

UNIT – VI:
3D Printing Applications: Brief overview of Applications in Design, Engineering, Aerospace Industry, Automotive Industry and Biomedical Industry

TEXT BOOKS:
1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W Rosen, Brent Stucker, Springer, 2010

2. Rapid Prototyping: Principles & Applications, Chuaa Chee Kai, Leong Kah Fai, World Scientific, 2010

REFERENCES:

1. Rapid Prototyping: Theory and Practice, Ali K. Karmani, Emand Abouel Nasr, Springer, 2006
2. Understanding Additive Manufacture: Rapid Prototyping, Rapid Tooling and Rapid Manufacture, Andreas Gebhardt, Hanser Publishers, 2013
3. Rapid Manufacturing: Advanced Research in Virtual and Rapid Prototyping, Hopkinson, N. Haque, and Dickens, Taylor and Francis, 2007

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B.Tech. VIII Semester	L	T/P/D	C
	3	0	3

(19OE1ME04) REVERSE ENGINEERING

COURSE PRE-REQUISITES: Elements of CAD, Introduction to 3D Printing, 3D Printing Machines, Tooling & Systems

COURSE OBJECTIVES:
- To understand Reverse Engineering (RE) and its methodologies
- To comprehend Data Acquisition Techniques for Reverse Engineering
- To understand Integration Between Reverse Engineering and Additive manufacturing
- To know the applications of reverse engineering

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Basic understanding of Reverse Engineering and its methodologies
CO-2: Understanding the data acquisition techniques for reverse engineering
CO-3: Understanding of amalgamation Between Reverse Engineering and Additive manufacturing
CO-4: Adapt the knowledge gained in reverse engineering for various applications

UNIT – I:
Introduction to Reverse Engineering: Need, Definition, The Generic Process, History of Reverse Engineering, Overview of Applications

UNIT – II:
Methodologies and Techniques: Potential for Automation with 3-D Laser Scanners, Computer-aided (Forward) Engineering, Computer-aided Reverse Engineering, Computer Vision and Reverse Engineering

UNIT – III:
Data Acquisition Techniques: Contact Methods: Coordinate Measurement Machine and Robotic Arms

UNIT – IV:
Data Acquisition Techniques: Noncontact Methods: Triangulation, Structured Light and Destructive Method

UNIT – V:
Integration Between Reverse Engineering and Additive manufacturing: Modeling Cloud Data, Integration of RE and AM for Layer-based Model Generation, Adaptive Slicing Approach for Cloud Data Modeling.

UNIT – VI:
Applications:
Automotive: Workflow for Automotive Body Design, Reverse Engineering for Better Quality
Aerospace: RE in Aerospace–A Work in Progress, Reducing Costs of Hard Tooling
Medical: Orthodontics, Hearing Instruments, Knee Replacement

TEXT BOOKS:

1. Reverse Engineering: An Industrial Perspective, V. Raja and K. Fernandes, Springer- Verlag
2. Reverse Engineering, K. A. Ingle, McGraw-Hill
3. Reverse Engineering, L. Wills and P. Newcomb, 1st Edition, Springer-Verlag

REFERENCES

1. Smart Product Engineering, Michael Abramovici, Rainer stark, Springer Berlin Heidelberg
2. Product Design: Techniques in Reverse Engineering and New Product Development, K. Otto and K. Wood, Prentice Hall, 2001

INTERNET OF THINGS

INTERNET OF THINGS

Internet of Things: The IoT creates opportunities for more direct integration of the physical world into computer-based systems, resulting in efficiency improvements, economic benefits, and reduced human exertions. *IoT* **is changing how we live, work, travel, and do business. It is even the basis of a new industrial transformation, known as** Industry 4.0**, and key in the** digital transformation **of organizations, cities, and society overall.** The IoT track helps students to learn about how to

- Learn different protocols and connectivity technologies used in IOT.
- Expose the various sensors and transducers for measuring mechanical quantities.
- Develop simple applications using 8051 microcontrollers.
- Understand the key routing protocols for sensor networks and their design issues.

Some of the more common career paths in the Internet of Things path are

- IoT Developer. ...
- IoT Architect…
- IoT Embedded Systems Designer…
- IoT Solutions Engineer…
- Professional in Sensors and Actuators…
- Embedded Programs Engineer…
- Safety Engineer…

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B.Tech. V Semester	L	T/P/D	C
	3	0	3

(19OE1EC01) SENSORS TRANSDUCERS AND ACTUATORS

COURSE PRE-REQUISITES: Engineering Physics, Electronic Measuring Instruments

COURSE OBJECTIVES:
- To expose the students to various sensors and transducers for measuring mechanical quantities
- To make the students familiar with the specifications of sensors and transducers
- To make the students identify for various sensors and transducers for various applications
- To expose the students to various actuators

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Classify and characterize various sensors and transducers
CO-2: Be familiar with the principle and working of various sensors and transducers
CO-3: Be familiar with the principle and working of various actuators
CO-4: Select proper Transducer / Sensor for a specific measurement application
CO-5: Select proper Actuator for a specific measurement application

UNIT – I:
Primary Sensing Elements and Transducers: Mechanical devices as primary detectors, mechanical spring devices, pressure sensitive primary devices, flow rate sensing elements, Transducers-electrical Transducers, classification of Transducers, characteristics and choice of Transducers, factors influencing the choice of Transducers.

UNIT – II:
Electric Transducers: Resistive transducers, Potentiometers, Strain gauges, Types of Strain gauges, Resistance thermometers, Thermistors, Thermocouples, variable Inductance Transducers, Linear Variable Differential Transformer, Synchros, Resolvers, Capacitive Transducers, Piezo electric Transducers.

UNIT – III:
Magnetic and Optical Transducers: Hall Effect Transducers, Magneto resistors, Magneto-Elastic and Magneto-Strictive Transducers, Opto electronic Transducers, Digital Encoding Transducers, Photo Optic Transducers.

UNIT – IV:
Smart Sensors and Applications: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation. Sensors Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring.

UNIT – V:

Mechanical and Electrical Actuators: Mechanical Actuation Systems-Types of motion, Kinematic chains, Cams, Gears, Ratchet and pawl, Belt and chain drives, Bearings, Mechanical aspects of motor selection, Electrical Actuation Systems, Electrical systems, Mechanical switches, Solid-state switches, Solenoids, D.C. Motors, A.C. Motors, Stepper motors.

UNIT – VI:

Pneumatic and Hydraulic Actuators: Pneumatic and Hydraulic Actuation Systems-Actuation systems, Pneumatic and hydraulic systems, Directional Control valves, Pressure control valves, Cylinders, Servo and proportional control valves, Process control valves, Rotary actuators.

TEXT BOOKS:

1. A Course in Electrical and Electronic Measurements and Instrumentation, A. K. Sawhney, Puneet Sawhney,19th Edition, 2011
2. Sensors and Transducers, D. Patranabis, 2nd Edition, PHI Learning Private Limited, 2013
3. Mechatronics, W. Bolton, 7th Edition, Pearson Education Limited, 2018

REFERENCES:

1. Sensors and Actuators, Patranabis, 2nd Edition, PHI, 2013

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B.Tech. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1EC02) INTRODUCTION TO MICROCONTROLLER AND INTERFACING

COURSE PRE-REQUISITES: Sensors Transducers and Actuators

COURSE OBJECTIVES:
- To differentiate various number systems
- To understanding programming concepts
- To develop simple applications using 8051 microcontrollers

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand basic computing concepts
CO-2: Know architecture of 8051 microcontrollers
CO-3: Program internal resources of 8051 microcontroller
CO-4: Interface peripherals to 8051 microcontroller

UNIT – I:
Introduction to Computing: Numbering and Coding Systems: Binary, Decimal, Hexadecimal and conversions, Binary and Hexadecimal Arithmetic, Complements, Alphanumeric codes. Digital Premier, Inside the Computer

UNIT – II:
Embedded System Design: Embedded system - Definition, Characteristics of embedded computing applications, Design challenges, Requirements, Specification, Architecture design, Designing hardware and software components, system integration, Design example: Model train controller.

UNIT – III:
8051 Microcontroller: Microcontrollers and Embedded Processors, Architecture and Programming Model of 8051, Special Function Register formats, Memory Organization, Timers and Counters- Operating modes, Serial port, Interrupts

UNIT – IV:
8051 Programming in C: Data types, software delay generation, Logical operations, Accessing code and data space in 8051, I/O port programming, Timer/counter programming.

UNIT – V:
8051 Programming: Serial IO modes and their programming in C, interrupts programming in C: serial, timer and external interrupts.

UNIT – VI:
Introduction to Arduino: Features of Arduino, Arduino components and IDE, Interfacing: Seven Segment Display, Pulse Width Modulation, Analog Digital Converter, Wireless connectivity to Arduino. Case study: From BT To WiFi: Creating WiFi Controlled Arduino Robot Car.

TEXT BOOKS:

1. The 8051 Microcontroller: Programming, Architecture, Ayala & Gadre, 3rd Edition, Cengage Publications, 2008
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, 2nd Edition, 2005

REFERENCES:

1. Digital Design, Morris Mano, PHI, 3rd Edition, 2006
2. Embedded Systems: Architecture, Programming and Design, 2nd Edition, TMH

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VII Semester	L	T/P/D	C
	3	0	3

(19OE1EC03) FUNDAMENTALS OF INTERNET OF THINGS

COURSE PRE-REQUISITES: Sensors Transducers and Actuators, Introduction to Microcontrollers and Interfacing

COURSE OBJECTIVES:
- To understand the basics of Internet of Things
- To learn about IOT and M2M
- To understand Cloud of Things
- To learn different applications with IoT

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the concepts of Internet of Things
CO-2: Understand the IOT, M2M
CO-3: Understand the concepts Cloud of Things
CO-4: Apply IOT to different applications in the real world

UNIT – I:
Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT-IoT Functional Blocks, IoT Communication Models, IoT Communication API's

UNIT – II:
IoT-enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Deployment Templates

UNIT – III:
IoT Platforms Design Methodology: Introduction, IoT Design Methodology- Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specification, IoT Level Specifications, Functional view Specification, Operational View Specification, Device & component Integration, Application Development

UNIT – IV:
IoT and M2M: Introduction, M2M, Difference between IoT and M2M – Communication Protocols, Machines in M2M Vs things in IoT, Hardware Vs Software emphasis, Data collection and analysis, applications, SDN and NFV for IoT

UNIT – V:
Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

UNIT – VI:
Domain Specific Applications of IoT: Applications of IoT– Home, Health, Environment, Energy, Agriculture, Industry and Smart City.

TEXT BOOKS:

1. Internet of Things: A Hands-On Approach, Vijay Madisetti, Arshdeep Bahga, Universities Press, 2015
2. The Internet of Things – Key Applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi, Wiley, 2012
3. The Internet of Things in the Cloud: A Middleware Perspective, Honbo Zhou, CRC Press, 2012

REFERENCES:

1. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers, 2013
2. Building the Internet of Things, Sara Cordoba, Wimer Hazenberg, Menno Huisman, BIS Publishers, 2011
3. Designing the Internet of Things, Adrian Mcewen, Hakin Cassimally, John Wiley and Sons, 2015

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B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1EC08) WIRELESS SENSOR NETWORKS

COURSE PRE-REQUISITES: Sensors Transducers and Actuators, Introduction to Microcontrollers and Interfacing, IoT Protocols and its Applications

COURSE OBJECTIVES:
- To expose basic concepts of wireless sensor network technology
- To study medium access control protocols and various issues in a physical layer
- To understand the key routing protocols for sensor networks and their design issues
- To understand sensor management in networks and design requirements

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Appreciate various design issues of wireless sensor networks
CO-2: Understand the hardware details of different types of sensors and select the application specific sensor
CO-3: Understand radio standards and communication protocols to be used for wireless sensor networks

UNIT – I:
Introduction: Overview of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.

UNIT – II:
Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (Operating Systems): TinyOS, MANTIS, Contiki, and RetOS.

UNIT – III:
Programming Tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet, NetSim)

UNIT – IV:
Overview of Sensor Network Protocols (Details of at least 2 important protocol per layer): Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi- hop and cluster-based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

UNIT – V:
Data Dissemination and Processing: Differences compared with other database management systems, Query models, In-network data aggregation, data storage; query processing.

UNIT – VI:
Specialized Features: Energy preservation and efficiency; security challenges; Fault tolerance, Issues related to Localization, connectivity and topology, Sensor

deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

TEXT BOOKS:

1. Wireless Sensor Networks Technology, Protocols, and Applications, Kazem Sohraby, Daniel Minoli, Taieb Znati, John Wiley & Sons, 2007
2. Protocols and Architectures for Wireless Sensor Networks, H. Karl and A. Willig, John Wiley & Sons, India, 2012
3. Wireless Sensor Networks, C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, 1^{st} Indian Reprint, Springer Verlag, 2010

REFERENCES:

1. Wireless Sensor Networks: An Information Processing Approach, F. Zhao and L. Guibas, Morgan Kaufmann, 1^{st} Indian Reprint, 2013
2. Wireless Sensor Network and Applications, Yingshu Li, My T. Thai, Weili Wu, Springer Series on Signals and Communication Technology, 2008
3. Principles of Mobile Communications, Gordon L. Stuber, 2^{nd} Edition, Springer International, 2001

AUGMENTED REALITY (AR) / VIRTUAL REALITY (VR)

AUGMENTED REALITY (AR) / VIRTUAL REALITY (VR)

Augmented reality and virtual reality (AR & VR): Augmented reality (AR) and Virtual Reality (VR) bridge the digital and physical worlds. They allow you to take in information and content visually, in the same way you take in the world. AR dramatically expands the ways our devices can help with everyday activities like searching for information, shopping, and expressing yourself. VR lets you experience what it's like to go anywhere from the front row of a concert to distant planets in outer space.

Job Roles in Augmented reality and virtual reality (AR & VR) Track

- Design Architect. ...
- Software Designer. ...
- System Validation Engineers. ...
- Software Developer. ...
- 3D Artist…

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B.Tech. V Semester	L	T/P/D	C
	3	0	3

(19OE1EC04) INTRODUCTION TO C-SHARP

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand the foundations of CLR execution
- To learn the technologies of the .NET framework and object-oriented aspects of C#
- To be aware of application development in .NET
- To learn web-based applications on .NET (ASP.NET)

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Explain how C# fits into the .NET platform
CO-2: Analyze the basic structure of a C# application
CO-3: Develop programs using C# on .NET
CO-4: Design and develop Web based applications on .NET

UNIT – I:

Introduction to C#: Introducing C#, Understanding .NET, overview of C#, Literals, Variables, Data Types, Operators, checked and unchecked operators, Expressions, Branching, Looping, Methods, implicit and explicit casting, Constant, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing.

UNIT – II:

Object Oriented Aspects of C#: Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism, sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, events, errors and exception, Threading.

UNIT – III:

Application Development on .NET: Building windows application, Creating our own window forms with events and controls, menu creation, inheriting window forms, SDI and MDI application, Dialog Box (Modal and Modeless), accessing data with ADO.NET, DataSet, typed dataset, Data Adapter, updating database using stored procedures

UNIT – IV:

SQL Server with ADO.NET, handling exceptions, validating controls, windows application configuration.

UNIT – V:

Web Based Application Development on .NET: Programming web application with web forms, ASP.NET introduction, working with XML and .NET, Creating Virtual Directory and Web Application, session management techniques, web.config, web services, passing datasets, returning datasets from web services, handling transaction, handling exceptions, returning exceptions from SQL Server.

UNIT – VI:

CLR and .NET Framework: Assemblies, Versoning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, remoting, security in .NET

TEXT BOOKS:

1. The Complete Reference: C# 4.0, Herbert Schildt, Tata McGraw Hill, 2012
2. Professional C# 2012 with .NET 4.5, Christian Nagel et al. Wiley India, 2012

REFERENCES:

1. Pro C# 2010 and the .NET 4 Platform, Andrew Troelsen, 5th Edition, A Press, 2010
2. Programming C# 4.0, Ian Griffiths, Matthew Adams, Jesse Liberty, 6th Edition, O"Reilly, 2010

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B.Tech. VI Semester	L	T/P/D	C
	3	0	3

(19OE1EC05) INTRODUCTION TO SIGNAL PROCESSING

COURSE PRE-REQUISITES: Introduction to C Sharp

COURSE OBJECTIVES:
- To understand various fundamental characteristics of signals and systems
- To analyze signals in frequency domain
- To know principles of signal transmission through systems
- To understand fundamentals of digital signal

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Classify signals and implement various operations on signals
CO-2: Analyze the characteristics of signals and systems
CO-3: Understand the basics of filter design
CO-4: Appreciate the processes of Multirate systems

UNIT – I:
Representation of Signals: Continuous time and Discrete Time signals, Classification of Signals – Periodic and aperiodic, even and odd, energy and power signals, deterministic and random signals, causal and non-causal signals, complex exponential and sinusoidal signals. Concepts of standard signals. Various operations on Signals.

UNIT – II:
Representation of Systems: Classification of discrete time Systems, impulse response, Concept of convolution in time domain and frequency domain, response of a linear system, System function, Signal bandwidth, system bandwidth. Ideal filter characteristics.

UNIT – III:
Sampling Theorem: Representation of continuous time signals by its samples - Sampling theorem – Reconstruction of a Signal from its samples, aliasing
Z –Transform: Basic principles of z-transform, region of convergence, properties of ROC, Inverse z-transform using Partial fraction.

UNIT – IV:
Introduction to Digital Signal Processing: Applications of Z-Transforms- Solution of Linear Constant Coefficient Difference equations (LCCD), System function, Frequency Response of the system.

UNIT – V:
Discrete Fourier Transforms: Circular convolution, Comparison between linear and circular convolution, Computation of DFT.
IIR Digital Filters: Design of IIR Digital filters (H(s) to be given) - Impulse invariance transformation techniques, Bilinear transformation method.

UNIT – VI:

FIR Digital Filters: Characteristics of linear phase FIR filters and its frequency response, Comparison of IIR and FIR filters. Design of FIR filters using Fourier Method and Windowing Technique (only Hanning).

Realization of IIR and FIR Filters: Direct and Cascade forms.

TEXT BOOKS:

1. Signals, Systems and Communications, B. P. Lathi, BS Publications, 2009
2. Signals and Systems, Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, 2nd Edition, PHI
3. Digital Signal Processing: Principles, Algorithms and Applications, John G. Proakis, D. G. Manolakis, 4th Edition, Perason/PHI, 2009

REFERENCES:

1. Signals and Systems, Simon Haykin and Barry Van Veen, 2nd Edition, John Wiley
2. Signals, Systems and Transforms, C. L. Philips, J. M. Parr and Eve A. Riskin, 3rd Edition, Pearson, 2004
3. Signals and Systems, Schaum's Outlines, Hwei P. Hsu, Tata McGraw Hill, 2004
4. Digital Signal Processing – A Practical Approach, Emmanuel C. Ifeacher, Barrie W. Jervis, 2nd Edition, Pearson Education

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1EC06) INTRODUCTION TO IMAGE AND VIDEO PROCESSING

COURSE PRE-REQUISITES: Introduction to C Sharp, Introduction to Signal Processing

COURSE OBJECTIVES:
- To introduce fundamentals of digital image and video processing
- To demonstrate digital signal processing techniques in spatial and frequency domains
- To study and compare various image and video compression algorithms
- To study applications of motion estimation in video processing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire, represent the digital image and transforms
CO-2: Apply various pixel position and intensity-based image processing techniques
CO-3: Understand and analyze the performance of block matching algorithms in MPEG video coding standards

UNIT – I:
Fundamentals of Image Processing and Image Transforms: Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels, 2–D Discrete Fourier Transform, Discrete Cosine Transform, Introduction to Wavelet transforms.

UNIT – II:
Image Enhancement-Spatial Domain Methods: Point Processing, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters.

UNIT – III:
Image Enhancement-Frequency Domain Methods: Basics of filtering in frequency domain, Image Smoothing, Image Sharpening, Selective Filtering.
Image Segmentation: Segmentation Concepts, Point, Line and Edge Detection, Thresholding, Region Based Segmentation.

UNIT – IV:
Image Compression: Image compression fundamentals – coding Redundancy, spatial and temporal redundancy.
Compression Models: Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding.

UNIT – V:
Basic Steps of Video Processing: Analog video, Digital Video, Time varying Image Formation models: 3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals.

UNIT – VI:

2-D Motion Estimation: Optical flow, pixel-based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Application of motion estimation in video coding.

TEXT BOOKS:

1. Digital Image Processing, Gonzaleze and Woods, 3rd Edition, Pearson
2. Video Processing and Communication, Yao Wang, Joem Ostarmann and Ya – Quin Zhang, 1st Edition, PHI

REFERENCES:

1. Digital Video Processing, M. Tekalp, Prentice Hall International
2. Image Acquisition and Processing with LabVIEW, Relf, Christopher G., CRC Press
3. Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms, Aner Ozdemi R., John Wiley & Sons
4. Fundamentals of Digital Image Processing, A Practical Approach with Examples in Matlab, Chris Solomon, Toby Breckon, John Wiley & Sons

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B.Tech. VIII Semester	L	T/P/D	C
	3	0	3

(19OE1EC07) FUNDAMENTALS OF AUGMENTED REALITY AND VIRTUAL REALITY

COURSE PRE-REQUISITES: Introduction to C Sharp, Introduction to Signal Processing, Introduction to Image & Video Processing

COURSE OBJECTIVES: Throughout the course, Students will be expected to develop AR VR applications by being able to do each of the following:

- To a review of current Virtual Reality (VR) and Augmented Reality (AR) technologies
- To the fundamentals of VR/AR modeling and programming
- To provides a detailed analysis of engineering scientific and functional aspects of VR/AR

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire knowledge in main applications VR / AR technologies
CO-2: Analyze different tools for VR/AR applications
CO-3: Developing VR/AR applications

UNIT – I:
Augmented Reality and Virtual Reality:
Augmented Reality: Introduction to Augmented Reality (AR), Fundamentals, Chronicle order of AR, features
Virtual Reality: Introduction to Virtual Reality (VR), Features of VR and Chronicle order of VR; Difference between AR and VR.

UNIT – II:
Types of Augmented Reality: Marker based AR, Marker less AR, Projection based AR, Super Imposition based AR, Applications of AR.

UNIT – III:
Types of Virtual Reality: Non- immersive simulation, Semi-immersive simulations, Fully immersive simulations; Applications VR.

UNIT – IV:
Making an AR App with Simple CUBE: Introduction to Unity, Installation steps, Fundamentals while implementing Project, importing a cube, Create an account in Vuforia, license manager, target manager, downloading database and uploading target database in unity.

UNIT – V:
AR App with Interaction: Introduction to C#, Scripting interactive objects, implementation C# Script using unity, uploading target object, deploying application into ANDROID Device.

UNIT – VI:

Creating an Virtual Reality: Creating an Virtual Reality Scene in unity, adding colliders, Settings of Unity to make the application compatible with Google cardboard.

TEXT BOOKS:

1. Augmented Reality for Developers, Build Practical Augmented Reality Applications with Unity, ARCore, ARKit, and Vuforia. Linowes, J., Babilinski, K United Kingdom, Packt Publishing, 2017
2. Building Virtual Reality with Unity and Steam VR, Murray, J. W., United Kingdom, CRC Press, 2020

REFERENCES:

1. Virtual Reality & Augmented Reality in Industry, Ma, D., Gausemeier, J., Fan, X., Grafe, M. (Eds.) Springer, 2011
2. Unity 2020 Virtual Reality Projects: Learn VR Development by Building Immersive Applications and Games with Unity 2019.4 and Later Versions, Linowes J 3rd Edition, United Kingdom, Packt Publishing, 2020

ARTIFICIAL INTELLIGENCE

ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) is a cognitive science with highly research activities in the major areas like Machine Learning, Robotics, Natural Language Processing and image processing. This track will cover basic foundations of artificial intelligence it will make the students industry-ready for artificial intelligence and data science job roles. Artificial intelligence is used in wide range of industrial applications such as healthcare, transportation, entertainment, insurance, transport and logistics, and customer service.

Future applications of AI would be utilized in automated transportation, cyborg technology, solving problems associated with climate change, deep-sea and space exploration.

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B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1MT01) MATHEMATICS FOR ARTIFICIAL INTELLIGENCE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To introduce the basic concepts of probability and matrices in the field of Artificial Intelligence
- To identify, explore the complex problem-solving strategies
- To develop problem solving skills related to algorithmic analysis required for AI
- To apply and build mathematical model to solve real-world problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explore and demonstrate practical approaches related to implementation of the AI algorithms using probability concepts
CO-2: Formulate and solve the Artificial intelligence related problems by using the knowledge of matrices and vectors
CO-3: Demonstrate the understanding of mathematical ideas from artificial intelligence perspective and machine learning
CO-4: Analyze and solve the complexity of a given problem with suitable optimization techniques

UNIT – I:
Probability: Basic rules and axioms, events, sample space, frequentist approach, dependent and independent events, conditional probability, Random variables, continuous and discrete, expectation, variance, distributions - joint and conditional, Bayes' theorem, Popular distributions - Bernoulli, Binomial, Poisson, Normal.

UNIT – II:
Descriptive Statistics & Linear Regression: Classification and tabulation of univariate data, graphical representation, Frequency curves. Descriptive measures - Central tendency and Dispersion. Simple Linear Regression Models.

UNIT – III:
Vector Space: Vectors, definition, scalars, addition, scalar multiplication, inner product (dot product), vector projection, cosine similarity, orthogonal vectors, normal and orthonormal vectors, vector norm, vector space, linear combination, linear span, linear independence, basis vectors.

UNIT – IV:

Matrices: Matrices definition, rank, System of equations: Direct methods - LU decomposition method, Tri-diagonal system; Applications of linear systems - Network flows and Mechanical systems.

UNIT – V:

Eigen Values & Eigen Vectors: Eigen values & eigen vectors, concept, intuition, significance, how to find principle component analysis, concept, properties, applications, Singular value decomposition, concept, properties, applications.

UNIT – VI:

Multivariate Calculus: Functions, Scalar derivative, partial derivatives, Gradient, chain rule, properties, method for derivative of vector-valued function with respect to scalar, vector four combinations - Jacobian, Hessian, Gradient of vector valued function, Gradient of matrices. Local/global maxima and minima, saddle point, convex functions, gradient descent algorithms - Learning rate, momentum, stochastic, Constrained optimization (Lagrange Multiplier method), convex optimization.

TEXT BOOKS:

1. Mathematics for Machine Learning, Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Cambridge University Press, 2020
2. Linear Algebra and it's Applications, David C. Lay, 3rd Edition, Pearson Publications
3. Probability and Statistics for Engineers, Richard A. Johanson, 5th Edition, Prentice-Hall, 1995

REFERENCES:

1. Math for Machine Learning: Open Doors to Data Science and Artificial Intelligence, Richard Han, Paperback, 2018
2. Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning, James V Stone
3. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006

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B.Tech. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CS01) FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence

COURSE OBJECTIVES:

- To understand and analyze the importance and basic concepts of artificial intelligence and the use of agents
- To identify, explore the complex problem-solving strategies and approaches
- To analyze the concepts of basic concepts of neural networks and learning process
- To explore and analyze the methodology used in machine learning

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand the basic concepts of artificial intelligence and the use of agents into the real-world scenario

CO-2: Design and formulate complex problem solutions with the use of various searching techniques

CO-3: Estimate the skill for representing knowledge using the appropriate technique for a given problem

CO-4: Apply AI techniques to solve problems of game playing, and machine learning

UNIT – I:

Introduction to AI: Foundations of AI – History of AI - Applications of AI, Intelligent Agents – Agents and Environments – Nature of Environments – Structure of Agents – Problem solving Agents – Problem formulation – Example Problems.

UNIT – II:

Searching Techniques: Uninformed Search Strategies – Breadth first search – Depth first search – Depth limited search - Bidirectional search – comparison – Search with partial information - Heuristic search – Greedy best first search – A* search – Memory bounded heuristic search - Heuristic functions - Local search- Hill climbing – Simulated annealing search - Local beam search, Genetic algorithms.

UNIT – III:

Constraint Satisfaction Problems: Backtracking search for CSP's - local search for constraint satisfaction problem. *Adversarial search* – Games - Minimax algorithm, Alpha beta pruning, cutting-off search.

UNIT – IV:

Knowledge Representation and Reasoning: Propositional Logic, Rules of Inference, First Order Logic (FOL) Syntax, Semantics, Entailment.

UNIT – V:

Classical Planning: Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches.

UNIT – VI:

Planning and Acting in the Real World: Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent Planning.

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall, 2010
2. Machine Learning, Tom M. Mitchell, McGraw Hill Publications
3. Neural Networks A Comprehensive Foundation, Simon Haykin, Pearson Education, 2nd Edition, 2004

REFERENCES:

1. Artificial Intelligence, Elaine Rich & Kevin Knight, 2nd Edition, TMH
2. Artificial Intelligence-A New Synthesis, Nils J. Nilsson, Elsevier
3. Artificial Neural Networks, Yegnanarayana B., PHI

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CS02) MACHINE LEARNING TECHNIQUES

COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence, Fundamentals of Artificial Intelligence

COURSE OBJECTIVES:

- To understand applications in computational learning theory
- To analyse the pattern comparison techniques

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand and Familiarize the basics concept, notations used in machine learning and mathematics behind machine learning algorithms

CO-2: Demonstrate different types of machine learning algorithms

CO-3: Apply the suitable machine learning techniques and construct a machine learning model to solve real world applications

CO-4: Evaluate model accuracy and familiarize with advanced learning algorithms

UNIT – I:

Introduction to Machine Learning: Perspectives and issues in machine learning, Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation.

UNIT – II:

Supervised Learning: Classification, decision boundaries; nearest neighbor methods, Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, Linear classifiers Bayes' Rule and Naive Baye's classification

Regression: Regression types, gradient descent; features of Over fitting and complexity; training, validation, test data, Logistic regression and applications.

UNIT -III:

Unsupervised Learning: Clustering, k-means, hierarchical, partition-based clustering, overlapping clustering, Support vector machines, Support vector regression.

UNIT -IV:

Reinforcement Learning: Introduction to Reinforcement learning, the learning task, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

UNIT- V:

Instance-Based Learning: Introduction, k-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT – VI:

Neural Networks: Introduction to neural networks, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and Convolution neural networks.

TEXT BOOKS:

1. Machine Learning, Tom M. Mitchell, McGraw-Hill
2. Neural Networks and Learning Machines, S. Haykin, Pearson, 2008

REFERENCES:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis
2. Machine Learning: The Art and Science of Algorithms that make Sense of Data, Peter Flash, Cambridge, University Press
3. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, MIT Press, 2012

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B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CS03) DEEP LEARNING

COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence, Fundamentals of Artificial Intelligence, Machine Learning Techniques

COURSE OBJECTIVES:
- To introduce the foundations of deep learning
- To acquire the knowledge on Deep Learning Concepts

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify and select appropriate learning network models required for real world problems
CO-2: Design an efficient model with various deep learning techniques
CO-3: Implement deep learning algorithms and solve real-world problems
CO-4: Apply optimization strategies necessary for problem solving required for large scale applications

UNIT – I:
Introduction to Deep Learning: History of Deep Learning, Deep Learning Success Stories, Biological Neuron, Idea of computational units, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm and Convergence.

UNIT – II:
Feedforward Networks: Multilayer Perceptron, Gradient Descent, Back-propagation, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks.

UNIT – III:
Regularization for Deep Learning: Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, Multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier.

UNIT – IV:
Optimization for Training Deep Models: Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithm.

UNIT – V:
Convolutional Neural Networks: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Markov Networks, Object Detection, RCNN, Fast RCNN, Faster RCNN, YOLO

UNIT – VI:

Auto-Encoders: Regularization in auto-encoders, De-noising auto-encoders, Sparse auto-encoders, Contractive auto-encoders, Structured probabilistic models of deep learning.

TEXT BOOKS:

1. Deep Learning: An MIT Press Book, Ian Goodfellow and Yoshua Bengio and Aaron Courville
2. Neural Networks and Learning Machines, Simon Haykin, 3^{rd} Edition, Pearson Prentice Hall

REFERENCES:

1. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
2. Pattern Recognition and Machine Learning, Christopher Bishop, 2007

BLOCKCHAIN TECHNOLOGIES

BLOCKCHAIN TECHNOLOGIES

The blockchain is one of the fastest growing skills in the IT sector today. This track will help the students to gain knowledge in blockchain technology, it has taken quite a turn in the industry given its popularity in providing safe and secured online transactions. Most individuals and organizations have started adopting blockchain because of the many benefits it offers to the industry today. It is used in many industry applications such as banking sector, voting, health care, real estate, the legal industry and government.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CS04) FUNDAMENTALS OF COMPUTER NETWORKS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce the fundamental various types of computer networks
- To demonstrate the TCP/IP and OSI models with merits and demerits
- To explore the various layers of OSI model
- To introduce UDP and TCP models
- To have the concept of different routing techniques for data communications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and explore the basics of Computer Networks reference models and the functionalities of physical layer
CO-2: Learn major concepts, principles involved in Data Link Layer and Network Layer
CO-3: Analyze how to maintain QoS in Network and maintaining of Congestion Control
CO-4: Demonstrate the Application Layer functionalities and importance of Security in the Network

UNIT – I:
Introduction to Networks: Internet, Protocols and Standards, The OSI Model, Layers in OSI Model, TCP/IP Suite, Addressing.
Physical Layer: Multiplexing, Transmission Media, Circuit Switched Networks, Datagram Networks, and Virtual Circuit Networks.

UNIT – II:
Data Link Layer: Introduction, Checksum, Framing, Flow and Error Control, Noiseless Channels, Noisy Channels, Random Access Controlled Access, Channelization, IEEE Standards, Ethernet, Giga-Bit Ethernet, Wireless LANs, SONET-SDH, Frame Relay and ATM.

UNIT – III:
Network Layer: Logical Addressing, Internetworking, Tunneling, Address Mapping, ICMP, IGMP, Forwarding, Routing-Flooding, Bellman& Ford, Disjkstra's routing protocols, RIP, OSPF, BGP and Multicast Routing Protocols. Connecting Devices-Passive Hubs, Repeaters, Active Hubs, Bridges, Routers.

UNIT – IV:
Transport Layer: Process to Process Delivery, UDP, TCP and SCTP Protocols, Congestion, Congestion Control, Quality of Service.

UNIT – V:

Application Layer: Domain Name Space, DNS in Internet, Electronic Mail, File Transfer Protocol, WWW, HTTP, SNMP, Multi-Media.

UNIT – VI:

Network Security: Security services, mechanisms and attacks, IPSec, SSL, VPN, Firewall. Bluetooth, Zigbee, IPv4, IPv6.

TEXT BOOKS:

1. Data Communications and Networking, Behrouz A. Forouzan, 4th Edition, McGraw Hill Education, 2006
2. Computer Networks, Andrew S. Tanenbaum, 4th Edition, Pearson Education
3. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education

REFERENCES:

1. Data Communications and Networks, William Stallings
2. Data Communication and Networks, Bhusan Trivedi, Oxford University Press, 2016
3. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education
4. Understanding Communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning

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B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CS08) RELATIONAL DATABASE MANAGEMENT SYSTEMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the basic elements of a relational database management system
CO-2: Identify the data models for relevant problems
CO-3: Design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data
CO-4: Apply normalization for the development of application software

UNIT – I:
Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.
Introduction to Database Design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.
Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data.
Logical database Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT – II:
Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.
SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

UNIT – III:
Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of

Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

UNIT – IV:
Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

UNIT – V:
Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.
Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

UNIT – VI:
Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.
Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.
Hash-Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw Hill Education (India) Private Limited
2. Database System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, 6th Edition, McGraw Hill Education (India) Private Limited,
3. Database Systems, R. Elmasri, Shamkant B. Navathe, 6th Edition, Pearson Education

REFERENCES:

1. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning
2. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Introduction to Database Systems, C. J. Date, Pearson Education

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VI Semester	L	T/P/D	C
	3	0	3

(19OE1CS05) DISTRIBUTED DATA BASES

COURSE PRE-REQUISITES: Fundamentals of Computer Networks

COURSE OBJECTIVES:
- To introducing distributed databases and exploring several algorithms for processing queries and be able to use them
- To describe the methods to translate complex conceptual data models into logical and Physical database designs
- To demonstrating query optimization and its algorithms
- To enumerating the concepts behind distributed transaction processing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze issues related to distributed database design
CO-2: Apply Partitioning techniques to databases
CO-3: Design and develop query processing strategies
CO-4: Demonstrate transaction processing and concurrency control in distributed databases

UNIT – I:
Introduction: Features of Distributed versus Centralized Databases,
Levels of Distribution Transparency: Reference Architecture for Distributed Databases, Types of Data Fragmentation, Distribution transparency for Read – only Applications, Distribution transparency for update Applications, Distributed database Access primitives, Integrity Constraints in Distributed Databases.

UNIT – II:
Distributed Database Design: A framework, the design of database fragmentation, the allocation of fragments.
Translation of Global Queries to Fragment Queries: Equivalence Transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries.

UNIT – III:
Optimization of Access Strategies: A Framework for Query Optimization, Join Queries, General Queries.

UNIT – IV:
The Management of Distributed Transactions: A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural aspects of Distributed Transactions.

UNIT – V:
Concurrency Control: Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.

UNIT – VI:

Reliability: Basic Concepts, Nonblocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart.

TEXT BOOKS:

1. Principles of Distributed Database Systems, M. Tamer OZSU and Patuck Valduriez, Pearson Education Asia, 2001
2. Distributed Databases, Stefano Ceri and Willipse Pelagatti, McGraw Hill

REFERENCES:

1. Database System Concepts, Henry F. Korth, A. Silberchatz and Sudershan, MGH
2. Database Management Systems, Raghuramakrishnan and Johhanes Gehrke, MGH

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CS06) CRYPTOGRAPHY AND NETWORK SECURITY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases

COURSE OBJECTIVES:

- To outline security concepts, threats, attacks, services and mechanisms
- To describe various cryptosystems-symmetric key cryptography, public key cryptography
- To apply authentication services and Secure hash functions
- To discuss the concepts of IP Security, web security, viruses and firewalls

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the security attacks, services, goals and mechanism of security
CO-2: Develop a security model using conventional approach to prevent the attacks
CO-3: Apply public key cryptography principles, examine authenticity and integrity of the messages in the communication
CO-4: Build a model for IP security, firewall and test the security issues

UNIT – I:
Security Attacks: Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

UNIT – II:
Conventional Encryption: Classical Encryption techniques, Fiestel Cipher Structure, Data Encryption Standard, Block Cipher Design Principles and Modes of Operation, Triple DES, RC-4, Evaluation criteria for AES, AES Cipher, Placement of Encryption Function, Traffic Confidentiality.

UNIT – III:
Public Key Cryptography and Authentication: Confidentiality using Symmetric Encryption – Principles of Public key Cryptosystems, RSA algorithm, Key Management, Diffie-Hellman key Exchange, Elliptic Curve Cryptography.
Authentication requirements, Authentication functions, Message Authentication Codes

UNIT – IV:

Hash Functions: Hash Functions, Security of Hash Functions and MACs, MD5 message Digest algorithm, Secure Hash Algorithm, HMAC, Digital Signatures, Authentication Protocols, Digital Signature Standard, Authentication Applications: Kerberos, X.509 Authentication Service

UNIT – V:

Network Security: Email Security and Web Security

Electronic Mail Security – PGP/ SMIME, IP security- Architecture, Authentication Header, Encapsulating Security Payload, Key Management, Web Security- Secure Socket Layer, Transport Layer Security and Secure Electronic Transaction

UNIT – VI:

System Level Security: Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

TEXT BOOKS:

1. Cryptography and Network Security – Principles and Practices, William Stallings, Prentice Hall of India, 4th Edition, 2005
2. Hack Proofing Your Network, Ryan Russell, Dan Kaminsky, Rain Forest, Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W. Manzuik and Ryan Permeh, Wiley Dreamtech

REFERENCES:

1. Network Security Essentials: Applications and Standards, William Stallings Prentice Hall,1999, ISBN 0130160938
2. Security in Computing, Charles B. Pfleeger, Shari Lawrence Pfleeger, 3rd Edition, Pearson Education, 2003

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B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CS07) BLOCKCHAIN TECHNOLOGY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases, Cryptography and Network Security

COURSE OBJECTIVES:
- To get the terminologies and overview of blockchain technologies
- To study the concepts and foundation of blockchain technology
- To understand security mechanism and consensus in blockchain
- To design use cases and architecture blockchain technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain a clear understanding of the concepts that underlie digital distributed ledger
CO-2: Understand key mechanisms like Decentralization, Transparency and trust, Immutability, High availability, Highly secure and different types of Blockchain
CO-3: Apply the concept of Hash Function and Related Hash Algorithm
CO-4: Design and implement applications using Blockchain Technology

UNIT – I:
Introduction to Blockchain Part I: Introduction to Centralized, Decentralized and Distributed system, History of Blockchain, Various technical definitions of Blockchain.
Introduction to Blockchain Technology Part II: Generic elements of a blockchain: Block, Transaction, Peer-to-peer network, Node, Smart contract, Why It's Called "Blockchain", Characteristics of Blockchain Technology, Advantages of blockchain technology.

UNIT – II:
Concept of Blockchain Technology Part I: Cryptography, Hashing, Nonce, Distributed database, Consensus, Smart Contract, Component of block, Structure of Block chain, Technical Characteristics of the Blockchain.
Concept of Blockchain Technology Part II: Applications of blockchain technology, Tiers of blockchain technology Blockchain 0, Blockchain 1, Blockchain 2, Blockchain 3, Generation of Blockchain X.

UNIT – III:
Technical Foundations Part I: Cryptography, Confidentiality, Integrity, Authentication, Cryptographic primitives, Public and private keys, RSA, Discrete logarithm problem, Hash Function: Message Digest (MD), Secure Hash Algorithms (SHAs), Design of Secure Hash Algorithms (SHA), SHA-256, Design of SHA3, Elliptic Curve Digital signature algorithm.

Technical Foundations Part II: Consensus algorithm: Proof of work (PoW), Proof-of-Stake (PoS), Byzantine Fault Tolerance (BFT)

UNIT – IV:

Types of Blockchain: Public blockchains, Private blockchains, Semi-private blockchains, Side chains, Permissioned ledger, Distributed ledger, Shared ledger, Fully private and proprietary blockchains, Tokenized blockchains, Tokenless blockchains, CAP theorem and blockchain

UNIT – V:

Financial markets and trading, Trading, Exchanges, Trade life cycle, Order anticipators, Market manipulation.

Crypto-Currency: Bitcoin, Bitcoin definition, Keys and addresses, Public keys in Bitcoin, Private keys in Bitcoin, Bitcoin currency units

UNIT – VI:

Implementation Platforms: Hyperledger as a protocol, Reference architecture, Hyperledger Fabric, Transaction Flow, Hyperledger Fabric Details, Fabric Membership, Fabric Membership

TEXT BOOKS:

1. Mastering Blockchain, Imaran Bashir, 2nd Edition, Packt
2. Blockchain Basic, Daniel Drescher, A Press

REFERENCES:

1. Blockchain For Dummies®, IBM Limited Edition, John Wiley & Sons Inc.

ROBOTICS

ROBOTICS

Robotics is a field of study that involves the design, construction and operation of robots. This field overlaps with electronics, computer science, mechatronics and artificial intelligence. Robotic companies are booming all over the world and are seeking engineers with skills for implementing **Next -Level Automation**. This Open Elective Track for Robotics consists of four courses and is intended for making students industry ready in the field of robotics.

The First course in this track" Fundamentals **of Robotics"** introduces various physical aspects of building a robot, exploring topics like how a robot perceives its environment using Sensors and how it interacts with its environment through various Actuators & Grippers. This course also inspects a variety of robot applications in different domains. Second Course in this track" Kinematics **& Dynamics of robots"** delves a level deeper discussing analysis and control of robots. It establishes strong mathematical foundation for describing and controlling robot movement. In this course students will learn in detail about Forward Kinematics, Inverse Kinematics, Workspace Analysis and Trajectory planning for robots.

Third Course in the Robotics track **"Drives and Control System for Robots"** explores in detail various Drive Mechanisms used in robotics such as Hydraulic, Pneumatic & Electric drives. After completing this course students will be able to analyze operational aspects of a drive system for a given robotic application. Fourth Course in the track **"Robot Programming and Intelligent Control System"** expands on Robot Programming, discussing various aspects of Robot Programming Languages and their functions. This course also dives deep into advanced topics like Artificial Intelligence, Neural Networks and Fuzzy control for robots.

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B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1EI01) FUNDAMENTALS OF ROBOTICS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the basic components of a Robot
- To learn different types of Robot sensors and actuators used in Robotics
- To identify different types of Robot grippers and their applications
- To acquire basic Knowledge on Robot kinematics
- To expose to various application fields of Robotics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain knowledge about basic concepts of robots
CO-2: Appreciate the usage of different sensors and actuators in Robotics
CO-3: Select appropriate Gripping mechanism for a particular application
CO-4: Analyze the direct and the inverse kinematic problems
CO-5: Appreciate robot design deference's for various applications

UNIT – I:
Basic Concepts: An overview of Robotics, classification of Robots, Robot Components, Robot degrees of freedom, Robot Joints, Robot Coordinates, Robot reference frames, Programming modes, Robot Characteristics.

UNIT – II:
Sensors: Sensor characteristics, Position sensors, Velocity sensors, Acceleration sensors, Force and Pressure sensors, Torque sensors, Microswitches, Light and infrared sensors, Touch and tactile sensors, Proximity sensors, Range finders.

UNIT – III:
Actuators: Characteristics of actuating system, Comparison of actuating systems, Hydraulic actuators, Pneumatic devices, Electric motors, Magneto-strictive actuators, Shape-Memory Metals, Electro-active Polymer Actuators.

UNIT – IV:
Grippers: Classification of Grippers, Drive system for Grippers, Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Adhesive Grippers, Hooks and Scoops, Gripper Force analysis and design, Active and Passive Grippers.

UNIT – V:
Kinematics: Robots as Mechanisms, Matrix Representation, Homogeneous Transformation Matrices, Representation of Transformations, Inverse of Transformation Matrices, Forward and Inverse Kinematics with Equations.

UNIT – VI:
Applications: Industrial applications, material handling, processing, assembly application, inspection application, application planning, justification of robots, non-industrial applications, Robot safety.

TEXT BOOKS:

1. Introduction to Robotics: Analysis, Control, Applications, Saeed B. Niku, Wiley, 2nd Edition
2. Robotics Technology and Flexible Automation, Deb S. R., John Wiley
3. Robotics and Control, R. K. Mittal, I. J. Nagrath, McGraw Hill Education

REFERENCES:

1. Industrial Robotics, Technology programming and Applications, Mikell P. Groover, Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, McGraw Hill, 2012
2. Robotics-Control, Sensing, Vision and Intelligence, K. S. Fu, R. C. Gonzalez, C. S. G Lee, McGraw-Hill International Edition
3. Robotic Engineering–An Integrated Approach, Klafter R. D., Chimielewski T. A., Negin M., Prentice Hall of India, New Delhi, 2009

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B.Tech. VI Semester	L	T/P/D	C
	3	0	3

(19OE1EI02) KINEMATICS AND DYNAMICS OF ROBOTS

COURSE PRE-REQUISITES: Fundamentals of Robotics

COURSE OBJECTIVES:
- To understand the basics of robot coordinate frames and their representation
- To obtain knowledge about direct kinematics and inverse kinematics for a robot manipulator
- To examine techniques for planning robot motion in a workspace
- To understand various methods for developing dynamic models for manipulator
- To learn control techniques applied to robot manipulators

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Mathematically represent a Robot system
CO-2: Calculate robot hand position and orientation for specific joint angles
CO-3: Calculate joint angles to achieve a particular hand position
CO-4: Plan trajectories for robot tool to do meaningful tasks
CO-5: Analyze different controlling techniques used for robot manipulators

UNIT – I:
Introduction: Introduction, position and orientation of objects, objects coordinate frame Rotation matrix, Euler angles Roll, pitch and yaw angles coordinate Transformations, Joint variables and position of end effector, Dot and cross products.

UNIT – II:
Direct Kinematics: Coordinate frames, Rotations, Homogeneous coordinates, Link coordinates D-H Representation, The ARM equation. Direct kinematic analysis for Four axis SCARA Robot and three, five and six axis Articulated Robots.

UNIT – III:
Inverse Kinematics: The inverse kinematics problem, General properties of solutions. Tool configuration, Inverse kinematics of four axis SCARA robot and three and five axis Articulated robot.

UNIT – IV:
Workspace Analysis and Trajectory Planning: Workspace Analysis, work envelope of a Four axis SCARA robot and five axis articulated robot workspace fixtures, the pick and place operations, Joint space technique - continuous path motion, Interpolated motion, straight line motion and Cartesian space technique in trajectory planning.

UNIT – V:
Manipulator Dynamics: Introduction, Lagrange's equation kinetic and potential energy. Link inertia Tensor, link Jacobian Manipulator inertia tensor. Gravity, Generalized forces, Lagrange-Euler Dynamic model, Dynamic model of a Two-axis planar robot, Newton Euler formulation, Lagrange - Euler formulation, problems.

UNIT – VI:
Robot Control: The Control Problem, State Equations: one axis robot; three axis SCARA robot, Constant solutions, Linear Feedback Systems, Single Axis PID Control, PD- Gravity Control.

TEXT BOOKS:

1. Fundamentals of Robotics: Analysis & Control, Robert J. Schilling, Prentice Hall of India
2. Robotics and Control, R. K. Mittal, I. J. Nagrath, McGraw Hill Education

REFERENCES:

1. Robotic Engineering–An Integrated Approach, Klafter. R. D., Chimielewski. T. A., Negin M, Prentice Hall of India, New Delhi, 2009
2. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover & Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, Tata McGraw-Hill Education, 2012
3. Robotics-Control, Sensing, Vision and Intelligence, K. S. Fu, R. C. Gonzalez, C. S. G. Lee, McGraw-Hill International Edition

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1EI03) DRIVES AND CONTROL SYSTEM FOR ROBOTICS

COURSE PRE-REQUISITES: Fundamentals of Robotics, Kinematics and Dynamics of Robotics

COURSE OBJECTIVES:

- To get acquainted with different robot drive mechanisms
- To understand in detail, working of hydraulic and pneumatic drives used in robotics
- To learn working principles of various electric drive systems for robotics
- To acquire basic Knowledge on servo systems for robot control

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Categorize various drive systems for robot movement
CO-2: Select appropriate drive system for a particular application
CO-3: Inspect different electric drives and their applications in robotics
CO-4: Analyze accurate positioning of robot end effector by servo control

UNIT – I:
Introduction: Objectives, motivation, open loop control, closed loop control with velocity and position feedback, Types of drive systems. Functions of drive system.

UNIT – II:
Robot Drive Mechanism: Lead Screws, Ball Screws, Chain & linkage drives, Belt drives, Gear drives, Precision gear boxes, Harmonic drives, Cyclo speed reducers.

UNIT – III:
Hydraulic Drives: Introduction, Requirements, Hydraulic piston and transfer valve, hydraulic circuit incorporating control amplifier, hydraulic fluid considerations, hydraulic actuators Rotary and linear actuators. Hydraulic components in robots.

UNIT – IV:
Pneumatic Drives: Introduction, Advantages, pistons-Linear Pistons, Rotary pistons, Motors-Flapper motor, Geared motor, Components used in pneumatic control. Pneumatic proportional controller, pneumatically controlled prismatic joint.

UNIT – V:
Electric Drives: Introduction, Types, DC electric motor, AC electric motor, stepper motors, half step mode operation, micro step mode. Types of stepper motors, Direct drive actuator.

UNIT – VI:
Servo Mechanism for Robot: Mathematical modeling of robot servos, error responses and steady state errors in robot servos, feedback and feed forward compensations, hydraulic position servo, computer-controlled servo system for robot applications, selection of robot drive systems.

TEXT BOOKS:

1. Engineering Foundation of Robotics, Francis N-Nagy Andras Siegler, Prentice Hall Inc.
2. Robotics Engineering - An Integrated Approach, Richard D. Klafter, Thomas A., Chri Elewski, Michael Negin, PHI Learning, 2009

REFERENCES:

1. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover & Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, Tata McGraw-Hill Education, 2012
2. Industrial Robotics, Bernard Hodges, 2nd Edition, Jaico Publishing House, 1993
3. Fundamentals of Robotics Analysis and Control, Robert J. Schilling, PHI Learning, 2009
4. Foundations of Robotics Analysis and Control, Tsuneo Yohikwa, MIT Press, 2003
5. Introduction to Robotics Mechanics and Control, John J. Craig, 3rd Edition, Pearson, 2008

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B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1EI04) ROBOT PROGRAMMING AND INTELLIGENT CONTROL SYSTEM

COURSE PRE-REQUISITES: Fundamentals of Robotics, Kinematics and Dynamics of Robotics, Drives and Control Systems for Robotics

COURSE OBJECTIVES:
- To understand the fundamentals of robot programming
- To learn robot textual languages that are in common use
- To expose to artificial intelligence in robotics
- To acquire basic Knowledge on neural networks in robotics
- To acquire basic Knowledge on fuzzy logic in robotics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain knowledge about different methods of robot programming
CO-2: Examine various robot language elements and their functions
CO-3: Analyze different AI techniques employed in robotics
CO-4: Design basic neuro-controller for robot motion control
CO-5: Apply fuzzy logic to robot control systems

UNIT – I:
Robot Programming: Methods of robot programming, leadthrough programming methods, robot program as a path in space - defining position in space, speed control, motion interpolation, WAIT, SIGNAL, DELAY commands, Branching.

UNIT – II:
Robot Languages: Textual robot language, generations of robot languages, robot language structure, operating systems, Robot language Elements and functions, constraints and variables, aggregates and location variables.

UNIT – III:
Basic Commands and Operations: Motion commands- move and related statements, speed control, points in workspace, paths and frames. End effector and sensor commands- end effector operation, sensor operation, REACT statement. Computations and operation. Program control and subroutines. Communications and data processing. Monitor mode commands.

UNIT – IV:
AI for Robotics: Introduction to Artificial Intelligence, goals of AI research, AI techniques- knowledge representation, problem representation, search techniques. LISP programming. AI and Robotics. LISP in the factory. Robotic Paradigms.

UNIT – V:

Neural Network Approach in Robotics: Introduction, Connectionist Models, Learning Principles and Learning Rules: Supervised, unsupervised, reinforcement learning. Sensor based robot learning, Neural Network in Robotics: Control of robot hands by neural network, neural set approach to robot motion coordination, robotic motor control using reinforcement learning optimization.

UNIT – VI:

Fuzzy Logic Approach in Robotics: Introduction, Fuzzy sets, Operation of Fuzzy sets, Fuzzy relations, Fuzzy rule formation, Control rules, Fuzzy algorithm in robotics, Robot obstacle avoidance using fuzzy logic, Fuzzy logic for robot path tracking and behavior coordination, fuzzy control system in mobile robots, fuzzy controller design for robot systems, Case study of fuzzy logic in robotics.

TEXT BOOKS:

1. Industrial Robotics Technology, Programming and Applications, Mikell. P. Groover, McGraw Hill, 2012
2. Robotics Technology and Flexible Automation, Deb S. R., Tata McGraw Hill Publishing Company Limited

REFERENCES:

1. Design and Control of Intelligent Robotic Systems, (Studies in Computational Intelligence 177) M. Begum, F. Karray (auth.), Dikai Liu, Lingfeng Wang, Kay Chen Tan (eds.), Springer
2. Neural Networks in Robotics, Edited by George Bekey, Kenneth Y. Goldberg, Springer US, 2012
3. Neural Networks, Fuzzy Logic, Genetic Algorithm - Synthesis and Applications, Rajasekharan and Rai, PHI Publications
4. Introduction to Neural Networks using MATLAB 6.0, S. N. Sivanandam, S. Sumathi, S. N. Deepa, TMH, 2006

CYBER SECURITY

CYBER SECURITY

Cybersecurity is **important** because it incorporates everything that relates to protecting our sensitive data, personally identifiable information (PII), protected health information (PHI), personal information, intellectual property, data, and governmental and **industry** information systems from stealing and destruction endeavoured. The cyber security track helps students to learn about how to

- Defend networks and data from unapproved access.
- Enhanced information security and business endurance supervision.
- Upgraded stakeholder confidence in your information security preparations.
- Developed company authorizations with the correct security controls in place.

Some of the more common career paths in the cyber security path are

- Chief Information Security Officer. ...
- Forensic Computer Analyst. ...
- Information Security Analyst. ...
- Penetration Tester. ...
- Security Architect. ...
- IT Security Engineer. ...
- Security Systems Administrator. ...
- IT Security Consultant.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CS04) FUNDAMENTALS OF COMPUTER NETWORKS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce the fundamental various types of computer networks
- To demonstrate the TCP/IP and OSI models with merits and demerits
- To explore the various layers of OSI model
- To introduce UDP and TCP models
- To have the concept of different routing techniques for data communications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and explore the basics of Computer Networks and Various Protocols and in a position to understand the World Wide Web concepts
CO-2: Administrate a network and flow of information
CO-3: Understand easily the concepts of network security, Mobile and ad-hoc networks

UNIT – I:
Introduction to Networks: Internet, Protocols and Standards, The OSI Model, Layers in OSI Model, TCP/IP Suite, Addressing.
Physical Layer: Multiplexing, Transmission Media, Circuit Switched Networks, Datagram Networks, and Virtual Circuit Networks.

UNIT – II:
Data Link Layer: Introduction, Checksum, Framing, Flow and Error Control, Noiseless Channels, Noisy Channels, Random Access Controlled Access, Channelization, IEEE Standards, Ethernet, Giga-Bit Ethernet, Wireless LANs, SONET-SDH, Frame Relay and ATM.

UNIT – III:
Network Layer: Logical Addressing, Internetworking, Tunneling, Address Mapping, ICMP, IGMP, Forwarding, Routing-Flooding, Bellman& Ford, Disjkstra's routing protocols, RIP, OSPF, BGP,- and Multicast Routing Protocols. Connecting Devices-Passive Hubs, Repeaters, Active Hubs, Bridges, Routers.

UNIT – IV:
Transport Layer: Process to Process Delivery, UDP, TCP and SCTP Protocols, Congestion, Congestion Control, Quality of Service.

UNIT – V:

Application Layer: Domain Name Space, DNS in Internet, Electronic Mail, File Transfer Protocol, WWW, HTTP, SNMP, Multi-Media.

UNIT – VI:

Network Security: Security services, mechanisms and attacks, IPSec, SSL, VPN, Firewall, Bluetooth, Zigbee, IPv4, IPv6.

TEXT BOOKS:

1. Data Communications and Networking, Behrouz A. Forouzan, 4th Edition, McGraw Hill Education, 2006
2. Computer Networks, Andrew S. Tanenbaum, 4th Edition, Pearson Education
3. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education

REFERENCES:

1. Data Communications and Networks, William Stallings
2. Data Communication and Networks, Bhusan Trivedi, Oxford University Press, 2016
3. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education
4. Understanding Communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning

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B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CS08) RELATIONAL DATABASE MANAGEMENT SYSTEMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the basic elements of a relational database management system
CO-2: Identify the data models for relevant problems
CO-3: Design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data
CO-4: Apply normalization for the development of application software

UNIT – I:
Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.
Introduction to Database Design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.
Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data,
Logical Database Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT – II:
Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.
SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

UNIT – III:
Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of

Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

UNIT – IV:
Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

UNIT – V:
Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.
Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

UNIT – VI:
Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.
Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.
Hash-Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:
1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw Hill Education (India) Private Limited
2. Database System Concepts, A. Silberschatz, Henry F. Korth, S. Sudarshan, 6th Edition, McGraw Hill Education (India) Private Limited
3. Database Systems, R. Elmasri, Shamkant B. Navathe, 6th Edition, Pearson Education

REFERENCES:
1. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning
2. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Introduction to Database Systems, C. J. Date, Pearson Education

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B.Tech. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CS06) CRYPTOGRAPHY AND NETWORK SECURITY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases

COURSE OBJECTIVES:
- To outline security concepts, threats, attacks, services and mechanisms
- To describe various cryptosystems- symmetric key cryptography, public key cryptography
- To apply authentication services and Secure hash functions
- To discuss the concepts of IP Security, web security, viruses and firewalls

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the security attacks, services, goals and mechanism of security
CO-2: Develop a security model using conventional approach to prevent the attacks
CO-3: Apply public key cryptography principles, examine authenticity and integrity of the messages in the communication
CO-4: Build a model for IP security, firewall and test the security issues

UNIT – I:
Security Attacks: Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

UNIT – II:
Conventional Encryption: Classical Encryption techniques, Fiestel Cipher Structure, Data Encryption Standard, Block Cipher Design Principles and Modes of Operation, Triple DES, RC-4, Evaluation criteria for AES, AES Cipher, Placement of Encryption Function, Traffic Confidentiality.

UNIT – III:
Public Key Cryptography and Authentication: Confidentiality using Symmetric Encryption – Principles of Public key Cryptosystems, RSA algorithm, Key Management, Diffie-Hellman key Exchange, Elliptic Curve Cryptography.
Authentication requirements, Authentication functions, Message Authentication Codes

UNIT – IV:

Hash Functions: Hash Functions, Security of Hash Functions and MACs, MD5 message Digest algorithm, Secure Hash Algorithm, HMAC, Digital Signatures, Authentication Protocols, Digital Signature Standard, Authentication Applications: Kerberos, X.509 Authentication Service

UNIT – V:

Network Security: Email Security and Web Security

Electronic Mail Security – PGP/ SMIME, IP security- Architecture, Authentication Header, Encapsulating Security Payload, Key Management, Web Security- Secure Socket Layer, Transport Layer Security and Secure Electronic Transaction

UNIT – VI:

System Level Security: Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

TEXT BOOKS:

1. Cryptography and Network Security – Principles and Practices, William Stallings, 4th Edition, Prentice Hall of India, 2005
2. Hack Proofing your Network, Ryan Russell, Dan Kaminsky, Rain Forest, Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W. Manzuik and Ryan Permeh, Wiley Dreamtech

REFERENCES:

1. Network Security Essentials: Applications and Standards, William Stallings Prentice Hall,1999, ISBN 0130160938
2. Security in Computing, Charles B. Pfleeger, Shari Lawrence Pfleeger, 3rd Edition, Pearson Education, 2003

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B.Tech. VII Semester	L	T/P/D	C
	3	0	3

(19OE1IT01) ESSENTIALS OF CYBER SECURITY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Cryptography and Network Security

COURSE OBJECTIVES:
- To identify the key components of cyber security in network
- To describe various security levels and categories, operating system security
- To define authentication issues and network security
- To describe memory management and protection measures

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Categorize cyber-crime and an understand social, political, ethical and psychological dimensions cyber security
CO-2: Demonstrate security levels and models with objects and access control
CO-3: Analyse tools and methods used in cybercrime
CO-4: Understand Organizational Implications and security risks

UNIT – I:
Introduction to Cybercrime: Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT – II:
Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT – III:
Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies an Measures in Mobile Computing Era, Laptops.

UNIT – IV:
Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan

Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT – V:

Cyber Security: Organizational Implications

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications.

UNIT – VI:

Social Media Marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

TEXT BOOKS:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley India

REFERENCES:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press
2. Introduction to Cyber Security, Chwan-Hwa (John) Wu, J. David Irwin, CRC Press T&F Group

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B.Tech. VIII Semester	L	T/P/D	C
	3	0	3

(19OE1IT02) COMPUTER FORENSICS

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Cryptography and Network Security, Essentials of Cyber Security

COURSE OBJECTIVES:

- To provide an understanding of computer forensics fundamentals
- To analyze various computer forensics technologies and to provide computer forensics systems
- To identify methods for data recovery
- To apply the methods for preservation of digital evidence

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Define and discuss the concepts of computer forensics
CO-2: Explain and apply the concepts of computer investigations
CO-3: Select and apply current computer forensics tools
CO-4: Identify and apply current practices for processing crime and incident scenes

UNIT – I:
Computer Forensics Fundamentals: What is Computer Forensics? Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists.

UNIT – II:
Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement — Computer Forensic Technology — Types of Business Computer Forensic Technology Computer Forensics Evidence and Capture: Data Recovery Defined — Data Back-up and Recovery — The Role of Back-up in Data Recovery — The Data-Recovery Solution.

UNIT – III:
Evidence Collection and Data Seizure: Why Collect Evidence? Collection Options — Obstacles — Types of Evidence — The Rules of Evidence — Volatile Evidence — General Procedure — Collection and Archiving — Methods of Collection — Artifacts — Collection Steps — Controlling Contamination: The Chain of Custody Duplication and Preservation of Digital Evidence: Preserving the Digital Crime Scene — Computer Evidence Processing Steps — Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer Image Verification and Authentication: Special Needs of Evidential Authentication — Practical Consideration —Practical Implementation.

UNIT – IV:

Computer Forensics Analysis and Validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project. Processing Crime and Incident Scenes: Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case.

UNIT – V:

Current Computer Forensic Tools: Evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.

Cell Phone and Mobile Device Forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

UNIT – VI:

Working with Windows and DOS Systems: understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

TEXT BOOKS:

1. Computer Forensics, Computer Crime Investigation, John R. Vacca, Firewall Media, New Delhi
2. Computer Forensics and Investigations, Nelson, Phillips Enfinger, Steuart, Cengage Learning
3. Real Digital Forensics, Keith J. Jones, Richard Bejtiich, Curtis W. Rose, Addison Wesley, Pearson Education

REFERENCES:

1. Forensic Compiling, A Practitioners Guide, Tony Sammes and Brian Jenkinson, Springer International Edition
2. Computer Evidence Collection & Presentation, Christopher L. T. Brown, Firewall Media
3. Homeland Security, Techniques & Technologies, Jesus Mena, Firewall Media
4. Software Forensics Collecting Evidence from the Scene of a Digital Crime, Robert M. Slade, TMH 2005
5. Windows Forensics, Chad Steel, Wiley India Edition

DATA SCIENCES / BIG DATA AND ANALYTICS

DATA SCIENCES / BIG DATA AND ANALYTICS

Data science helps in risk evaluation and observing, possible deceitful comportment, payments, customer analysis, and experience, among much other exploitation. The capability to make **data**-driven choices generates a steadier financial situation and **data scientists** make the strength of the **industry.**

As such, **data science** track helps students to apply business concepts in banking, finance, manufacturing, transport, e-commerce, education, etc. that use **data science**. As a consequence, there are numerous **Data Science** Applications associated to it

Job Roles in Data Science Track

- Data Analyst
- Data Engineers
- Database Administrator
- Machine Learning Engineer
- Data Scientist
- Data Architect
- Statistician
- Business Analyst
- Data and Analytics Manager

Big Data analytics track helps the students to learn the process of gathering, establishing and examining large sets of **data** (called **Big Data**) to determine patterns and other beneficial information. Analysts occupied with **Big Data** characteristically want the acquaintance that comes from investigating the **data**.

Big data analytics is the practice of mining useful information by examining different **types** of big data sets. Big data analytics is utilized to determine concealed patterns, market developments and consumer favorites, for the advantage of organizational decision making.

Job responsibilities in a Big Data Analytics Track are

- To gather and accumulate data from disparate sources, clean it, organize it, process it, and analyse it to extract valuable insights and information.
- To identify new sources of data and develop methods to improve data mining, analysis, and reporting.
- To create data definitions for new database files or alterations made to the already existing ones for analysis purposes.
- To present the findings in reports (in table, chart, or graph format) to help the management team in the decision-making process.
- To apply statistical analysis methods for consumer data research and analysis purposes.
- To keep track of the trends and correlational patterns among complex data sets.
- To perform routine analysis tasks to support day-to-day business functioning and decision making.
- To collaborate with Data Scientists to develop innovative analytical tools.
- To work in close collaboration with both the IT team and the business management team to accomplish company goals.

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B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1MT02) STATISTICAL METHODS FOR DATA SCIENCE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To provide insights about the basic roles of various statistical methods in building computer applications
- To develop a greater understanding of the importance of Data Visualization techniques
- To develop problem-solving skills
- To make inferences about the population parameters using sample data
- To provide an understanding on the importance and techniques of predicting a relationship between the two sets of data and determine the goodness of fitted model

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Analyze an extremely large data set and perform exploratory data analysis to extract meaningful insights

CO-2: Develop various visualizations of the data in hand and communicate results of analysis effectively (visually and verbally)

CO-3: Examine a real-world problem and solve the same with the knowledge gained from various distributions study

CO-4: Use and fit a linear regression model to data and use it for prediction

CO-5: Fit a polynomial regression model to data and use it for prediction

UNIT – I:

Introduction to Statistics: Definition of statistics, basic objectives, applications in various branches of science with examples, collection of data: internal and external data, primary and secondary data, population and sample, representative sample.

UNIT – II:

Descriptive Statistics: Classification and tabulation of univariate data, graphical representation, frequency curves, descriptive measures - central tendency and dispersion, bivariate data, summarization, marginal and conditional frequency distribution.

UNIT – III:

Introduction to R: Introduction, Installing R and data types in R, programming using R: operators, conditional statements, looping, scripts, function creation, creating list, list operations, recursive list, creating a data frame, operations on data frames.

UNIT – IV:

Data Visualization using R: Import - export of data, measures of central tendency and measures of dispersion, data visualization – scatter plot, pie chart, histogram, bar chart, box plot, absolute and relative frequencies, frequency distribution.

UNIT – V:

Correlation & Linear Regression:

Correlation: Correlation, types of correlation, coefficient of correlation, rank correlation coefficient.

Linear Regression: Introduction, regression model, interval estimation, estimation of parameters of β_0 and β_1, Estimation of $\sigma^{2.}$

UNIT – VI:

Non-Linear Regression: Regression of second-degree polynomial (non-linear least square method for polynomial function), power function, exponential, estimation of coefficients, linear and polynomial regressions in R.

TEXT BOOKS:

1. Introductory Statistics, Thomas H. Wonnacott & Ronald J. Wonnacot, John Wiley & Sons Inc., 1969
2. Applied Statistics and Probability for Engineers, Douglas C. Montgomery, George C. Runger, 3rd Edition, John Wiley & Sons, Inc., 2003
3. R for Beginners, Sandip Rakshit, 1st Edition, McGraw-Hill Education, 2017

REFERENCES:

1. R-The Statistical Programming Language, Dr. Mark Gardner, Wiley India Pvt. Ltd, 2013
2. Introduction to the Theory of Statistics, A. M. Mood, F. A. Graybill and D. C. Boes, 3rd Edition, McGraw Hill Education, 2017
3. Introduction of Probability Models, S. M. Ross, 11th Edition, Academic Press, N.Y., 2014
4. Statistical Methods, S. P. Gupta, 42nd Revised Edition, Sultan Chand & Sons, 2012

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B.Tech. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1IT03) COMPUTATIONAL THINKING USING PYTHON

COURSE PRE-REQUISITES: Statistical Methods for Data Science

COURSE OBJECTIVES:

- To understand why Python is a useful scripting language for developers
- To create and execute Python programs and to Learn how to use lists, tuples, and dictionaries in Python programs
- To learn how to build and package Python modules for reusability
- To learn how to design object-oriented programs with Python classes
- To learn how to use exception handling in Python applications for error handling

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms)
CO-2: Adequately use standard programming constructs: repetition, selection, functions, composition, modules, aggregated data (arrays, lists, etc.)
CO-3: Explain what a given program (in Python) does identify and repair coding errors in a program
CO-4: Understand and use object-based software concepts (constructing OO software will be dealt with in the course Software Engineering)
CO-5: Use library software for (e.g.) building a graphical user interface, web application, or mathematical software

UNIT – I:
Introduction: History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator, Conditional Statements-If
If- else Nested if-else Looping for While Nested loops Control Statements Break
Continue Pass String Manipulation Accessing Strings Basic Operations String slices Function.

UNIT – II:
Methods, Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods,
Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods
Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties.

UNIT – III:
Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.

Modules: Creation, Importing module, Math module, Random module, Packages.

UNIT – IV:

Composition: Input-Output-Printing on screen, Reading data from keyboard, Opening and closing file Reading and writing files, Functions.

Exception Handling: Exception, Exception Handling, Except clause, Try? Finally clause, User Defined Exceptions

UNIT – V:

OOPs Concept: Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding, Regular expressions- Match function, Search function, Matching VS Searching, Modifiers, Patterns.

Multithreading: Thread, Starting a thread, Threading module, Synchronizing threads.

CGI: Introduction, Architecture, CGI environment variable, GET and POST methods, Cookies, File upload.

UNIT – VI:

Database: Introduction, Connections, Executing queries, Transactions Handling error,

Networking: Socket, Socket Module, Methods, Client and server, Internet modules, Sending email.

TEXT BOOKS:

1. Learning Python, David Ascher and Mark Lutz, O'Relly

REFERENCES:

1. Python Programming: An Introduction to Computer Science, John M. Zelle, 2nd Edition, Kindle Edition
2. Python Essential Reference, David M. Beazley, 4th Edition, Developer's Library

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1IT04) FUNDAMENTALS OF DATA MINING

COURSE PRE-REQUISITES: Statistical Methods for Data Science, Computational Thinking using Python

COURSE OBJECTIVES:
- To introduce the basic concepts and techniques in building a Data Warehouse
- To apply preprocessing methods for any given raw data
- To develop skills of using recent data mining software for solving practical problems
- To implement and apply basic algorithms for supervised and unsupervised learning

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Assess raw input data and process it to provide suitable input for a range of data mining algorithms.
CO-2: Discover and measure interesting patterns from different kinds of databases
CO-3: Evaluate and select appropriate data-mining algorithms and apply, interpret and report the output appropriately
CO-4: Design and implement data-mining applications using sample, realistic data sets and modern tools

UNIT – I:
Data Warehousing & Modeling: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading.

UNIT – II:
Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.

UNIT – III:
Data Warehouse Implementation & Data Mining: Data Warehouse Architecture, What is data mining, Challenges, From Data Warehousing and Data Mining, Data Mining Tasks, Data Mining Functionalities, Major Issues in Data Mining. Data: Types of Data, Data Quality, Data Pre-processing, Measures of Similarity and Dissimilarity.

UNIT – IV:

Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.

UNIT – V:

Classification: Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.

UNIT – VI:

Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph- Based Clustering, Scalable Clustering Algorithms.

TEXT BOOKS:

1. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, First Impression, Pearson, 2014
2. Data Mining-Concepts and Techniques, Jiawei Han, Micheline Kamber, Jian Pei, 3rd Edition, Morgan Kaufmann, 2012

REFERENCES:

1. Data Warehousing in the Real World, Sam Anahory, Dennis Murray, Tenth Impression, Pearson, 2012
2. Mastering Data Mining, Michael J. Berry, Gordon S. Linoff, 2nd Edtion, Wiley, 2012

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B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1IT05) DATA ANALYSIS AND VISUALIZATION

COURSE PRE-REQUISITES: Statistical Methods for Data Science, Computational Thinking using Python, Fundamentals of Data Mining

COURSE OBJECTIVES:
- To introduce concept and characteristics of probability distribution
- To introduce underlying design principles, properties and assumptions of linear and non-linear regression modelling
- To introduce design principles involved in identifying interesting classification and prediction of data patterns
- To introduce properties of time series data and perform time series analysis

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply probability distribution concepts to identify univariate data patterns
CO-2: Apply regression modelling to build efficient mathematical models for prediction and classification
CO-3: Apply decision and regression trees for supervised learning
CO-4: Visualize time series data by applying time series techniques

UNIT – I:
Data Definitions and Analysis Techniques: Elements, Variables, and Data categorization, Introduction to statistical learning, Descriptive Statistics: Measures of central tendency, Measures of location of dispersions.

UNIT – II:
Basic Analysis Techniques: Basic analysis techniques, Statistical hypothesis generation and testing, Chi-Square test, t-Test Analysis of variance, Correlation analysis, Maximum likelihood test.

UNIT – III:
Data Analysis Techniques: Regression analysis and visualization, Classification techniques and visualization, Clustering and visualization, Association rules analysis and visualization

UNIT – IV:
Time-series Analysis and Forecasting – Time-series components, Variation in Time Series, Cyclic Variation, Seasonal Variation, Irregular Variation.

UNIT – V:

Smoothing Techniques: A problem involving all four components of time series, Introduction to forecasting, forecasting models, Trend and Seasonal effects, Trend Analysis

UNIT – VI:

Case-studies and Projects: Understanding business scenarios, Feature engineering and visualization, Sensitivity Analysis.

TEXT BOOKS:

1. Data Mining and Analysis, Mohammed J. Zaki, Wagner Meira, Cambridge, 2012
2. Data Mining: Theories, Algorithms, and Examples, Nong Ye, CRC Press Taylor & Francis Group, 2014
3. Statistics for Management, David S. Rubin, Sanjay Rastogi, Masood Husain Siddiqui Richard I. Levin, 7th Edition, Pearson Learning

REFERENCES:

1. Probability & Statistics for Engineers & Scientists, Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, 9th Edition, Prentice Hall Inc.
2. The Elements of Statistical Learning, Data Mining, Inference and Prediction, Trevor Hastie, Robert Tibshirani, Jerome Friedman, 2nd Edition, Springer, 2014
3. An Introduction to Statistical Learning Mining Massive Data Sets, A. Rajaraman and J. Ullman, Cambridge University Press, 2012
4. Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers, Springer

AUTONOMOUS VEHICLES

AUTONOMOUS VEHICLES

The invention of the wheel marked a large step in the evolution of mankind. With mobility, man experienced a newfound freedom that opened the doors for several other inventions. Automobile engineering or automotive engineering is one of the most challenging careers in the field of engineering with a wide scope. This branch deals with the designing, developing, manufacturing, testing and servicing automobiles such as cars, trucks, motorcycles, scooters, etc. and the related engineering sub systems. For the perfect blend of designing and manufacturing automobiles, automobile engineering uses the features of different elements of engineering such as mechanical, electrical, electronic, instrumentation, civil, software and safety engineering. Exploring the topic from an interdisciplinary perspective is indispensable. Globalization and incredible growth of automobile industry have resulted in numerous opportunities for engineers both in India and abroad.

The 17^{th} and 18^{th} centuries were mostly about steam-powered vehicles transporting people and goods. While electric cars enjoyed popularity in the 19^{th} and early 20^{th} centuries, the later period saw the accelerated adoption of the petrol car, due to its advantages of power, mass production, cost and advances in the internal combustion engine. It is only in the 21^{st} century that interest in electric cars has come back, given the need for cleaner, greener modes of transport. The modern period is associated with several path breaking technologies. Over the last couple of decades, there has been an explosion of electronics in vehicles. Connected cars that include technology features are ever more popular. These smart cars come with internet access, GPS, wi-fi, superior infotainment, advanced telematics and navigation capabilities. More innovations in in-vehicle infotainment and electronics promise to give car users even more enhanced capabilities in the near future.

Today, safety has become a larger concern than ever before. While entertainment and infotainment have made car driving a pleasure, this has also given rise to a growing tribe of distracted drivers. Add to this, underdeveloped roads, which take a toll on drivers today. Increased distractions and fatigue can also contribute to human fatalities. The future certainly points in the direction of driverless cars, which promise to alleviate concerns of traffic congestion and road safety. Driverless cars, also known as autonomous cars, will usher in a paradigm shift in the evolution of the modern automobile. Self-driving cars can sense the environment and traffic with the help of RADAR, LIDAR, GPS and computer vision and navigate without human intervention. Autonomous cars are claimed to have greater accuracy, reliability and faster reaction time compared to human drivers. This would lead to fewer traffic collisions and less road congestion.

Autonomous driving is a popular subject of today's discussion and automakers are developing complex systems that allow cars to drive themselves. If technology continues on its current course, car will do the concentrating for you.

Self-parking, automatic emergency braking, adaptive cruise control and lane keeping are just some of the technologies that have leapt into the market in the past few years. Put them all together, get a picture of driving to assisted driving to fully autonomous cars. The open elective track "Autonomous Vehicles" offered by the department of automobile engineering trains the students to meet the technological challenges and diverse needs of the industry and society in various areas of automobile engineering and equips them to excel in a truly competitive industry. With through knowledge in this filed, engineering graduates get opportunity to serve many top-notch automobile companies and IT companies as well.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1AE01) PRINCIPLES OF AUTOMOBILE ENGINEERING

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the layout of an automobile and functionalities subsystems
- To provide overview on concepts of engine, cooling, lubrication and fuel systems
- To present constructional features and working of automotive driveline and running systems
- To study the fundamentals and principles of automotive electrical systems

COURSE OUTCOMES After completion of the course, the student should be able to
CO-1: Explain the functionalities of automotive systems and subsystems
CO-2: Give an overview on engine and engine subsystems.
CO-3: Describe working of automotive driveline and running systems
CO-4: Discuss the concepts of automotive starting, ignition and charging systems

UNIT – I:
Introduction: Classification of automobiles, layout of an automobile, automobile sub systems and their role. Types of chassis, role and requirement of a chassis frame, types of frames, materials, loading points and types of bodies.

UNIT – II:
Engine: Classification and components of an engine, principle and working of four stoke and two stroke SI and CI engines, petrol fuel system - carburetor, diesel fuel system - diesel fuel pump, injectors, introduction to electronic fuel injection system – MPFI and CRDI.

UNIT – III:
Cooling and Lubrication: Necessity of cooling, air-cooling, water cooling - thermosyphon and pump cooling, radiator, pump, thermostat, antifreeze solution and radiator fan. Mist, splash and forced lubrication, oil filters and oil pumps.

UNIT – IV:
Drive Line: Clutches, principle, single plate clutch, multi plate clutch and centrifugal clutch. Gear box - Need, sliding mesh, constant mesh and synchromesh gear box. Propeller shaft, universal joint, differential, wheels and tyres.

UNIT – V:
Running Systems: Suspension systems – Objective, rigid axle and independent suspension system and torsion bar. Steering system – Layout, steering mechanism, steering geometry and steering gear boxes. Brake system –Principle, stopping distance, types of brakes and actuation.

UNIT – VI:
Electrical Systems: Starting system - Principle, working of different starter drive units and solenoid switches. Ignition system **-** Conventional ignition system types, ignition

advance and retarding mechanisms. Charging system – Alternator principle, construction and working, cut-outs and regulators.

TEXT BOOKS:

1. Advanced Vehicle Technology, Heinz Heisler, Butterworth Heinemann Publishers, 2002
2. Automobile Electrical Equipment, Crouse W. H., 3rd Edition, McGraw Hill Book Co., Inc., New York,1986

REFERENCES:

1. Motor Vehicle, Garrett T. K., Newton K. and Steeds W. ButterWorths & Co. Publishers Ltd., New Delhi, 2001
2. Automotive Electrical Equipment, Kohli P. L., Tata McGraw Hill Co., Ltd., New Delhi, 1975
3. Automotive Chassis and Body, Crouse W. H., McGraw Hill Book Co., 5th Edition, 1976
4. Automotive Mechanics, Giri N. K., Khanna Publications, 2006

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1AE02) MODERN AUTOMOTIVE TECHNOLOGIES

COURSE PRE-REQUISITES: Principles of Automobile Engineering

COURSE OBJECTIVES:
- To provide an overview on advanced engine control system concepts
- To know the interdisciplinary concepts and intelligent automotive systems
- To understand the interdisciplinary concepts and GPS-enabled applications in automobile
- To present intelligent vehicle technologies like comfort, safety and security systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply advanced engine control system concepts in engineering
CO-2: Discuss the need for implementation intelligent vehicle technologies
CO-3: Address the key technologies in automotive navigation
CO-4: Appreciate the technological advancements driver assistance systems

UNIT – I:
Advanced Engine Controls: Concept of an electronic engine control system, engine control module, powertrain control module, electronic fuel injection - throttle body fuel injection, multi-point fuel injection, gasoline direct injection, common rail direct injection, electronic ignition control, engine mapping, on-board diagnostics.

UNIT – II:
Introduction to Intelligent Vehicles: Driver information, driver perception, driver convenience, driver monitoring, general vehicle control, longitudinal and lateral control, collision avoidance, vehicle monitoring.

UNIT – III:
Telematics: Global positioning system, geographical information systems, navigation system, architecture, automotive vision system, road recognition.

UNIT – IV:
Comfort Systems: Adaptive cruise control system, active suspension system, power steering, collapsible and tiltable steering column, power windows.

UNIT – V:
Safety Systems: Active and passive safety, airbags, seat belt tightening system, forward collision warning systems, child lock, anti-lock braking systems, traction control system, lane departure warning system.

UNIT – VI:
Security Systems: Anti-theft technologies – mechanical, electromechanical and electronic immobilizers, alarm system, stolen vehicle tracking system, remote keyless entry, smart card system, number plate coding.

TEXT BOOKS:

1. Understanding Automotive Electronics, William B. Ribbens, 5th Edition, Butterworth Heinemann Woburn,1998
2. Intelligent Vehicle Technologies: Theory and Applications, Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann Publications, Oxford, 2001

REFERENCES:

1. Automotive Handbook, Robert Bosch, SAE, 5th Edition, 2000
2. Navigation and Intelligent Transportation Systems – Progress in Technology, Ronald K. Jurgen, Automotive Electronics Series, SAE, USA, 1998
3. Understanding Automotive Electronics, Bechhold, SAE, 1998

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.TECH. VII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1AE03) ELECTRIC, HYBRID AND FUEL CELL VEHICLES

COURSE PRE-REQUISITES: Principles of Automobile Engineering, Modern Automotive Technologies

COURSE OBJECTIVES:
- To study the concepts and drivetrain configurations of electric and hybrid vehicles
- To understand about electric propulsion system
- To provide various energy storage devices
- To present principle, working and automotive applications of fuel cell and solar technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the concepts and drivetrain configurations of electric and hybrid vehicles
CO-2: Discuss various electric motors and controls
CO-3: Present various energy storage devices
CO-4: Describe automotive applications of fuel cell and solar technology

UNIT – I:
Electric Vehicles: Layout of an electric vehicle, system components, traction motor characteristics, transmission, electronic control system, advantage and limitations, performance and energy consumption of electric vehicles.

UNIT – II:
Hybrid Vehicles: Concepts of hybrid electric drivetrain based on hybridization and powertrain configuration, architecture of series, parallel and series-parallel hybrid electric drivetrains, modes of operation, merits and demerits, plug-in hybrid architecture, speed and torque coupling of hybrid electric drivetrains.

UNIT – III:
Electric Motors: Review of technology suited to automotive propulsion, requirements, DC motors, Induction motors, permanent magnet brushless DC motors and switched reluctance motors.

UNIT – IV:
Motor Drives: Speed and torque control, DC motor - Chopper based four quadrant operations, induction motor, permanent magnet motor and switched reluctance motor.

UNIT – V:
Energy Storages: Electromechanical batteries - Types, parameters, lead acid batteries, nickel-based batteries, lithium-based batteries, battery management system and ultracapacitors.

UNIT – VI:

Fuel Cell and Solar Vehicles: Fuel cell vehicle – Operating principle, types of fuel cells, fuel cell options for fuel cell vehicle and fuel cell hybrid vehicle. Solar vehicle - Solar photovoltaic cell, solar array, solar car electrical system and drive train.

TEXT BOOKS:

1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, CRC Press, 2004
2. Electric Vehicle Technology-Explained, James Larminie and John Loury, John Wiley & Sons Ltd., 2003

REFERENCES:

1. Electric and Hybrid Vehicles – Design Fundamentals, Iqbal Husain, CRC Press, 2010
2. Electric Vehicle Battery Systems, Sandeep Dhameja, Butterworth–Heinemann, 2002
3. Electric and Hybrid – Electric Vehicles, Ronald K. Jurgen, SAE, 2002
4. Light Weight Electric/Hybrid Vehicle Design, Ron Hodkinson and John Fenton, Butterworth–Heinemann

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1AE04) CONNECTED AND AUTONOMOUS VEHICLES

COURSE PRE-REQUISITES: Principles of Automobile Engineering, Modern Automotive Technologies, Electric, Hybrid and Fuel Cell Vehicles

COURSE OBJECTIVES:
- To understand the fundamentals of vehicle communication and networking
- To provide state-of-the-art in wireless communication technology within and between vehicles
- To know various levels of vehicle autonomy and intelligent automotive systems
- To provide an overview on driver-assist and self-driving processes

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Present the fundamentals of vehicle communication and networking
CO-2: Appreciate intra-vehicle and inter-vehicle communication technologies
CO-3: Describe various levels of vehicle autonomy
CO-4: Discuss the driver-assist and self-driving processes

UNIT – I:
Introduction to Vehicle Communications: Intra-vehicle communications - communications protocols, systems and sensors (Braking, steering, power train, chassis systems, body electronics, instrument clusters, infotainment systems), inter-vehicle communications - cooperative driving (accident warning, frontal/rear collision prevention, lane change, assistance). Consumer assistance – traffic information, multimedia support and smart parking

UNIT – II:
Communication Fundamentals and Controller Area Network: Communication fundamentals – Frequency, bandwidth, power measurement, signal to noise ratio, transmission rate constraints, radio frequency spectrum allocation, RADAR operation and types of RADAR. CAN evolution, versions, types of controllers, layered architecture. CAN bus, message frames and error handling.

UNIT – III:
Intra-Vehicle Communications: Wired communication – Network comparison, two tier approach, LIN applications - Localized vehicle area support, general support areas, CAN applications - In vehicle operation, infotainment, wireless communication – Bluetooth vehicle applications, satellite services – satellite radio, vehicle care and traffic status.

UNIT – IV:
Inter-Vehicle Communication: Adhoc Communications –Applications in Vehicle traffic Monitoring, Collision and congestion avoidance, Highway lane reservation, Emission Control, Vehicle Frequency Utilization – AM Radio, Bluetooth, FM Radio, GPS, Short range RADAR, Wireless LAN, Intelligent Roadway-Infrastructure to vehicle and vehicle to vehicle communications. Evolving smart vehicle – ECU, wireless

networking, forward RADAR, side RADAR, GPS, cellular transmission and event Recorder.

UNIT – V:

Autonomous Vehicles: Importance, levels of automation, policy making, social costs, safety and crashes, congestion, land use, energy and emissions, costs and disadvantages

UNIT – VI:

Current State of Autonomous Vehicles: Research, challenges, commercial development, sensor systems, sensor suits, environmental challenges, graceful degradation, V2V and V2I communication, sharing the drive, integrity, security, verification and policy implications.

TEXT BOOKS:

1. Inter and Intra Vehicle Communications, Gilbert Held Auerbach Publications, 2008
2. Autonomous Vehicle Technology-A Guide for Policymakers, James M. Anderson, Nidhi Kalra, Karlyn D. Stanley, Paul Sorensen, Constantine Samaras, Oluwatobi A. Oluwatola, RAND Corporation, Santa Monica, Calif., 2016
3. Autonomous Driving - Technical, Legal and Social Aspects, Markus Maurer, J. Christian Gerdes, Barbara Lenz, Hermann Winner, Editors, Springer, 2016

REFERENCES:

1. Intelligent Vehicle Technologies: Theory and Applications, Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann Publications, Oxford, 2001
2. Navigation and Intelligent Transportation Systems – Progress in Technology, Ronald K. Jurgen, Automotive Electronics Series, SAE, USA, 1998
3. Automotive In–vehicle Networks, J. Gabrielleen, Wiley-Blackwell, 2008
4. In-Vehicle Network Architecture for the Next-Generation Vehicles, Syed Masud Mahmud, IGI
5. Communication Technologies for Vehicles, Mohamed Kassab Springer, 2015

GENERAL - COMPUTING

1. PROGRAMMING THROUGH JAVA

Java is an extensively **used** programming language specifically intended for use in the distributed environment of the internet. **Java** help students to create wide-ranging applications that possibly will run on a single workstation or be distributed among servers and clients in a network.

Java is an extremely fruitful language and an upper option for many developers for many years. The motive that it has remained so prevalent is since it still happens the needs of functioning across networks.

Students will have different roles and responsibilities by learning Java Programming

- Designing, implementing, and maintaining Java applications that are often high-volume and low-latency, required for mission-critical systems.
- Delivering high availability and performance.
- Contributing in all phases of the development lifecycle.
- Writing well-designed, efficient, and testable code.

2. RELATIONAL DATABASE MANAGEMENT SYSTEMS

A relational database permits you to effortlessly find precise information. It also consents you to sort based on any field and produce reports that comprise only definite fields from each record. With features like, Data Accuracy, Easy Access to Data, Data Integrity, Flexibility, Normalization, High Security, Feasible for Future Modifications

By learning RDBMS Students will have different roles in Database environment

- Data Administrator,
- Database Administrator
- Database Designer
- Application Programmer

3. COMPUTATIONAL THINKING USING PYTHON

The **python** language is one of the utmost accessible programming languages available because it has streamlined syntax and not complex, which gives more importance on natural language. Due to its comfort of learning and practice, **python** codes can be readily written and executed much quicker than former programming languages.

Data Science: The libraries and frameworks Python offers, e.g. PyBrain, PyMySQL, and NumPy are one of the big reasons. Another reason is diversity. Python experience allows you to do a lot more than any other language, e.g. you can create scripts to automate stuff, go into web development, and so much more.

Students will have various Job Profiles by learning Python

- Software Engineer.
- Python Developer.
- Research Analyst.
- Data Analyst.
- Data Scientist.
- Software Developer.

4. INTRODUCTION TO DATA ANALYTICS

Data Scientists and Analysts **use data analytics** techniques in their research, and businesses also **use** it to inform their conclusions. **Data analysis** can assistance corporations healthier comprehend their customers, assess their ad-campaigns, personalize gratified, create content approaches and progress products.

By learning Data Analytics students will get Jobs with different designations

- IT Systems Analyst. Systems analysts use and design systems to solve problems in information technology. ...
- Healthcare Data Analyst. ...
- Operations Analyst. ...
- Data Scientist. ...
- Data Engineer. ...
- Quantitative Analyst. ...
- Data Analytics Consultant. ...
- Digital Marketing Manager.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech.	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1IT06) PROGRAMMING THROUGH JAVA

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce object-oriented programming concepts using the Java language
- To introduce the principles of inheritance and polymorphism; and demonstrates how they relate to the design of abstract classes
- To introduce the implementation of packages and interfaces
- To introduce exception handling, event handling and multithreading

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Develop applications for range of problems using object-oriented programming techniques
CO-2: Design simple graphical user interface applications
CO-3: Explore the design of graphical user interface using applets and swings

UNIT – I:
Object Oriented Thinking and Java Basics: Need for OOP Paradigm, Summary of OOP Concepts, Coping with Complexity, Abstraction Mechanisms, A Way of Viewing World – Agents, Responsibility, Messages, Methods, History of Java, Java Buzzwords, Data Types, Variables, Scope and Life Time of Variables, Arrays, Operators, Expressions, Control Statements, Type Conversion and Casting, Simple Java Program, Concepts of Classes, Objects, Constructors, Methods, Access Control, This Keyword, Garbage Collection, Overloading Methods and Constructors, Method Binding, Inheritance, Overriding and Exceptions, Parameter Passing, Recursion, Nested and Inner Classes, Exploring String Class.

UNIT – II:
Inheritance, Packages and Interfaces: Hierarchical Abstractions, Base Class Object, Subclass, Subtype, Substitutability, Forms of Inheritance- Specialization, Specification, Construction, Extension, Limitation, Combination, Benefits of Inheritance, Costs of Inheritance. Member Access Rules, Super Uses, Using Final with Inheritance, Polymorphism- Method Overriding, Abstract Classes, The Object Class.
Defining, Creating and Accessing a Package, Understanding Classpath, Importing Packages, Differences between Classes and Interfaces, Defining an Interface, Implementing Interface, Applying Interfaces, Variables in Interface and Extending Interfaces, Exploring Java.IO.

UNIT – III:
Exception Handling and Multi-threading: Concepts of Exception Handling, Benefits of Exception Handling, Termination or Resumptive Models, Exception Hierarchy, Usage of Try, Catch, Throw, Throws and Finally, Built in Exceptions, Creating Own Exception Sub Classes.
String Handling, Exploring Java. Util, Differences between Multi-Threading and Multitasking, Thread Life Cycle, Creating Threads, Thread Priorities, Synchronizing

Threads, Interthread Communication, Thread Groups, Daemon Threads. Enumerations, Autoboxing, Annotations, Generics.

UNIT – IV:
Event Handling: Events, Event Sources, Event Classes, Event Listeners, Delegation Event Model, Handling Mouse and Keyboard Events, Adapter Classes.
The AWT Class Hierarchy, User Interface Components- Labels, Button, Canvas, Scrollbars, Text Components, Check Box, Check Box Groups, Choices, Lists Panels – Scrollpane, Dialogs, Menubar, Graphics, Layout Manager – Layout Manager Types – Border, Grid, Flow, Card and Grid Bag.

UNIT – V:
Applets: Concepts f Applets, Differences between Applets and Applications, Life Cycle of an Applet, Types of Applets, Creating Applets, Passing Parameters to Applets.

UNIT – VI:
Swing: Introduction, Limitations of AWT, MVC Architecture, Components, Containers, Exploring Swing- Japplet, Jframe and Jcomponent, Icons and Labels, Text Fields, Buttons – The Jbutton Class, Check Boxes, Radio Buttons, Combo Boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

TEXT BOOKS:
1. Java The Complete Reference, Herbert Schildt, 7th Edition, TMH
2. Understanding OOP with Java Updated Edition, T. Budd, Pearson Education
3. An Introduction to Programming and OO Design using Java, J. Nino and F.A. Hosch, John Wiley & Sons

REFERENCES:
1. Introduction to Java Programming, Y. Daniel Liang, Pearson Education
2. An Introduction to Java Programming and Object-Oriented Application Development, R. A. Johnson, Thomson
3. Core Java 2, Vol. 1 - Fundamentals, Cay. S. Horstmann and Gary Cornell, 8th Edition, Pearson Education
4. Core Java 2, Vol. 2 - Advanced Features, Cay. S. Horstmann and Gary Cornell, 8th Edition, Pearson Education

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B.Tech.	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CS08) RELATIONAL DATABASE MANAGEMENT SYSTEMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the basic elements of a relational database management system
CO-2: Ability to identify the data models for relevant problems
CO-3: Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data
CO-4: Apply normalization for the development of application software

UNIT – I:
Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.
Introduction to Database design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.
Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data
Logical Database Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT – II:
Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.
SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

UNIT – III:
Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of

Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

UNIT – IV:
Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

UNIT – V:
Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.
Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

UNIT – VI:
Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.
Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.
Hash-Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:
1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw Hill Education (India) Private Limited
2. Database System Concepts, A. Silberschatz, Henry F. Korth, S. Sudarshan, 6th Edition, McGraw Hill Education (India) Private Limited
3. Database Systems, R. Elmasri, Shamkant B. Navathe, 6th Edition, Pearson Education

REFERENCES:
1. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning
2. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Introduction to Database Systems, C. J. Date, Pearson Education

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B.Tech.	L	T/P/D	C
	3	0	3

(19OE1IT03) COMPUTATIONAL THINKING USING PYTHON

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand why Python is a useful scripting language for developers
- To create and execute Python programs and to Learn how to use lists, tuples, and dictionaries in Python programs
- To learn how to build and package Python modules for reusability
- To learn how to design object-oriented programs with Python classes
- To learn how to use exception handling in Python applications for error handling

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms)
CO-2: Adequately use standard programming constructs: repetition, selection, functions, composition, modules, aggregated data (arrays, lists, etc.)
CO-3: Explain what a given program (in Python) does identify and repair coding errors in a program
CO-4: Understand and use object-based software concepts (constructing OO software will be dealt with in the course Software Engineering)
CO-5: Use library software for (e.g.) building a graphical user interface, web application, or mathematical software

UNIT – I:
Introduction: History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator, Conditional Statements-If
If- else Nested if-else Looping for While Nested loops Control Statements Break
Continue Pass String Manipulation Accessing Strings Basic Operations String slices Function.

UNIT – II:
Methods, Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods, Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods
Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties.

UNIT – III:
Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.
Modules: Creation, Importing module, Math module, Random module, Packages.

UNIT – IV:

Composition: Input-Output-Printing on screen, Reading data from keyboard, Opening and closing file Reading and writing files, Functions.

Exception Handling: Exception, Exception Handling, Except clause, Try? Finally clause, User Defined Exceptions

UNIT – V:

OOPs Concept: Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding, Regular expressions- Match function, Search function, Matching VS Searching, Modifiers, Patterns.

Multithreading: Thread, Starting a thread, Threading module, Synchronizing threads.

CGI: Introduction, Architecture, CGI environment variable, GET and POST methods, Cookies, File upload.

UNIT – VI:

Database: Introduction, Connections, Executing queries, Transactions Handling error,

Networking: Socket, Socket Module, Methods, Client and server, Internet modules, Sending email.

TEXT BOOKS:

1. Learning Python, David Ascher and Mark Lutz, 2nd Edition, O'Relly, 2003

REFERENCES:

1. Python Programming: An Introduction to Computer Science, John M. Zelle, 2nd Edition, Kindle Edition
2. Python Essential Reference, David M. Beazley, 4th Edition, Developer's Library

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech.	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1IT07) INTRODUCTION TO DATA ANALYTICS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To be exposed to conceptual framework of big data
- To understand different techniques of data analysis
- To be familiar with concepts of data streams
- To be exposed to item sets, clustering, frame works and Visualization

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand big data fundamentals
CO-2: Learn various data analysis techniques
CO-3: Implement various data streams
CO-4: Understand item sets, clustering, frame works & Visualizations

UNIT – I:
Introduction to Big Data: Introduction to Big Data Platform – Challenges of Conventional systems – Web data – Evolution of Analytic scalability, analytic process and tools, Analysis vs Reporting – Modern data analytic tools,
Statistical Concepts: Sampling distributions, resampling, statistical inference, prediction error.

UNIT – II:
Data Analysis: Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and Kernel methods
Analysis of Time Series: Linear systems analysis, nonlinear dynamics – Rule induction –
Neural Networks: Learning and and Generalisation, competitive learning, Principal component analysis and neural networks
Fuzzy Logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.

UNIT – III:
Mining Data Streams: Introduction to Streams Concepts – Stream data model and architecture – Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a Window – Decaying window – Real time Analytics Platform (RTAP) applications – case studies – real time sentiment analysis, stock market predictions.

UNIT – IV:
Frequent Itemsets and Clustering: Mining Frequent itemsets – Market based Modeling – Apriori Algorithm – Handling large data sets in Main Memory – Limited Pass Algorithm – Counting frequent itemsets in a Stream – Clustering Techniques – Hierarchical – K-Means.

UNIT – V:

Clustering high dimensional data – CLIQUE and ProCLUS – Frequent pattern-based clustering methods – Clustering in non-Euclidean space – Clustering for streams and Parallelism.

UNIT – VI:

Frameworks and Visualization: MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – S3 – Hadoop Distributed file systems – Visualizations – Visual data analysis techniques,

Interaction Techniques: Systems and Applications

TEXT BOOKS:

1. Intelligent Data Analysis, Michael Berthold, David J. Hand, Springer, 2007
2. Mining of Massive Datasets, Anand Rajaraman and Jeffrey David Ullman, Cambridge University Press, 2012

REFERENCES:

1. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks, John Wiley & Sons, 2012
2. Big Data Glossary, Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, Pete Warden, O'Reilly, 2011
3. Data Mining Concepts and Techniques, Jiawei Han, Micheline Kamber, 2nd Edition, Elsevier, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech.	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CS11) FUNDAMENTALS OF COMPUTER ALGORITHMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To reinforce algorithms analysis methods
- To ability to analyse running time of an algorithm
- To understand different algorithm design strategies
- To familiarity with an assortment of important algorithms

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply algorithm design techniques and concepts to solve given engineering problem

CO-2: Analyze running times of algorithms using asymptotic analysis

CO-3: Develop efficient algorithms for computational tasks

CO-4: Computing complexity measures of algorithms

UNIT – I:

Introduction: Characteristics of algorithm. Analysis of algorithms: Asymptotic analysis of complexity bounds – best, average and worst-case behaviour; Performance measurements of Algorithm, Time and space trade-offs.

UNIT – II:

Divide and Conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication. Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

UNIT – III:

Greedy Method: General method, applications-Job sequencing with deadlines, 0/1 knapsack problem, Minimum cost spanning trees, Single source shortest path problem, Huffman Codes.

UNIT – IV:

Dynamic Programming-I: General method, Principle of optimality, applications-Multistage graphs, Matrix chain multiplication, Optimal binary search trees.

UNIT – V:

Dynamic Programming-II: 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem, Reliability design.

UNIT – VI:

Backtracking: General method, applications- N-Queen problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles.

TEXT BOOKS:

1. Fundamentals of Computer Algorithms, E. Horowitz et al, Galgotia Publications

2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Lieserson, Ronald L. Rivest and Clifford Stein, 4th Edition, MIT Press/McGraw-Hill

REFERENCES:

1. Algorithm Design, Jon Kleinberg and Eva Tardos, 1st Edition, Pearson
2. Algorithm Design: Foundations, Analysis and Internet Examples, Michael T. Goodrich and Roberto Tamassia, 2nd Edition, Wiley
3. Algorithms – A Creative Approach, Udi Manber, 3rd Edition, Addison-Wesley, Reading, MA
4. Introduction to the Design and Analysis of Algorithms, Anany Levitin, 3rd Edition, Pearson Publications

GENERAL

PROFESSIONAL ETHICS AND HUMAN VALUES

Ethics is a necessary and listed Graduate Attribute for all engineers according to the Washington Accord. As engineers deal with the society and provide for the society, it is important that the ethical concerns pertaining to technology are well-understood and addressed. Human Values form the basis for all Ethics and ethical theories help resolve professional dilemmas too. This course aims to create an appreciation for normative and applied ethics with special focus on professionalism and technology education and practice. Given the diverse set of roles an engineer or computer scientist may play in the society, there is an inherent societal need for engineers, technologists, and computer scientists to be ethical. The formative years of students of engineering are the best time to impress upon them the practical importance and application aspects of ethics. The curriculum is designed to include an inherent appreciation for the Indian Ethos and cover a wide variety of topics with suitable case studies and examples all through, so as to enable the learners to find practical contexts in global and contemporary careers of their future. The course also leads to attaining two other Graduate Attributes majorly, along with Ethics, *viz.* Engineer and Society, and Lifelong Learning.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1HS01) PROFESSIONAL ETHICS AND HUMAN VALUES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To emphasize on the importance of ethics for engineers and computer scientists
- To provide a toolkit for ethical behaviour in personal and professional settings
- To relate the profession of engineering to sociocultural as well as ethical and moral contexts in India and globally
- To develop more socially conscious engineers who create and conceive a better society and a better world without sacrificing or ignoring public good

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Distinguish morals, values, and ethics in Indian and global contexts
CO-2: Resolve moral and ethical dilemmas through ethical inquiries and appropriate ethical theories
CO-3: Realize the professional role of engineers in society and the support available in creating safe solutions for the society focusing on public welfare
CO-4: Conduct themselves ethically in various roles that present themselves in professional and business environments

UNIT – I:
Motivation and Introduction to Human Values: Motivation to study ethics in engineering with justifying case studies, historical events, and current affairs; Morals, Values, and Ethics – Definitions; Moral Judgement vs. Value Judgement; Moral Character and Moral Autonomy – Conscientiousness, Integrity, Empathy as basic building blocks; The Golden Rule; Maslow's Theory of Needs; Universal Human Values and Theories; Conventional and Constitutional Values in Indian Ethos; Anomie vs. Civic Virtue as a foundation for an ideal society; Ethics as a basis of legal framework; Privacy and Confidentiality – Increasing emphasis in personal and professional lives, technological considerations and examples; Profession, Professionalism – Definitions, Engineering as a Profession

UNIT – II:
Ethics, Ethical Theories, and Professionalism: Ethics through Spirituality, Religion, and beyond; Indian Philosophy and Ethos, ancient to modern – Family System, Ethical Pluralism, Unity in Diversity; Ethics as application of values and as moral philosophy – Kohlberg's theory vs. Gilligan's theory of moral development leading to ethics, examples; Moral and Ethical Dilemmas – Definition, Causes, Case Studies and Examples; Resolution of Ethical Dilemmas through Ethical Inquiries – Normative, Conceptual, and Factual Inquiries, Classification of Ethics by Character and

Conduct – Consequentialism/ Utilitarianism, Deontological Ethics, Virtue Ethics and Theories, Rights Theories; Ethical Frameworks and examples; Practical application of ethical theories for decision-making in personal life

UNIT – III:

Professionalism, Engineering in the Societal Context: Professionalism – Professional Traits, Rights, Responsibilities, Roles, Virtues; Business Ethics; Engineering as Social Experimentation – Context with examples, Comparison with standard experiments, Application of Ethical Inquiries to gain knowledge and to gather relevant information, Responsibility of Experimenters, Accountability and Answerability, Consensus and Need for Informed Consent – how to address exceptions; Responsible Innovation – Social Context of Innovation, Responsible Research and Innovation, Data Privacy and Protection of Individual Rights, being Ethical by Design; Trust in the context of professionalism – confidentiality, non-disclosure agreements (NDA); Intellectual Property (IP) – IP Rights (IPR) as Professional Rights, Law, Moral Rights and Economic Rights, Patenting; Diverse roles of Engineers as Professionals – Manager, Leader, Consultant, and Expert Witness

UNIT – IV:

Professional Ethics, Ethics at Workplace and Roles of Engineers: Overview of Organizational Behaviour; Collegiality, Loyalty, Trust in professional context; Respect for Authority vs. Moral Autonomy, Moral Responsibility; Organizational context of Ethics – Minor, interpersonal, severe, organizational workplace deviances; Occupational Crime, Culpable mistakes, Collateral damage; Gifts and bribes; Industrial Ethics for non-professionals; Code of ethics and Code of Conduct – Role of professional societies in guiding, promoting, and protecting professionals and professions, Examples of common professional societies in Engineering and Science; Decision-making in professional context – Choosing the right guidance, choosing the right ethical theory; Conflicts in profession and at workplace - Employee Relations and Discrimination, Conflict of Interest, Conflict Management and Resolution, Framework for Conflict Resolution; Multinational Companies and Corporates – Work Culture and Respect for Diversity and Pluralism; Employee Rights vs. Professional Rights; Whistleblowing – Social, Organizational, and Legal context with examples

UNIT – V:

Public Welfare, Safety & Risk: Impact of engineering activities and technology on Public Welfare; Ethical Concerns of Public welfare in the context of Emerging Technologies – Artificial Intelligence, Machine Learning, Internet of Things, Cybersecurity and Cybercrime; Issues of Public Concern – Informed Consent, Health and environmental aspects, data security; Safety and Risk – Definitions; Risk Assessment – Known and Unintended consequences, Risk-Benefit Analysis, Reducing Risk, Optimum Level of Safety, Capability Curves, Safe Exit; Learning from the Past – Case Studies in Ethics Context: Titanic, Bhopal, Chernobyl; Environmental Ethics and Sustainable Development Goals; Computer Ethics and various Technology Ethics; Ethics in the context of War and Weapon Development; Ethics and Economics – Fair

Trade, Capitalism vs. Communism, Developed vs. Developing vs. Underdeveloped economies

UNIT – VI:

Ethics for Lifelong Learning: Ethics in the context of Globalization; Moral Character and Ethical Leadership – Case Studies and Examples of success and failure; Overview and comparison of different schools of thought, comparison of the works of pioneering philosophers and social scientists – Immanuel Kant, John Rawls, Martin Heidegger, Swami Vivekananda, Jiddu Krishnamurti, Dr. Abdul Kalam, *etc.*; Impact of Ethical and Unethical Behaviour in personal and professional lives, developing and maintaining ethical behaviour, threats to moral autonomy and how to continue to be ethical in personal and professional lives

TEXT BOOKS:

1. Ethics in Engineering, Mike W. Martin, Roland Schinzinger, McGraw Hill Education, 2017 (ISBN: 978-9339204457)
2. Business Ethics: An Indian Perspective, A. C. Fernando, K. P. Muralidheeran, E. K. Satheesh, Pearson Education, 2019 (ISBN: 978-9353437442)
3. Professional Ethics, R. Subramanian, Oxford University Press, 2017 (ISBN: 978-0199475070)

REFERENCES:

1. Engineering Ethics: Concepts & Cases, Charles E. Harris, Jr., Michael S. Pritchard, Michael J. Rabins, Cengage Learning, 2012 (ISBN: 978-8131517291)
2. Classical Indian Ethical Thought: A Philosophical Study of Hindu, Jaina and Bauddha Morals, Kedar Nath Tiwari, Motilal Banarsidass Publishers, 2017 (ISBN: 978-8120816084)
3. The Manual for Indian Start-Ups, Dalai Lama, Ethics for the Whole World 978-9351360803 Vijay Kumar Ivaturi et al., Penguin Random House India, 2017 (ISBN: 978-0143428527)
4. To Be Human, Jiddu Krishnamurti, Shambhala, 2000 (ISBN: 978-1570625961)
5. On Ethics and Economics, Amartya Sen, Oxford India, 1999 (ISBN: 978-0195627619)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VI Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1HS02) ENTREPRENEURSHIP

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To motivate the engineers to inculcate the skills thereof in any professional role and to consider intrapreneurship or entrepreneurship as career choices for personal and societal growth
- To impart lean management principles and practices to plan, execute, and convert one's own idea into a sustainable business model
- To gain practical knowledge to design one's own lean startup
- To identify and avoid the potential pitfalls in validation, design, production, and marketing phases of an innovative product or service

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Discover societal problems as entrepreneurial opportunities and ideate to develop solutions through systematic and creative approaches to innovation and business strategy

CO-2: Apply lean methodology to startup ideas using Business Model Canvas and Lean Canvas and be able to create Business Plan

CO-3: Validate ideas, design, production, and marketing systematically using techniques such as 5 Whys, Innovation Accounting, Value and Growth Propositions

CO-4: To strategize during ideation, production, market research, marketing and facing competition

UNIT – I:

Entrepreneurial Skills and Opportunities : Role of Entrepreneurs in Indian and World Economy; Entrepreneurship as a career for engineers, scientists, and technologists; Personality and Skill Set of an Entrepreneur; Need for Ethics and Empathy for Entrepreneurs; Stories of Successful and Failed Enterprises; Current Business Trends; Entrepreneurial Management vs. Corporate Management – Roles and Scope; Concepts of Intrapreneurship, Social Entrepreneurship, Technopreneurship, Studentpreneurship; Opportunities in Telangana State and India – incubators, schemes, accelerators

UNIT – II:

Introduction to Lean Startup Methodology: Overview, Principles of Lean Startup, Lean vs. Traditional Startup; Vision-to-Steering, Start-Define-Learn-Experiment, Leap-Test-Measure-Pivot, Build-Measure-Learn

UNIT – III:

Business Model Concepts: Components of Business Plan; Business Model Canvas (BMC); Lean Canvas (LC); Pitch Deck; Elevator Pitch; Financial Aspects – Financing, Funding Stages, Inflows, Outflows; Market Research and Marketing

UNIT – IV:

Building Your Business Model: Desirability, Feasibility, and Viability; Minimum Viable Product (MVP), Proof of Concept (PoC), Prototype; Early Adopters; Value Proposition; Overview of opportunities in India – Financing and Support Schemes, Online and Offline Resources, Entrepreneurial Networks

UNIT – V:

Evaluating Your Business Model: Three Learning Milestones of Innovation; Root Cause Analysis (RCA) through 5 Whys; Pivot or Persevere; The Engines of Growth: Sticky, Viral, and Paid; Kan-ban Diagram for Project Planning and Resource Allocation

UNIT – VI:

Strengthen Your Business Model: Why startups fail? Value and Waste; Design Thinking for Business; Analogs and Antilogs; Paralysis by Analysis and Extinct by Instinct; The three A's: Actionable, Accessible, and Auditable Metrics and Vanity Metrics

TEXT BOOKS:

1. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Eric Ries, Penguin Portfolio, 2015 (ISBN: 978-0670921607)
2. Entrepreneurship, Robert D. Hisrich, Michael P. Peters and Dean A. Shepherd, Tata McGraw Hill, 11th Ed., 2020 (ISBN: 978-9390113316)
3. Entrepreneurship Simplified: From Idea to IPO, Ashok Soota, S R Gopalan, Penguin Random House India, 2016 (ISBN: 978-0670088959)

REFERENCES:

1. Measure What Matters: OKRs: The Simple Idea that Drives 10x Growth, John Doerr, Penguin Portfolio, 2018 (ISBN: 978-0241348482)
2. Entrepreneurship Development and Business Ethics, Abhik Kumar Mukherjee, Shaunae Roy, Oxford University Press, 2019 (ISBN: 978-0199494460)
3. The Manual for Indian Start-Ups, Vijay Kumar Ivaturi et al., Penguin Random House India, 2017 (ISBN: 978-0143428527)
4. Social Entrepreneurship in India: Quarter Idealism and a Pound of Pragmatism, Madhukar Shukla, SAGE Publications India Pvt Ltd, 2020 (ISBN: 978-9353882372)
5. Entrepreneurship: A South Asian perspective. Donald F Kuratko, T.V Rao. Cengage Learning, 2012

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1HS03) PERSONALITY DEVELOPMENT AND PUBLIC SPEAKING

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To develop skills and techniques for Effective Communication and Public Speaking
- To develop Leadership qualities and increase Self – confidence
- To get along with people and Team-Building
- To enhance career opportunities by Goal setting
- To develop an acceptable PERSONALITY

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Communicate better and speak with confidence
CO-2: Exhibit Leadership qualities and increased Self – confidence
CO-3: Work towards Team-Building
CO-4: Use career opportunities by Goal setting
CO-5: Acquire a forceful personality to maintain a pleasant relationship between the seniors and subordinates and other stakeholders

UNIT – I:
EFECTIVE COMMUNICATION
i. Fundamentals of Effective Communication
ii. How to sell your ideas
iii. Communication within Industry (awareness of motivation, ego states, games, etc.)
iv. Guidelines on: Listening, Reading and Writing
v. Non-verbal Communication (Body Language)
vi. Barriers of Communication

UNIT – II:
PUBLIC SPEAKING (SPEECH COMMUNICATION)
i. How to develop courage and self-confidence
ii. Speech purposes, preparation patterns and outlining of speech
iii. Fundamentals and secrets of good delivery
iv. How to make your meaning clear and convince an audience / client
v. How to close effectively and get action?
vi. How to participate in conferences, group discussions and office meetings

UNIT – III:
PERSONALITY DEVELOPMENT -1
i. Leadership - qualities of a successful leader ; Leadership Styles; Leadership in Administration; Problem-solving & Decision-making
ii. Group Dynamics and Team Building
iii. Importance of groups in organization; Interactions in group, Group Decision Taking, Team Building, Interaction with the Team, Building a good team

UNIT – IV:
PERSONALITY DEVELOPMENT -2

i. Interpersonal Relations- Introduction; Transactional Analysis in communication Awareness of Ego states and their application in communication
ii. Conflict Management- Introduction & Causes of Conflict; Managing Conflict

UNIT – V:
PERSONALITY DEVELOPMENT -3

i. Positive Attitude & Ways to develop positive attitude
   Self Esteem & Confidence Building
ii. Motivation- Importance of self-motivation;
iii. Stress -Causes of Stress & Impact of Stress; Managing Stress

UNIT – VI:
PERSONALITY DEVELOPMENT -4

i. Goal Setting-Meaning; Short, medium and Long Term Goals;
   Importance of Goal setting & Steps for Goal Setting
ii. Creativity-Meaning; Barriers to Creativity & Steps to stimulate Creativity
   Understanding and Importance of Human Values; Ideals in Life; Becoming a Role Model
iii. Time Management - Time as a Resource; Techniques for better Time Management.

TEXT BOOKS:

1. Advance Speaking Skills, Jeremy Harmar & John Arnold, Essex, Longman Group Limited, 1978
2. Developing Soft Skills, Sherfield, R.M., Montgomery, R.J., Moody, P.G. 4th Edition, Pearson, 2010
3. Personality Development and Soft Skills, Barun K. Mitra, Oxford University Press, 2016

REFERENCES:

1. Body Language: A Guide for Professionals, Hedwig Lewis, Response Books (a division of Sage Publications India, Pvt. Ltd.,) New Delhi, 1998
2. Emotional Intelligence, Daniel Goldman, Bantam Books, 1995
3. Personality Development, Rajiv Mishra, Rupa & Co., 2004

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VIII Semester	L	T/P/D	C
	3	0	3

(19OE1HS04) FOREIGN LANGUAGE – FRENCH

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To communicate verbally in a simple way by asking and responding to simple questions related to everyday language needs
- To read and comprehend different kinds of texts (notices, informal letters, catalogues, menus etc.)
- To write clear, concise, and correct sentences and paragraphs on familiar topics.
- To recognize and use basic syntax and structures in French including articles, prepositions and connecting words as well as master basic vocabulary

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Use vocabulary contextually and effectively
CO-2: Use reading skills to comprehend different kinds of texts
CO-3: Understand everyday expressions dealing with simple and concrete everyday needs, in clear, slow and well-articulated speech and manage very short mini dialogues /conversations
CO-4: Demonstrate basic competence in Written French including grammar, sentence and paragraph structure, coherence

UNIT – I: Introduce oneself and introduce someone:
Reading: Read and understand an introduction about someone
Grammar: Question words, Subject verb agreement, Mas/fem and prepositions with cities and countries
Vocabulary: professions, nationalities, countries numbers, days of the week and verbs
Writing: Build basic sentences and Write about oneself
Life Skills: Greetings, Formal and Informal way of asking questions

UNIT – II: Express likes and dislikes and Talk about your locality:
Reading: Read and understand description of a place
Grammar: Articles, prepositions, possessive adjectives, basic connecting words such as **"like, and, but",** and Negation
Vocabulary: Adjectives, verbs of preference, different places, and basic vocabulary on leisure and sports activities.
Writing: Write about hobbies and pastimes
Life Skills: Conversation fillers

UNIT – III: Take / Fix an appointment with someone:
Reading: Understand propositions and counters

Grammar: How to say time, Interrogative adjectives
Vocabulary: Irregular verbs, days of the week, Fixed expressions with Etre and Avoir and expressions to ask for appointment or refuse/accept a proposed time
Life Skills: Telephone etiquette and colloquial expressions in French

UNIT – IV: Talk about your routine / Invite someone and Accept or refuse an invitation
Reading: Read and understand an invitation on basic info: date and time, venue, occasion, type of invitation etc.
Grammar: Question word Why, Connecting word "because", partitive and contracted articles, reflexive verbs
Vocabulary: Expressions to propose, thank / apologize and accept or refuse an invitation,
Writing: Respond to an invitation (Accept or refuse)
Life Skills: At the table

UNIT – V: Ask for information (timings, price, etc) and Ask for/ Give Directions
Reading: Understand signboards and instructions
Grammar: Imperative mode and prepositions.
Vocabulary: Directions, Expressions to ask information or seek precision
Writing: Give instructions and fill a form

UNIT – VI: Vacation (plan vacation, choose destination, visit, and appreciate)
Reading: Read and understand travel brochures for basic info on offers, locations, touristic attractions hotels and so on
Grammar: demonstrative adjectives and near future tense
Vocabulary: Weather forecast, modes of transport, and vacation activities
Writing: Write a post card
Life Skills: Types of vacation in France

TEXT BOOKS:

1. Painless French, Carol Chitin, M.S., Lynn Gore, Barrons Educational Series, 2016 (ISBN: 978-1438007700)
2. Language Learning University, French: Learn French for Beginners Including French Grammar, French Short Stories and 1000+ French Phrases, Createspace Independent Publications, 2018 (ISBN: 978-1726415002)
3. Language School, French Language for Beginners, 2019 (ISBN: 978-1700175700)

REFERENCES:

1. Practice Makes Perfect: Complete French All-in-One, Annie Heminway, McGraw-Hill Education, 2018 (ISBN: 978-1260121032)
2. Easy French Step-by-Step, Myrna Bell Rochester, McGraw-Hill Education, 2008 (ISBN: 978-0071453875)
3. Contacts: Langue et Culture Françaises, Jean-Paul Valette, Rebecca Valette, Wadsworth Publishing Co. Inc., 2012 (ISBN: 978-1133309581)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech.	L	T/P/D	C
	3	0	3

(19OE1CE09) SMART CITIES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand smart city basic concepts, global standards, and Indian context of smart cities
- To explain smart community, smart transportation and smart buildings
- To understand Energy demand, Green approach to meet Energy demand and their capacities
- To identify Smart Transportation Technologies in cities and concepts towards smart city

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain and elaborate smart city concepts and their international and national standards
CO-2: Conceptualize smart community, transportation and building concepts
CO-3: Develop and calibrate energy demand and their capacity limits
CO-4: Predict the various smart urban transportation systems and the transition from existing city towards a smart city

UNIT – I:
Introduction to Smart Cities: Introduction to Smart Cities - Understanding Smart Cities -Dimensions of Smart Cities – World urbanization, Global Experience of Smart Cities, Smart City case studies-Indian scenario - India "100 Smart Cities" Policy and Mission.

UNIT – II:
City as a System of Systems: Systems thinking – Developing a smart city approach – Core elements of a smart city – Relevant open data for a smart city – Sustainability – Privacy and Ethics – Energy systems for smarter cities.

UNIT – III
Smart Cities Planning and Development: Introduction to Smart Community; Smart community concepts: Concept of Smart Community - Smart Transportation - Smart Building and Home Device - Smart Health - Smart Government - Smart Energy and Water - Cybersecurity, Safety, and Privacy; Internet of Things, Blockchain, Artificial Intelligence, Alternate Reality, Virtual Reality.

UNIT – IV:
Smart Urban Energy Systems: Conventional vs. Smart, City components, Energy demand, Green approach to meet Energy demand, Index of Indian cities towards smartness – a statistical analysis -Meeting energy demand through direct and

indirect solar resources- Efficiency of indirect solar resources and its utility, Capacity limit for the indirect solar resources- Effectiveness in responsive environment in smart city; Smart communication using green resources- **Relevant case studies**

UNIT – V:

Smart Transportation Systems: Smart Transportation Technologies - Driverless and connected vehicles - ride sharing solutions - The "improve" pathway - The "shift" pathway – Smart Roads and Pavement systems – Relevant case studies

UNIT – VI:

Future of Smart Cities: The transition of legacy cities to Smart - Right transition process - the benefit of citizens, cities have to adopt effective management and governance approaches-factors in the transition phase of legacy cities to Smart cities and their managerial implications.

TEXT BOOKS:

1. Internet of Things in Smart Technologies for Sustainable Urban Development, G. R. Kanagachidambaresan, R. Maheswar, V. Manikandan, K. Ramakrishnan., Springer, 2020
2. Society 5.0: A People-Centric Super-Smart Society, Hitachi-UTokyo Laboratory (H-UTokyo Lab), Springer, 2020
3. The Routledge Companion to Smart Cities, Katharine S. Willis, Alessandro Aurigi, Routledge International Handbooks, 2020

REFERENCES:

1. Smart Cities in Asia: Governing Development in the Era of Hyper-Connectivity Yu-min Joo, Yu-Min Joo, Teck-Boon Tan, Edward Elgar Pub, 2020
2. Urban Systems Design: Creating Sustainable Smart Cities in the Internet of Things Era, Yoshiki Yamagata, Perry P. J. Yang, Elsevier, 2020
3. Smart Cities and Artificial Intelligence: Convergent Systems for Planning, Design, and Operations, Christopher Grant Kirwan, Zhiyong Fu, Elsevier, 2020

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech.	L	T/P/D	C
	3	0	3

(19OE1EE05) TRENDS IN ENERGY SOURCES FOR SUSTAINABLE DEVLOPMENT

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand the role of sustainable energy
- To know components of solar PV and wind energy conversion systems
- To understand the principles of Biomass, geo-thermal and wave energy systems
- To learn various energy storage methods

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand various sources for sustainable energy
CO-2: Understand Solar Photo voltaic and wind energy systems
CO-3: Learnt the harnessing techniques of Biomass, geothermal and ocean energy
CO-4: Familiarize with energy storage methods

UNIT – I:
Introduction: Trends in energy consumption - Conventional and renewable sources, Energy sources and their availability, Energy Conservation status in India -need of new energies for sustainable development.

UNIT – II:
Fundamentals of Solar Radiation: Introduction-The Sun as Source of Energy, Extraterrestrial and Terrestrial Radiations, Spectral Power Distribution of Solar Radiation, instruments for measuring solar radiation and sunshine recorder.
Solar PV Conversion: The PV Cell-Crystalline Solar cells -Thin film and amorphous solar cells, Module, Array, Equivalent Electrical circuit- Open circuit voltage and Short circuit current, I-V, P-V Curves. Developments in efficient non silicon solar cells

UNIT – III:
Wind Energy: origin of winds-Global (or Planetary) Winds- Local Winds-Factors Affecting the Distribution of Wind Energy on the Surface of Earth, Wind Turbine – Types, construction of HAWT, VAWT, performance characteristics, Betz criteria.

UNIT – IV:
Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Biogas digesters, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.

UNIT – V:
Geothermal Energy: Resources, types of wells, methods of harnessing the energy

Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles.

Tidal and Wave Energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT – VI:

Energy Storage:

Electro Chemical Storage: lead-acid- nickel cadmium-nickel-metal-hydride and lithium type batteries-Principle of operation, Types, Advantages and disadvantages.

Non-Electric Storage: Methods of Energy storage –Pumped Energy Storage – Compressed air Energy Storage, Superconducting Magnet Energy Storage.

TEXT BOOKS:

1. Non-Conventional Energy Sources, G.D. Rai, 6^{th} Edition, Khanna Publishers, 2004
2. Non-Convention Energy Resources, B.H. Khan, 3^{rd} Edition, McGraw Hill, 2017

REFERENCES:

1. Renewable Energy Sources, Twidell & Weir, 3^{rd} Edition, CRC Press, 2015
2. Solar Energy, Sukhatme, 3^{rd} Edition, McGraw Hill, 2008
3. Non-Conventional Energy, Ashok V. Desai, Wiley Eastern, 1990

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B.Tech.	**L**	**T/P/D**	**C**
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(19OE1ME05) 3D PRINTING AND DESIGN

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the need and know about the applications of 3D Printing
- To understand the need of liquid and solid based 3D Printing systems
- To know about the laser-based 3D Printing systems and importance of CAD for 3D Printing
- To understand post-processing, inspection and testing involved in 3D Printing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize the importance of 3D Printing
CO-2: Explain the process involved in liquid and solid based 3D Printing Systems
CO-3: Explain about the laser-based 3D Printing systems and CAD for 3D Printing
CO-4: Plan post-processing techniques and perform inspection and testing in 3D Printing

UNIT – I:
Introduction: Introduction to 3D Printing, Classification, 3D Printing Process Chain, Materials for 3D Printing, Distinction between 3D Printing & Conventional Manufacturing.
Applications: Brief overview of applications in Aerospace, Automotive, Biomedical, Defense, Construction, Jewelry, Coin and Tableware Industry.

UNIT – II:
Liquid Based 3D Printing Systems: Introduction, Principle, Processes and Applications of Material Jetting and Stereolithography.

UNIT – III:
Solid Based 3D Printing Systems: Introduction, Principle, Processes and Applications of Fused Deposition Modeling (FDM) and Laminated Object Manufacturing (LOM).

UNIT – IV:
Powder Based 3D Printing Systems: Introduction, Principle, Processes and Applications of Selective Laser Sintering (SLS), Three-Dimensional Printing (3DP).

UNIT – V:
CAD for 3D Printing: CAD data formats, CAD model preparation, Part orientation and support generation, Overview of 3D Printing softwares like MAGICS and MIMICS only.

UNIT – VI:

Post Processing: Introduction, Post Processing Techniques like Support material removal, Cleaning, Sanding and Polishing.

Inspection: Introduction, Significance, Inspection techniques like Dimensional measurement along X, Y and Z axes, visual inspection of the surface finish (overall aesthetics and intact features), flatness or warp check, and FOD (foreign objects or debris) check.

TEXT BOOKS:

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W. Rosen, Brent Stucker, Springer, 2010
2. Rapid Prototyping: Principles and Applications, Chua C. K., Leong K. F., and Lim C. S., 3rd Edition, World Scientific, 2010

REFERENCES:

1. Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development, Liou L. W. and Liou F. W., CRC Press, 2007
2. Rapid Prototyping: Theory and Practice, Kamrani A. K. and Nasr E. A., Springer, 2006
3. Rapid Tooling: Technologies and Industrial Applications, Hilton P. D. and Jacobs P. F., CRC Press, 2000
4. Rapid Prototyping, Gebhardt A. Hanser, Gardener Publications, 2003

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B.Tech.	L	T/P/D	C
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(19OE1EC09) EMBEDDED SYSTEMS FOR IOT

COURSE PRE-REQUISITES: Programming through C

COURSE OBJECTIVES:

- To understand the basics of computing with embedded Systems
- To expose the students to various smart sensors
- To make the students familiar with the programming concepts of Embedded development board
- To understand the basics of Internet of Things and Cloud of things

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Familiarize with architectural and programming issues of Embedded Systems
CO-2: Select proper smart Sensor for a specific measurement application
CO-3: Analyze various protocols for Internet of Things
CO-4: Apply Internet of Things to different applications in the real world

UNIT – I:
Embedded System Design: Numbering and Coding Systems, Digital Premier, Inside the Computer
Embedded System: Definition, Characteristics of embedded computing applications, Design challenges, Requirements, Specification, Architecture design, Designing hardware and software components, system integration.

UNIT – II:
Smart Sensors & Applications: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation.

UNIT – III:
Sensors Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring.

UNIT – IV:
Micro Controller Board: Features of Arduino, Arduino components and IDE, Interfacing: Seven Segment Display, Pulse Width Modulation, Analog Digital Converter, Wireless connectivity to Arduino. Case study: From BT To WiFi: Creating WiFi Controlled Arduino Robot Car.

UNIT – V:

Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Deployment Templates, M2M, IoT vs M2M.

UNIT – VI:

Domain Specific Applications of IoT: IoT Design Methodology, Applications of IoT– Home, Health, Environment, Energy, Agriculture, Industry and Smart City.

TEXT BOOKS:

1. The 8051 Microcontroller: Programming, Architecture, Ayala & Gadre, 3rd Edition, Cengage Publications, 2008
2. Sensors and Transducers, D. Patranabis, 2nd Edition, PHI Learning Private Limited, 2013
3. Internet of Things: A Hands-On Approach, Vijay Madisetti, Arshdeep Bahga, Universities Press, 2015

REFERENCES:

1. Embedded Systems: Architecture, Programming and Design, 2nd Edition, TMH
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, 2nd Edition, 2005
3. Internet of Things with Raspberry Pi and Arduino, Singh R., Gehlot A., Gupta L., Singh B., Swain M., Boca Raton, CRC Press, 2020

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(19OE1CS09) ARTIFICIAL INTELLIGENCE – A BEGINNER'S GUIDE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand and analyze the basic concepts of artificial intelligence
- To identify, explore the complex problem-solving strategies and approaches
- To analyze the concepts of basic concepts of neural networks and learning process
- To explore and analyze the methodology used in machine learning and computer vision

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand and apply the basic concepts of artificial intelligence and its use cases. lives

CO-2: Explore the various search strategies and approaches for problem solving

CO-3: Correlate the fields related to AI, and articulate various learning paradigms

CO-4: Describe several issues and ethical concerns surrounding AI

UNIT – I:

Introduction to AI: What is AI-On Overview, History of AI, Applications and Examples of AI, AI Concepts, Terminology, Key fields of AI. AI Issues, Concerns, and Ethical Considerations.

UNIT – II:

AI as Search Process: On overview of Search Strategy. Types of Searches-Uninformed, Informed, Bidirectional search, Heuristic search. Local search, Local beam search, Adversarial Search.

UNIT – III:

AI as Knowledge Exploration: Introduction to Propositional Logic, Rules of Inference, First Order Logic (FOL) Syntax, Semantics, Entailment, Tools to represent knowledge.

UNIT – IV:

AI as a Learning Task: Introduction to Learning, Learning types -Supervised, Unsupervised, Reinforcement Learning, Machine learning, Deep Learning, The link between AI, ML, DL.

UNIT – V:

AI as Neural Networks: Introduction to biological neural networks. Link between biological neuron and artificial neuron. Architecture of artificial neural network, Types of Neural networks-single layer, multilayer, Back propagation networks.

UNIT – VI:

The Future of AI: Computer Vision - Seeing the World Through AI, Bots - Conversation as a Platform, AI and the society, AI in action-the Use Cases, Building AI Projects.

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall, 2010
2. Machine Learning, Tom M. Mitchell, M. C. Graw Hill Publications
3. Neural Networks-A Comprehensive Foundation, Simon Haykin, 2nd Edition, Pearson Education, 2004

REFERENCES:

1. Artificial Intelligence, Elaine Rich & Kevin Knight, 2nd Edition, TMH
2. Artificial Intelligence, A New Synthesis, Nils J. Nilsson, Elsevier
3. Artificial Neural Networks, Yegnanarayana B., PHI

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(19OE1CS10) BLOCKCHAIN TECHNOLOGY ESSENTIALS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce and get the technological overview of blockchain technologies
- To Study the foundation of Blockchain Technology and demonstrate the various types of Blockchain
- To explore the application area of Blockchain Technology
- To introduce smart contract, consensus algorithm and Security Mechanism
- Introduction to available platforms to implement Blockchain Technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and explore the Blockchain Technology
CO-2: Describe smart contract concepts
CO-3: Explore different types of Blockchain
CO-4: Develop the platforms to implement Blockchain Technology

UNIT – I:
Fundamental of Blockchain Part I: Introduction to Centralized, Decentralized and Distributed system, computer network peer to peer connection
Fundamental of Blockchain Part II: History of Blockchain, Various technical definitions of Blockchain. Generic elements of a blockchain: Block, Transaction, Node, Why It's Called "Blockchain", Characteristics of Blockchain Technology, Advantages of blockchain technology, Limitations of blockchain as a technology

UNIT – II:
Concept of Blockchain Technology Part I: Applications of blockchain technology, Tiers of blockchain technology Blockchain 0, Blockchain 1, Blockchain 2, Blockchain 3, Generation of Blockchain X, smart contract
Concept of Blockchain Technology Part II: Types of blockchain: Public blockchain, private blockchain, hybrid blockchain, examples of Public, private, hybrid blockchain and it merit and demerit.

UNIT – III:
Technical Foundations Part I: Component of block, Structure of Block chain, Technical Characteristics of the Blockchain, genesis block, Nonce
Technical Foundations Part II: Cryptography, Hashing, Distributed database, Consensus mechanisms, and basic of Cryptographic primitives, Technical Characteristics of Secure Hash Algorithms (SHA), Digital signature.

UNIT – IV:

Consensus Algorithm: Proof of work (PoW), Proof-of-Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of authority (PoA), Confidentiality, Integrity, Authentication, Permissioned ledger, Distributed ledger, Shared ledger, Fully private and proprietary blockchains, Tokenized blockchains, Tokenless blockchains, CAP theorem and blockchain

UNIT – V:

E-Governance and other contract enforcement mechanisms, Financial markets and trading, Trading, Exchanges, Trade life cycle, Order anticipators, Market manipulation.

Crypto Currency: Bitcoin, Bitcoin definition, Keys and addresses, Public keys in Bitcoin, Private keys in Bitcoin, Bitcoin currency units

UNIT – VI:

Implementation Platforms: Hyperledger as a protocol, Reference architecture, Hyperledger Fabric, Transaction Flow, Hyperledger Fabric Details, Fabric Membership, Fabric Membership

TEXT BOOKS:

1. Mastering Blockchain, Imaran Bashir, 2nd Edition, Packt
2. Blockchain Basic, Daniel Drescher, A Press

REFERENCES:

1. Blockchain For Dummies®, IBM Limited Edition, John Wiley & Sons, Inc

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(19OE1EI05) FUNDAMENTALS OF ROBOTICS AND DRONES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To classify by coordinate system and control system
- To acquire knowledge on different types Power Sources and Sensors
- To classify different types of Manipulators, Actuators and Grippers
- To acquire knowledge on kinematics and Vision systems used for different Robots
- To acquire knowledge on the basics of Drones

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire knowledge on different types of Power Sources (actuators) and Sensors, Manipulators, Actuators and Grippers
CO-2: Acquire knowledge on different applications of various types of robots
CO-3: Analyze the direct and the inverse kinematic problems and calculate the manipulator dynamics
CO-4: Acquire knowledge on the applications of Machine Vision in Robotics
CO-5: Acquire Knowledge on the basics of Drones

UNIT – I:
Basic Concepts & Fundamentals: An overview of Robotics, classification of Robots, Robot Components, Robot degrees of freedom, Robot Joints, Robot Coordinates, Robot reference frames, Programming modes, Robot Characteristics.

UNIT – II:
Sensors and Actuators:
Sensors: Sensors characteristics, Position sensors, velocity sensors, acceleration sensors, torque sensors, micro switches, lighten infrared sensors, touch and tactile sensors, proximity sensors, range finders.
Actuators: Characteristics of activating system, comparison of activating system Hydraulic devices, Pneumatic devices, electric motors, magneto-strictive actuators.

UNIT – III:
Manipulators and Grippers:
Grippers: Robot end effectors, Classification, drive system for Gripper, Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Adhesive Grippers, Hooks, Scoops and other Miscellaneous Devices, Gripper force Analysis and Gripper Design, Active and passive Grippers.

UNIT – IV:
Kinematics: Matrix representation of translational and Rotational motion – Homogeneous Transformation-DH representation of standard configuration Robots-Inverse Kinematics. Joint space vs. Cartesian space-Basics of Trajectory planning in joint and Cartesian space.

UNIT – V:

Robot Vision: Low level and High-level vision

Image acquisition, Illumination Techniques, Imaging Geometry, Some Basic Relationships between Pixels, Segmentation, Description, Segmentation and Description of 3-D Structures, Recognition, Interpretation.

UNIT – VI:

Basics of Drones: Theory behind how drones work, individual components that makeup a drone, basic concepts involved radio-controlled model flying, building a complete quad copter drone from scratch

TEXT BOOKS:

1. Introduction To Robotics: Analysis, Control, Applications, Wiley, Saeed B. Niku, 2nd Edition
2. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover, Nicholas G Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, McGraw Hill, 2012

REFERENCES:

1. Robotics Technology and Flexible Automation, Deb S. R., John Wiley
2. Robots and Manufacturing Automation, Asfahl C. R., John Wiley
3. Robotic Engineering–An Integrated Approach, Klafter. R. D., Chimielewski. T. A., Negin. M, Prentice Hall of India, New Delhi
4. Drones for Beginners, Udemy

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(19OE1IT08) FUNDAMENTALS OF CYBER SECURITY

COURSE PRE-REQUISITES: Basic Knowledge of Computers, Basic Knowledge of Networking and Internet

COURSE OBJECTIVES:
- To identify the key components of cyber security in network
- To describe the techniques in protecting Information security
- To define types of analyzing and monitoring potential threats and attacks
- To access additional external resources to supplement knowledge of cyber forensics and laws

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand, appreciate, employ, design and implement appropriate security technologies
CO-2: Demonstrate policies to protect computers and digital information
CO-3: Identify & Evaluate Information Security threats and vulnerabilities in Information Systems
CO-4: Understanding computer forensics and analyzing them

UNIT – I:
Introduction: Introduction to Cybersecurity, Cybersecurity objectives, Cybersecurity roles, Differences between Information Security & Cybersecurity, Cybersecurity Principles - Confidentiality, integrity, & availability, Authentication & nonrepudiation, The Trinity of IT Security (CIA), Computer Protocols, Cookies, The TCP/IP

UNIT – II:
Who are the cyber criminals, Classification of cybercrimes, E-mail Spoofing, Spamming, Cyber defamation, Internet Time Theft, Salami Attack/ Salami Technique, Data Diddling, Forgery, Web Jacking, Newsgroup Spam/ Crimes Emanating from Usenet Newsgroup, Industrial Spying/Industrial Espionage, Hacking, Online Frauds, Pornographic Offenses, Software Piracy, Computer Sabotage, E-mail Bombing/Mail Bombs, UseNet Newsgroup as the Source of Cybercrimes, Computer Network Intrusions, Password Sniffing, Credit Card Frauds, Identity Theft.

UNIT – III:
Cyber Offenses: How Criminals Plan Them: Introduction, Categories of Cybercrime, How Criminals Plan the Attacks, Reconnaissance, Passive Attacks, Active Attacks, Scamming and Scrutinizing Gathered Information, Attack (Gaining and Maintaining the System Access), Social Engineering, Classification of Social Engineering, Cyber stalking, Types of Stalkers, Cases Reported on Cyber stalking, How Stalking Works?, Real-Life Incident of Cyber stalking, Cyber cafe and Cybercrimes,

UNIT – IV:
Security Threats: Introduction to security threats-Virus, Worms, Trojan horse, Bombs, Trap Door, E-Mail Virus, Virus Life cycle, How virus works?, Malware, Network and

Services attack- Dos attacks, Types of Dos attacks, Methods of attacks, Examples of attacks-SYN flooding, TCP flooding ,UDP flooding ,ICMP flooding ,Smurf, Ping of death, Tear drop, Security threats to E-commerce-Electronic payment system, Credit card/Debit cards, Smart cards, E- money, Electronic Fund Transfer, E-commerce security System, Electronic Cash, Digital Signatures

UNIT – V:

Introduction to Computer Forensics: computer crimes, evidence, extraction, preservation, etc. Overview of hardware and operating systems: structure of storage media/devices; windows/Macintosh/ Linux -- registry, boot process, file systems, file metadata. Data recovery: identifying hidden data, Encryption/Decryption, Steganography, recovering deleted files. Digital evidence controls: uncovering attacks that evade detection by Event Viewer, Task Manager, and other Windows GUI tools, data acquisition, disk imaging, recovering swap files, temporary &cache files, Computer Forensic tools, Network Forensic. Computer crime and Legal issues: Intellectual property, privacy issues, Criminal Justice system for forensic, audit/investigative situations and digital crime scene, investigative procedure/standards for extraction, preservation, and deposition of legal evidence in a court of law.

UNIT – VI:

Fundamentals of Cyber Law: Evolution of the IT Act, Genesis and Necessity , Salient features of the IT Act, 2000, various authorities under IT Act and their powers, Penalties & Offences, amendments, Impact on other related Acts Cyber Space Jurisdiction - Jurisdiction issues under IT Act, 2000- Traditional principals of Jurisdiction - Extra-terrestrial Jurisdiction- Case Laws on Cyber Space Jurisdiction Sensitive Personal Data or Information (SPDI) in Cyber Law (a) SPDI Definition and Reasonable Security Practices in India (b) Reasonable Security Practices – International perspective

TEXT BOOKS:

1. Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunit Belpure, Wiley
2. Fundamentals of Cyber Security, Mayank Bhusan, Rajkumar Singh Rathore, Aatif Jamshed, BPB Publications
3. Cyber Law & Cyber Crimes, Advocate Prashant Mali, Snow White Publications, Mumbai

REFERENCES:

1. Computer Forensics and Cyber Crime: An Introduction, Marjie T. Britz, 3rd Edition, 2013
2. Digital Forensics with Open-Source Tools. Cory Altheide and Harlan Carvey, Elsevier, 2011(ISBN: 978-1-59749- 586-8)
3. Network Forensics: Tracking Hackers Through Cyberspace, Sherri Davidoff, Jonathan Ham Prentice Hall, 2012
4. Cyber Law in India, Farooq Ahmad, Pioneer Books
5. Information Technology Law and Practice, Vakul Sharma, Universal Law Publishing Co. Pvt. Ltd.

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(19OE1IT09) FUNDAMENTALS OF DATA SCIENCE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration
- To exploring data analysis, predictive modeling, descriptive modeling, data product creation, evaluation, and effective communication
- To understand the basic knowledge of algorithms and reasonable programming experience and some familiarity with basic linear algebra and basic probability and statistics
- To identify the importance of recommendation systems and data visualization techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data
CO-2: Discuss the significance of exploratory data analysis (EDA) in data science and to apply basic tools (plots, graphs, summary statistics) to carry out EDA
CO-3: Apply basic machine learning algorithms and to identify common approaches used for Feature Generation
CO-4: Analyze fundamental mathematical and algorithmic ingredients that constitute a Recommendation Engine and to Build their own recommendation system using existing components

UNIT – I:
Introduction: What is Data Science? - Big Data and Data Science hype – and getting past the hype - Why now? – Datafication - Current landscape of perspectives - Skill sets needed - Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model - Intro to R

UNIT – II:
Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - **Case Study:** Real Direct (online real estate firm) - Three Basic Machine Learning Algorithms-Linear Regression - k-Nearest Neighbors (k-NN) - k-means

UNIT – III:
One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam

UNIT – IV:
Data Wrangling: APIs and other tools for scrapping the Web - Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user

(customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests

UNIT – V:

Recommendation Systems: Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis - Exercise: build your own recommendation system - Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighbourhood properties in graphs

UNIT – VI:

Data Visualization: Basic principles, ideas and tools for data visualization 3 - Examples of inspiring (industry) projects - Exercise: create your own visualization of a complex dataset - Data Science and Ethical Issues - Discussions on privacy, security, ethics - A look back at Data Science - Next-generation data scientists

TEXT BOOKS:

1. Doing Data Science, Straight Talk From The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014
2. Mining of Massive Datasets v2.1, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, Cambridge University Press, 2014
3. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, 2013 (ISBN 0262018020)

REFERENCES:

1. Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani and Jerome Friedman, 2nd Edition, 2009 (ISBN 0387952845)
2. Foundations of Data Science, Avrim Blum, John Hopcroft and Ravindran Kannan
3. Data Mining and Analysis: Fundamental Concepts and Algorithms, Mohammed J. Zaki and Wagner Miera Jr. Cambridge University Press, 2014
4. Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, 3rd Edition, 2011 (ISBN 0123814790)

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(19OE1AE05) INTRODUCTION TO ADVANCED VEHICLE TECHNOLOGIES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the layout of an automobile and functionalities chassis elements
- To provide the concepts of automotive electrical systems and electric & hybrid vehicles
- To present various intelligent automotive systems and levels of vehicle autonomy

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the functionalities of automotive systems and subsystems
CO-2: Discuss the concepts of automotive electrical systems and electric & hybrid vehicles
CO-3: Describe various intelligent automotive systems and levels of vehicle autonomy

UNIT – I:
Introduction: Classification of automobiles, layout of an automobile and types of bodies.
Automotive Chassis: Introduction to chassis systems - engine, cooling, lubrication, fuel feed, ignition, electrical, driveline - clutch, transmission, propeller shaft, differential, axles, wheels and tyres, steering, suspension and braking.

UNIT – II:
Engine: Working principle of four stoke and two stroke SI and CI engines, fuel system – layout of petrol and diesel fuel systems, electronic fuel injection - multi-point fuel injection, gasoline direct injection, common rail direct injection.

UNIT – III:
Electrical System: Simple automotive wiring diagram and components of electrical system, starting system – starter circuit, standard Bendix and over running clutch drive, charging system – alternator, cut-outs and regulators, ignition system - conventional and electronic ignition system.

UNIT – IV:
Electric and Hybrid Vehicles: Electric vehicle – Layout, components, configurations, advantages and limitations. Hybrid vehicle - Concepts of hybrid electric drivetrain based on hybridization and powertrain configuration, architecture of series, parallel and series-parallel hybrid electric drivetrains, modes of operation, merits and demerits.

UNIT – V:
Intelligent Vehicle Systems: Automotive navigation, night vision, head-up display, airbag, seat belt tightening system, immobilizers, adaptive cruise control, forward collision warning, lane departure warning and anti-lock braking system.

UNIT – VI:

Autonomous Vehicles: Levels of automation, research, challenges, commercial development, sensor systems, sensor suits, environmental challenges, graceful degradation, V2V and V2I communication, sharing the drive, integrity, security, verification and policy implications.

TEXT BOOKS:

1. Advanced Vehicle Technology, Heinz Heisler, Butterworth Heinemann, 2002
2. Intelligent Vehicle Technologies: Theory and Applications, Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann, Oxford, 2001
3. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, CRS Press, 2004

REFERENCES:

1. Automotive Mechanics, Giri N. K., Khanna Publications, 2006
2. Automotive Electrical Equipment, Kohli P. L., Tata McGraw Hill Co., Ltd., New Delhi, 1975
3. Electric and Hybrid Vehicles – Design Fundamentals, Iqbal Husain, CRC Press, 2010
4. Autonomous Vehicle Technology-A Guide for Policymakers, James M. Anderson, Nidhi Kalra, Karlyn D. Stanley, Paul Sorensen, Constantine Samaras, Oluwatobi A. Oluwatola, RAND Corporation, Santa Monica, Calif., 2016

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(19OE1CS12) INTRODUCTION TO APPLICATION DEVELOPMENT WITH C#

COURSE OBJECTIVES:

- To create an integrated development environment for object-oriented C# programs
- To build website menus with CSS and JavaScript
- To relate programming language constructs and problem solving techniques
- To analyze and Apply modifications to C# programs that solve real-world problems

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand the fundamentals of HTML5 and define the styles for web pages using CSS

CO-2: Create web pages and add dynamic behavior to web pages using Javascript

CO-3: Communicate with the database using SQL

CO-4: Develop a simple CUI [Character User Interface] based application using C# & SQL

UNIT – I:

Computer, Software Engineering Fundamentals & OOP: Introduction to Computer Basics, Basics of Network, Networking Levels and Layers and Protocols, Protocol Stacks, Networking and Internet Service, Software Engineering Fundamentals - Overview of Requirement Analysis, Overview of Software Design, Overview of Software Implementation, Overview of Testing, Overview of Software Maintenance, Overview of Configuration management and version

Control, Agile Basics, OOP - Object Oriented Concepts, Objects and Classes, Principles in Object-

Oriented technology

Usecase: Create a class for BankAccount

UNIT – II:

HTML & CSS: Introduction to Web Technology, Introduction to HTML5, HTML5 Elements, Semantic Elements, Table, List, Working with Links, Image Handling, Form-Input Elements, HTML5 Form elements, HTML5 Attributes, Video & Audio, iframes, CSS - Introduction to CSS3, CSS Syntax, CSS Styling, Text and Fonts properties, CSS Selectors, Different color schemes, CSS Borders, CSS Margins, CSS Backgrounds

Use Case: Create a website for college

UNIT – III:

JavaScript, RDBMS Concepts and SQL: JavaScript basics, Functions in Javascript, Javascript validation, Events, Javascript event handling, JavaScript Strings, JavaScript Dates, Array in Javascript, Document Object Model (Window, Frame, Navigator Objects), Working with Document Object (Its Properties and methods, Cookie handling), Introduction to RDBMS Concepts, Introduction to SQL, Creating and Managing Tables, Data Manipulation, Basic SQL SELECT Statements, Scalar & Aggregate Functions, Joins & Subqueries, Views & Index

Use Case: Apply validations for Telephone Complaint Registration Form

Use Case: Create student table for College Management System(CMS)

UNIT – IV:

Introduction to C# Programming: Introduction to .NET Framework 4.5 - What is .NET Framework, .NET Framework, Languages, and Tools, .NET Framework Major Components, Common Language Runtime (CLR), Compilation and Execution in .NET, Understand the .NET Framework 4.5stack, Exploring VS2017, Introduction to C# 6.0 - Features of C#, C# Compilation and Execution, General Structure of a C# Program, Creating and Using a DLL

Use Case: Create a Console Application (.exe) project called CalcClientApp

UNIT – V:

Language Fundamentals of C#: Language Fundamentals - Keywords, Value Types and Reference Types, Implicit and explicit type conversions, Boxing and Unboxing, Enum, Operators and Assignments,Variables and Literals, Flow

Control: C# Control Statements, Nullable, Classes and Objects, Strings, Array, Generic Collections

Use Case: Store employee objects using Generic Collections

UNIT – VI:

Basics of ADO.NET: Various Connection Architectures, Understanding ADO.NET and its class library, Important Classes in ADO.NET, Connection Class, Command Class, DataReader Class, DataAdapter Class, DataSet Class

Use Case: Implement ADO.NET classes that belong to both Connected and Disconnected Architectures

TEXT BOOKS:

1. Web Programming, Building Internet Applications, Chris Bates, 2nd Edition, Wiley Dreamtech
2. Introduction to Database Systems, C. J. Date, Pearson Education
3. Professional C# 2012 with .NET 4.5, Christian Nagel et al. Wiley India, 2012

REFERENCES:

1. Programming World Wide Web, Sebesta, Pearson
2. Internet and World Wide Web – How to Program, Dietel and Nieto PHI/Pearson Education Asia

3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Pro C# 2010 and the .NET 4 Platform, Andrew Troelsen, 5th Edition, A Press, 2010
5. Programming C# 4.0, Ian Griffiths, Matthew Adams, Jesse Liberty, 6th Edition, O"Reilly, 2010

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech.	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CS13) INTRODUCTION TO APPLICATION DEVELOPMENT WITH JAVA

COURSE OBJECTIVES:

- To create an integrated development environment for object-oriented Java programs
- To build website menus with CSS and JavaScript
- To relate programming language constructs and problem solving techniques
- To analyze and Apply modifications to Java programs that solve real-world problems

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand the fundamentals of HTML5 and define the styles for web pages using CSS

CO-2: Create web pages and add dynamic behavior to web pages using Javascript

CO-3: Communicate with the database using SQL

CO-4: Develop a simple CUI [Character User Interface] based application using Java & SQL

UNIT – I:

Computer: Computer Fundamentals, Preface to Networks, Networking Levels, Layers of Computer Networks, Protocol Stacks, Networking, and Internet Service

Software Engineering Fundamentals: Introduction, Requirements Collection & Analysis, Fundamentals of Software Design, Software Implementation, Types of Testing, Software Maintenance, Overview of Configuration management and version Control Tools, Basics of Agile Process

Object Oriented Programming: Object Oriented Paradigm, Classes and Objects, Principles in Object- Oriented technology

Use Case: Create a class for Bank Account

UNIT – II:

HTML: Introduction to Web Technology, HTML5 Introduction, HTML5 Elements, Semantic Elements, Table, List, Links in HTML5, Handling of Images, Form Elements, HTML5 Form elements and Attributes, Video & Audio, iframes

Style Sheets:

Introduction to CascadingStyleSheet3, CSS Syntax, CSS Styling, Text and Fonts properties, CSS Selectors, Color schemes, CSS Borders, CSS Margins, CSS Backgrounds

Use Case: Design a website for college

UNIT – III:

JavaScript: Introduction to JavaScript, JavaScript Functions, JavaScript validation, Event handling in JavaScript, JavaScript Strings, JavaScript Dates, Array in JavaScript, Document Object Model (Window, Frame, Navigator Objects), Document Object (Its Properties and methods, Cookie handling),

RDBMS Concepts and SQL: Introduction to RDBMS Concepts, Introduction to SQL, Creating and Managing Tables, Data Manipulation, Basic SQL SELECT Statements, Scalar & Aggregate Functions, Joins & Subqueries, Views & Index

Use Case: Check the validations for Telephone Complaint Registration Form

Use Case: Create student table for College Management System (CMS)

UNIT – IV:

Introduction to Java: Java Environment, Java Fundamentals - Keywords, Primitive Data Types, Operators and Assignments, Java's Control Statements, Wrapper Classes, Using Scanner Class, Strings - String Handling functions, Array - One dimensional array, Array of Objects, Using Arrays class, variable length arguments

Use Case: To keep track of customers data who are buying products from a store

UNIT – V:

The Collection Framework: Lists – Array List, LinkedList, Stack, Vector, Set – HashSet, Linked Hash Set, Tree Set, Map – HashMap, Linked HashMap, Hash table. Retrieving Elements from Collections – Enumeration, Iterator, List Iterator, String Tokenizer – Sorting using Comparable and Comparator.

Use Case: Store employee objects using collection framework

UNIT – VI:

JDBC: Overview of JDBC, JDBC Architecture, Types of JDBC Drivers. Process SQL with JDBC - Create Connection, Query, Update

Use Case: Write the menu driven program using JDBC which will have following options

a. Store

b. Display by id

c. Delete by id

d. Update salary by id

e. Exit

TEXT BOOKS:

1. Web Programming, Building Internet Applications, Chris Bates, 2nd Edition, Wiley Dreamtech
2. Introduction to Database Systems, C. J. Date, Pearson Education
3. Big Java, Cay Horstmann, John Wiley and Sons, 2nd Edition

REFERENCES:

1. Programming World Wide Web, Sebesta, Pearson
2. Internet and World Wide Web – How to program, Dietel and Nieto PHI/Pearson Education Asia

3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Java How to Program, H. M. Dietel and P. J. Dietel, 6th Edition, Pearson Education/PHI
5. Core Java 2, Vol. 1, Fundamentals, CayS. Horstmann and Gary Cornell, 7th Edition, Pearson Education

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech.	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19OE1CS14) INTRODUCTION TO APPLICATION DEVELOPMENT WITH PYTHON

COURSE OBJECTIVES:

- To create an integrated development environment for object-oriented Python programs
- To build website menus with CSS and JavaScript
- To relate programming language constructs and problem solving techniques
- To analyze and Apply modifications to Python programs that solve real-world problems

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand the fundamentals of HTML5 and define the styles for web pages using CSS

CO-2: Create web pages and add dynamic behavior to web pages using Javascript

CO-3: Communicate with the database using SQL

CO-4: Develop a simple CUI [Character User Interface] based application using Python & SQL

UNIT – I:

Concepts of Networks, Overview of Software Engineering & OOP: Computer Basics, Network basics, Networking Levels, Layers and Protocols, Protocol Stacks, Networking and services of Internet

Software Engineering lifecycle - Overview of Requirement Analysis, Software Design, Implementation of software, Outline of Testing, Maintenance, Configuration management and version Control, Agile fundamentals

OOP - Object Oriented Concepts, OOP Principles

Use Case: Create a class for Employee Account

UNIT – II:

Introduction to Web Technology: Overview of Web Technology, Introduction to HTML5, HTML5 Elements, Semantic Elements, Table, List, Links, Image Handling, Form-Input Elements, HTML5 Form elements, HTML5 Attributes, Video & Audio, iframes,

CSS - Introduction to CSS3, CSS Syntax, CSS Styling, Text and Fonts properties, CSS Selectors, Different color schemes, CSS Borders, Margins, Backgrounds

Use Case: Create a website for an institution

UNIT – III:

Outline of JavaScript, RDBMS Concepts and SQL: JavaScript basics, Functions ,validations, Events, handling events ,Strings, Dates, Arrays, DOM(Window, Frame, Navigator Objects), Document Object -Properties and methods, handling of Cookies,

RDBMS Concepts, SQL, Management of Tables, Manipulation of tables, SQL SELECT Statements, Scalar & Aggregate Functions, Joins &Sub queries, Views & Index

Use Case: Apply validations for Telephone Complaint Registration Form

Use Case: Create student table for College Management System (CMS)

UNIT – IV:

Introduction to Python: Introduction, Features of Python, Versions, Keywords and Identifiers, Statements & Comments, Variables, Datatypes, Type Conversion, I/O and import, Language Fundamentals - Operators, Namespace, Modules in Python, Python DateTime

Use Case: Develop an application using Python for accepting your personal details and display the same

UNIT – V:

Classes and Objects: Classes and Objects in Python? Advantages of Using Classes in Python, Defining a Class in Python, Creating an Object in Python, The self, The_init_() function in Python, class and instance variables, Python Inheritance and its Types, Strings, Lists, Sets, Tuples, Dictionary

Use Case: Store employee objects using various data structures

UNIT – VI:

Advance Concepts in Python: Array - What is an Array, Difference between Array and List in Python, Creating an Array, Accessing a Python Array Element, Basic Operations of Arrays, Functions - Creating a Function, Calling a Function, Pass by reference vs value, Required arguments, Keyword arguments, Default arguments, Variable-length arguments, The Anonymous Functions, The return Statement, Global vs. Local variables, Modules - What is a Module?, Create a Module, Use a Module, Variables in Module, Naming a Module, Renaming a Module, Built-in Modules, Using the dir() Function, Import From Module, Packages, NumPy

Use Case: Develop an application for Hospital Management System(HMS)

TEXT BOOKS:

1. Web Programming, Building Internet Applications, Chris Bates, 2nd Edition, Wiley Dreamtech
2. Introduction to Database Systems, C. J. Date, Pearson Education
3. Python Programming: A Modern Approach, Vamsi Kurama, Pearson

REFERENCES:

1. Programming World Wide Web, Sebesta, Pearson
2. Internet and World Wide Web – How to Program, Dietel and Nieto, PHI/Pearson Education Asia
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Core Python Programming, W. Chun, Pearson
5. Introduction to Python, Kenneth A. Lambert, Cengage

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VII Semester	L	T/P/D	C
	3	0	3

(19HS1MG04) PRINCIPLES OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR

COURSE PRE-REQUISITES: Engineering Economics and Accounting

COURSE OBJECTIVES:
- To understand the principles, functions and theories of management and expose with a systematic and critical understanding of organizational theory, structures and design
- To comprehend the conceptual knowledge relating to Organizational Behaviour
- To provide a basic understanding of the behavior of individuals and groups in the organizations
- To develop theoretical and practical insights and problem-solving capabilities for effectively managing the organizational processes

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Apply theories to improve the practice of management and describe and assess the basic design elements of organizational structure and evaluate their impact on employees
CO-2: Analyse the behaviour of individuals and groups in organizations in terms of the key factors that influence organizational behaviour
CO-3: Appreciate the management challenges associated with high levels of change in the organizations
CO-4: Evaluate the appropriateness of various leadership styles, conflict management strategies and motivational strategies used in a variety of organizational settings

UNIT – I:
Introduction to Management:
Concepts of Management: Nature, Importance, and Functions of management; Taylor's Scientific Management Theory; Fayol's Principles of Management; Social Responsibilities of Management; Planning-definition and types of plans; decision making-definition and process
Organizing: Definition and Principles of Organization; Organization chart; Types of mechanistic and organic structures of organization - Line Organization, Line And Staff Organization, Functional Organization, Committee Organization, Matrix Organization, Virtual Organization, Cellular Organization, Team Structure, Boundaryless Organization, Inverted Pyramid Structure, And Lean And Flat Organization Structure; features and suitability.

UNIT – II:
Motivation and Leadership:
Motivation: Definition; Theories: Maslow's need of Hierarchy, Herzberg two Factor, Mc Gregor Theory X and theory Y and Alderfer's ERG.
Leadership: Definition; Styles and Theories: Trait, Behavioural and Contingency.

UNIT – III:

Introduction to Organizational Behaviour:

Organizational Behaviour: Definition; Historical Background; Nature, Scope and Importance; Linkages with other social Sciences; Approaches and Models.

UNIT – IV:

Perception and Personality:

Perception: Definition; Factors influencing; Perceptual Selectivity; Perceptual Organisation and Social Perception.

Personality: Definition; Determinants; Theories; Traits; Big Five Personality Model.

UNIT – V:

Interpersonal Skills:

Communication: Definition; Process; Direction; Interpersonal and Organizational and Barriers.

Teams and Groups: Definition; Types of teams and groups; Five-Stage Model; Characteristics of an effective teams; Johari Window & Transactional Analysis

UNIT – VI:

Organizational – Conflict, Stress Management, Change and Development:

Organizational Conflict: Definition; Reasons; Types and Levels; Handling Styles.

Stress Management: Definition; Types; Model; Consequences and Strategies to manage

Organizational Change: Definition; Types; Resistance; Overcoming and Approaches: Lewin's Three-Step Change Model, Kotter's Eight-Step Plan for Implementing Change.

Organizational Development: Definition; Nature and Interventions.

TEXT BOOKS:

1. Management, James Arthur, Finch Stoner, R. Edward Freeman, and Daniel R. Gilbert, 6th Edition, Pearson Education/Prentice Hall
2. Organizational Behaviour, Stephen P. Robbins, Prentice Hall, 2013
3. Organizational Behaviour, Fred Luthans, McGraw-Hill, 2013

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VII Semester	L	T/P/D	C
	3	0	3

(19PC1EC13) MICROWAVE ENGINEERING

COURSE PRE-REQUISITES: EM Waves and Transmission Lines (19PC1EC07)

COURSE OBJECTIVES:

- To present a cohesive overview of the required fundamentals on Transmission lines and Wave Propagation Theory in the case of Wave guides
- To understand various coupling techniques in waveguides and the basic properties of Polarization in Ferrite based materials in the case of waveguide components
- To introduce the multiport junction concept for splitting the microwave energy in a desired direction
- To get exposure on Microwave components in building a Microwave test bench setup for measurements

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Understand the basics of wave propagation inside waveguides

CO-2: Illustrate the functioning of microwave components and Junctions

CO-3: Classify various microwave sources

CO-4: Measure the microwave parameters

UNIT – I:

Microwave Transmission Lines: Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides: Solution of Wave Equations in Rectangular coordinates. TE/TM mode Analysis, Expression for E and H fields, Characteristic Equation and Cut-off Frequencies. Phase and Group Velocities, Wavelengths and Impedance Relations.

Microstrip Lines: Introduction, Quasi TEM mode, Z0 Relations, Effective Dielectric Constant, Applications, Q Factor and Losses.

UNIT – II:

Waveguide Components-I: Cavity Resonators: Introduction, Rectangular Cavities, Dominant Modes and Resonant Frequencies, Q factor and Coupling Coefficients, Illustrative Problems. Coupling Mechanisms: Probe, Loop, Aperture types. Waveguide Discontinuities: Waveguide Windows, Tuning Screws and Posts, types of Matched Loads. Waveguide Attenuators: Different types, Resistive Card and Rotary vane Attenuators; Waveguide Phase shifters: Types, Dielectric and Rotary vane Phase shifters.

UNIT – III:

Waveguide Components-II: Ferrite materials –Composition and Characteristics, Faraday Rotation, Ferrite Components - Isolator, Circulator, Gyrator. Scattering matrix: Significance, scattering parameters, formulation and properties of S- Matrix. Waveguide multiport Junctions: E- plane, H-Plane and Magic Tee; Directional coupler –two-hole, Bethe hole types. Calculation of S matrix for multiport junctions.

UNIT – IV:

Microwave Tubes (Qualitative treatment only): Limitations of Conventional tubes at Microwave frequencies, Microwave Tubes- Classifications, Two cavity Klystrons–Structure, Velocity Modulation process and Applegate diagram, Reflex Klystrons-Structure, Velocity Modulation, Applegate diagram and Principle of Working, Mode Characteristics ; Travelling Wave tubes, Slow wave structures, Amplification Process, Microwave crossed field tube, Cavity Magnetron-Structure and characteristics, PI mode operation

UNIT – V:

Microwave Solid State Devices: PIN diode and its applications

Transferred Electronic Devices: Introduction, Gunn Diode-Principle, Two valley theory, High field domain, Basic modes of operation.

Avalanche Transit Time Devices: Introduction, Avalanche multiplication. IMPATT, TRAPATT -Principle of Operation.

UNIT – VI:

Microwave Measurements: Description of microwave bench, measurement of Attenuation, low-power, medium and high-power measurements, Bolometer, Frequency, VSWR and Impedance measurements, Antenna radiation pattern measurement, Introduction to reflectometer, Network Analyser.

TEXTBOOKS:

1. Microwave Devices and Circuits, Samuel Y. Liao, 3rd Edition, Pearson, 2003
2. Microwave and Radar Engineering, M. Kulkarni, 5th Edition, Umesh Publications, 2003

REFERENCES:

1. Foundations for Microwave Engineering, R. E. Collin, IEEE Press, 2nd Edition, John Wiley
2. Microwave Engineering Passive Circuits, Peter A. Rizzi, PHI, 1999
3. Microwave Engineering, David Pozar, 3rd Edition, Addison Wesley 1997
4. Microwave Principles, Herbert J. Reich, J. G. Skalnik, P. F. Ordung and H. L. Krauss, CBS Publishers and Distributors, New Delhi, 2004

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B.Tech. VII Semester	L	T/P/D	C
	3	0	3

(19PE1EC07) FIBER OPTIC COMMUNICATION

COURSE PRE-REQUISITES: Engineering Physics (19BS1PH02)

COURSE OBJECTIVES:
- To learn about the basic elements of optical fiber transmission link, fiber modes, configurations, structures and losses associated
- To know the working principles of various optical sources and photo detectors
- To understand the modulation technique in optical communications
- To analyze and design a fiber optic link for a given budget requirement

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Recognize the structures of Optical fiber and types

CO-2: Discuss the Optical power launching and channel impairments like losses and dispersion

CO-3: Classify the Optical sources and detectors and to discuss their principles

CO-4: Estimate an optical communication system for a particular application

UNIT – I:

Overview of Optical Fiber Communication: Introduction, general system, advantages, disadvantages, and applications of optical fiber communication, Ray theory, single mode and multi-mode fibers, cut-off wavelength, mode field diameter.

Transmission Characteristics of Optical Fibers: Introduction, Attenuation, absorption, scattering losses, bending losses, dispersion, Intra model dispersion, Inter model dispersion.

UNIT – II:

Fiber Couplers and Connectors: Introduction, connectors and return losses, fiber splicing-splicing techniques, fiber alignment and joint loss- Single mode and multimode fiber joints.

UNIT – III:

Optical Sources: Introduction, LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product. Injection Laser Diodes- Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, Resonant frequencies.

UNIT – IV:

Optical Detectors: Introduction, Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors.

UNIT – V:
Source to Fiber Power Launching - Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling.
WDM: WDM concepts-operation principles, WDM standards, types of WDM.

UNIT – VI:
Optical Link Design: Considerations, Component choice, multiplexing. Point-to-point links, System considerations, Link power budget with examples, Rise time budget with examples, Transmission distance, Line coding in Optical links.

TEXTBOOKS:

1. Optical Fiber Communications, Gerd Keiser, 4th Edition, TMH, 2008
2. Optical Fiber Communications, John M. Senior, 3rd Edition, Pearson Education, 2009

RERFERENCES:

1. Fiber Optic Communications, D.K. Mynbaev, S.C. Gupta and Lowell L. Scheiner, Pearson Education, 2005
2. Text Book on Optical Fibre Communication and its Applications, S. C. Gupta, PHI, 2005
3. Fiber Optic Communication Systems, Govind P. Agarwal, 3rd Edition, John Wiley, 2004
4. Fiber Optic Communications, Joseph C. Palais, 4th Edition, Pearson Education, 2004

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(19PE1EC08) SPEECH AND AUDIO PROCESSING

COURSE PRE-REQUISITES: Signal and Systems (19PC1EC04), Digital Signal Processing (19PC1EC09)

COURSE OBJECTIVES:
- To provide students with the knowledge of basic characteristics of speech signal in relation to production and perception of speech by humans
- To describe basic algorithms of speech analysis common to many applications of speech signal processing
- To give foundation for applications of speech signal processing (enhancement, and coding)
- To get an overview of implementation aspects of Voice and Speech Recognition Technology
- To familiarize with different Audio processing and editing tools and open-source software

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify the basic components and parameters of speech
CO-2: Analyze different processes for speech modeling and recognition
CO-3: Design a speech recognition system and to use different speech synthesis techniques
CO-4: Familiarize with speech coding and diverse Speech Processing applications

UNIT – I:
Speech Production: Speech signal; Speech Production process: Lungs, Larynx and Vocal folds, Vocal tract; Acoustic Phonetics: Vowels, Diphthongs, Semi vowels, Nasals, Unvoiced fricatives, Voiced fricatives, Voiced and unvoiced stops; Acoustic theory of speech production; Digital model for speech signals, Deep Learning.

UNIT – II:
Time Domain Methods for Speech Processing: Time domain parameters of Speech signal, Methods for extracting the speech parameters (Energy, Average Magnitude, Zero crossing Rate), Silence Discrimination using Zero crossing Rate and energy, Short Time Auto Correlation Function, Pitch period estimation using Auto Correlation Function.

UNIT – III:
Frequency Domain Methods for Speech Processing: Short-Time Fourier Transform (STFT), Sampling the STFT in Time and Frequency, The Speech Spectrogram, homomorphic speech analysis: homomorphic systems for convolution, Definition of the Cepstrum and complex Cepstrums, pitch extraction using homomorphic speech processing.

UNIT – IV:
Linear Predictive Analysis of Speech: Linear prediction of speech, auto correlation, formulation of Linear prediction coding equations, Solution of Linear prediction coding equations, Levinson Durbin recursion, Application of Linear prediction coding parameters: Pitch detection using Linear prediction coding parameters, Deriving acoustic parameters PLPs, LPCCs, and MFCCs from LPCs

UNIT – V:
Speech Enhancement: Nature of Interfering Sounds; Speech Enhancement (SE) Techniques: Basic principles of Spectral Subtraction; Wiener Filtering; Wiener filtering for noise reduction; Statistical-Model-based method: Maximum-likelihood estimator for speech enhancement; Applications of speech enhancement.

UNIT – VI:
Speech Coding: Closed-Loop Coders: Predictive Coding, Delta Modulation, Adaptive Differential PCM Systems, Analysis-by-Synthesis Coding, Multi-Pulse Excitation Linear Prediction (MPLP), Code-Excited Linear Prediction (CELP).
Speech Systems: Introduction to Feature extraction; Classifiers for automatic speaker recognition and automatic speaker identification.

TEXTBOOKS:

1. Introduction to Digital Speech Processing, Lawrence R. Rabiner and Ronald W. Schafer, now Publishers Inc, Hanover, USA, 2007
2. Discrete Time Speech Signal Processing: Principles and Practice, Thomas F. Quateri, Ed., PE, 2004
3. Speech Enhancement, Philipos C. Loizou, 2nd Edition, CRC Press, Taylor & Francis Group, 2013

REFERENCES:

1. Digital Processing of Speech Signals, L. R. Rabiner and R.W. Schafer, Prentice-Hall Inc. USA, 1978
2. Speech Communications Human and Machine, Douglas O. Shaughnessy, 2nd Edition, IEEE Press, 2000
3. Statistical Methods of Speech Recognition, Frederick Jelinek, MIT Press, 1997
4. Speech Recognition, Claudio Becchetti and Lucio Prina Ricotti, John Wiley and Sons, 1999
5. Speech and Audio Signal Processing, Processing and Perception of Speech and Music, Ben Gold and Nelson Morgan, Wiley-India Edition, 2006

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1IT04) OPERATING SYSTEMS

COURSE OBJECTIVES:

- To study the basic concepts and functions of operating systems
- To summarize various approaches to solve the problem of process concurrency in an operating system
- To evaluate the memory usage trade-offs in terms of size (main memory, auxiliary memory) and processor speed
- To understand disk storage strategies and file strategies with protection and security issues

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify System calls and evaluate process scheduling criteria of OS
CO-2: Develop procedures for process synchronization and scheduling services of an OS
CO-3: Distinguish disk access, file systems supported by an OS
CO-4: Extend operating systems virtual memory, protection and security aspects

UNIT – I:
Computer System and Operating System Overview: Overview of Computer System hardware, Operating System Objectives and functions Operating System Services, System Calls, System Programs.
CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms and evaluation.

UNIT – II:
Linux Utilities: File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking commands, Filters, Text processing utilities and Backup utilities, sed – scripts, operation, addresses, commands, applications, awk – execution, fields and records, scripts are using system commands in awk.

UNIT – III:
Process Management: Process Description, Process Control Block, Process States, Threads Overview.
Concurrency: Cooperating Processes, Inter-process Communication, Principles of Concurrency, Mutual Exclusion, Software and hardware approaches, Semaphores, Monitors, Message Passing, Classic problems of synchronization.
Inter Process Communication: Introduction to IPC, Pipes, and FIFOs, Introduction to three types of IPC-message queues, semaphores and shared memory. Message Queues Kernel support for messages, client/server example.

UNIT – IV:
Principles of Deadlock: System Model, Deadlock Characterization, Methods for handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlocks, Dining philosopher's problem.

UNIT-V:

Memory Management: Basic concepts, Swapping, Contiguous memory allocation, Paging, Segmentation, Virtual memory, Demand paging, Page-replacement algorithms, Thrashing.

Secondary Storage Structure: Disk structure; Disk scheduling, Disk management, Swap space Management, RAID structure, Stable-storage Implementation

Case Studies: windows, Unix, Linux.

UNIT –VI:

File Management: File system-File concepts, File System Structure, Inodes, File Attributes, File types, Access methods, Symbolic links & hard links, Directory structure, Filesystem mounting, Implementing file systems-File system structure and implementation, Directory implementation, Allocation methods, Free-space management, Efficiency and performance

Protection & Security: Protection mechanisms, OS Security issues, threats, Intruders, Viruses,

Case Studies: windows, Unix, Linux.

TEXT BOOKS:

1. Operating System Principles, Abraham Silberchatz, Peter B. Galvin, Greg Gagne, 7th Edition, John Wiley
2. Unix Concepts and Applications, Sumitabha Das, 4th Edition, TMH, 2006

REFERENCES:

1. Modern Operating Systems, Andrew S. Tanenbaum, 2nd Edition, Pearson/PHI
2. Operating Systems – A Concept Based Approach, D. M. Dhamdhere, 2nd Edition
3. Unix System Programming using C++, T. Chan, PHI
4. Operating Systems - Internal and Design Principles, Stallings, 5th Edition, Pearson Education/PHI, 2005

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PE1EC21) INTRODUCTION TO MACHINE LEARNING

COURSE PRE-REQUISITES: Linear Algebra, Ordinary Differential Equations and Laplace Transform (19BS1MT04), Neural Networks and Deep Learning (19PE1CS10)

COURSE OBJECTIVES:
- To prepare the data for modelling and evaluation
- To learn machine learning techniques such as supervised and unsupervised learning
- To understand computational learning theory

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand how to prepare a data, model, evaluation methods
CO-2: Understand the concepts of supervised machine learning
CO-3: Understand the concepts of unsupervised machine learning
CO-4: Understand other types of machine learning methods

UNIT – I:
Introduction: Human learning, Machine learning, Types of machine learning, Applications
Data Preparation: Introduction, Machine learning activities, types of data, exploring the structure of data, data quality and remediation, data pre-processing.

UNIT – II:
Modeling and Evaluation: Selecting and training a model, representation and interpretability, performance evaluation, performance improvisation.
Feature engineering- Introduction, feature transformation, subset selection.
Bayesian Decision Theory: Bayes' theorem and concept learning, Bayesian belief network in machine learning.

UNIT – III:
Classification: Classification model, learning steps, Algorithms- KNN, Decision tree, Random forest model, Support vector machines.

UNIT – IV:
Regression: Simple linear regression, Multiple linear regression, Assumptions & challenges in regression analysis, improving accuracy of linear regression, Polynomial regression, Logistic regression, Maximum likelihood estimation.

UNIT – V:
Unsupervised Learning: Supervised vs Unsupervised learning, types of clustering techniques, partitioning methods, k-medoids, hierarchical clustering, density-based methods-DBSCAN, finding pattern using association rule.

UNIT – VI:
Other Types of Learning: Representation Learning, Active learning, Instance based learning, Association learning rules, Ensemble learning, Regularization algorithm.

TEXTBOOKS:

1. Machine Learning, Amit Kumar Das, Saikat Dutt, Subramanian Chandramouli, Pearson, 2018
2. Introduction to Machine Learning, Ethem Alpaydın, 4th Edition, The MIT Press Cambridge, Massachusetts, 2020

REFERENCES:

1. Machine Learning, Tom Mitchel, McGraw-Hill, 2017
2. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer Series in Statistics, Springer, 2009
3. Pattern Recognition and Machine Learning, Christopher Bishop, Information Science and Statistics, Springer, 2010
4. Pattern Classification, Richard O. Duda, Peter E. Hart, David G. Stork, Second Edition, John Wiley & Sons, 2012

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
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(19PE1EC09) ASIC DESIGN

COURSE PRE-REQUISITES: Digital System Design (19PC1EC03), VLSI Design (19PC1EC11)

COURSE OBJECTIVES:
- To prepare the student to be an entry-level industrial standard ASIC designer
- To understand issues and tools related to ASIC design
- To make the students proficient in verifying and testing ASIC design
- To learn about the algorithms used for ASIC Design

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand the issues involved in ASIC design, including technology choice, power constraints
CO-2: Understand and analyze the physical design flow in ASIC
CO-3: Verify and test ASIC design
CO-4: Understand various algorithms used to design ASIC

UNIT – I:
Introduction to ASICs: Types of ASICs, ASIC Design flow, EDA tools for ASIC Design, ASIC cell libraries, Combinational Logic Cell, Sequential logic cell, Data path logic cell, I/O cell.

UNIT – II:
Simulation and Synthesis: Simulation, types of simulation- Gate-level Modeling and Simulation, Switch level modeling and simulation, Logic Synthesis
Static timing Analysis: Timing paths, Meta-stability, Clock issues, setup and hold time Violations, steps to remove Setup and hold time violations.

UNIT – III:
Partitioning- System level partitioning, Board level partitioning, chip level partitioning.
Floor-planning – objectives, Circuit Description, Design Constraints, Design Planning, Pad Placement, Power Planning, Macro Placement, Clock Planning.

UNIT – IV:
Placement: Objectives of placement, constructive placement and iterative placement, clock tree synthesis

UNIT – V:
Routing: Objectives of routing- global routing, detailed routing, special routing, circuit extraction.

UNIT – VI:
Verification and Testing: Verification-Functional Verification, Timing Verification, Physical Verification Testing-Functional Test, Scan Test, Boundary Scan Test, Fault Detection.

TEXTBOOKS:

1. Application Specific Integrated Circuits, J. Smith, Addison-Wesley, 2010
2. Physical Design Essentials, Khosrow Golshan, Springer, 2007

REFERENCES:

1. Algorithms for VLSI Design Automation, S. H. Gerez, Wiley, 2006
2. Algorithms for VLSI Physical Design Automation, Naveed Sherwani, 3rd Edition, 2013

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PE1EC10) SATELLITE COMMUNICATION

COURSE PRE-REQUISITES: Antennas and Wave propagation (19PC1EC08), Microwave Engineering (19PC1EC13)

COURSE OBJECTIVES:
- To know, design understand the construction and principles of Satellites used for communications
- To know the tracking techniques of satellites
- To learn about various multiple accessing techniques
- To know about the application of satellites in GPS and other applications

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand the orbital mechanics and functioning of subsystems of a satellite
CO-2: Illustrate the various multiple access techniques for communication
CO-3: Design the power budget for satellite links
CO-4: Demonstrate the principles of GPS

UNIT – I:
Introduction: Origin of Satellite Communications, Historical Background, Basic Concepts of Satellite Communications, Frequency allocations for Satellite Services, Applications, Future Trends of Satellite Communications.
Orbital Mechanics and Launchers: Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbital determination, Launches and Launch vehicles, Orbital effects in communication systems performance.

UNIT – II:
Satellite Subsystems: Attitude and Orbit control system, Telemetry, Tracking, Commanding and Monitoring, Power Systems, Communication Subsystems, Satellite antennas, Equipment reliability and Space qualification.

UNIT – III:
Multiple Access: Frequency Division Multiple Access (FDMA), Intermodulation, calculation of C/N. Time Division Multiple Access (TDMA), Frame structure, Examples. Satellite Switched TDMA Onboard processing, DAMA, Code Division Multiple Access (CDMA), Spread Spectrum Transmission and Reception.

UNIT – IV:
Satellite Link Design: Basic transmission theory, system noise temperature and G/T ratio, Design of down links, Uplink design, Design of satellite links for specified C/N, System design examples.
Earth Station Technology: Introduction, Transmitters, Receivers, Antennas, Tracking systems, Terrestrial Interface, Primary Power test methods.

UNIT – V:

Low Earth Orbit and Geo-Stationary Satellite Systems: Orbit considerations, Coverage and Frequency Consideration, Delay and Throughput considerations, Systems considerations, Operational NGSO Constellation Designs.

UNIT – VI:

Satellite Navigation and Global Positioning System: Radio and Satellite Navigation, GPS Position Location principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Navigation Message, GPS Signal Levels, GPS Receiver Operation, GPS C/A code accuracy, Differential GPS.

TEXTBOOKS:

1. Satellite Communications, Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, 2^{nd} Edition, Wiley Publications, 2003
2. Satellite Communications Engineering, Wilbur L. Pritchard, Robert A. Nelson and Henri G. Suyderhoud, 2^{nd} Edition, Pearson Publications, 2003

REFERENCES:

1. Satellite Communications: Design Principles, M. Richharia, 2^{nd} Edition, B. S. Publications, 2003
2. Satellite Communication, D. C. Agarwal, 5^{th} Edition Khanna Publications
3. Fundamentals of Satellite Communications, K. N. Raja Rao, PHI, 2004
4. Satellite Communications, Dennis Roddy, 4^{th} Edition, McGraw Hill, 2009

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(19PE1EC11) SOFTWARE DEFINED RADIO

COURSE PRE-REQUISITES: Analog Circuits (19PC1EC06), Digital Signal Processing (19PC1EC09)

COURSE OBJECTIVES:
- To understand the SDR and its architecture
- To understand the system design and signal conversion techniques
- To understand signal processing techniques
- To understand the transmitter and receiver architecture and working principle

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Conceptualize the SDR and implementation details
CO-2: Identify the blocks of SDR for a specific application
CO-3: Recognize the challenges in the implementation of SDR
CO-4: Analyze the transmitter and receiver architectures in SDR

UNIT – I:
Introduction: Software Defined Radio – The Need for Software Radios, What is Software Radio, Characteristics and benefits of software radio- Design Principles of Software Radio, A Traditional Hardware Radio Architecture – Signal Processing Hardware History – Software Defined Radio Project Complexity.

UNIT – II:
Basic Software Defined Radio Architecture: Introduction – 2G Radio Architectures- Hybrid Radio Architecture- Basic Software Defined Radio Block Diagram.
RF System Design: Introduction- Noise and Channel Capacity- Link Budget- Receiver Requirements- Multicarrier Power Amplifiers- Signal Processing Capacity Tradeoff.

UNIT – III:
Analog-to-Digital and Digital-to-Analog Conversion: Introduction – Digital Conversion Fundamentals- Sample Rate- Bandpass Sampling- Oversampling- Antialias Filtering – Quantization – ADC Techniques-Successive Approximation- Figure of Merit-DACs- DAC Noise Budget- ADC Noise Budget.

UNIT – IV:
Digital Frequency Up- and Down Converters: Introduction, Frequency Converter Fundamentals- Digital NCO- Digital Mixers- Digital Filters- Halfband Filters- CIC Filters- Decimation, Interpolation, and Multirate Processing-DUCs - Cascading Digital Converters and Digital Frequency Converters.
Signal Processing Hardware Components: Introduction- SDR Requirements for Processing Power- DSPs- DSP Devices- DSP Compilers-.

UNIT – V:
Software Architecture and Components: Introduction- Major Software Architecture Choices – Hardware – Specific Software Architecture- Software Standards for

Software Radio-Software Design Patterns- Component Choices- Real Time Operating Systems- High Level Software Languages- Hardware Languages.

UNIT – VI:

Smart Antennas for Software Radio: Introduction- 3G smart Antenna Requirements- Phased Antenna Array Theory- Applying Software Radio Principles to Antenna Systems- Smart Antenna Architectures- Optimum Combining/ Adaptive Arrays- DOA Arrays- Beam Forming for CDMA- Downlink Beam Forming.

TEXTBOOKS:

1. Software Defined Radio Architecture System and Functions, Markus Dillinger, Kambiz Madani, Wiley 2003
2. Software Defined Radio: Enabling Technologies, Walter Tuttle Bee, 2002, Wiley Publications

REFERENCES:

1. Software Defined Radio for 3G, Paul Burns, Artech House, 2002
2. RF and DSP for SDR, Tony J. Rouphael, Elsevier Newnes Press, 2008
3. Digital Synthesizers and Transmitter for Software Radio, Jouko Vanakka, Springer, 2005
4. RF and Baseband Techniques for Software Defined Radio, P. Kenington, Artech House, 2005

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(19PE1EC12) EMBEDDED SYSTEMS

COURSE PRE-REQUISITES: Microprocessor and Microcontrollers (19PC1EC10)

COURSE OBJECTIVES:

- To learn the general embedded system concepts
- To understand design of embedded hardware and software development tools
- To learn the basics of OS and RTOS
- To describe key issues such as CPU scheduling, memory management, task synchronization, and file system in the context of real-time embedded systems

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand the basic requirements of embedded systems
CO-2: Identify the hardware to develop the Embedded System
CO-3: Apply the software tools for Real time Embedded Applications
CO-4: Analyze the RTOS concepts to develop the Embedded Applications

UNIT – I:
Fundamentals of Embedded Systems: Embedded System-Definition, Characteristics, Design metrics, Classification of Embedded Systems, Real Time Systems - Need for Real-time systems, Hard and Soft Real-time systems, Processors in the system, Other Hardware units, Software components, Examples for embedded systems, Challenges in Embedded System Design.

UNIT – II:
Embedded Hardware Development Environment: Processor Architecture- Structured units of a processor - Processor selection factors, Common memory devices - Memory selection, Watch dog timer, Serial Communication Protocols.

UNIT – III:
Embedded Software Development Environment: Embedded System Development Process, Programming languages, Software Development tools - Host and Target machines, Linkers/Locators for embedded software, getting embedded software into the target system, Testing on host machine.

UNIT – IV:
Real Time Operating Systems Concepts–I: Basics of Operating system, Need for RTOS in embedded system, GPOS versus RTOS, RTOS Architecture and Characteristics, Tasks and Task states, Task scheduling, Scheduling algorithms - Rate Monotonic, EDF, Round Robin, Round Robin with Interrupts, Priority driven – Preemptive and Non-preemptive scheduling.

UNIT – V:
Real Time Operating Systems Concepts–II: Inter-Process Communication mechanisms – Semaphores, Message queues, Mailboxes, Pipes, Task Synchronization - Shared data - Priority Inversion - Inheritance and Ceiling, Dead lock, Memory management, Interrupt routines in RTOS environment, Device driver.

UNIT – VI:

Design Examples and Case Studies: Case study of embedded system design and coding for Automatic Chocolate Vending machine using µCOS RTOS, Case study of Digital Camera Hardware and Software architecture.

TEXTBOOKS:

1. Embedded Systems Architecture, Programming and Design, Raj Kamal, 2nd Edition, Tata McGraw Hill, 2011
2. An Embedded Software Primer, David E. Simon, 1st Edition, Pearson, 2005

REFERENCES:

1. Real-Time Systems, J. W. S. Liu, Pearson, 2009
2. Real-Time Embedded Systems: Design Principles and Engineering Practices, 1st Edition, Newnes, 2015
3. Computers as Components - Principles of Embedded Computing System Design, Wayne Wolf, 2nd Edition, Morgan Kaufmann, 2008

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B.Tech. VII Semester	L	T/P/D	C
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(19PE1CS21) DATA ANALYTICAL COMPUTING

COURSE OBJECTIVES:
- To explore the fundamental concepts of data analytics
- To learn to analyze the data analysis techniques
- To explore the techniques related to Hadoop framework
- To understand, explore visualization methods

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Collect the data, and process it for Data Analysis
CO-2: implement various Statistical methods for Data Analysis
CO-3: Analyze the Hadoop framework tools
CO-4: Build the Process for visualizing large data sets

UNIT – I:
Data Management: Introduction, Sources of data, Types of Data, Data preprocessing, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources.

UNIT – II:
Big Data and Data Analysis: Introduction to Big Data Platform, Challenges of Conventional Systems, Web Data, Evolution of Analytic Scalability, Analytic Processes and Tools, Analysis vs Reporting, Modern Data Analytic Tools.
Statistical Concepts: Sampling Distributions, ReSampling, Statistical Inference - Prediction Error, Regression Modeling, Multivariate Analysis.

UNIT – III:
Data Analysis: Introduction, Terminology and concepts, Summary statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT.

UNIT – IV:
Hadoop: Meet Hadoop, Comparison with other systems, A brief history of Hadoop and the Hadoop ecosystem, Analyzing the Data with Hadoop, Hadoop Distributed File System, HDFS concepts, Design of HDFS, Data Flow in HDFS, Developing a Map Reduce Application.

UNIT – V:
Frameworks: Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services –HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper

UNIT – VI:
Data Visualization: Prepare the data for Visualization, Use tools like Tableau, Qlick View and D3, Draw insights out of Visualization tool.

TEXT BOOKS:

1. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Stream with Advanced Analytics, Bill Franks, John Wiley & Sons, 2012
2. Mining of Massive Datasets, Anand Rajaraman and Jeffrey David Ullman, Cambridge University Press, 2012
3. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O'reilly Media, 2012

REFERENCES:

1. Making Sense of Data, Glenn J. Myatt, John Wiley & Sons, 2007
2. Big Data Glossary, Pete Warden, O'Reilly, 2011
3. Data Mining Concepts and Techniques, Jiawei Han, Micheline Kamber, 2nd Edition, Elsevier, 2008

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PE1EC13) VERIFICATION AND SCRIPTING LANGUAGES FOR VLSI DESIGN

COURSE PRE-REQUISITES: VLSI Design (19PC1EC11)

COURSE OBJECTIVES:

- To learn principles of verification using System Verilog and design test benches
- To understand the use of the System Verilog in RTL design and verification
- To understand the importance of scripting languages in VLSI Design
- To understand utilization of PERL and TCL in CAD Tools Interfacing

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand the verification methodology in VLSI
CO-2: Develop verification methods using System Verilog
CO-3: Apply scripting language concepts for data handling
CO-4: Demonstrate the use of TCL in VLSI Design

UNIT – I:
Introduction to Verification Methodology: Verification guidelines, Basic Testbench Functionality, Directed Testing, Methodology Basics, Functional Coverage, Testbench Components, Layered Testbench, Building a Layered Testbench, Simulation Environment

UNIT – II:
System Verilog-I: Built-In Data Types, fixed-Size Arrays, Dynamic Arrays, Associative Arrays, Queues, Linked Lists, User Defined Data types, Type conversion, Enumerated data types, User defined structures, Procedural statements, Tasks and Functions.

UNIT – III:
System Verilog-II: Connecting the Testbench and design-Separating the Testbench and Design, The Interface Construct, Stimulus Timing, Interface Driving and Sampling, Connecting It All Together, Top-Level Scope; classes, objects and methods in system verilog, Randomization in System Verilog

UNIT – IV:
Scripting Languages: Characteristics and uses of scripting languages, importance of scripting languages in VLSI
PERL: PERL features, Names and values, Variables and assignment, Scalar expressions, Control structures, Built-in functions, Collections of Data, Working with arrays and hashes, Working with Strings Simple input and output

UNIT – V:
Advanced PERL: Patterns and Regular expressions, Subroutines, Pack and Unpack, working with files, Type globs, References, Data structures, Packages, Libraries and modules, Objects, Extraction and analyzation of data in VLSI design using PERL

UNIT – VI:

TCL: TCL phenomena, Philosophy, Structure, Syntax, Variables and data in TCL, Control flow, Data structures, Simple input/output, Procedures, working with strings and files, Libraries and packages, Namespaces, Trapping errors, Event-driven programs, Generate TCL files for VLSI Design flow.

TEXTBOOKS:

1. System Verilog for Verification - A Guide to Learning the Test Bench Language Features, Chris Spear, Gregory J. Tumbush, Springer, 2012
2. The World of Scripting Languages, David Barron, Wiley Student Edition, 2010

REFERENCES:

1. System Verilog Assertions and Functional Coverage: Guide to Language, Methodology and Applications, Ashok B. Mehta, Springer, 2020
2. Learning Perl 6 Keeping the Easy, Hard, and Impossible Within Reach, Brian D. Foy, O'reilly, 2018
3. Tcl/Tk: A Developer's Guide, Clif Flynt, Waltham M. A., Morgan Kaufmann, 2012

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	0	**2**	**1**

(19PC2EC10) SIGNAL PROCESSING AND COMMUNICATION APPLICATIONS LABORATORY

COURSE PRE-REQUISITES: Signals and Systems, Analog and Digital Communications and Digital Signal Processing

COURSE OBJECTIVES:
- To study the performance of various Image compression algorithms
- To understand digital audio compression techniques and different CODECS
- To compare different methods for mitigating channel impairments

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Apply filtering operations to remove noise in images and various compression techniques
CO-2: Design of communication channels to combat fading using Equalization
CO-3: Simulation of Orthogonal Frequency Division Multiplexing (OFDM) waveform
CO-4: Implementation of Automatic gain and frequency control techniques

LIST OF EXPERIMENTS:

Programs can be simulated using Matlab/Python/Octave/Scilab/LabVIEW

1. Removal of various types of Noise from signals acquired by sensors.
2. Removal of noise from Image data for further Image processing.
3. Design of FIR adaptive filter as an Equalization filter
4. Develop OFDM standard complaint waveforms using FFT and other blocks
5. Digital modulation and demodulation in AWGN and other channel setting.
6. Compress images using different standards such as JPEG, JPEG 2000 and SPIHT and EZW codes
7. Compress video signals using standards H261, H263 and MPEG4 and H264 CODECS
8. Evaluate different performance aspects required for lossy and lossless Compression methods.
9. Perform Automatic gain and frequency control for an Audio signal.
10. Audio compression algorithms (Using Sub band coding and Linear predictive code)

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	0	**2**	**1**

(19PC2EC11) MICROWAVE ENGINEERING LABORATORY

COURSE PRE-REQUISITES: EM Waves and Transmission Lines (19PC1EC07)

COURSE OBJECTIVES:

- To study the performance of microwave oscillators
- To measure the characteristic parameters of Microwave components
- To calculate scattering parameters of microwave junctions
- To analyze various parameters of Microwave components

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Analyze the performance characteristics of Microwave sources and measure various microwave parameters
CO-2: Analyze the scattering parameters of microwave junctions
CO-3: Understand the design aspects of a RF system

LIST OF EXPERIMENTS:

Minimum of 12 experiments to be conducted.

1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.
3. Attenuation Measurement.
4. Directional Coupler Characteristics.
5. VSWR Measurement.
6. Impedance and Frequency Measurement.
7. Waveguide parameters measurement.
8. Scattering parameters of Circulator.
9. Scattering parameters of E-Plane Tee and H-Plane Tee junctions.
10. Scattering parameters of Magic Tee.
11. Study the characteristics of a rectangular waveguide in the dominant mode and evaluate the field components.
12. Design a RF receiver system for the given specifications and analyze the parameters at each sub system using RF Budget analysis tool.
13. Analysis of Co planar waveguide Transmission line in X band application using RF toolbox.
14. Design Two stage Low noise amplifier using Microstrip Transmission line matching Network.

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	0	**4**	**2**

(19PW4EC04) MINI-PROJECT

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand the formulated industry / technical problem
CO-2: Analyze and / or develop models for providing solution to Industry / Technical problems
CO-3: Interpret and arrive at conclusions from the project carried out
CO-4: Demonstrate effective communication skills through oral presentation
CO-5: Engage in effective written communication through project report

COURSE OUTLINE:

- A student shall undergo an industry oriented mini-project, in collaboration with an industry of their specialization, during the summer vacation after sixth semester (III year II semester) of the B.Tech. programme.
- Mini-project shall be carried out for a minimum period of 04 weeks and maximum of 06 weeks.
- Evaluation of the mini-project shall be done by a Project Review Committee (PRC) consisting of the Head of the Department, faculty supervisor and a senior faculty member of the department.
    - The industry oriented mini-project shall be submitted in a report form and presented before the Project Review Committee (PRC) for evaluation.

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	3	**0**	**3**

(19PE1EC14) ADVANCED COMMUNICATIONS

COURSE PRE-REQUISITES: Analog and Digital Communications (19PC1EC05)

COURSE OBJECTIVES:
- To understand basic concepts of cellular communications
- To classify Spread spectrum communications and multiple access types
- To analyze OFDM and MIMO systems
- To study of SONET/SDH and ATM traffic

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand the basic concepts of cellular communications
CO-2: Compare different Spread spectrum communications
CO-3: Analyze principles of OFDM and MIMO systems
CO-4: Apply the concepts of SONET and ATM

UNIT – I:
Concepts of Cellular Communications: Cellular concepts and frequency re-use, Co-channel interference, determining the co-channel re-use distance, analysis of co-channel interference, Hand-off strategies, spectral efficiency and Grade of service, methods to improve cellular systems capacity- Cell splitting and Sectorization.

UNIT – II:
Spread Spectrum Communications: Spreading sequences- pseudo-noise, Gold, Kasami, Walsh and Barker Sequences, Properties of Spreading Sequences, Direct sequence spread spectrum (DS-SS) transmitter and receiver, Frequency Hopping spread spectrum (FH-SS) transmitter and receiver.

UNIT – III:
Orthogonal Frequency Division Multiplexing: Basic Principles of Orthogonality, OFDM Block Diagram, OFDM Signal Mathematical Representation, Pulse shaping in OFDM Signal and Spectral Efficiency, Applications of OFDM, FFT Point Selection Constraints in OFDM.

UNIT – IV:
MIMO Systems: Introduction, exploitation of Space Diversity and Smart Antenna system, MIMO Based System Architecture, Space – Time Processing, MIMO Channel Modelling, MIMO Channel Measurement, MIMO Channel Capacity, Space Time Coding, Advantages and Applications of MIMO in Present Context, MIMO Applications in 3G Wireless System and Beyond, MIMO-OFDM.

UNIT – V:
SONET/SDH: Architecture, SONET Layers, SONET Frames, STS Multiplexing, SONET Networks, Virtual Tributaries, Asynchronous Transfer Mode (ATM): Overview, Virtual channels, Virtual paths, VP and VC switching, ATM cells, Header format, Transmission of ATM cells, Adaptation layer, AAL services and protocols.

UNIT – VI:

ATM Traffic and Congestion Control: Requirements for ATM Traffic and Congestion Control, Cell Delay Variation, ATM Service Categories, Traffic and Congestion Control Framework, Traffic Control, Congestion Control.

TEXT BOOKS:

1. Introduction to Wireless Telecommunications Systems and Networks, Gary J. Mullett, Cengage, 2006
2. Wireless Communication, Upena Dalal, Oxford University Press, 2016
3. ISDN and Broadband ISDN with Frame Relay and ATM, William Stallings, Prentice Hall, 4th Edition. Prentice Hall,1999

REFERENCES:

1. Wireless Communication System, Ke-Lin Du & M. N. S. Swamy, Cambridge University Press, 2010
2. Data Communications and Networking, Behrouz A. Forouzan, 4th Edition, McGraw Hill, 2007
3. Mobile Cellular Communication, Gottapu Sasibhusan Rao, Pearson, 2012

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	3	0	3

(19PE1EI08) BIOMEDICAL SIGNAL PROCESSING

COURSE OBJECTIVES:

- To interpret the essential bio signals such as ECG and EEG
- To apply signal and data processing techniques to bio signals and applications in biomedicine
- To illustrate the use of wavelets in medical applications
- To grasp the advancements of biomedical engineering with the help of emerging technologies like BCI

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Reflect on biological systems from a signals and systems viewpoint and apply suitable signal processing techniques
CO-2: Apply advanced data compressing, modelling, and signal processing techniques to ECG and EEG signals
CO-3: Design and implement digital filters for noise reduction in electrophysiological data
CO-4: Demonstrate real-world applications of BCI

UNIT – I:
Cardiological Signal Processing: preprocessing of ECG signal, QRS detection methods-Differentiation based and template based, Rhythm analysis and Arrhythmia detection algorithms. Automated ECG analysis.

UNIT – II:
Data Compression Techniques: Turning Point algorithm, AZTEC, CORTES, KL transform, Adaptive filters, Weiner filter principles, LMS & RLS, medical Applications of Adaptive Noise Cancellation.

UNIT – III:
Neurological Signal Processing: Stochastic process, Linear prediction, Yule-Walker equations, Auto Regressive Modeling of EEG signal, Detection of EEG Rhythms, Template matching for EEG spike and wave detection, Detection of EEG spike and wave complexes, Coherence analysis of EEG channels, Adaptive segmentation of EEG signals.

UNIT – IV:
Sleep EEG: Data Acquisition and Classification of Sleep stages, The Markov Model and Markov Chains, Dynamics of Sleep-Wake Transitions, Hypnogram Model Parameters.
PRONY'S Method: Exponential Modelling, Exponential Parameter Estimation, The original Prony Problem, Least Squares Prony Method, The Covariance Method of Linear Prediction.

UNIT – V:

Wavelets in Medicine: Need for wavelets, Types of wavelets, Selection of a wavelet for an application, Decomposition and reconstruction of signals using wavelets, Denoising using wavelets, typical medical applications.

UNIT – VI:

Brain-Computer Interface: Brain signals for BCIs, Generic setup for a BCI, Feature extraction and Feature translation involved in BCIs. Typical medical applications.

TEXTBOOKS:

1. Biomedical Signal Analysis: A Case-Study Approach, Rangaraj M. Rangayyan, John Wiley & Sons, 2005
2. Biomedical signal processing, D C Reddy, The McGraw-Hill Companies, 2005

REFERENCES:

1. Biomedical Digital Signal Processing, Willis J. Tompkins, Prentice-Hall of India Pvt. Ltd., 2012
2. Statistical Digital Signal Processing and Modeling, Monson H. Hayes, Wiley-India, 2009
3. Brain-Computer Interfaces: Principles and Practice, Jonathan Wolpaw and Elizabeth Winter Wolpaw, Oxford University Press, 2012
4. Wavelet Tour of Signal Processing: The Sparse Way, Stephan Stephane Mallat, 3rd Edition, Academic Press, 2008

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B.Tech. VIII Semester	**L**	**T/P/D**	**C**
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(19PE1CS01) MOBILE COMPUTING

COURSE OBJECTIVES:
- To understand the basic concepts of mobile computing and mobile telecommunication system
- To be familiar with the network layer protocols and Ad-Hoc networks
- To know the basis of transport and application layer protocols
- To gain knowledge about different mobile platforms and application development

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Illustrate the basics of mobile telecommunication systems
CO-2: Determine the functionality of medium access control and Network layer
CO-3: Analyze the functionality of Transport and Application layer and issues related to database management in mobile computing
CO-4: Identify a routing protocol for a given ad hoc network

UNIT – I:
Introduction to Mobile Communications: Introduction to Mobile Computing, Novel applications, Limitations and Architecture, Generations of mobile communication technologies.
GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services-GPRS.

UNIT – II:
Medium Access Control: (Wireless) Medium Access Control (MAC): Motivation for a Specialized MAC (Hidden and Exposed Terminals, Near and Far Terminals), Multiplexing-SDMA- TDMA- FDMA- CDMA.

UNIT – III:
Mobile Network Layer: WIRELESS LAN: Infra-red Vs radio transmission, Infrastructure and Ad-hoc Network, IEEE 802.11: System Architecture, Protocol Architecture, Bluetooth: User Scenarios, Architecture

UNIT – IV:
Mobile Network and Transport Layer:
Mobile IP Network Layer: Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP).
Mobile Transport Layer: Traditional TCP, Classical TCP improvements- Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/ time-out freezing, Selective retransmission, Transaction oriented TCP

UNIT – V:
Mobile Adhoc Networks: Characteristics of Mobile Ad-hoc Networks (MANETs), Applications of MANETs, Routing, Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV, Hybrid routing –ZRP, Multicast Routing- ODMRP

UNIT – VI:

Database Issues: Database Issues: Hoarding techniques, caching invalidation mechanisms. Data Dissemination: Communications asymmetry, classification of new data delivery mechanisms, push-based mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques

TEXT BOOKS:

1. Mobile Communications, Jochen Schiller, Second Edition, PHI, 2003
2. Mobile Computing, Raj Kamal, Oxford University Press, 2007

REFERENCES:

1. Fundamentals of Mobile Computing, Prasant Kumar Pattnaik, Rajib Mall, PHI Learning Pvt. Ltd, New Delhi
2. Handbook of Wireless Networks and Mobile Computing, Stojmenovic and Cacute, Wiley, 2002
3. Introduction to Wireless and Mobile systems, Dharma Prakash Agarval, Qing and An Zeng, Thomson Asia Pvt. Ltd., 2005
4. Principles of Mobile Computing, Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, Springer, 2003

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B.Tech. VIII Semester	**L**	**T/P/D**	**C**
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(19PE1IT05) CLOUD COMPUTING

COURSE OBJECTIVES:

- To understand cloud computing architecture and deployment models
- To identify security issues and management in cloud computing
- To know audit and compliance in cloud computing

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify security aspects of each cloud model
CO-2: Develop a risk-management strategy for moving to the Cloud
CO-3: Implement a public cloud instance using a public cloud
CO-4: Service provider Apply trust-based security model to different layer

UNIT – I:
Introduction to Cloud Computing: Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing.

UNIT – II:
Cloud Computing Architecture: Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model
Cloud Deployment Models: Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise.

UNIT – III:
Security Issues in Cloud Computing: Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security.
Identity and Access Management Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management.

UNIT – IV:
Security Management in the Cloud: Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS.
Privacy Issues: Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations

UNIT – V:

Audit and Compliance: Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud.

UNIT – VI:

Advanced Topics: Recent developments in hybrid cloud and cloud security

TEXT BOOKS:

1. Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, 2009

REFERENCES:

1. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice), Tim Mather, ISBN-10: 0596802765, O'Reilly Media, September 2009

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B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PE1EC15) RF IC DESIGN

COURSE PRE-REQUISITES: VLSI Design (19PC1EC11) and Analog Circuits (19PC1EC06)

COURSE OBJECTIVES:
- To know the basic concepts of RF and Wireless Technology
- To learn the basic concepts of RF design
- To study the transceiver architecture and design of its internal components
- To understand the design considerations of oscillators and power amplifiers

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand the design bottlenecks specific to RF IC design
CO-2: Design constituent blocks of RF receiver front end
CO-3: Design Low Noise Amplifiers
CO-4: Design oscillators and PLL

UNIT – I:
Introduction to RF and Wireless Technology: Complexity comparison, Design bottlenecks, Applications, Analog and Digital Systems, Choice of Technology.

UNIT – II:
Basic Concepts in RF Design: Nonlinearity and time variance, Inter Symbol Interference, Random process and noise, sensitivity and dynamic range, passive impedance transformation.

UNIT – III:
Transceiver Architectures: General considerations, receiver architecture, Transmitter Architecture, transceiver performance tests, case studies.

UNIT – IV:
Low Noise Amplifiers and Mixers: Low Noise Amplifiers-General Considerations, Input Matching, Bipolar LNAs, CMOS LNAs.
Down Conversion Mixers: General Considerations, Bipolar Mixers, CMOS Mixers, and Noise in Mixers.

UNIT – V:
Oscillators: General Considerations, Basic LC topologies, Voltage-Controlled Oscillators, Bipolar and CMOS LC oscillators.
Frequency Synthesizers: General considerations, Phase Locked loop, RF Synthesizer architectures- Integer-N architecture, Fractional- N architecture, Frequency Dividers.

UNIT – VI:
Power Amplifiers: General considerations, linear and nonlinear Power amplifiers, classification, High-efficiency power amplifiers, large-signal impedance matching, linearization techniques.

TEXTBOOKS:

1. RF Microelectronics, Behzad Razavi, 2nd Edition, Prentice Hall of India, 2013
2. The Design of CMOS Radio Integrated Circuits, Thomas H. Lee, 2nd Edition, Cambridge University Press, 2003

REFERENCES:

1. Design of Analog CMOS Integrated Circuits, Behzad Razavi, TMH Edition, 2002
2. CMOS Analog Circuit Design, Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition / Indian Edition, 2010
3. CMOS Integrated Analog-to-Digital and Digital-to-Analog Converters, Rudy Van De Plass che, Kluwer Academic Publishers, 2003
4. CMOS Mixed-Signal Circuit Design, R. Jacob Baker, Wiley Inter science, 2009

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B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PE1EC16) RADAR SYSTEMS

COURSE PRE-REQUISITES: EM Waves and Transmission Lines (19PC1EC07), Microwave Engineering (19PC1EC13)

COURSE OBJECTIVES:

- To understand the components of a radar system and their relationship to overall system performance, the radar operating environment and techniques used to confront it, and top-level measures of performance
- To understand basic detection theory as applies to radar
- To understand the concepts of the matched filter, ambiguity functions, and other aspects of waveform with noise
- To understand radar measurements, associated quality, and the fundamentals of radar tracking

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Describe the principle of radars and factors affecting the radar performance
CO-2: Analyse different types of radar systems to assess their performance
CO-3: Illustrate the characteristics of radar receivers and their performance
CO-4: Perform the radar receiver in terms of noise

UNIT – I:
Basics of Radar: Introduction, Radar block diagram and operation, Maximum Unambiguous Range, Simple form of Radar Equation, Radar frequencies and Applications. Prediction of Range Performance, Minimum detectable Signal, Receiver Noise, Modified Radar Range Equation, Illustrative Problems.
Radar Equation: SNR, Envelope Detector, False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets: sphere, cone–sphere), Transmitter Power, PRF and Range Ambiguities. Systems Losses (qualitative treatment) Illustrative Problems.

UNIT – II:
CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW Radar. Illustrative problems.
FM-CW Radar: Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar.

UNIT – III:
MTI and Pulse Doppler Radar: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filter. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.

UNIT – IV:

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one- and two- coordinates), Phase Comparison Monopulse. Tracking in Range, Acquisition and Scanning Patterns. Comparison of Trackers.

UNIT – V:

Detection of Radar Signals in Noise: Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise.

UNIT – VI:

Radar Receivers: Noise Figure and Noise Temperature. Displays – types. Duplexers – Branch type and Balanced type. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering, types, applications, Advantages and Limitations.

TEXTBOOKS:

1. Introduction to Radar Systems, Merrill I. Skolnik, TMH Special Indian Edition, 2nd Edition, 2007
2. Radar Principles, Peebles Jr. P. Z., Wiley, New York, 1998

REFERENCES:

1. Introduction to Radar Systems, Merrill I. Skolnik, 3rd Edition, TMH, 2001
2. Radar: Principles, Technology, Applications, Byron Edde, Pearson Education, 2004

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B.Tech. VIII Semester	L	T/P/D	C
	3	0	3

(19PE1EC17) ADAPTIVE SIGNAL PROCESSING

COURSE PRE-REQUISITES: Digital Signal Processing (19PC1EC09)

COURSE OBJECTIVES:
- To know the concepts of optimum and linear prediction filters
- To familiarize various applications of adaptive systems
- To understand the basic principles of various adaptive signal processing algorithms with applications

COURSE OUTCOME: After completion of the course, students should be able to
CO-1: Design optimum and linear prediction filters
CO-2: Analyze and implement different algorithms
CO-3: Develop various adaptive signal processing applications

UNIT – I:
Introduction to Adaptive Systems: Definitions, Characteristics, Applications, Example of an Adaptive System, The Adaptive Linear Combiner – Description, Weight Vectors, Desired Response, Performance function – Gradient & Mean Square Error, innovation representation of stationary random process.

UNIT – II:
Linear Prediction Filters: Forward and Backward Linear Prediction, Optimum reflection coefficients for the Lattice Forward and Backward Predictors, Solution of the Normal Equations- Levinson Durbin Algorithm, Schur Algorithm, Properties of Linear Prediction Filters.

UNIT – III:
Wiener Filters: FIR Wiener Filter, Orthogonality Principle in Linear Mean -Square Estimation.
Wiener- Hopf equations, Error Performance surface, IR Wiener Filter, Non causal Wiener Filter.

UNIT – IV:
Adaptive FIR Filters: Minimum Mean Square error criterion, The LMS algorithm, related stochastic gradient algorithms, Properties of the LMS algorithm, RLS algorithm, Fast RLS algorithm, Properties of the RLS algorithms.

UNIT – V:
Kalman Filters: Recursive minimum mean square estimation for scalar random variables, Statement of Kalman filtering problem, The Innovation Process, Estimation of State using the Innovation Process, Filtering, the extended Kalman filter.

UNIT – VI:
Applications of Adaptive Filters: System identification or system modelling, Adaptive channel equalization, Echo cancellation in data transmission over telephone channels, suppression of narrowband interference in a wideband signal, adaptive

line enhancer, adaptive noise cancelling, linear predictive coding of speech signal, adaptive arrays.

TEXTBOOKS:

1. Digital Signal Processing: Principles, Algorithms and Applications, John G. Proakis, D. G. Manolakis, 4th Edition, Perason/PHI, 2013
2. Adaptive Filter Theory, Simon Haykin, 4th Edition, Pearson, 2016

REFERENCES:

1. Adaptive Signal Processing, Bernard Widrow, Samuel D. Strearns, Pearson, 2005
2. Optimum Signal Processing: An Introduction, Sophocles. J. Orfamadis, 2nd Edition, McGraw-Hill, New York, 1988
3. Adaptive Signal Processing-Theory and Applications, S. Thomas Alexander, Springer–Verlag, 1986
4. Statistical Signal Processing in Engineering, Umberto Spagnolini, Wiley, 2018

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B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PE1EC18) WIRELESS SENSOR NETWORKS AND PROTOCOLS

COURSE PRE-REQUISITES: Computer Networks and Systems Approach (19PC1EC12)

COURSE OBJECTIVES:
- To understand basics of Wireless Sensor Networks
- To study of medium access control protocols
- To distinguish key routing protocols used in sensor networks
- To learn transport layer protocols used in for sensor networks

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify engineering components, systems and protocols necessary for establishing the WSN to any application
CO-2: Appreciate the merits and security requirements of the different WSN protocols
CO-3: Demonstrate proficiency in using different WSN Protocols with sufficient security
CO-4: Identify the design goals and issues in Routing and Transport Layer Protocols for Ad Hoc Wireless Networks

UNIT – I:
Overview of Wireless Sensor Networks: Key definitions of sensor networks, Advantages of sensor Networks, Unique constraints and challenges, Driving Applications, Enabling Technologies for Wireless Sensor Networks.

UNIT – II:
Networking Technologies: Physical Layer and Transceiver Design Considerations, Personal area networks (PANs), hidden node and exposed node problem, Topologies of PANs, MANETs, WANETs.

UNIT – III:
MAC Protocols for Wireless Sensor Networks: Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals, Classifications of MAC Protocols, MAC Protocols that use Directional Antennas,

UNIT – IV:
Routing Protocols: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms.

UNIT – V:
Transport Layer Protocols: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions.

UNIT – VI:

Security in WSN: Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.

TEXTBOOKS:

1. Adhoc Wireless Networks: Architectures and Protocols, C. Siva Ram Murthy and B. S. Manoj, PHI, 2004
2. Wireless Adhoc and Sensor Networks: Protocols, Performance and Control, Jagannathan Sarangapani, CRC Press, 2007
3. Protocols and Architectures for Wireless Sensor Networks, Holger Karl & Andreas Willig, John Wiley, 2005

REFERENCES:

1. Wireless Sensor Networks - Technology, Protocols, and Applications, Kazem Sohraby, Daniel Minoli, & Taieb Znati, John Wiley, 2007
2. Wireless Sensor Networks - An Information Processing Approach, Feng Zhao & Leonidas J. Guibas, Elsevier, 2007
3. Adhoc Mobile Wireless Networks: Protocols & Systems, C. K. Toh, 1st Edition, Pearson Education
4. Wireless Sensor Networks, C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer
5. Wireless Sensor Networks, S. Anandamurugan, Lakshmi Publications

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B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PE1CS17) DISTRIBUTED TRUST AND BLOCKCHAIN TECHNOLOGIES

COURSE OBJECTIVES:
- To get the terminologies and overview of block chain technologies
- To study the concepts and foundation of blockchain Technology
- To understand Security Mechanism and Consensus in blockchain
- To design Use Cases and Architecture blockchain Technology

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Gain a clear understanding of the concepts that underlie digital distributed ledger
CO-2: Understand key mechanisms like Decentralization, Transparency and trust, Immutability, High availability, Highly secure and different types of Blockchain
CO-3: Understand the concept of Hash Function and Related Hash Algorithm
CO-4: Learn how to design and implement any application in Blockchain Technology

UNIT – I:
Need for Distributed Record Keeping, Byzantine Generals problem Consensus algorithms and their scalability problems, Technologies Borrowed in Blockchain – hash pointers, consensus, digital cash etc.

UNIT – II:
Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems

UNIT – III:
Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use

UNIT – IV:
Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts

UNIT – V:
Hyperledger fabric, Fabric Membership, Fabric Membership, plug and play platform and mechanisms in permissioned blockchain

UNIT – VI:
Pseudo-anonymity vs. anonymity, attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks.

TEXT BOOKS:

1. Blockchain Technology: Cryptocurrency and Applications, S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, Oxford University Press, 2019

2. Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming, Josh Thompson, Create Space Independent Publishing Platform, 2017

REFERENCES:

1. Blockchain Quick Reference, Brenn Hill, Samanyu Chopra, Paul Valencourt, 2018, Packt Publishing
2. Blockchain: Blueprint for a New Economy, Melanie Swa, 2015
3. Mastering Bitcoin: Programming the Open Blockchai, Andreas M. Antonopoulos, 2017

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B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PE1EC19) DSP PROCESSORS AND ARCHITECTURES

COURSE PRE-REQUISITES: Digital Signal Processing (19PC1EC09), Microprocessors and Microcontrollers (19PC1EC10)

COURSE OBJECTIVES:
- To study the architectural features of programmable DSPs
- To analyze the importance of numeric formats and sources of errors in DSP implementation
- To understand the concepts of Memory & I/O interfacing
- To develop various DSP algorithms and their implementation

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand and Identify various DSP Architectures
CO-2: Discriminate different number representations and their effects
CO-3: Demonstrate the features of on-chip peripheral devices and memory-I/O interfacing along with its programming
CO-4: Demonstrate the features of Real Time, Fixed point and Floating-point DSP architectures

UNIT – I:
Introduction to DSP Processors: Digital Signal Processors, various architectures: VLIW Architecture, Multiprocessor DSPs, SHARC, SIMD, MIMD, RISC and CISC.
Implementation considerations - Data representations and arithmetic, finite word length effects, real time implementation considerations.

UNIT – II:
Execution Control and Pipelining: Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branch effects, Interrupt effects, Pipeline Programming models.

UNIT – III:
Typical Real-Time DSP System: Data representations and arithmetic, Analog - to – digital conversion process, Uniform and non-uniform quantization and encoding, Oversampling in A/D conversion, Digital to analog conversion process: signal recovery, the DAC, Anti-imaging filtering, Oversampling in D/A conversion, Analog I/O interface for real-time DSP systems, sources of errors in DSP implementation, real time implementation considerations.

UNIT – IV:
Fixed-Point DSP Processors: Architecture of TMS 320C 5X, C54X Processors, addressing modes, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline operation of TMS320C54XX Processors, speed issues.

UNIT – V:

Memory and I/O Interfacing: External bus interfacing signals, Memory interface, Parallel I/O interface: Programmed I/O, Interrupts and I/O, Direct memory access (DMA). Hardware interfacing, Multichannel Buffered Serial Port (McBSP), CODEC interface circuit.

Implementation of DSP Algorithms: The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, FFT Algorithm, Adaptive Filters, 2-D Signal Processing.

UNIT – VI:

Floating-Point DSP Processors: TMS320C6000 series, architecture study, Central processing UNIT and data paths, Functional UNITs and its operations, Addressing modes in C6X, memory architecture, Peripherals, Assembly Instructions for arithmetic, logical operations

TEXTBOOKS:

1. Digital Signal Processing, Avtar Singh and S. Srinivasan, Thomson Publications, 2016
2. Digital Signal Processing - A Practical Approach, Emmanuel C. Ifeachor, Barrie W. Jervis, 2nd Edition, Pearson Publications. 2002
3. Digital Signal Processing and Applications with the C6713 and C6416 DSK, Rulph Chassaing, Wiley, 2005

REFERENCES:

1. Digital Signal processors Architectures, implementations and Applications, Sen M. Kuo, Woon-Seng S. Gan, Pearson Publications, 2009
2. Digital Signal Processors, Architecture, Programming and Applications, B. Venkata Ramani and M. Bhaskar, TMH, 2007
3. DSP Processor Fundamentals, Architectures and Features, Lapsley, S. Chand, 2003
4. DSP Applications with TMS 320 Family, K. Shin, Prentice Hall, 1987

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
	0	**8**	**4**

(19PW4EC05) MAJOR PROJECT PHASE-I

B.Tech. VIII Semester	**L**	**T/P/D**	**C**
	0	**12**	**6**

(19PW4EC06) MAJOR PROJECT PHASE-II

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify and formulate the problem (Industry/technical/societal)
CO-2: Analyze, design and develop a solution to industry/technical/societal problems
CO-3: Implement and execute the solution
CO-4: Demonstrate effective communication skills through oral presentation
CO-5: Engage in effective written communication through project report

COURSE OUTLINE:

- A student shall initiate major project in seventh semester (IV year I semester) and continue it in the eighth semester (IV year II semester).
- Major project shall be carried out in two phases i.e., Major Project Phase-I in the seventh semester and Major Project Phase-II in the eighth semester.
- Major project shall be evaluated for a total of 200 marks. Out of which, Major Project Phase-I shall be evaluated for 100 marks in seventh semester and Major Project Phase-II for 100 marks in eighth semester.
- Evaluation of Major Project Phase-I and Major Project Phase-II shall consist of both CIE and SEE in each semester.
- CIE shall be done by a Project Review Committee (PRC) consisting of Head of the Department, project supervisor and senior faculty member of the Department.
- CIE shall be done on the basis of two seminars conducted in each semester as per the academic calendar and as per the evaluation format provided by the DoA.
- A student shall submit project progress in prescribed report format during each of the project reviews.
- SEE shall be carried out in both Major Project Phase-I and Major Project Phase-II.
- SEE in Major Project Phase-I shall be conducted by a committee consisting of Head of the Department, the project supervisor and one senior faculty of the programme.
- SEE in Major Project Phase-II (project viva-voce) shall be conducted by a committee consisting of an external examiner, Head of the Department, the project supervisor and one senior faculty of the programme.