R18

TAMASOMA JYOTHIRGAMAYA

B.Tech.
(ELECTRICAL AND ELECTRONICS ENGINEERING)

B.Tech. R18 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 135 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
E-mail: postbox@vnrvjiet.ac.in, Website: www.vnrvjiet.ac.in

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

ELECTRICAL AND ELECTRONICS ENGINEERING

VISION OF THE DEPARTMENT

To excel in Education, Technology and Research in Electrical and Electronics Engineering leading to sustainable socioeconomic development of the nation.

MISSION OF THE DEPARTMENT

- Excellent teaching-learning environment imbibed with professional ethics and social responsibility in promoting quality education.

- Promoting research through industry collaborations and innovative projects.

B.TECH.

(ELECTRICAL AND ELECTRONICS ENGINEERING)

B.TECH. (EEE)

PROGRAM EDUCATIONAL OBJECTIVES

PEO-I: Excel in chosen career and/or higher education with technical competence

PEO-II: Demonstrate multidisciplinary skills and professional ethics in relating engineering issues to broader societal context

PEO-III: Work effectively as an individual and team member with good managerial and

PEO-IV: Engage in lifelong learning to maintain and enhance professional skills communication skills

B.TECH. (EEE)

PROGRAM OUTCOMES

PO-1: Apply mathematics, basic sciences and electrical engineering fundamentals to solve technical problems with the background of multi-disciplinary knowledge.

PO-2: Identify, formulate, research literature and analyze complex electrical and electronics engineering problems attaining reasonable conclusions using fundamentals of mathematics, basic and engineering sciences.

PO-3: Design solutions for complex electrical and electronics engineering problems and the process to attain the specified solutions with societal, environmental and safety considerations

PO-4: Bring out alternate solutions using research based knowledge and methodology

PO-5: Create, select and apply modern tools to carryout complex electrical and electronics engineering activities with an understanding of the limitations

PO-6: Apply contextual knowledge in professional engineering practice to enhance the society in the aspects of economy, health, safety, legal and culture.

PO-7: Understand the impact of engineering solutions on the environment to mitigate any ill effects and ensure sustainability of the solutions arrived.

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

PO-9: Function effectively as an individual and as a member or leader in diverse and multi disciplinary teams

PO-10: Communicate effectively on complex engineering activities with the engineering community and with society at large

PO-11: Administer and regulate projects subjected to financial personnel and time constraints

PO-12: Engage in lifelong learning to adopt or develop the technological advancements to meet the growing and changing societal needs

B.TECH. (EEE)

PROGRAM SPECIFIC OUTCOMES

PSO-1: Apply mathematics, basic sciences and electrical engineering fundamentals to solve technical problems with the background of multi-disciplinary knowledge.

PSO-2: Identify, formulate, research literature and analyze complex electrical and electronics engineering problems attaining reasonable conclusions using fundamentals of mathematics, basic and engineering sciences.

PSO-3: Design solutions for complex electrical and electronics engineering problems and the process to attain the specified solutions with societal, environmental and safety considerations

PO-4: Create, select and apply modern tools to carryout complex electrical and electronics engineering activities with an understanding of the limitations

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY HYDERABAD
B.TECH. I YEAR
(EEE, ECE and EIE)

I SEMESTER **R18**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
18BS1MT01	Advanced Calculus	3	1	0	4	4
18BS1CH01	Engineering Chemistry	3	1	0	4	4
18HS1EN01	English	2	0	0	2	2
18ES1CS01	Programming through C	3	0	0	3	3
18BS2CH01	Engineering Chemistry Laboratory	0	0	3	3	1.5
18HS2EN01	English Language Communication Skills Laboratory	0	0	2	2	1
18ES2CS01	Programming through C Laboratory	0	0	4	4	2
18ES2ME01	Workshop Practices	1	0	3	4	2.5
Total		**12**	**2**	**12**	**26**	**20**
18MN6HS01	Induction Programme	-	-	-	-	-

II SEMESTER **R18**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
18BS1MT03	Linear Algebra, Ordinary Differential Equations and Laplace Transforms	3	1	0	4	4
18BS1PH02	Engineering Physics	3	1	0	4	4
18ES1EE01	Basics of Electrical Energy for Engineers	3	1	0	4	4
18ES3ME02	Engineering Drawing	1	0	4	5	3
18BS2PH02	Engineering Physics Laboratory	0	0	3	3	1.5
18ES2EE01	Basic Electrical Engineering Laboratory	0	0	3	3	1.5
18PW4EE01	Design Sensitization	0	0	2	2	1
Total		**10**	**3**	**12**	**25**	**19**

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

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

III SEMESTER **R18**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
18BS1MT05	Complex Analysis and Transforms	3	0	0	3	3
18PC1EE01	Electrical Circuit Analysis	3	1	0	4	4
18PC1EE02	Electromagnetic Fields	3	0	0	3	3
18PC1EC02	Electronic Devices and Circuits	3	0	0	3	3
18PC1EE03	Electrical Machines – I	3	0	0	3	3
18PC1ME16	Fluid Mechanics and Hydraulic Machines	3	0	0	3	3
18PC2EE01	Electrical Circuits and Simulation Laboratory	0	0	2	2	1
18PC2EE02	Electrical Machines-I Laboratory	0	0	2	2	1
18PC2EC06	Electronic Devices Laboratory	0	0	2	2	1
Total		**18**	**1**	**6**	**25**	**22**

IV SEMESTER **R18**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
18PC1EE04	Electrical Machines – II	3	0	0	3	3
18PC1EE05	Power Systems-I	3	0	0	3	3
18PC1EC05	Analog Circuits	3	0	0	3	3
18PC1EC06	Digital System Design	3	0	0	3	3
18PC1CS06	Data Structures Through C	3	0	0	3	3
18PC2EE03	Electrical Machines-II Laboratory	0	0	2	2	1
18PC2EC07	Analog Electronics Laboratory	0	0	2	2	1
18PC2EC08	Digital Logic Design Laboratory	0	0	2	2	1
18PC2CS03	Data Structures through C Laboratory	0	0	2	2	1
Total		**15**	**0**	**8**	**23**	**19**
18MN6HS03	Gender Sensitization	0	0	2	2	0

L – Lecture T – Tutorial P – Practical

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

V SEMESTER **R18**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
18PC1EE08	Power Electronics	3	0	0	3	3
18PC1EE07	Power Systems – II	3	0	0	3	3
18PC1EE06	Control Systems	3	0	0	3	3
18HS1MG01	Engineering Economics and Accountancy	3	0	0	3	3
	Professional Elective -I					
18PE1EE01	Utilization of Electrical Energy	3	0	0	3	3
18PE1EE02	Renewable Energy Systems					
18PE1EE03	Special Machines and Control					
18PC1IT05	Operating Systems					
18PC1EC03	Signals and Systems					
	Open Elective -I	3	0	0	3	3
18PC2EE05	Power Electronics Laboratory	0	0	2	2	1
18PC2EE04	Control Systems Laboratory	0	0	2	2	1
18PC2CS04	Python Programming Practice	0	0	2	2	1
18PW4EE02	Internship*	0	0	2	2	1
Total		**18**	**0**	**8**	**26**	**22**
18MN6HS02	Environmental Sciences	**2**	**0**	**0**	**2**	**0**

*** Internship to be pursued during summer vacation after IV semester and evaluated in V semester**

VI SEMESTER **R18**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
18PC1EE09	Electrical Measurements and Instrumentation	3	0	0	3	3
18PC1EC09	Microprocessors and Microcontrollers	3	0	0	3	3
18HS1MG02	Principles of Management and Organizational Behavior	3	0	0	3	3
	Professional Elective -II					
18PE1EE04	Electrical Drives	3	0	0	3	3
18PE1EE05	Storage Technologies					
18PE1EE06	Digital Control Systems					
18PC1IT02	Computer Organization					
18PE1EC02	MOS Circuits					
	Open Elective -II	3	0	0	3	3
18PC2EC10	Microprocessors and Microcontrollers Laboratory	0	0	2	2	1
18PC2EE06	Electrical Measurements and Instrumentation Laboratory	0	0	2	2	1
18HS2EN02	Advanced English Communication Skills Laboratory	0	0	2	2	1
18PW4EE03	Design Thinking	0	0	4	4	2
Total		**15**	**0**	**10**	**25**	**20**

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 **(18OE1CE01)**	Green Building Technology **(18OE1CE02)**	Smart Materials and Structures **(18OE1CE03)**	Intelligent Transportation System **(18OE1CE04)**
Waste Management (CE)	Solid Waste Management **(18OE1CE05)**	Hazardous Waste Management **(18OE1CE06)**	Waste to Energy **(18OE1CE07)**	Intelligent Waste Management and Recycling System **(18OE1CE08)**
Green Energy (EEE)	Renewable Energy sources **(18OE1EE01)**	Renewable Energy Technologies **(18OE1EE02)**	Energy Storage Technologies **(18OE1EE03)**	Energy Management and Conservation **(18OE1EE04)**
3D Printing and Design (ME)	Elements of CAD **(18OE1ME01)**	Introduction to 3D Printing **(18OE1ME02)**	3D Printing - Machines, Tooling and Systems **(18OE1ME03)**	Reverse Engineering **(18OE1ME04)**
Internet of Things (ECE)	Sensors Transducers and Actuators **(180E1EC01)**	Introduction to Microcontrollers and Interfacing **(180E1EC02)**	IoT Protocols and its applications **(180E1EC03)**	Wireless Sensor Networks **(18OE1EC08)**
Augmented Reality (AR) / Virtual Reality (VR) (ECE)	Introduction to C Sharp **(180E1EC04)**	Introduction to Signal Processing **(180E1EC05)**	Introduction to Image and Video Processing **(180E1EC06)**	Applications of AR and VR **(18OE1EC07)**
Artificial Intelligence (CSE)	Mathematics for Artificial Intelligence **(18OE1MT02)**	Fundamentals of Artificial Intelligence **(18OE1CS01)**	Machine Learning Techniques **(18OE1CS02)**	Deep Learning **(18OE1CS03)**
Blockchain Technologies (CSE)	Fundamentals of Computer Networks **(18OE1CS04)** / Relational Data Base Management Systems **(18OE1CS08)**	Distributed Data Bases **(18OE1CS05)**	Cryptography and Network Security **(18OE1CS06)**	Blockchain Technology **(18OE1CS07)**
Robotics (EIE)	Fundamentals of Robotics **(18OE1EI01)**	Kinematics and Dynamics of Robotics **(18OE1EI02)**	Drives and Control Systems for Robotics **(18OE1EI03)**	Robot Programming and Intelligent Control Systems **(18OE1EI04)**
Cyber Security (IT)	Fundamentals of Computer Networks **(18OE1CS04)** / Relational Data Base Management Systems **(18OE1CS08)**	Cryptography and Network Security **(18OE1CS06)**	Essentials of Cyber Security **(18OE1IT01)**	Computer Forensics **(18OE1IT02)**
Data Sciences / Big Data and Analytics (IT)	Statistical Methods for Data Science **(18OE1MT03)**	Computational Thinking using Python **(18OE1IT03)**	Fundamentals of Data Mining **(18OE1IT04)**	Data Analysis and Visualization **(18OE1IT05)**
Autonomous Vehicles (AME)	Principles of Automobile Engineering **(18OE1AE01)**	Modern Automotive Technologies **(18OE1AE02)**	Electric, Hybrid and Fuel Cell Vehicles **(18OE1AE03)**	Connected and Autonomous Vehicles **(18OE1AE04)**

GENERAL POOL OF OE COURSES:

OE TRACKS (Parent Departments)	**COURSES**
General-Computing (CSE / IT)	• Programming through Java **(18OE1IT06)** • Relational Data Base Management Systems **(18OE1CS08)** • Computational Thinking using Python **(18OE1IT03)** • Introduction to Data Analytics **(18OE1IT07)** • Fundamentals of Computer Algorithms **(18OE1CS11)**
General (H&S)	• Professional Ethics and Human Values (**18OE1HS01**) • Entrepreneurship (**18OE1HS02)** • Personality Development and Public Speaking (**18OE1HS03)** • Foreign Language-French/ German (**18OE1HS04)**
General	• Smart Cities **(18OE1CE09)** • Trends in Energy Sources for Sustainable Development **(18OE1EE05)** • 3D Printing and Design **(18OE1ME05)** • Embedded Systems for IoT **(18OE1EC09)** • Artificial Intelligence - A Beginner's Guide **(18OE1CS09)** • Blockchain Technology Essentials **(18OE1CS10)** • Fundamentals of Robotics and Drones **(18OE1EI05)** • Fundamentals of Cyber Security **(18OE1IT08)** • Fundamentals of Data Science **(18OE1IT09)** • Introduction to Advanced Vehicle Technologies **(18OE1AE05)**

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

VII SEMESTER **R18**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
18PC1EC30	Principles of Digital Signal Processing	3	0	0	3	3
18PC1EE10	Switchgear and Protection	3	0	0	3	3
	Professional Elective - III					
18PE1EE07	Power System Operation and Control	3	0	0	3	3
18PE1EC20	Sensors and Actuators					
18PE1EE08	Electrical Distribution Systems and Automation					
18PE1MT02	Essential Mathematics for Machine Learning					
18PE1EC05	CPLD and FPGA Architecture					
	Professional Elective - IV					
18PE1EE09	Flexible AC Transmission Systems	3	0	0	3	3
18PE1EC08	Internet of Things					
18PE1EE10	Power System Dynamics and Control					
18PE1EE11	Artificial Neural Networks and Fuzzy Logic					
18PE1EC12	Embedded Real Time Operating Systems					
	Open Elective - III	3	0	0	3	3
18PC2EC16	Principles of Digital Signal Processing Laboratory	0	0	2	2	1
18PC2EE07	Power Systems Laboratory	0	0	2	2	1
18PW4EE04	Mini-Project	0	0	4	4	2
18PW4EE05	Project - 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**

VIII SEMESTER **R18**

Course Category	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
	Professional Elective – V					
18PE1EE12	High Voltage Engineering	3	0	0	3	3
18PE1EE13	Smart Grids					
18PE1EE14	HVDC Transmission					
18PC1CS10	Big Data Analysis					
18PE1EC04	Digital Image Processing					
	Professional Elective – VI					
18PE1EE15	Power Quality	3	0	0	3	3
18PE1EE16	Electric Vehicles					
18PE1EE17	Reliability Engineering Applications to Power Systems					
18PE1EE18	Energy Audit and Conservation					
18PC1EC10	VLSI Design					
	Open Elective – IV	3	0	0	3	3
18PW4EE06	Project – II	0	0	12	12	6
Total		**9**	**0**	**12**	**21**	**15**

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Semester – Common to all branches	**L**	**T/P/D**	**C**
	3	**1**	**4**

(18BS1MT01) ADVANCED CALCULUS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To learn geometrical approach to the mean value theorems and their application to the mathematical problem
- To learn concept of Sequence and Series
- To learn evaluation of improper integrals using Beta and Gamma functions
- 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: Solve problems involving mean value theorems
CO-2: Analyze the nature of convergence of sequence and series
CO-3: Evaluate integrals using special functions and change of variables
CO-4: Evaluate double and triple integrals
CO-5: Transform line integral to surface and surface to volume integrals

UNIT-I:
Calculus of Single and Several Real Variables: Mean value theorems–Rolle's Theorem, Lagrange's Mean value theorem Cauchy's Mean value theorem**,** Taylor's expansion and McLaurin's expansion of functions (without proofs). Partial differentiation, partial derivatives of first and second order in terms of partial derivatives, change of variables, Jacobian, Taylor's theorem of two variables (without proof). Maxima and Minima of two variables, Lagrange's method of undetermined multipliers.

UNIT-II:
Sequences and Series: Sequence: Definition of a Sequence, limit; Convergent, Divergent and Oscillatory sequences. Series: Convergent, Divergent and Oscillatory Series; Series of positive terms; Comparison test, p-test, D-Alembert's ratio test; Raabe's test; Cauchy's Integral test; Cauchy's root test; logarithmic test. Alternating series: Leibnitz test; Alternating Convergent series: Absolute and Conditionally Convergence, Power series.

UNIT-III:
Improper Integrals: Definition of Improper Integral: Beta and Gamma functions, Relation between the Beta and Gamma functions (without proof) and their applications, Standard forms of beta functions.

UNIT-IV:
Multiple Integrals: Evaluation of Double Integrals (Cartesian and polar coordinates); change of order of integration (only Cartesian form); Evaluation of Triple Integrals: Change of variables (Cartesian to polar) for double and (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, Divergence and Curl. Directional derivatives, Tangent plane and normal line. Vector Identities (without proofs). Scalar potential functions. Solenoidal and Irrotational vectors.

UNIT-VI:

Vector Integral Calculus: Line, Surface and Volume Integrals. Theorems of Green, Gauss and Stokes (without proofs) and their applications.

TEXT BOOKS:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley
2. Higher Engineering Mathematics, B. V. Ramana, 11th Reprint, Tata McGraw-Hill, New Delhi, 2010

REFERENCES:

1. Calculus and Analytic Geometry, Thomas and Finney, 9th Edition, Pearson Education, 2002
2. Higher Engineering Mathematics, B. S. Grewal, 36th Edition, Khanna Publishers, 2010
3. Elementary Analysis: The Theory of Calculus, Kenneth Ross, Springer
4. Advanced Engineering Mathematics, Peter 'O' Neil, Cengage Learning

B.Tech. I Semester– Common to all branches	L	T/P/D	C
	3	1	4

(18BS1CH01) ENGINEERING CHEMISTRY

COURSE PRE-REQUISITES: None

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 and describe the thermodynamic equilibrium of a system using phase rule
- 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 and predict the behaviour of a system under different variables
CO-4: Familiarize with the role of nanomaterials, environmental & green chemistry and assess the use of analytical techniques

UNIT-I:
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, Dendrimers-definition, features, applications. FRPs and their applications.

UNIT-II:
Surfactants: Types of surfactants, cleaning mechanism, hydrophobic and hydrophilic interactions, micelles, reverse micelles and critical micelle concentration. Detergents and their role as cleaning agents.
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, knocking, octane number, cetane number. Cracking-definition, types of cracking, fluid-bed cracking. Limitations of fossil fuels. 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, Solar cells- principle and applications.

UNIT-IV:

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

Phase rule, definition of terms in phase rule, advantages and limitations of phase rule, simple phase diagram -water system.

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.

UNIT-V:

Nanomaterials: Definition, synthesis-top down and bottom up approaches. Properties and application of fullerenes, fullerols 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: 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
2. Engineering Chemistry, Prasanta Rath, B. Rama Devi, Ch. Venkata Ramana Reddy, SubhenduChakroborty, Cengage Publications, Delhi, 2018
3. A Textbook of Engineering Chemistry, Shashi Chawla, Dhanpat Rai Publications, New Delhi

REFERENCES:

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

B.Tech. I Semester – Common to all branches

L	T/P/D	C
2	0	2

(18HS1EN01) ENGLISH

COURSE PRE-REQUISITES: None

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 effectively and contextually
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. Speaking & Listening: Pronunciation, Stress, Intonation and Rhythm
3. Grammar: Prepositions
4. Vocabulary: Word Formation- I
5. Writing: Punctuation, Clauses and Sentences
6. Life Skills: Values and Ethics; 'If' by Rudyard Kipling

UNIT-II:

1. Reading: The Brook by Alfred Tennyson
2. Speaking & Listening: Introducing oneself and others, making announcements
3. Grammar: Articles
4. Vocabulary: Word Formation- II
5. Writing: Principles of Good Writing-Coherence, Cohesion
6. Life Skills: Self Improvement; How I Became a Public Speaker by G.B. Shaw

UNIT-III:

1. Reading: The Death Trap by Saki
2. Speaking & Listening: Gaining attention, Interrupting Conversations
3. Grammar: Noun-Pronoun Agreement; Subject-Verb Agreement
4. Vocabulary: Word Formation- III

5. Writing: Transitional Devices & Paragraph Writing; Writing Process
6. Life Skills: Time Management; On Saving Time by Seneca

UNIT-IV:

1. Reading: ChinduYellamma
2. Speaking & Listening: Making Requests and Responding to them; Extended Listening
3. Grammar: Misplaced Modifiers
4. Vocabulary: Synonyms and Antonyms
5. Writing: Writing a Summary
6. Life Skills: Innovation; MuhammadYunus

UNIT-V:

1. Reading: Politics and the English Language by George Orwell
2. Speaking & Listening: Interview Skills; Making a Presentation
3. Grammar: Cliches; Redundancies
4. Vocabulary: Common Abbreviations
5. Writing: Cause and Effect Paragraphs
6. 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 BOOK:

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

RECOMMENDED BOOKS:

1. Technical Communication, Meenakshi Raman & Sangeeta Sharma, Oxford University Press
2. Effective Communication Skills, Kulbushan Kumar, Khanna Publishing House, Delhi
3. Communication Skills, Pushplata, Sanjay Kumar, Oxford University Press
4. Longman Dictionary of Common Errors, N.D. Turton and J.B. Heaton

SUGGESTED READINGS:

1. Practical English Usage. Michael Swan. OUP. 1995
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006
5. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
6. Rhetorical Grammar: Grammatical Choices, Rhetorical Effects (7th ed.), Martha Kolln& Loretta Gray. New York: Longman, 2012. ISBN-10: 0321846729; ISBN-13: 978-0321846723

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Semester– Common to all branches	L	T/P/D	C
	3	0	3

(18ES1CS01) PROGRAMMING THROUGH C

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To relate basics of programming language constructs and problem solving techniques
- To classify and implement 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 the computer fundamentals and basics of C programming for problem solving and represent the same by algorithm, flowchart, and pseudocode.
CO2: Apply and write C programs using C language construct basic and derived data types.
CO3: Classify different searching and sorting techniques, and able to use preprocessor directives
CO4: Develop a solution for a given problem using modular approach, file I/O

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, basic sorting algorithms (bubble, insertion and selection), finding roots of equations, notion of order of complexity through example programs (no formal definition required)

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, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT-V:
Structures: Defining structures and array of structures.
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, random access of files, command line arguments.

TEXT BOOKS:

1. Schaum's Outline of Programming with C, Byron Gottfried, McGraw-Hill
2. Programming in ANSI C, E. Balaguruswamy, Tata McGraw-Hill

REFERENCES:

1. The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, Prentice Hall of India

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Semester – Common to all branches	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

(18BS2CH01) ENGINEERING CHEMISTRY LABORATORY

COURSE PRE-REQUISITES: None

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: To record the amount of hardness and chloride content in water and interpret the significance of its presence in water
CO-2: To analyze the influence of variation of concentration with time on rate constant
CO-3: To report and predict the significance of properties like absorption of light, adsorption, conductance, viscosity, pH and surface tension
CO-4: To 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. Verification of Freundlich/Langmuir isotherm for adsorption of acetic acid on charcoal.
5. Estimation of copper present in the given solution by colorimetric method.
6. Conductometric titration of Acid vs Base.
7. Determination of viscosity of sample oil by Redwood Viscometer-I.
8. Determination of pH of various sample solutions by pH meter.
9. Determination of R_f value of organic compounds in a mixture by Thin Layer Chromatography.
10. Determination of surface tension of a liquid by drop method using Stalagmometer.
11. Titration of Acid vs Base using pH metric method.
12. Synthesis of a Polymer-Bakelite/Nylon.

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, Dr. O. P. Pandey, D. N. Bajpai, and Dr. S. Giri, S. Chand Publications

REFERENCES:

1. Vogel's Textbook 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. I Semester – Common to all branches	**L**	**T/P/D**	**C**
	0	**2**	**1**

(18HS2EN01) ENGLISH LANGUAGE COMMUNICATION SKILLS LABORATORY

COURSE PRE-REQUISITES: None

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: Should have learnt the basic vocabulary of 3000 words (as identified by oxford/Cambridge advanced learners dictionary)

UNIT-I:
1. Introduction of Self and others
2. Listening Comprehension-Listening for details
3. Reading Skills- Skimming and Scanning

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
3. Reading Skills - 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

UNIT-V:
1. Speaking Activity: Book/Film Review
2. Reading Comprehension-Contextual Vocabulary
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

SUGGESTED READINGS:

1. Practical English Usage, Michael Swan, OUP, 1995
2. Remedial English Grammar, F. T. Wood, Macmillan, 2007
3. Exercises in Spoken English, Parts I-III, CIEFL, Hyderabad. Oxford University Press
4. Cambridge or Oxford Dictionary
5. Fowler's Modern English Usage, Revised, R. W. Burchfield

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Semester– Common to all branches

L	T/P/D	C
0	4	2

(18ES2CS01) PROGRAMMING THROUGH C LABORATORY

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
CO1: Use the fundamental process of problem solving using any programming environment.
CO2: Design and develop the efficient solution for a given problem using different basic and derived data types.
CO3: Solve the given problem using C language constructs, modules, file I/O
CO4: Choose the data type, language construct for a given problem, design and record the solution using algorithm, flowchart.

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

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment.

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures.

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.t., sum of series.

Tutorial 5: 1D arrays: searching, sorting:
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and strings
Lab 6: Matrix problems, string operations.

Tutorial 7: Functions, call by value:

Lab 7: Simple functions.

Tutorial 8 and 9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls.
Lab 10: Recursive functions.

Tutorial 11: Pointers, structures and dynamic memory allocation.
Lab 11: Pointers and structures

Tutorial 12: File handling
Lab 12: File operations.

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B.Tech. I Semester – Common to all branches	L	T/P/D	C
	1	3	2.5

(18ES2ME01) WORKSHOP PRACTICES

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: Exposure to Various types of manufacturing Process
CO-2: Fabricate/make components from wood, MS flat, GI Sheet etc. – hands on experience
CO-3: Exposure 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. Metal Casting
8. Welding (Arc Welding & Gas Welding), Brazing
9. Power Tools
10. Printed Circuit Boards

TRADES:

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, Scitech
2. Elements of Workshop Technology, Vol. I and Vol. II, Hajra Choudhury S. K., Hajra Choudhury A. K. and Nirjhar Roy S. K., Media Promoters and Publishers Private Limited, Mumbai, 2008 and 2010
3. Printed Circuit Boards: Design, Fabrication, and Assembly, R. S. Khandpur, McGraw-Hill

REFERENCES:

1. Manufacturing Engineering and Technology, Kalpakjian S. and Steven S. Schmid, 4th Edition, Pearson Education India Edition, 2002
2. Manufacturing Technology – I, 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. I and Vol. II, Rao P.N., Tata McGraw-Hill House, 2017

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester– Common to EEE,ECE & EIE	**L**	**T/P/D**	**C**
	3	**1**	**4**

(18BS1MT03) LINEAR ALGEBRA, ORDINARY DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

COURSE PRE-REQUISITES: Matrices, Differentiation and Integration

COURSE OBJECTIVES:
- To concept of Rank of the matrix and its application to consistency of system of linear equations
- To concept of Eigen Values and Eigen Vectors
- To the methods of solving first order differential equations and learn about its applications to basic engineering problems
- To the methods of solving higher order differential equations and learn about its applications to basic engineering problems
- To laplace transforms of standard function

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Find the rank of a matrix and to analyze the solution of system of linear equations
CO-2: Calculate Eigen values and Eigen vectors
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 transform as tool to solve problems

UNIT-I:
Linear Algebra-Matrices: Rank of a matrix by Echelon form and Normal form, System of linear equations; Consistency of Homogeneous and Non-Homogeneous equations. **Real and Complex matrices:** Symmetric; Hermitian; Skew-Symmetric; Skew-Hermitian; orthogonal matrices; Unitary Matrices.

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

UNIT-III:
First Order and First-Degree ODE: 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:

Higher Order ODE with constants Coefficients: Second order linear differential equations with constant coefficients: Solution of Homogenous non homogeneous differential equations, Non-Homogeneous terms of the type e , sin (ax), cos (ax), polynomials in x, e 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: Legendre's equation, Cauchy-Euler equation. Series solutions of second order Ordinary Differential Equations, Singular point, Regular singular point, Frobineous Method.

UNIT-VI:

Laplace Transforms: Laplace transform, 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. Linear Algebra: A Modern Introduction, D. Poole, 2nd Edition, Brooks/Cole, 2005
2. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, JohnWiley, 2006
3. Higher Engineering Mathematics, B.V. Ramana, Tata McGraw Hil,New Delhi, 11th Reprint, 2010

REFERENCES:

1. Higher Engineering Mathematics,B.S.Grewal, 36thEditionKhanna Publishers, 2010
2. Differential Equations,S.L.Ross, 3rdEdition, Wiley India,1984
3. Advanced Engineering Mathematics, Peter 'O' Neil, Cengage Learning
4. Advanced Engineering Mathematics, R.K.Jain and S.R.K.Iyengar,Narosa Publications

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester– Common to EEE, ECE, CSE, EIE & IT	**L**	**T/P/D**	**C**
	3	**1**	**4**

(18BS1PH02) ENGINEERING PHYSICS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To comprehend various phenomena of light- Interference and Diffraction
- To understand the basic principles, working of lasers and optical fibers
- To learn and enhance the basic concepts in quantum physics required to deal with behavior of particle
- To understand behavior of an electron in a periodic potential in crystal
- To understand various types of semiconductors and semiconductor materials

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Realize the importance of Interference in thin films, Fraunhofer diffraction
CO-2: Analyze the lasing action of various laser sources and optical fiber materials elucidate the behavior of a particle quantum mechanically
CO-3: Classify solids based on band gap
CO-4: Perceive 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 from a single slit, Double slit diffraction, Diffraction grating (Qualitative), 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 Vol. 2, Halliday, Resnick and Krane, John Wiley & Sons
2. Engineering Physics, R. K. Gaur and S. L. Gupta, Dhanpat Rai and Sons
3. Engineering Physics, B. K. Pandey and S. Chaturvedi, Cengage Learning

REFERENCES:

1. A Textbook of Engineering Physics, Dr. M. N. Avadhanulu and Dr P. G. Kshirsagar, S. Chand & Company PVT Ltd
2. Optics, A. Ghatak, McGraw-Hill Education, 2012
3. Applied Physics, P.K. Mittal, IK International Publishing House Pvt. Ltd.
4. Introduction to Solid State Physics, Charles Kittel, John Wiley & Sons
5. Engineering Physics, P. K. Palanisamy, Scitech Publications (India) Pvt. Ltd

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester– Common to EEE, ECE, CSE, EIE & IT	L	T/P/D	C
	3	1	4

(18ES1EE01) BASICS OF ELECTRICAL ENERGY FOR ENGINEERS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the use of Electrical Energy in different engineering fields
- To analyze electrical circuits using different network theorems
- To know the working & construction of electrical machines, converters and electronic components
- To identify different LT electrical installation components and know the safety standards

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Appreciate the role of Electrical Energy in various engineering branches and to use different electronic components for system modelling
CO-2: Get familiarised with different electrical components and to find their suitability in the relevant fields of engineering
CO-3: Find the compatibility of Electrical Machines and Power Converters to different systems with required back ground knowledge
CO-4: Know about Low Voltage Electrical Installation components and the safety norms

UNIT-I:
Introduction to Electrical Energy & DC Circuits: The role of Electrical Energy in modern life and various engineering branches, Overview of electrical energy generation, Transmission, Distribution and Utilization, basic review of electrical potential and current, Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current and voltage laws, series parallel connections, analysis of simple circuits with DC excitation, concept of linearity – Superposition theorem, time response of series RL and RC circuits.

UNIT-II:
Steady state AC Circuits: Representation of sinusoidal waveforms, average and RMS values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), series resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III:
Transformers and DC Machines: Role of Transformers in the fields of engineering, Transformer principle, Ideal and Practical Transformers, Equivalent circuit, Regulation and Efficiency, Auto Transformer, Three phase transformer connections (star- delta connections).
Basic Construction of DC machine, DC generator principle, Emf equation, DC motor principle, back emf, Load characteristics and speed control of separately excited dc motor.

UNIT-IV:

Alternating Current Machines: Three phase induction motor, types, principle, torque-Slip characteristics, power flow diagram, Single phase induction motor-principle-Double Field Revolving Theory, Working principle of Synchronous generator, Stepper motor- Applications.

UNIT-V:

Power Converters: Basics of AC to DC, DC to AC and DC to DC power converters-their necessity and applications in engineering (block diagram approach), UPS block diagram,

Electrical Installations: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB and MCCB-Types of Wires and Cables - Earthing - Types of Batteries, charging and discharging- Electrical Characteristics for Batteries- Elementary calculations for energy consumption, electrical safety standards.

UNIT-VI:

Amplifiers, Transducers and Data Acquisition: Ideal operational amplifier, commercial IC 741 operational amplifier. Remote control and monitoring - Transducers, different types of transducers for measuring or sensing strain, temperature, acceleration, and light, examples. A/D and D/A converters, Data Acquisition and Control.

TEXT BOOKS:

1. Basic Electrical Engineering, D.P. Kothari and I.J. Nagrath, Tata McGraw Hill, 3rd Edition 2010
2. Basic Electrical Engineering, D.C. Kulshreshtha, Tata McGraw Hill, 2009
3. Basic Electrical Engineering,Dr.P. Ramana, Dr. M. Suryakalavathi, Dr.G.T. Chandra Sekhar, S. Chand Technical Publications

REFERENCES:

1. Electrical and Electronics Technology, E. Hughes, 10thEdition, Pearson, 2010
2. Electrical Engineering Fundamentals, Vincent Deltoro, 2ndEdition, Prentice Hall India, 1989
3. Electrical and Electronics Measurements and Instrumentation, A.K. Sawhney, Dhanpat Rai & Co.
4. Fundamentals of Electrical Engineering, L.S. Bobrow, Oxford University Press, 2011
5. Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, 6thEdition,McGraw Hill Company

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

B.Tech. II Semester– Common to EEE, ECE, EIE, CSE & IT	L	T/P/D	C
	1	4	3

(18ES3ME02) ENGINEERING DRAWING

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:
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: Surface Inclined to both the Planes

UNIT-IV:
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.

TEXTBOOKS:

1. Engineering Drawing, Bhatt N.D., Panchal V.M. & Ingle P.R.,CharotarPublishing House, 2014
2. Engineering Drawing and Computer Graphics, Shah M.B. & Rana B.C., PearsonEducation, 2008
3. Textbook on Engineering Drawing, Narayana, K.L. & P. Kannaiah, ScitechPublishers, 2008

REFERENCES:

1. AutoCAD Software Theory and User Manuals

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester– Common to EEE, ECE, CSE, EIE & IT	L	T/P/D	C
	0	3	1.5

(18BS2PH02) ENGINEERING PHYSICS LABORATORY

COURSE PRE-REQUISITES: None

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 periodic motion by measuring rigidity modulus of a material and discharging of a capacitor
CO-3: Asses the various characteristics 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 A.C 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, Physics Faculty of VNRVJIET
2. Laboratory Manual of Engineering Physics, Dr. Y. Aparna & Dr. K. Venkateswara Rao, VGS Publications
3. Engineering Physics Practicals, Dr. B. Srinivasa Rao, Keshava Vamsi Krishna and K. S. Rudramamba, 2nd Edition, Laxmi Publications Pvt. Ltd. (University Science Press)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester– Common to EEE,ECE,EIE,CSE & IT	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

(18ES2EE01) BASIC ELECTRICAL ENGINEERING LABORATORY

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the construction of electrical equipment
- To recognize different circuit reduction techniques using theorems
- To practice the techniques to control and assess electrical machines
- To know different electric safety measures

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: Realize the compatibility of electrical machines in different engineering fields
CO-4: Control different electrical machines and evaluate their performance

LIST OF EXPERIMENTS:

PART – A:
1. Demonstration of Safety Precautions, Measuring instruments and Electrical Components.
2. Identification of Ratings of resistors using color codes and Electrical circuit bread board practice
3. Demonstration of Cut-out sections of Electrical Machines.
4. Demonstration of LT Switchgear Components.
5. Demonstration of various converters and UPS.
6. Demonstration and study of Step response using Automatic Data Acquisition.

PART – B:
1. Verification of KVL & KCL.
2. Verification of Superposition Theorem.
3. Time Response of RC and RL circuits.
4. Analysis of series RL, RC and RLC circuits
5. Load test on 1- φ Transformer
6. Speed control of DC shunt Motor.
7. Torque Speed Characteristics of Separately Excited DC motor.
8. Brake test on 3- φ Induction Motor.
9. Control of Synchronous generator voltage through its field excitation.
10. Constant Voltage and Constant Current charging of Batteries.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester– Common to EEE,ECE & EIE	L	T/P/D	C
	0	2	1

(18PW4EE01) DESIGN SENSITISATION

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To create awareness of design among students of engineering
- To motivate students to think of design before implementing an engineering project
- To teach a systematic approach to identifying and defining a problem before brainstorming for a solution
- To instil a sense of significance towards applying creativity to product and service design

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Learn to identify design principles from an engineering perspective
CO-2: Cultivate sensitivity towards design aspects in objects made by engineers and non-engineers, which are typically used in daily life
CO-3: Understand and create visual design elements to communicate more effectively
CO-4: Construct clear problem statements, understand the importance of validation, and design services creatively
CO-5: Develop fundamental team skills: working in teams and managing teams, strategizing tasks, and streamlining activities pertaining to a project

Students' Responsibilities:
1. Students will form teams of 3–5 members each, while working collaboratively throughout the semester.
2. Students will present and report the tasks to the class and to the concerned faculty members and design experts, using their oral and written communication skills as well as creativity and team skills.
3. Students must proactively engage in observing the objects and processes which are part of their daily life and society from a design perspective and discuss with peers to learn collaboratively.

MODULE-1: Design Overview and Motivation
History and Context of birth of Design; Design thinking: Introduction and Motivation; Various definitions and interpretations of design, Design Vocabulary; Design in Indian Context; Art and Design: Art in Design, Design beyond Art; Design in Creative Industries

MODULE-2: Design Sensitisation for Engineers
Design Engineering vs. Engineering Design, Examples of Engineering Design and Design Engineering in various engineering domains, Examples of design failures leading to bad products and services, Real-world examples of bad design that caused engineering and technological disasters, Domain-specific Engineering Design examples

MODULE-3: Design Thinking Foundations
The Design Double Diamond: Discover-Define-Develop-Deliver
User-centric design approaches: Importance of user-centricity for design, Empathisation, Empathy Maps, Data collection from users and for users, Data Validation
Responsible Innovation and Ethical Design: Ethics as foundation for design, Concern for environment and sustainability

MODULE-4: Communication Skills for Design, Culture and Art
Communication Media to express an idea: Visuals, Text, Voice and Audio, Infographics
General guidelines for a good Presentation: Target audience, slideshow templates, appropriate visual elements, presentation styles, guidelines
General guidelines for a good Report: Documentation classification, standards, styles, and templates
Modes of communication: Reports and documents, Presentation, poster, graphic, blog or website.
Understanding Art in Design: Need for creativity, Elements of Visual Design
Design Aesthetics: Influences and impressions of Colours, Shapes, Layouts, Patterns, and Fonts as Design Elements

MODULE-5: Applied Creativity and Design for Services
Methods to brainstorm solutions for user issues; Combining solutions to workable solution concepts; Identifying the user needs in a service-driven economy; Process Flows and Customer Experience considerations for designing and improving services; 5 Why's; Service Delivery Pathways

MODULE-6: Doing Design
Looking for a problem, Ideation and Rules of Ideation, Framing and stating the problem; Basic considerations of Prototyping/ Model Building, Basics of Testing and Validation, Incorporating feedback

TEXT BOOKS:

1. Complete Design Thinking Guide for Successful Professionals, Daniel Ling, Create Space Independent Publishing, 2015 (ISBN: 978-1514202739)
2. Change by Design, Tim Brown, Harper Business, 2012 (ISBN: 978-0062337382)
3. Design Thinking for Startups: A Handbook for Readers and Workbook for Practitioners, Jimmy Jain, Notion Press, 2018 (ISBN: 978-1642495034)

REFERENCES:

1. The Design of Everyday Things, Donald A. Norman, MIT Press, 2013 (ISBN: 978-0262525671)
2. Design As Art, Bruno Munari, Penguin UK, 2009 (ISBN: 978-0141035819)
3. The Art of Innovation, Tom Kelly, Jonathan Littman, Harper Collins Business, 2002 (ISBN: 978-0007102938)
4. Design Thinking: Integrating Innovation, Customer Experience, and Brand Value, Thomas Lockwood, Allworth Press, 2009 (ISBN: 978-1581156683)
5. Design Thinking for Entrepreneurs and Small Businesses: Putting the Power of Design to Work, Beverly Rudkin Ingle, APress, 2013 (ISBN: 978-1430261810)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18BS1MT05) COMPLEX ANALYSIS AND TRANSFORMS

COURSE PRE-REQUISITES: Differentiation, Integration

COURSE OBJECTIVES:

- To analytic functions and their properties
- To concept of complex integration
- To the notion of conformal mapping
- To the properties of Fourier transforms
- To classifications and method of solving Partial Differential 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: Analyze the image of the given curve under the given transformation
CO-4: Expand the function as Fourier series
CO-5: Model the problem into PDE and solve it

UNIT-I:
Functions of a Complex Variable: Functions of a complex variable, Continuity, Differentiability, Analyticity, Cauchy-Riemann equations in Cartesian and polar coordinates, Harmonic and conjugate harmonic functions, Milne – Thompson method.

UNIT-II:
Complex Integration, Complex Power Series and Residues: Line integral, evaluation long a path and by indefinite integration. Cauchy's integral theorem, Cauchy's integral formula, generalized integral formula. Expansion of Taylor's series and Laurent series (without proofs). Singular point, isolated singular point, pole of order m, essential singularity. Residues – Evaluation of residue by formulae, Residue theorem, Evaluation of real integrals.

UNIT-III:
Conformal Mapping: Transformation of e^z, lnz, z^2, 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-IV:
Fourier Series: Fourier Series of periodic functions, Euler's formulae, Fourier series of even and odd functions, having arbitrary periods, half range Fourier series.

UNIT-V:

Fourier Transforms: Fourier integral representation of a function, Fourier sine and cosine integral, Complex Fourier transform, Sine and Cosine transforms and their properties, Finite Fourier Transform.

UNIT-VI:

Partial Differential Equations: Partial Differential Equations of second order: Classifications- parabolic, elliptic and hyperbolic, solving partial differential equations using Method of separation of variables. Problems of vibrating string- wave equation.

TEXT BOOKS:

1. Complex Variables and Applications, J. W. Brown and R. V. Churchill, 7thEdItion, McGraw-Hill, 2004
2. Higher Engineering Mathematics,B.S.Grewal, 36thEdition,Khanna Publishers, 2010
3. Higher Engineering Mathematics, B.V. Ramana,11thReprint, Tata McGraw-Hill, New Delhi, 2010

REFERENCES:

1. Advanced Engineering Mathematics, Peter O'Neil, 5thEdition, Cengage Learning, 2000
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9thEdition, John Wiley & Sons, 2006

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1EE01) ELECTRICAL CIRCUIT ANALYSIS

COURSE OBJECTIVES:

- To understand Theorems and circuit analysis
- To analyze single phase and three phase ac circuits
- To analyze DC and AC transients in electrical systems
- To evaluate Network parameters of given Electrical network and design of filters

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply network theorems for the analysis of electrical circuits
CO-2: Analyse circuits in the sinusoidal steady-state (single-phase and three-phase)
CO-3: Obtain the transient and steady-state response of electrical circuits
CO-4: Analyse two port network behavior and characteristics of filter

UNIT-I:
Network Theorems: Mesh and Nodal analysis, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem with independent and dependant sources (AC and DC Excitations).

UNIT-II:
Magnetic Circuits:MMF, flux, reluctance, 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 magneticcircuit.

UNIT-III:
AC Circuit Analysis: Review of 1-ph circuits: concept of Resonance in series, parallel circuits, band width and Q factor, locus diagrams.
Three Phase Circuits: Phase sequence – Star and Delta connection – Relation between line and phase voltages and currents in balanced systems – Analysis of balanced and Unbalanced 3 phase circuits – Measurement of Active and Reactive Power- Different methods-Problems

UNIT-IV:
Transient Analysis: Transient response of R-L, R-C, R-L-C circuits (Series and parallel combinations) for D.C. and sinusoidal excitations – Initial conditions - Solution using differential equation approach and Laplace transforms, Response of R-L, R-C, R-L-C circuits for step, ramp, pulse and impulse excitation using Laplace Transforms.

UNIT-V:
Network Functions and Two Port Networks: Network Functions for One-port and Two-port networks, Poles and Zeros of Network Functions, Significance of Poles and Zeros. Two Port Networks, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.
UNIT-VI:

Filters: Classification of filters – Low pass, High pass, Band pass and Band Elimination, Constant-k and M-derived filters-Low pass and High pass Filters (qualitative and quantitative treatment) and Band pass and Band elimination filters (quantitative treatment only), Illustrative problems.

TEXT BOOKS:

1. Network Analysis, M. E. Van Valkenburg, PHI
2. Fundamentals ofElectric Circuits, C. K. Alexander and M. N. O. Sadiku, McGraw-Hill Education, 2004
3. Engineering Network Analysis and Filter Design, Gopal G.Bhise, Prem R. Chadda, Durgesh C.Kulshreshtha, Umesh Publications

REFERENCES:

1. Engineering Circuit Analysis, W. H. Hayt and J. E. Kemmerly, McGraw-Hill Education, 2013
2. Networks and Systems, D. Roy Choudhury, New Age International Publications, 1998
3. Circuit Theory, A. Chakrabarti, 6^{th}Edition, DhanpatRai and Co.
4. Electrical Circuit Theory, K. Rajeswaran, Pearson Education, 2004
5. Electric Circuits, MahmoodNahvi, Joseph A.Edmister,5^{th}Edition, Schaum's Outline

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1EE02) ELECTROMAGNETIC FIELDS

COURSE OBJECTIVES:

- To introduce concepts of electrostatic field
- To introduce concepts of magnetic field
- To understand the concepts of time varying fields
- To appreciate the modifications in Maxwell equation

COURSE OUTCOMES: After completion of the course, the student should be able to**CO-1:** To analyze electric fields due to simple charge configurations
CO-2: To obtain magnetic fields and forces due to different configurations
CO-3: To analyze Maxwell's equation in different forms and media
CO-4: To understand the evolve of Faraday's Laws of electromagnetic induction

UNIT-I:
Static Electric Field: Electrostatic Fields-Coulomb's law, Electric Field Intensity(EFI)-EFI due to a Line charge, Surface charge; Work done in moving a point charge in an electrostatic field,Absolute Electric potential and Potential difference,Properties of potential function,Potential gradient,Gauss law and its applications for different configurations, Maxwell's first equation, Div **D**= ρ_V,Laplace's and Poisson's equations,Solution of Laplace's equation in one variable,

UNIT-II:
Conductors,Dipole,Dielectrics and Capacitance: Electric dipole-EFI,Potential and Torque on an electric dipole; Conductors- Properties when placed in electric field, Current and current densities, Ohms Law in Point form, Continuity equation of current; Dielectric-Polarization, Permittivity of dielectric materials, Boundary conditions of perfect dielectric materials, conductor- dielectric; Capacitance of a parallel plate, spherical and co-axial capacitors with composite dielectrics, Electrostatic Energy stored and Energy density in static electric field

UNIT-III:
Static Magnetic Fields: Static magnetic fields-Biot- Savart's Law and its alternate forms, Magnetic Field Intensity due to straight current carrying filament, MFI due to circular, square and solenoid current carrying wire using Biot Savart's law, Relation between magnetic flux, magnetic flux density and MFI, Maxwell's second equation div **B**=0,Ampere's Circuital law and its application for MFI due to long current carrying filament& infinite sheet of current,Maxwell's third equation Curl **H**=$\mathbf{J}_C$

UNIT-IV:
Magnetic Forces and Magnetic Dipole: Magnetic force-Moving charges in a magnetic field, Lorentz force equation, Force on a differential current element, straight long current carrying conductor in a magnetic field, Force between two straight long and parallel current carrying conductors, Magnetic dipole and dipole moment, Torque on a current loop placed in magnetic field

UNIT-V:

Magnetic Materials and Inductance: Nature of Magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic Circuits, Energy stored and Energy density, Inductances due to solenoids, toroids and cables, Scalar Magnetic Potential and limitations, Vector Magnetic potentials and properties, Vector magnetic potential due to simple configurations, vector Poison's equations

UNIT-VI:

Time Varying Fields and Maxwell's Equation: Faraday's law for Electromagnetic induction, Its integral and point forms-Maxwell's fourth equation curl $\mathbf{E}=-\delta\mathbf{B}/\delta t$, Statically induced EMF and Dynamically induced EMF-simple problems, Displacement current and Displacement current density, Modification of Maxwell's equations for time varying fields from Gauss Law, Ampere's law, Faraday's law in integral and differential forms, Poynting Theorem and Poynting vector

TEXT BOOKS:

1. Engineering Electromagnetics, William H. Hayt & John A. Buck,7thEdition,McGraw-Hill Companies,2006
2. Elements of Electromagnetics, M. N. O. Sadiku, Oxford University Publication, 2014

REFERENCES:

1. Electromagnetics, S. Kamakshaiah, Right Publishers, 2007
2. Electromagnetism-Problems with Solution, Pramanik, Prentice Hall India, 2012
3. The Electromagnetic Field in its Engineering Aspects, G. W. Carter, Longmans, 1954
4. Electricity and Magnetism, W. J. Duffin, McGraw Hill Publication, 1980

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1EC02) ELECTRONIC DEVICES AND CIRCUITS
(Common to ECE and EEE)

COURSE PRE-REQUISITES: Engineering Physics

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 principles 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 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: The 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 V_{BE}, $\beta$and I_{CO}, 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, Halkias, and Satyabratha Jit, Tata McGraw-Hill, 2nd Edition, 2007
2. Electronic Devices and Circuits, R. L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall, 11th Edition, 2016

REFERENCES:

1. Integrated Electronics, J. Millman and Christos 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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester	**L**	**T/P/D**	**C**
	3		**03**

(18PC1EE03) ELECTRICAL MACHINES-I

COURSE OBJECTIVES:

- To understand the electro-mechanical energy conversion process and operation of DC machines and transformers
- To know the different testing methods for dc machines and transformers
- To know the behavior of DC machines and transformers
- To learn about different method to control the speed of DC motor and voltage of transformers

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: To identify the different parts and their role in electro-mechanical energy conversion operation of DC machines and transformers
CO-2: To select DC machines and Transformers for appropriate application
CO-3: To start and control the DC motor speed and transformer output voltage
CO-4: To carry out different assessment tests to predetermine the efficiency of DC machines and transformers

UNIT-I:
Electromagnetism and Electromechanical Energy Conversion: Review of Ampere and Biot Savart Laws, Magnetic field patterns of bar magnet and a current carrying coil - through different media, influence of highly permeable materials on the magnetic flux lines, Linear and Non-linear Magnetization characteristics. Energy stored in the magnetic field, Derivation of Electro-magnetic force in Singly excited electromagnetic systems, Examples, Derivation of Electromagnetic Torque and Reluctance (saliency or eccentricity) Torque in Multi Excited Systems, examples

UNIT-II:
DC Generators-I: Simple Loop generator- commutator action, Armature windings- lap and wave windings, Types of field excitations – separately excited, shunt, series and Compound generators, Open circuit characteristic of separately excited DC generator, voltage build-up in a shunt generator- critical field resistance and critical speed

UNIT-III:
DC Generators-II: Armature reaction- armature MMF wave-MMF wave by Field winding- air gap flux density distribution with armature reaction. Commutation- linear and delayed commutation-Methods of improving commutation, voltage and current characteristics of separately excited, shunt and series and Compound generators

UNIT-IV:
DC Motors: Types of DC motors, Mechanical Power developed, Derivation of Torque equation, Operating characteristics of dc motors. Starting & Speed control of DC motors, Losses, Swin-burne’s test- Brake Test- Back-to back test- Field’s Test

UNIT-V:

Transformers-I: construction of single-phase transformers, transformer on No-load, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Transformer on Load, phasor diagrams, voltage regulation, losses and efficiency, Open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses, All-Day efficiency

UNIT-VI:

Transformers-II: Parallel operation of single phase transformers, Three-phase transformers, Construction, Open Delta connection, Scott connection, On Load and Off Load Tap-changers, Three-winding transformers, Autotransformers,Cooling of transformers.

TEXT BOOKS:

1. Electric Machines, J. Nagrath and D. P. Kothari, McGraw-Hill Education, 2010
2. Electrical Machinery, P. S. Bimbhra, Khanna Publishers, 2011

REFERENCES:

1. Electric Machinery, E. Fitzgerald and C. Kingsley, McGraw-HillEducation, 2013
2. Performance and Design of AC Machines, M. G. Say, CBS Publishers, 2002
3. Performance and Design of DC Machines,E. Clayton and N. N. Hancock, CBS Publishers, 2004

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1ME16) FLUID MECHANICS AND HYDRAULIC MACHINES

COURSE PRE-REQUISITES: Mathematics, Physics and Engineering Mechanics

COURSE OBJECTIVES:
- To understand the properties of fluids, principles of buoyancy, flow, force and head calculations
- To understand the hydro dynamic force and impact of jet
- To principles of operation of different types of hydraulic turbines
- To principles of operation of different types of hydraulic pumps

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the knowledge of fluids and properties to solve flow, force and velocity problems
CO-2: Apply the knowledge to find the head loss due to friction inpipe and other losses
CO-3: Apply the knowledge of fluid flow and dynamics in solving problems in hydraulic machines
CO-4: Perform model analysis of hydraulic machinery and select appropriate machines for hydro power plant

UNIT-I:
Fluid Statics: Properties of fluid – specific gravity, viscosity, surface tension, vapor pressure and their influence on fluid motion, Pressure at a point, measurement of pressure.
Fluid Kinematics: Classification of flows, acceleration equations, Streamline, path line and streak lines and stream tube, continuity equation, Stream function, velocity potential function.

UNIT-II:
Fluid Dynamics: Surface and body forces – Euler's and Bernoulli's equation, Venturimeter, Orifice meter, Pitot tube, Reynolds experiment –Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel. Momentum equation.

UNIT-III:
Basics of Turbo Machinery: Hydrodynamic force of jets on flat, inclined and curved vanes - jet striking centrally and at tip, flow over radial vanes.

UNIT-IV:
Elements of Hydroelectric Power Station: Types of power plants, storage requirements, estimation of power from a given catchment area, head and efficiency.

UNIT – V:
Hydraulic Turbines: Classification of turbines, design of Pelton wheel, Francis turbine and Kaplan turbine – working proportion, work done, efficiency, draft tube-theory, functions and efficiency. Geometric similarity, Unit and specific quantities,

characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank and water hammer.

UNIT – VI:

Hydraulic Pumps: Classification, centrifugal pumps types, working, work done, manometric head, losses and efficiency, specific speed pumps in series and parallel – performance characteristic curves, NPSH. Reciprocating Pump –types, Working, Discharge, slip, indicator diagrams.

TEXT BOOKS:

1. Hydraulics And Fluid Mechanics Including Hydraulics Machines, P.N. Modi, S.M. Seth, Standard Book House,2009

REFERENCES:

1. Fluid Mechanics & Hydraulic Machines, R.K.Rajput, 3rdRev. Edition, S. Chand & Co. Ltd, 2006
2. Fluid Mechanics - Fundamentals &Applications, Yunus A. Çengel, John M. Cimbala, McGraw-Hill Higher Education, 2006
3. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Lakshmi Publications, 2005

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC2EE01) ELECTRICAL CIRCUITS AND SIMULATION LABORATORY

COURSE OBJECTIVES:
- To design electrical systems
- To analyze a given network by applying various network theorems
- To measure three phase active and reactive power
- To understand the locus diagrams

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze complex DC and AC linear circuits
CO-2: Apply concepts of electrical circuits across engineering
CO-3: Evaluate response in a given network by using theorems
CO-4: Simulate the electrical circuits using suitable software

LIST OF EXPERIMENTS:

1. Verification of Thevenin's and Norton's Theorems
2. Verification of Superposition and Reciprocity theorems
3. Verification of and Maximum Power Transfer and Compensation Theorem
4. Locus Diagrams of RL and RC Series Circuits
5. Series and Parallel Resonance
6. Determination of Self, Mutual Inductances and Coefficient of coupling
7. Determination of Z and Y Parameters
8. Determination of Transmission and Hybrid parameters
9. Measurement of Active Power for Star and Delta connected balanced loads
10. Measurement of Reactive Power for Star and Delta connected balanced loads
11. Simulation of DC circuits and transient analysis.
12. Simulation of circuits using mesh, nodal analysis and Thevenin's theorem.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC2EE02) ELECTRICAL MACHINES-I LABORATORY

COURSE OBJECTIVES:

- To expose the students to the operation of DC machines
- To perform different tests on transformers and DC machines
- To know different methods of controlling the speed of DC motors
- To examine the self excitation phenomenon in DC generators

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Start and control the different DC machines
CO-2: Assess the performance of DC machines and transformers using different testing methods
CO-3: Identify different conditions to be satisfied for self-excitation of DC generators
CO-4: Separate iron losses of DC machine into different components

LIST OF EXPERIMENTS:

1. Magnetization characteristics of DC shunt generator
2. Swinburne's Test on DC Shunt Machine
3. Speed control of DC Shunt Motor
4. Separation of losses of a DC Shunt Machine
5. Load Test on DC Shunt Generator
6. Load Test on DC Series Generator
7. Hopkinson's Test on a Pair of Identical DC Shunt Machines
8. Field's Test on a pair of Identical DC Series Machines
9. Open circuit and short circuit tests on single phase Transformer
10. Load Characteristics' of DC Compound Generator
11. Brake Test on DC Compound Motor
12. Determination of Voltage Regulation of Single Phase Transformer by direct method

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC2EC06) ELECTRONIC DEVICES LABORATORY

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

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: Understand the characteristics of various special semiconductor devices

LIST OF EXPERIMENTS:

Part A: (Only for viva-voce Examination)
ELECTRONIC WORKSHOP PRACTICE (in 2 lab sessions):

1. Identification, Specification, testing of R,L,C components (colour codes), Potentiometers, Switches (SPDT, DPDT), Relays, Coils, Gang Condenser, Bread Board, PCB.
2. Identification, Specification, testing of Active devices: Diodes, BJT, JFET, MOSFET, Power Transistors, LED, LCD, SCR, UJT.
3. Study and operation of
    1. Function Generator
    2. Regulated Power Supplies
    3. Digital storage oscilloscope (DSO)

Part B: (LIST OF EXPERIMENTS)

1. V-I characteristics of PN junction diode under forward and reverse biased condition
2. V-I characteristics of Zener diode and verify Zener as voltage regulator
3. Half wave Rectifier without filter and with filter: Computation of Ripple factor and percentage regulation
4. Full wave Rectifier without filter and with filter: Computation of Ripple factor and percentage regulation
5. Input and Output characteristics of transistor in CE configuration
6. Input and Output characteristics of transistor in CB configuration
7. Transfer and drain characteristics of JFET
8. Transfer and drain characteristics of MOSFET
9. SCR characteristics
10. UJT characteristics and relaxation oscillator
11. Transistor as a switch
12. Photo diode and photo transistor characteristics

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

(18PC1EE04) ELECTRICAL MACHINES-II

COURSE OBJECTIVES:

- To understand the armature windings and the flux patterns in AC machines
- To know the construction and operation of induction and synchronous machines
- To know the different testing methods for induction and synchronous machines
- To know the behavior of induction and synchronous machines

COURSE OUTCOMES: After completion of the course, the student should be able to**CO-1:** To identify different parts of ac machines and develop AC windings to establish the rotating magnetic fields
CO-2: To understand the operation of AC machines and assess the performance for appropriate application
CO-3: To start and control the AC machines in view of speed, voltage, active and reactive powers
CO-4: To carry out different assessment tests to predetermine the efficiency of ACmachines

UNIT-I:
Fundamentals of AC Machine Windings: A.C armature windings-differences between ac and dc armature windings- single-turn and multi-turn coils - active portion and overhang- winding axis; Pitch Factor-Winding Distribution factor- winding factor; Air-gap MMF distribution with direct current through concentrated, uniformly and Sinusoidally distributed windings- 3D visualization of the above winding types; Production of Pulsating fields- Production of Rotating magnetic Field in Two phase and three phase systems.

UNIT-II:
Three Phase Induction Machines-I: Construction, Types, Torque-Slip Characteristics with different rotor resistances, Starting and Maximum Torques, Equivalent circuit, Phasor Diagram, Losses and Efficiency, Effect of variation of stator voltage, frequency on torque speed characteristics, Circle Diagram

UNIT-III:
Three Phase Induction Machines-II: Methods of starting, Braking, Speed control for induction motors, Cogging and Crawling, Induction Generator operation- Self-excitation, Doubly-Fed Induction Machines (Elementary treatment).

UNIT-IV:
Single-Phase Induction Motors: Constructional features, Cross Field Theory, Split-phase starting methods, Resistance and capacitor split phase motors, shaded pole motors, applications, equivalent circuit-determination of machine parameters.

UNIT-V:

Synchronous Machines-I: Constructional features, types, cylindrical rotor synchronous machine - generated EMF, armature reaction, synchronous impedance, phasor diagram, equivalent circuit, voltage regulation, methods to find voltage regulation, Analysis of Salient pole machine - two reaction theory, phasor diagram, Slip Test, synchronization, power delivered, power angle characteristics, Effect of change of excitation and fuel input, Short circuit analysis

UNIT-VI:
Synchronous Machines-II: Synchronous motor, principle, Starting of Synchronous Motors, Phasor diagram, V-curves, Synchronous Condenser, Hunting.

TEXT BOOKS:

1. Electric Machines, J. Nagrath and D. P. Kothari, McGraw-Hill Education, 2010
2. Electrical Machinery, P. S. Bimbhra, Khanna Publishers, 2011

REFERENCES:

1. Performance and design of AC machines, M. G. Say, CBS Publishers, 2002
2. Electric Machinery, E. Fitzgerald and C. Kingsley, New York, McGraw-Hill Education, 2013
3. Alternating current machines, S. Langsdorf, McGraw-Hill Education, 1984
4. Principles of Electric Machines and Power Electronics, P. C. Sen, John Wiley & Sons,2007

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

(18PC1EE05) POWER SYSTEMS-I

COURSE OBJECTIVES:
- To explain the various generation sources such as hydro, thermal, nuclear and gas power plants
- To describe Transmission line parameters and derive its expressions for various configurations and analyze different types of transmission lines
- To describe Travelling wave theory and derive expressions for reflection and refraction coefficients with various terminations of the lines
- To describe DC and AC distribution systems and its voltage drop calculations

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the functioning of different power plants
CO-2: Evaluate the performance of Transmission lines and cables
CO-3: Analyze the travelling wave phenomena including corona
CO-4: Assess the performance of DC and AC distribution systems

UNIT-I:
Generation of Electrical Energy: Conventional Power Plants: Operation of Hydel, Thermal, Nuclear and Gas Power plant with layout- Description of TPS components-Choice of site- advantages and Disadvantages. Description of Renewable power generation methods(Qualitative treatment).

UNIT-II:
Transmission Line Parameters: Types of conductors - Calculation of resistance for solid conductors – Calculation of inductance for single phase lines, three phase single circuit and double circuit lines, Transposed lines, concept of GMR and GMD, Skin and Proximity effects. Calculation of capacitance for single phase lines, three phase single circuit and double circuit lines, Transposed lines, Numerical Problems.

UNIT-III:
Performance of Transmission Lines: Classification of Transmission Lines, Performance of Short, Medium lines –Nominal-T and π Networks and A, B, C, D Constants - Numerical Problems. Long Transmission Line-Rigorous Solution, evaluation of A, B, C, D Constants, efficiency and regulation, Representation of Long Lines - Equivalent-T and π network models- Numerical problems - Ferranti effect.

UNIT – IV:
Power System Transients and Corona: Transients - Travelling wave theory - Attenuation, Distortion, Reflection and Refraction Coefficients - Termination of lines with different types of conditions - Open Circuited Line, Short Circuited Line, T-Junction, Lumped Reactive Junctions. Bewley's Lattice Diagrams-Numerical Problems
Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss - Problems, Radio Interference.

UNIT-V:

Mechanical Design of OH Lines and UG Cables: Sag and Tension Calculations with equal and unequal heights of towers, Effect of wind and Ice loading; Types of Insulators, String efficiency and Methods of improvement - Capacitance grading and Static Shielding - Numerical Problems.
Construction, Types of Cables, Insulation resistance, Capacitance of Single and 3-Core belted cables. Comparison of Over Head Lines and Under Ground Cables.

UNIT VI:
Distribution Systems: Substations: Air Insulated and Gas Insulated Substations - Layouts – Description – comparisonClassification of Distribution Systems - Comparison of DC Vs AC Distribution Systems - Requirements and Design features of Distribution Systems-Voltage Drop Calculations in D.C Distribution system for the following cases-Radial system - fed at one end - fed at both the ends with equal and unequal Voltages, Ring Main Distribution system. Voltage Drop Calculations in A.C. Distribution system, Numerical problems.

TEXT BOOKS:
1. Electrical Power Systems, C.L.Wadhawa, New Age International (P) Limited, 1997
2. A Text Book on Power System Engineering, M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, Dhanpat Rai and Co. Pvt. Ltd, 1999

REFERENCES:
1. Modern Power System Analysis, I.J.Nagrath and D.P.Kothari, 2nd Edition, Tata McGraw-Hill Publishing Company
2. Power System Analysis, John J. Grainger, William D. Stevenson, 4th Edition, TMC Companies
3. Power System Analysis, Hadi Saadat, TMH

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

(18PC1EC05) ANALOG CIRCUITS
(Common to ECE and EEE)

COURSE PRE-REQUISITES: Electronic Devices and Circuits

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: Analyse and compute the parameters of single stage and multistage amplifiers
CO-2: Appreciate the design considerations of various large signal amplifiers
CO-3: Design the wave shaping circuit for a specified output
CO-4: Explain various characteristics of an operational amplifier
CO-5: Appreciate the applications of various linear integrated circuits

UNIT-I:
Frequency Response of BJT Amplifiers: Analysis at low and high frequencies, Effect of coupling and bypass capacitors, 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, n-stage cascaded amplifier, Miller's Theorem, 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:
Power Amplifiers: Classification of power amplifiers, Series-fed and Transformer coupled Class A audio power amplifier, Efficiency of Class A amplifier , Class B amplifier, Transformer-coupled Class B push-pull amplifier, Complementary-symmetry Class B push-pull amplifier, Efficiency of Class B amplifier, Cross Over Distortion, Heat sinks.
Tuned Amplifiers: Introduction, Small signal single tuned amplifiers, Double-tuned amplifiers, Effect of cascading single and double tuned amplifiers on bandwidth.

UNIT-IV:

Linear and Non-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.

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, differential.

OP-AMP Applications: Basic application 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.

Introduction to 555 timer, functional diagram, Mono-stable, As table and Schmitt Trigger operations, PLL – operation and application.

TEXT BOOKS:

1. Integrated Electronics, Jacob Millman and Christos C. Halkias and Chetan D. Parikh, 2ndEdition, Tata McGraw-Hill Education, 2010
2. Op-Amps and Linear ICs, Ramakanth A. Gayakwad, PHI,1987
3. Pulse, Digital and Switching Waveform, J. Millman, H. Taub, Surya Prakash Rao M., 3rd Edition, McGraw-Hill, 2017

REFERENCES:

1. Electronic Circuit Analysis, S. Salivahanan, N. Suresh Kumar, 3rd Edition,Tata McGraw-Hill Education, 2013
2. Linear Integrated Circuits, D. Roy Chowdhury, 4th Edition, New Age International (P) Ltd., 2008
3. Pulse and Digital Circuits, K. Venkata Rao, K. Rama Sudha, G. Manmadha Rao,Pearson Edition India, 2010

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

(18PC1EC06) DIGITAL SYSTEM DESIGN
(Common to ECE, EIE and EEE)

COURSE PRE-REQUISITES: Basic Electronics

COURSE OBJECTIVES:
- To understand and analyse 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

UNIT-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 Design: 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, 3rdEdition, 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 Circuits and Systems, D. V. Hall, Tata McGraw-Hill, 1989
2. Digital Electronics- An Introduction to Theory and Practice, W. H. Gothmann, 2nd Edition, PHI, 2006
3. Fundamentals of Logic Design, Charles H. Roth, Larry L. Kinney, 6thEdition, Cengage Learning

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

(18PC1CS06) DATA STRUCTURES THROUGH C
(Common to EEE, EIE, ME and AE)

COURSE OBJECTIVES:
- To summarize efficient storage mechanisms of data for an easy access
- To familiarize concepts of various linear data structures
- To introduce concept of non-linear data structures
- To develop applications using data structures

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Find time complexity notations for various sorting techniques
CO-2: Implement the operations of creation, insertion, deletion on linear data structures
CO-3: Implement the operations of creation, insertion, deletion on non-linear data structures
CO-4: Implement applications using data structure concepts

UNIT-I:
Data Structures – Introduction to data structures, abstract data types. Asymptotic notations. Merge sort, Quick Sort, Radix sort.

UNIT-II:
Linked List: Singly linked list implementation, insertion, deletion and searching operations on linear list, circular linked list implementation
Double linked list implementation, insertion, deletion and searching operations. Applications of Linked Lists – Polynomial addition and subtraction**.**

UNIT–III:
Stacks: Operations, array and linked representations of stacks, stack applications-infix to postfix conversion, postfix expression evaluation, Towers of Hanoi recursive implementation.

UNIT–IV:
Queues: operations, array and linked representations of queues. Circular queue operations, dequeue operations.

UNIT–V:
Trees: Definitions, binary tree representation, binary search tree, binary tree traversals-Preorder, Inorder, Postorder.

UNIT–VI:
Graphs: Definitions, graph representations, spanning tree, graph traversals- BFS and DFS.

TEXT BOOKS:

1. C Programming& Data Structures, B.A.Forouzan and R.F. Gilberg, 3rdEdition, Cengage Learning
2. Data Structures Using C, Aaron M. Tenenbaum

REFERENCES:

1. C& Data Structures, P. Padmanabham, 3rdEdition, B.S. Publications
2. Data Structures using C, A.M.Tanenbaum, Y.Langsam, and M.J. Augenstein, Pearson Education
3. C Programming & Data Structures, E. Balagurusamy, TMH
4. C Programming & Data Structures, P. Dey, M. Ghosh R. Thereja, Oxford University Press
5. C& Data Structures, E. V. Prasad and N. B. Venkateswarlu, S. Chand&Co.

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

(18PC2EE03) ELECTRICAL MACHINES- II LABORATORY

COURSE OBJECTIVES:

- To understand the operation of synchronous machines
- To know different methods of finding voltage regulation of synchronous generators
- To understand different testing methods to assess electrical machines
- To learn how to convert phase between 3 to 2 and vice-versa

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Assess the performance of different machines using different testing methods
CO-2: Convert the phase from 3 phase to 2 phase and vice-versa
CO-3: Compensate the changes in terminal voltages of synchronous generator after estimating the change by different methods
CO-4: Start different machines and Control the active and reactive power flows insynchronous machines

LIST OF EXPERIMENTS:

1. Sumpner's test on two identical single-phase transformers
2. Scott-connected Transformer
3. Seperation of Iron losses of a single phase transformer
4. No-Load and blocked rotor tests on three-phase squirrel-cage Induction Motor. Analysis through equivalent circuit diagram.
5. No-Load and blocked rotor tests on three-phase squirrel-cage Induction Motor. Analysisthrough Circle diagram
6. Brake test on three phase slip ring induction motor
7. Speed Control of three phase slip ring Induction Motor
8. Regulation of three-phase Alternator by synchronous impedance method.
9. Regulation of three-phase Alternator by ZPF Method
10. Slip test on three-phase salient pole Alternator
11. **V** and inverted **V** curves of a three-phase synchronous motor
12. Equivalent circuit and Brake test on Single-phase Induction Motor

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

(18PC2EC07) ANALOG ELECTRONICS LABORATORY

COURSE OBJECTIVES:

- To explain the operation, design and Analysis of multistage amplifiers using BJT
- To understand the operation of power amplifiers and its efficiency
- 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: Analyze and design application specific circuits using Op-Amp
CO-3: Design the Active filters using Op-Amp
CO-4: Design applications using IC 555 Timer

LIST OF EXPERIMENTS:

Part A:

Design and simulation of the following circuits using simulation software and implementation through hardware

1. BJT amplifier in CE configuration
2. Two stage RC-coupled amplifier
3. Darlington amplifier
4. MOSFET amplifier configuration

Part B:

Implement the following

1. Linear wave shaping (Low pass-RC and High pass-RC circuit)
2. Non linear wave shaping-clippers and clampers
3. Integrator and differentiator using IC 741 Op-amp
4. Square wave and triangular wave generation using Op-amp
5. R-2R Ladder D-A converter
6. Monostabe and Astable multi-vibrator using IC 555 timer
7. Schmitt trigger circuit using IC 555 timer
8. Colpitts oscillator

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

(18PC2EC08) DIGITAL LOGIC DESIGN LABORATORY

COURSE OBJECTIVES:
- To learn VERILOG hardware description language
- To understand the design of combinational and Sequential Circuits through different specifications
- To design digital circuits using CAD tools
- To understand & implement the finite state machine

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Develop VERILOG HRL code to design a combinational system
CO-2: Develop VERILOG HDL Code to design a digital system
CO-3: Understand the design flow of CAD tools for digital system design
CO-4: Analyze the importance of Finite State machine

LIST OF EXPERIMENTS:

Design and simulate the following circuits

1. Logic Gates-(Universal gates and Ex-OR gate)
2. Full Adder and Full Subtractor
3. Code converter (Binary to Gray)
4. Multiplexer (4x1 MUX) and De-Multiplexer(1x4 D-MUX)
5. Encoder and Decoder
6. Parity Generator
7. 4-bit comparator
8. Flip-flops (JK & D) using truth table and state diagram
9. Up & down counter
10. Decade counter
11. Shift registers (Universal)
12. Mealy state Machine

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	0	**2**	**1**

(18PC2CS03) DATA STRUCTURES THROUGH C LABORATORY
(Common to EEE, EIE, ME and AE)

COURSE OBJECTIVES:
- To impart the implementation of data structures such as linked lists, Stacks and Queue
- To introduce the various advanced data structures such as tree traversals
- To analyze the sorting algorithms
- To teach the various graph traversal algorithms

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the algorithms to determine the time and space complexities
CO-2: Implement the linear data structures like stacks, queues and linked lists
CO-3: Evaluate the non-linear data structures like Trees and graphs
CO-4: Predict the tree and graph traversing techniques

WEEK 1
1. Write a C program for Merge Sort

WEEK 2
2. Write a C Program for Quick Sort
3. Write a C program for Radix Sort

WEEK 3
4. Write a C program for SLL creation, insertion, deletion, searching, display operations.

WEEK 4
5. Write a C program for CLL creation, insertion, deletion, searching, display operations.

WEEK 5
6. Write a C program for DLL creation, insertion, deletion, searching, display operations.

WEEK 6
7. Write a C program to implement STACK operations using arrays and Linked List.

WEEK 7
8. Write a C Program for infix to postfix conversion.

WEEK 8
9. Write a C program for postfix evaluation.
10. Write a C program for tower of Hanoi problem

WEEK 9

11. Write a C program to implement QUEUE operations using arrays and LL.

WEEK 10
12. Write a C program to implement CIRCULAR QUEUE operations using arrays.

WEEK 11
13. Write a C program to implement DEQUEUE operations using arrays.

WEEK 12
14. Write a C program to implement Binary tree traversals using recursion.

WEEK 13
15. Write a C program to implement Graph traversals (BFS and DFS).

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

(18MN6HS03) 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 howto 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 theStructure 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

B.Tech. V Semester

	L	T/P/D	C
	3	**0**	**3**

(18PC1EE08) POWER ELECTRONICS

COURSE PRE-REQUISITES: Circuit Theory, Network Analysis, Electronic Devices and Circuits

COURSE OBJECTIVES:

- To design/develop suitable power converter for efficient control or conversion of power in drive applications
- To design / develop suitable power converter for efficient transmission and utilization of power in power system applications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the operating characteristics of various power electronic devices and theirprotection
CO-2: Analyze operating principles of different converters and find their applications
CO-3: Understand the control range/ control methodologies for various power electronicconverters

UNIT – I:
Power Semiconductor Devices: Thyristors – Silicon Controlled Rectifiers (SCR's) – BJT – Power MOSFET – Power IGBT and their characteristics
Basic theory of operation of SCR – Static and Dynamic characteristics of SCR - Salient points - Two transistor analogy-UJT firing circuit – Series and Parallel connections of SCRs - Snubber circuit details – Specifications and Ratings of SCRs, BJT, MOSFET, IGBT, Numerical problems, natural and forced commutation (Principle only).

UNIT – II:
Single Phase Controlled Converters: Single Phase Half Controlled Converters: Half controlled converters with R, RL and RLE loads – Derivation of average load voltage and current -with free- wheeling Diode – Numerical problems
Single Phase Fully controlled Converters: Bridge connections with R, RL and RLE loads- Derivation of average load voltage and current - Performance parameters of single phase full bridge converter, Effect of source inductance – Numerical problems.

UNIT – III:
Three Phase Controlled Converters : Three Phase Converters – Three pulse and six pulse converters – Bridge connections, average load voltage with R and RL loads – Effect of Source inductance – Numerical Problems.

UNIT – IV:
DC-DC Buck Converter: Elementary chopper with an active switch and diode, concepts of duty ratio and averagevoltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratiocontrol of output voltage.
DC-DC Boost Converter: Power circuit of a boost converter, analysis and waveforms at steady state, relation betweenduty ratio and average output voltage.
UNIT – V:
Single-Phase Voltage Source Inverter: Power circuit of single-phase voltage source inverter, switch states and instantaneous outputvoltage, square wave operation of

the inverter, concept of average voltage over a switchingcycle, bipolar sinusoidal modulation and uni-polar sinusoidal modulation, modulation indexand output voltage.

Three-Phase Voltage Source Inverter: Powercircuitofathree-phasevoltagesourceinverter,switchstates, instantaneous outputvoltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation.

UNIT – VI:

AC Voltage Controllers: Single phase AC voltage controllers with R and RL loads-wave forms – Modes of operation of Triac – Triac with R and RL loads – Derivation of RMS load voltage – Numerical problems

Cyclo Converters: Cyclo converters – Single phase midpoint cyclo converters with Resistive and inductive load (Principle of operation only)

TEXT BOOKS:

1. Power Electronics: Circuits, Devices and Applications, M. H. Rashid, Pearson Education India, 2009
2. Power Electronics, P. S. Bimbhra, Khanna Publishers
3. Power Electronics: Converters, Applicationsand Design, N. Mohan and T. M. Undeland, John Wiley & Sons, 2007

REFERENCES:

1. Fundamentals of Power Electronics, R. W. Erickson and D. Maksimovic, Springer Science & Business Media, 2007
2. Power Electronics, P. C. Sen, Tata McGraw-Hill Education
3. Thyristorised Power Controllers, S. R. Doradla,A. Joshi,R.M. K. Sinha, G. K. Dubey, New Age Books
4. Power Electronics, M. D. Singh, K. B. Kanchandhani, 2nd Edition, Tata McGraw-Hill Publishing Company, 2006
5. Power Electronics: Essentials and Applications, L. Umanand, Wiley India, 2009

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1EE07) POWER SYSTEMS-II

COURSE PRE-REQUISITES: Knowledge of Power Systems-I, Circuit Theory and Electrical Machines

COURSE OBJECTIVES:
- To describe load flow methods
- To analyze symmetrical and unsymmetrical faults
- To describe stability types
- To learn different methods of stability analysis

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Develop Network matrices and Solve Load flow problems using different methods
CO-2: Analyze symmetrical and unsymmetrical faults
CO-3: Evaluate steady state stability of Synchronous Machine
CO-4: Assess transient stability and understand its improvement methods

UNIT – I:
Power System Network Matrices: Graph Theory: Basic Concepts-Branch, Link, bus Incidence Matrix, Formation of Bus Admittance Matrix using direct inspection and singular transformation methods- Numerical Problems. Formation of Zbus: Algorithm for Modification of Zbus Matrix for addition of an element for the following cases- Addition of an element as a link, Addition of an element as a tree branch.

UNIT – II:
Power Flow Analysis: Introduction, Classification of buses, Formulation of static load flow equations, Solution techniques using Gauss Seidel Method- Algorithm and Flowchart. Newton Raphson Method in Rectangular and Polar Coordinates Form- Algorithm and Flowchart. Decoupled and Fast Decoupled Methods- Algorithm and Flowchart, Comparison of Different Methods.

UNIT – III:
Symmetrical Fault Analysis: Per-Unit System: p.u. Representation of a transformer, p.u. equivalent reactance network of Power System, Numerical Problems. Symmetrical fault Analysis: Short Circuit on NL Synchronous Machine – sub transient, transient and steady state models, Short Circuit on loaded Synchronous Machine. Short circuit Current and MVA Calculations,Fault limiting Reactors- Generator reactors, Bus bar Reactors and Feeder Reactors - Numerical Problems.

UNIT – IV:
Unsymmetrical Fault Analysis: Symmetrical Component Theory: Symmetrical Component Transformation and its power invariance, Sequence Networks: Positive, Negative and Zero sequence Networks for transformers, transmission line and synchronous machines - Numerical Problems.

Unsymmetrical Fault Analysis: LG, LL, LLG faults, Interconnection of sequence networks, effect of fault impedance, Numerical Problems.

UNIT – V:

Steady State Stability Analysis: Classification of Power system stability, Stability: Concept of steady state, Dynamic and Transient Stability. Dynamics of synchronous machine and its Inertia Constant, Derivation of Swing Equation. Equivalent Inertia Constant for two machine coherent system. Classical machine model, Power Angle Curve. Determination of Steady State Stability limit, Transfer Reactance, Synchronizing Power Coefficient, Numerical problems.

UNIT – VI:

Transient Stability Analysis: Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion: Sudden change in Pm, Sudden loss of one of parallel lines, Sudden short circuit on one of the lines-SC at at one end, away from line and reclosure. Critical Clearing Angle Calculation, Solution of Swing Equation: Point-by-Point Method and transient stability improvement methods.

TEXT BOOKS:

1. Modern Power system Analysis, I.J. Nagrath and D.P. Kothari, 2nd Edition, Tata McGraw-Hill, Publishing Company
2. Elements of Power System, Stevenson, Tata McGraw Hill
3. Power System Analysis, B.R.Gupta, Wheeler Publications

REFERENCES:

1. Power System Analysis, Grainger and Stevenson, Tata McGraw Hill
2. Power System Analysis, A.R.Bergen, Prentice Hall, Inc.
3. Power System Analysis, Hadi Saadat, TMH Edition
4. Computer Techniques in Power System Analysis, M.A.Pai, TMH Publications

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

(18PC1EE06) CONTROL SYSTEMS
(Common to EEE, ECE& EIE)

COURSE PRE-REQUISITES: Ordinary Differential Equations and Laplace Transform

COURSE OBJECTIVES:
- To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system 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 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, J. Nagrath andM. Gopal, NewAge International, 2009
2. Modern Control Engineering, K. Ogata, Prentice Hall, 1991

REFERENCES:

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

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

(18HS1MG01) 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, 13thEdition, 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

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

(18PE1EE01) UTILIZATION OF ELECTRICAL ENERGY

COURSE PRE-REQUISITES: Electrical Machines, Circuit Theory

COURSE OBJECTIVES:
- To make the student familiar with electrical energy and its use when it is converted into several forms of energy
- To deal with the fundamentals of illumination and its classification and the
- electric heating and welding
- To learn the basic knowledge of electric drives
- To learn the different types of speed time curves in traction system

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the basic principles of illumination and its design and electric welding and its types
CO-2: Describe various methods of electric heating and design of heating element
CO-3: Know types of electric drives, performance characteristics, braking methods and their applications
CO-4: Describe existing electric traction systems, Speed-time curves for different services
CO-5: Understand the Mechanics of Train movement and specific energy consumption

UNIT – I:
Illumination: Introduction, Terms used in illumination, laws of illumination, sources of light, Incandescent lamps, Discharge lamps-MV and SV lamps, fluorescent lamps, Effect of voltage variation on lamp efficiency – Comparison of Incandescent and Discharge lamps, Type of lighting schemes, factory lighting, flood lighting and street lighting.

UNIT – II:
Electric Heating: Electrical heating-advantages, methods and applications, Resistance heating, design of heating element, efficiency calculations. Induction heating: Core type and Core less furnaces and high frequency eddy current heating, dielectric heating: principle and applications – Problems.

UNIT – III:
Electric Welding: Electric welding-advantages, Types of welding-resistance and arc welding, Electric welding equipment, comparison between A.C and D.C Welding.

UNIT – IV:
Electric Drives: Introduction to Electric drive-advantages, Types of electric drives, choice of motor, starting and running characteristics, speed control, Methods of Electric Braking: Plugging, Rheostatic and Regenerative Braking. Temperature rise, particular applications of electric drives, types of industrial loads, continuous, intermittent and variable loads, load equalization.

UNIT – V:

Electric Traction – I: Electric traction--types, Review of existing electric traction systems in India. Special features of traction motor, Modern 25 KV A.C. single phase traction systems: advantages, equipment and layout of 25 KV single phase A.C. tractionsystem.Simplified speed time curves, Average and scheduled speed - Quadrilateral and Trapezoidal speed time curves-Problems.

UNIT – VI:

Electric Traction – II: Mechanics of train movement: Adhesive Weight, coefficient of Adhesion, tractive effort and specific energy consumption, factors affecting specific energy consumption-problems.

TEXT BOOKS:

1. Utilization of Electric Energy, E. Openshaw Taylor, Orient Longman Private Limited, 1971
2. Art & Science of Utilization of Electrical Energy, Partab, Dhanpat Rai &Sons
3. Utilization of Electric Power and Electric Traction, G.C.Garg, KhannaPublishers

REFERENCES:

1. Utilization of Electrical Power including Electric Drives and Electric Traction, N.V.Suryanarayana, New Age International (P) Limited, Publishers,1996
2. Generation, Distribution and Utilization of Electrical Energy, C.L. Wadhwa, New Age International (P) Limited, 1997
3. Utilization of Electrical Power, J.B.Gupta, Kataria Publishers

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

(18PE1EE02) RENEWABLE ENERGY SYSTEMS

COURSE PRE-REQUISITES: Environmental Science and Physics

COURSE OBJECTIVES:
- To provide necessary knowledge about the modeling, design and analysis of various PV systems
- To show WECS environmentally sustainable alternative to the world's energy supplies
- To understand the power conditioning of PV & WECS system's power output

COURSE OUTCOME: After completion of the course, the student should be able to
CO-1: Model, analyze and design various photovoltaic systems
CO-2: Design appropriate power conditioning system for WECS system
CO-3: Designefficient storage systems for standalone Renewable Energy systems

UNIT – I:
Photovoltaic Energy Conversion: Photovoltaic Energy Conversion, Solar radiation and measurement -solar cells and their 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, I-V, P-V Characteristics. Solar cell arrays- PV modules-PV generators- shadow effects and bypass diodes- hot spot problem in a PV module

UNIT – II:
Solar PV Power Conditioning: Switching devices for solar energy conversion, DC Power conditioning converters - maximum power point tracking algorithms -AC power conditioners -Line commutatedinverters -synchronized operation with grid supply - Harmonic problem, Battery charger operation –Applications.

UNIT – III:
Wind Energy Conversion (WEC): Basic Principle of wind energy conversion -nature of wind -wind survey in India -Power in the wind -components of a wind energy -conversion system -Performance of induction generators for WECS, Site selection, classification of WECS.

UNIT - IV:
Self-Excited & Grid Connected WECS: Self excited induction generator for isolated power generators -Theory of self-excitation-Capacitance requirements -Power conditioning schemes -Controllable DC Power from Self excited induction generators (SEIGs) -system performance. Grid Connected WECS:Grid connectors concepts -wind farm and its accessories -Grid related problems

UNIT – V:

Storage Systems: Energy Storage Parameters -Lead–Acid Batteries –Ultra capacitors -Flywheels -Superconducting Magnetic Storage System -Pumped Hydroelectric Energy Storage -Compressed Air Energy Storage -Storage Heat -Energy Storage as an Economic Resource.

UNIT – VI:

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

TEXT BOOKS:

1. Non-conventional Energy Sources,Rai, G.D.,Khanna Publishers Limited, NewDelhi,2002
2. Wind and Solar Power Systems, Mukund R. Patel, CRC Press, 2004
3. Energy Storage Technologies and Applications, Ahmed Faheem Zobaa, InTechPublishers, 2013

REFERENCES:

1. Solar Energy Utilization, Rai G.D., Khanna Publishers Limited, New Delhi,1997
2. Wind Energy Systems, GrayL.Johnson, Prentice Hall Inc., Singapore, 1985

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

(18PE1EE03) SPECIAL MACHINES AND CONTROL

COURSE OBJECTIVES:

- To understand the working and construction of special machines which are not covered under conventional machine courses
- To know the use of special machines in different feed-back systems
- To understand the use of micro-processors for controlling different machines
- To know their applications as control systems components

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Use different special machines as part of control system components
CO-2: Use special machines as transducers for converting physical signals into electrical signals
CO-3: Use micro-processors for controlling different machines
CO-4: Select different special machines as control system components

UNIT - I:
Stepping Motors: Constructional features, principle of operation, modes of excitation, single phase stepping motors, torque production in variable Reluctance (VR) stepping motor, Dynamic characteristics, Drive systems and circuit for open loop control, Closed loop control of stepping motor, microprocessor-basedcontroller.

UNIT – II:
Synchronous Reluctance Motors: Constructional features: axial and radial air gap Motors. Operating principle, reluctance torque – Phasor diagram, motor characteristics, linear induction motors.

UNIT – III:
Switched Reluctance Motors: Constructional features, principle of operation. Torque equation, Power controllers, Characteristics and control. Microprocessor based controller. Sensor less control.

UNIT-IV:
Permanent Magnet Brushless DC Motors: Commutation in DC motors, Difference between mechanical and electronic commutators, Hall sensors, Optical sensors, Multiphase Brushless motor, Square wave permanent magnet brushless motor drives, Torque and emf equation, Torque-speed characteristics, Controllers- Microprocessor based controller. Sensorless control.

UNIT-V:
Permanent Magnet Synchronous Motors: Principle of operation, EMF equation, power input and torque expressions, Phasor diagram, Power controllers, Torque speed characteristics, Self-control, Vector control, Current control schemes. Sensor less control.

UNIT-VI:

Axial Flux Machines: Principle of Operation, comparison between axial and radial flux machines, advantages,N-N and N-S type, single air-gap and multi air-gap machines, sizing equations, power density comparison between axial and radial flux machines, applications.

TEXT BOOKS:

1. Brushless Permanent Magnet and Reluctance Motor Drives, T.J.E. Miller, Clarendon Press, Oxford,1989
2. Stepping Motors – A Guide to Motor Theory and Practice, P.P. Aearnley, Peter Perengrinus, London,1982

REFERENCES:

1. Stepping Motors and Their Microprocessor Controls, T. Kenjo, Clarendon Press London, 1984
2. Permanent Magnet and Brushless DC Motors, T. Kenjo and S. Nagamori,Clarendon Press, London,1988

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B.Tech. V Semester - CSE, IT & EEE	L	T/P/D	C
	3	0	3

(18PC1IT05) 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, the student 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 Systemhardware, Operating System Objectives and functionsOperating 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 ofConcurrency, 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 handlingDeadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock detection, Recovery fromDeadlocks, 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, SwapspaceManagement, 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 systemstructure and implementation, Directory implementation, Allocation methods, Free-spacemanagement, 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, 7^{th}Edition, John Wiley
2. Unix Concepts and Applications, Sumitabha Das, 4^{th}Edition, TMH, 2006

REFERENCES:

1. Modern Operating Systems, Andrew S. Tanenbaum, 2^{nd} Edition, Pearson/PHI
2. Operating Systems – A Concept Based Approach, D. M. Dhamdhere, 2^{nd}Edition
3. Unix System Programming using C++, T.Chan, PHI
4. Operating Systems - Internal and Design Principles, Stallings, 5^{th}Edition, Pearson Education/PHI, 2005

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

(18PC1EC03) SIGNALS AND SYSTEMS

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

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: Appreciate the processes of discretization of signals

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: Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signals, standard signals and periodic signals, properties of Fourier transform, Inverse Fourier Transform.
Laplace Transform: Concept of Region ofConvergence (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, 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

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

(18PC2EE05) POWER ELECTRONICS LABORATORY

COURSE PRE-REQUISITES: Power Electronics

COURSE OBJECTIVES:
- To apply the concepts of power electronic converters for efficient conversion/controlof power from source to load
- To design the power converter with suitable switches meeting a specific load requirement

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the operating principles of various power electronic converters
CO-2: Use power electronic simulation packages& hardware to develop the powerconverters
CO-3: Analyze and choose the appropriate converters for various applications

LIST OF EXPERIMENTS:

1. Characteristics of SCR, MOSFET & IGBT
2. Gate firing circuit for SCR using UJT, Gate drive circuits for MOSFET, IGBT
3. Single Phase fully controlled bridge converter with R and RL loads
4. DC-DC buck converter
5. DC-DC boost converter
6. Single Phase Bridge inverter with R and RL loads
7. Single Phase AC Voltage Controller with R and RL Loads
8. Single Phase Cyclo-converter with R and RL loads
9. a) Simulation of single-phase Semi converter using R and RL loads
   b) Simulation of single-phase full converter using R, RL and RLE loads
10. Simulation of three-phase full converter using R, RL and RLE loads
11. (a)Simulation of DC-DC buck converter
(b)Simulation of DC-DC boost converter
12. (a)Simulation of single-phase Inverter with PWM control
    (b)Simulation of three phase Inverter with PWM control

REFERENCES:

1. Simulation of Electric and Electronic circuits using PSPICE, M.H.Rashid, M/s PHI Publications
2. PSPICE A/D User's Manual, Microsim, USA
3. PSPICE Reference Guide, Microsim, USA
4. MATLAB and its Tool Box, User's Manual, Mathworks, USA

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

(18PC2EE04) CONTROL SYSTEMS LABORATORY

COURSE PRE-REQUISITES: Control Systems

COURSE OBJECTIVES:
- To understand the different ways of system representations such as Transfer function representation and state space representations
- To get the transfer functions of various physical and laboratory-based systems
- To design various controllers and compensators to improve system performance and test them in the laboratory
- To get the performance of various devices (Magnetic amplifiers, Servo motors and stepper motors etc.)

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the system 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

LIST OF EXPERIMENTS:

1. Time response of second order system with different values of ζ
2. Effect of PID Controller on dynamic response of second order systems.
3. Design of lead compensator and its magnitude and phase plots
4. Design of lag compensator and its magnitude and phase plots
5. Transfer function of DC motor
6. Effect of feedback on performance of DC servo motor
7. Characteristics of AC servo motor
8. Temperature control using PID Controller
9. Simulation of PID controllers and its effects on system performance
10. Stability analysis using Root locus, Bode and Nyquist plots through Simulation
11. Root locus-based design of controllers for improving system performance through Simulation
12. Frequency domain-based design of compensators for improving system stability through Simulation

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	0	**2**	**1**

(18PC2CS04) PYTHON PROGRAMMING PRACTICE

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
a) Running instructions in Interactive interpreter and a Python Script
b) Write a program to purposefully raise Indentation Error and correct it

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

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

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

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

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

Exercise -7 Strings Continued

a) Python program to split and join a string
b) Python Program to Sort Words in Alphabetic Order

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

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

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

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

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

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

Exercise - 14
a) Write a program to implement Code Conversions – BCD to Gray, Gray to Binary.
b) Write a program to implement Digital Multiplexer, Decoder, Encoder and Counter.

Week-15
Assignment: Develop web application using python base framework.

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 Learning

B.Tech. V Semester

	L	T/P/D	C
	0	**2**	**1**

(18PW4EE02) 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
	2	0	0

(18MN6HS02) ENVIRONMENTAL SCIENCE

COURSE PRE-REQUISITES: 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:
- Recognize the impacts of human interventions towards environment
- List out the benefits in creating a sustainable environment
- Sketch out various activities in achieving a cleaner environment
- 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 safeguarding 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, Anubha Kaushik & C. P. Kaushik, 4thEdition, New Age International Publishers

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

(18PC1EE09) ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

COURSE PRE-REQUISITES: Circuit Theory, Electrical Machines – II, Electro Magnetic Field Theory

COURSE OBJECTIVES:
- To introduce the basic concepts related to the operation of Electrical and Electronic Measuring Instruments
- To measure high voltages & high currents in distribution systems using Instrument transformers
- To measure unknown inductance, Resistance, capacitance using D.C Bridges &A.C Bridges
- To know the operation of AC and DC potentiometers

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the knowledge about the instruments to use them more effectively
CO-2: Suggest the kind of instrument suitable for typical measurements
CO-3: Apply the knowledge about transducers to use them effectively
CO-4: Apply the knowledge about instrument transformers to use them more effectively in distribution systems

UNIT – I:
Introduction to Measuring Instruments: Static characteristics of instruments- Accuracy, Precision, Linearity, Sensitivity, Dead time, Dead zone &Resolution. Types of errors, Random error analysis, Probable error or tolerance
Introduction to Measuring Instruments: Classification of measuring Instruments- operating forces in measuring instruments & systems to provide Deflecting, Control and Damping Torques.

UNIT – II:
Measurement of Voltage, Current, Power, Power Factor and Energy: PMMC, Moving iron type instruments-Expression for the deflecting torque and control torque Extension of range using shunts and series resistance, dynamometer type instruments, single phase energy meter, errors and calibration, Measurement of Power and Energy, Power factor meter.

UNIT – III:
Measurement of Resistance, Inductance and Capacitance: Measurement of low, medium and high resistances,insulation resistance measurement, Megger.
AC bridges Inductance Measurement: Maxwell's inductance bridge, Maxwell's inductance-Capacitance Bridge, Anderson's bridge, Owen's bridge, Hay's bridge.
Capacitance Measurement: Desauty's bridge, Shearing bridge, High voltage shearing bridge, Wien's bridge.

UNIT – IV:

Instrument Transformers and Potentiometers: Current and Potential transformers, ratio and phase angle errors, turns compensation, measurement of power using instrument transformers.

Potentiometers: DC potentiometers, Calibration of Voltmeters,Ammeters and UPF watt meter using D.C potentiometers.

UNIT – V:

Electronic Measurements: Digital voltmeters & types, digital multimeters, CRO: calculation of deflection sensitivity, Deflection factor, Frequency and phase angle measurements using CRO, Digital storage oscilloscope, electronic timer & counter for frequency & time measurement.

UNIT – VI:

Instrumentation: Transducers, classification of transducers, strain gauges, Types of strain gauges, inductive & capacitive transducers, piezoelectric and Hall-effect transducers for displacement measurement, thermistors, thermocouples, Introduction to smart sensors.

Data Acquisition Systems: Types of instrumentation systems, components of analog data acquisition systems.

TEXT BOOKS:

1. Electrical and Electronics Measurements and Instrumentation, A.K.Sawhney, Dhanpat Rai &Co.Publications
2. Electrical Measurement and Measuring Instruments, GoldingE.W,3rdEdition, Sir Issac Pitman and Sons, 1960
3. Modern Electronic Instrumentation and Measurement Techniques, Helfrick Albert D, Cooper William D., Prentice-Hall of India, 1992

REFERENCES:

1. Instrumentation Measurement and Feedback, Jones B.E., Tata McGraw-Hill, 1986

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	3	**0**	**3**

(18PC1EC09) MICROPROCESSORS AND MICROCONTROLLERS
(Common to ECE, EEE & EIE)

COURSE PRE-REQUISITES: Digital Fundamentals, 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 architecture of microprocessor/ microcontroller and their operation
CO-2: Demonstrate programming skills in assembly language for processors and Controllers
CO-3: Analyze and interface various peripherals for the design of processor/ controller-based systems

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

UNIT – III:
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 data communication, Serial data transmission methods and standards - RS-232C. Intel's 8251A- USART architecture and interfacing with 8086.

UNIT – IV:
Memory Interfacing and Interrupt Mechanism: 8086 Memory addressing and address decoding techniques, Semiconductor Memory Interfacing- Static RAM and ROM/PROM Interfacing with 8086 microprocessor.8086 Interrupts - Interrupt responses, Interrupt types and Interrupt Vector Table, Intel's
8259A- architecture.

UNIT – V:

Intel 8051 Microcontroller Architecture: 8051 Microcontroller Architecture – Von-Neumann Vs Harvard architecture. Programming model, Hardware, I/O pins, Ports and circuits, External memory, Counters and Timers, Serial data input and output, Interrupts, Addressing modes, Instruction set.

UNIT – VI:

8051 Programming and Interfacing: Parallel and Serial port programming, Timers/Counters programming, Interrupt programming, Stepper Motor, keyboard and LCD interfacing with 8051 Microcontroller.

Introduction to ARM processors- features and architecture.

TEXT BOOKS:

1. Microprocessors and Interfacing, Douglas V. Hall, 2ndEdition, TMH, 1999
2. The 8051 Microcontrollers and Embedded Systems, Mazidi and Mazidi, PHI, 2000

REFERENCES:

1. The 8051 Microcontroller Architecture, Programming and Applications, Kennith J.Ayala, West Publishing Company
2. Microcomputer Systems - The 8086/8088 Family Architecture, Programming and Design, Y.Liu and G.A. Gibson, 2nd Edition, PHI
3. ARM System Developer's Guide: Designing and Optimizing System Software, Andrew N. Sloss, Dominic Symes, Chris Wright, Elsevier Inc., 2007
4. The 8085 Microprocessor: Architecture Programming and Interfacing, K.Uday Kumar, B.S. Umashankar, Pearson, 2008

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

(18HS1MG02) PRINCIPLES OF MANAGEMENT AND ORGANISATIONAL BEHAVIOUR
(Common for all branches)

COURSE PRE-REQUISITES: Engineering Economics and Accounting (EEA)

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, the student 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: Appreciatethe 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, 6thEdition, Pearson Education/Prentice Hall
2. Organizational Behaviour, Stephen P. Robbins, Prentice Hall, 2013
3. Organizational Behaviour, Fred Luthans, McGraw-Hill, 2013

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	3	0	3

(18PE1EE04) ELECTRICAL DRIVES

COURSE PRE-REQUISITES: Power Electronics, Electrical Machines – I, II & III

COURSE OBJECTIVES:
- To introduce the drive system and operating modes of drive and its characteristics
- To understand Speed – Torque characteristics of different motor drives by various Power converter topologies
- To understand the motoring and braking operations of drive
- To understand the differences between DC drives and AC drives

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the characteristics of DC motors and induction motors.
CO-2: Understand the principles of speed-control of DC motors and induction motors
CO-3: Understand the power electronic converters used for DC motor and induction motorspeed control

UNIT – I:
DC Motor Characteristics: Review of EMF and Torque equations of DC machine, review of torque-speed characteristics of separately excited dc motor, change in torque-speed curve with armature voltage, load torque-speed characteristics, operating point, armature voltage control for varying motor speed, flux weakening for high speed operation.

UNIT – II:
Multi-Quadrant Chopper Fed DC drive: Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple, calculation of losses in dc motor and chopper, efficiency of dc drive, smooth starting. Review of motoring and generating modes operation of a separately excited dc machine, four quadrant operation of dc machine; single-quadrant, two-quadrant and four-quadrant choppers; steady- state operation of multi-quadrant chopper fed dc drive, regenerative braking.

UNIT – III:
Closed-Loop Control of DC Drive: Control structure of DC drive, inner current loop and outer speed loop, dynamic model of dc motor – dynamic equations and transfer functions, modeling of chopper as gain with switching delay, plant transfer function, for controller design, current controller specification and design, speed controller specification and design.

UNIT – IV:
Induction Motor Characteristics: Review of induction motor equivalent circuit and torque-speed characteristic, variation of torque-speed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and frequency, typical torque-speed curves of fan and pump loads, operating point, constant flux operation, flux weakening operation.
UNIT – V:

Scalar Control or Constant V/f Control of Induction Motor: Review of three-phase voltage source inverter, generation of three-phase PWM signals, sinusoidal modulation.
V/f control of induction motor, steady-state performance analysis based on equivalent circuit, speed drop with loading, slip regulation.

UNIT – VI:
Control of Slip Ring Induction Motor: Impact of rotor resistance of the induction motor torque-speed curve, operation of slip-ring induction motor with external rotor resistance, starting torque, power electronic based rotor side control of slip ring motor, slip power recovery.

TEXT BOOKS:

1. Power Semiconductor Controlled Drives, G. K. Dubey, Prentice Hall, 1989
2. Electric Motor Drives: Modeling, Analysis and Control, R. Krishnan, PrenticeHall, 2001

REFERENCES:

1. Fundamentals of Electrical Drives, G. K. Dubey, CRC Press, 2002
2. Control of Electric Drives, W. Leonhard, Springer Science & Business Media, 2001

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

(18PE1EE05) STORAGE TECHNOLOGIES

COURSE PRE-REQUISITES: Power Electronics and Power Systems

COURSE OBJECTIVES:
- To understand non-electrical storage technologies available
- To understand Electro chemical secondary batteries characteristics
- To understand efficiency improvement techniques in storage systems
- To appreciate various applications of storage systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Learn Mechanical, Magnetic and Electrostatic storage systems
CO-2: Enumerate merits and demerits of various secondary batteries
CO-3: Study characteristics of Lead acid batteries
CO-4: Improve the efficiency of storage systems
CO-5: Apply knowledge on storage technologies in EV and Power systems

UNIT – I:
Nonelectrical Storage Systems: 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 – II:
Electro Chemical Storage: History, General battery concepts- Types of Batteries-Primary, secondary- Battery Vs Cell, Nickel-Cadmium -Nickel-Metal Hydride, Nickel hydrogen, Lithium-Ion- Lithium-Polymer, Fuel cells

UNIT–III:
Specifications and Characteristics: Domains of applications of Energy storage- Starter-Traction-stationary-mobile or nomadic, Review of storage requirements, Definitions of characteristics, Terminology of States, Battery Design, Battery Charging, Charge Regulators,Battery Management, General Equivalent Electrical Circuit, Performance Characteristics

UNIT – IV:
Sealed-Lead Cells and Batteries: Discharge Characteristics, Charging-Importance-characteristics-charge acceptance-over charging, Types of charging- Constant voltage charging- Constant current charging- Taper charging-special charging-Charging power sources, storage, Testing, safety.

UNIT–V:
Electrical Energy Storage System Efficiency Improvement: Hybrid Electrical Energy storage – Design Considerations- Architecture- Charge management- components Modeling of Power Conversion, Reconfigurable EES Array Architecture, Cycle Efficiency and Capacity Utilization of EES Bank, General Bank Reconfiguration

Architecture, Dynamic Reconfiguration Algorithm, Cycle Efficiency and Capacity Utilization Improvement

UNIT–VI:

Storage Applications: Electric Vehicle application- Regenerative Brake- PV module assistance-Storage bank reconfiguration- Overall cost analysis, Energy storage in Transient regimes of Power system-Problem formulation-modeling- steady state stability analysis with storage-storage Parameters to ensure transient stability, Battery rating calculations for standalone system.

TEXT BOOKS:

1. Energy Storage for Power Systems, A. Ter-Gazarian, Peter Peregrinus Ltd., 1994
2. Design and Management of Energy-Efficient Hybrid Electrical Energy StorageSystems, Younghyun Kim, Naehyuck Chang, Springer, 2014
3. Rechargeable BatteriesApplicationsHandbook, EDNSeries of DesignEngineers, Elsevier

REFERENCES:

1. Lithium Batteries and Other Electrochemical Storage Systems, Christian Glaize,Sylvie Geniès
2. Wind and Solar Power Systems, Mukund R. Patel, Second Edition,CRC Press, 2006

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B.Tech. VI Semester

L	T/P/D	C
3	0	3

(18PE1EE06) DIGITAL CONTROL SYSTEMS

COURSE PRE-REQUISITES: Control Systems, Linear Control Systems

COURSE OBJECTIVES:
- To introduce the components of digital control system and to study the Z-transforms
- To provide knowledge on pulse transfer functions and their analysis
- To introduce state variable analysis and stability concepts in discrete domain
- To educate on tuning of PID controllers in discrete domain

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Expose to the concepts of Digital control systems
CO-2: Provide adequate knowledge of discrete systems in state variable analysis
CO-3: Learn the concept of stability analysis and design of discrete time systems
CO-4: Provide comprehensive knowledge of optimal control

UNIT – I:
Introduction Sampling and Reconstruction: Introduction, Examples of Data control systems – Digital to Analog conversion and Analog to Digital conversion, sample and hold operations.
Z – Transforms: Introduction, Linear difference equations, pulse response, Z – transforms, Theorems of Z – Transforms, the inverse Z – transforms, Modified Z- Transforms

UNIT – II:
Z-Plane Analysis of Discrete-Time Control System: Z-Transform method for solving difference equations; Pulse transforms function, block diagram analysis of sampled – data systems, mapping between s-plane and z-plane: primary strips and complementary strips.

UNIT – III:
State Space Analysis: State space representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and it's Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state – space equations

UNIT – IV:
Controllability and Observability: Concepts of Controllability and Observability, Tests for controllability and Observability. Duality between Controllability and Observability, Controllability and Observability conditions for Pulse Transfer Function of state feedback controller through pole placement – Necessary and sufficient conditions, Ackerman's formula. State Observers – Full order and Reduced order observers.

UNIT – V:

Stability Analysis: Mapping between the S-Plane and the Z-Plane – Primary strips and Complementary Strips – Constant frequency loci, Constant damping ratio loci, Stability Analysis of closed loop systems in the Z-Plane. Jury stability test – Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion. Stability analysis using Liapunov theorems.

UNIT – VI:

Design of Discrete Time Control System by Conventional Methods: Transient and steady – State response Analysis – Design based on the frequency response method –Bilinear Transformation and Design procedure in the w- plane, Lead, Lag and Lead-Lag compensators and digital PID controllers.

TEXT BOOKS:

1. Discrete-Time Control Systems, K. Ogata, Pearson Education/PHI, 2ndEdition
2. Digital Control and State Variable Methods, M.Gopal, TMH

REFERENCES:

1. Digital Control Systems, Kuo, 2ndEdition, Oxford University Press, 2003
2. Digital Control Engineering, M.Gopal, New Age International Publishers
3. Digital Control Engineering Analyses and Design, M. Sami Fadali and Antoni Visioli, AP Academic Press

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1IT02) COMPUTER ORGANISATION

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 pipeline, RISC pipeline Vector Processing, Array Processors.

TEXT BOOKS:

1. Computer Organization and Design: The Hardware/Software Interfaces, David A. Patterson and John L. Hennessy, 5thEdition, Elsevier
2. Computer Organization and Embedded Systems, Carl Hamacher, 6thEdition, McGraw Hill Higher Education

REFERENCES:

1. Computer System Architecture, M. Morris Mano, Third Edition
2. Computer Architecture and Organization, John P. Hayes, 3rdEdition, WCB/McGraw-Hill
3. Computer Organization and Architecture: Designing for Performance, William Stallings, 10thEdition, Pearson Education
4. Computer System Design and Architecture, Vincent P. Heuring and Harry F. Jordan, 2ndEdition, Pearson Education

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PE1EC02) MOS CIRCUITS

COURSE PRE-REQUISITES: Electronic Devices and Circuits, Electronic Circuit Analysis

COURSE OBJECTIVES:
- To learn the MOS device physics
- To know the design procedure of various 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 applications of MOSFET
CO-3: Conceptualize the memory classification and designing of memory circuits

UNIT – I:
Basic MOS Device Physics: Small Signal and large signal Models of MOS transistor, MOS I/V Characteristics, MOSFET as a switch, MOSFET capacitances, Scaling and Short channel effects.

UNIT – II:
MOS Single Stage Amplifiers: review of Common source amplifier with different loads, source follower, Common gate amplifier, Cascode Amplifiers, Frequency Response of Integrated circuits, frequency response (miller effect) of CG, CS, and CD amplifiers.

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

UNIT – IV:
Nonlinear Analog Circuits &Other Applications: Precision rectification, Sampling Circuits using NMOS, PMOS, CMOS Switches and Switch capacitor circuit. Switched capacitor integrator, oscillators, ADC, DAC.

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, RAM array organization, DRAM Types, Operation, Leakage currents in DRAM cell and refresh operation, SRAM operation Leakage currents in SRAM cells.
TEXT BOOKS:

1. Design of Analog CMOS Integrated Circuits, Behzad Razavi, TMH Edition, 2012
2. Digital Integrated Circuits, Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, 2nd Edition, Pearson Education

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 Edition, 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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC2EC10) MICROPROCESSORS AND MICROCONTROLLERS LABORATORY
(Common to ECE, EEE & EIE)

COURSE PRE-REQUISITES: Concepts of Digital Design and Basic Programming

COURSE OBJECTIVES:
- To understand internal structure of processors and controllers
- 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: Enhance programming skills for simple and complex tasks used in various engineeringdisciplines
CO-2: Apply the knowledge of interfacing techniques to design microprocessor-based systems
CO-3: Apply the knowledge of interfacing techniques to design microcontroller-based systems

LIST OF EXPERIMENTS:

1. Programs for 16-bit arithmetic operations for 8086 (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 for digital clock design using 8086
6. Interfacing ADC and DAC to 8086 / 8051
7. Interfacing stepper motor to 8086 / 8051
8. Programming using arithmetic, logical and bit manipulation instructions of 8051
9. Program and verify Timer/ Counter in 8051
10. Program and verify Interrupt handling in 8051
11. UART Operation in 8051
12. Communication between 8051 kit and PC
13. Interfacing LCD to 8051
14. Interfacing Matrix / Keyboard to 8051

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

(18PC2EE06) ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LABORATORY

COURSE PRE-REQUISITES: Electrical Measurements and Instrumentation

COURSE OBJECTIVES:
- To calibrate LPF Watt Meter, energy meter, P.F Meter using electro dynamo meter type instrument as the standard instrument
- To determine unknown inductance, resistance, capacitance by performing experiments on D.C Bridges &A.C Bridges
- To determine three phase active & reactive powers using single wattmeter method practically
- To determine the ratio and phase angle errors of current transformer and potential transformer

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Get the ability to choose instruments
CO-2: Test any instrument
CO-3: Find the accuracy of any instrument by performing experiment
CO-4: Calibrate PMMC instrument using D.C potentiometer

LIST OF EXPERIMENTS:

1. Measurement of batch of resistances and estimation of statistical parameters
2. Measurement of (i) low resistance using Kelvin's double bridge (ii)earth
3. resistance and insulation resistance using Megger
4. Measurement of L and C using Anderson Bridge, Schering bridge, and LCR meter
5. Calibration of D.C voltmeter Ammeter & watt meter using dc potentiometer
6. Calibration of dynamometer type power factor meter & energy meter
7. Measurement of Three phase Active and Reactive power
8. Testing of Dielectric strength of transformer oil
9. Measurement of Three phase power using instrument transformers
10. Measurement of current using Shunts, C.T and Hall sensors
11. Measurement of Linear Displacement with the help LVDT
12. Measurement of different ranges of temperatures using i)RTD ii)Thermo couple
13. Measurement of load with the help of strain gauges
14. Measurement of % ratio error and phase angle of given C.T. by Silsbee'smethod
15. Measurement of % ratio error and phase angle of given P.T by Silsbee'smethod

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

(18HS2EN02) ADVANCED ENGLISH COMMUNICATION SKILLS LABORATORY
(Common to all branches)

COURSE OBJECTIVES:
- Enable the students to create clear, accurate, and succinct content to write business letters, resume, SOP, Proposals and Technical Reports for academics as well as for workplace
- Enable students to adjust technical content to meet the needs of a specific target audience
- Groom students to speak accurately and fluently and prepare them for real world activities through behavioral skills
- Train students in soft skills through role play and group discussion to improve their EQ

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: Write covering letters, resume, SOP, Project Proposals and Technical Reports
CO-3: Speak fluently and address a large group of audience and participate in debates and discussions
CO-4: Negotiate terms, manage situations through interpersonal skills, persuade people and make quick decisions

UNIT – I:
Application Writing:
1. Cover Letter & Resume Writing
2. Statement of Purpose

UNIT – II:
Correspondence Skills:
1. E-Correspondence
2. Netiquette
3. Social Media Etiquette

UNIT – III:
Employability Skills-1:
1. Grooming
2. Social Etiquette
3. Nonverbal Communication

UNIT – IV:
Employability Skills-2:
1. Group Discussions
2. Interview Skills – Face to Face
3. Interview Skills – Telephonic / Video

UNIT – V:

Presentation Skills:

1. Oral Presentations
2. Powerpoint Presentations

UNIT – VI:

Report Writing:

1. Technical Report Writing
2. White Paper Writing
3. Writing Agenda & Minutes

TEXT BOOKS:

1. Effective Technical Communication, Ashraf, Rizvi M., 2nd Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2005
2. Technical Communication, A Reader-Centered Approach, Anderson, Paul V. Reports in Paul V. Anderson's, 9th Edition, Heinle, Boston, 2003
3. Technical Communication: A Practical Approach, William S. Pfeiffer, 8th Edition, Pearson, 2012

REFERENCES:

1. Technical Communication, Burnett, Rebecca, 6th Edition, Cengage Learning, 2001
2. Technical Writing Process and Product, Gerson Sharon J. and Steven Gerson, 3rd Edition, Prentice Hall, 1999
3. Technical Communication: Situations and Strategies, Markel, Mike, 8th Edition, 2006-07
4. Business Correspondence and Report Writing, R. C. Sharma and K. Mohan, 20th Edition, Tata McGraw-Hill, New Delhi, 2017
5. Technical Communication, Principles and Practices, M. Raman and S. Sharma, 3rd Edition, OUP, 2015

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PW4EE03) 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:

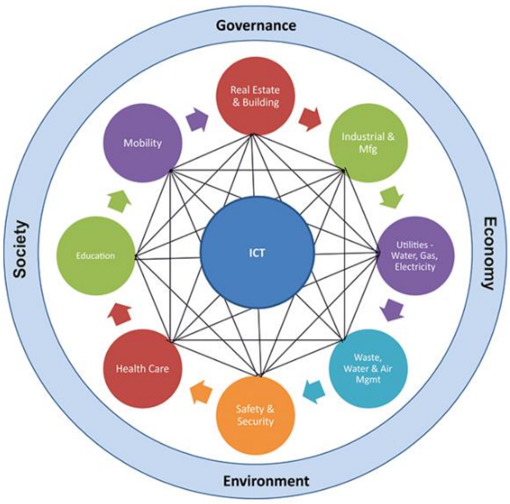
- Public information systems
- Redressal of grievances
- Electronic service delivery
- Maximum engagement of citizens
- Reduced energy and fuel usage
- Reduces the development of wastes
- Smart water monitoring
- Treatment of wastewater
- Sustainable monitoring water quality
- Maximum utilization of 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

(18OE1CE01) 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 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 - 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**

(18OE1CE02) 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-II, 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-II, 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**

(18OE1CE03) 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 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 advancements in the field of smart structures, materials 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: Identify suitable smart sensors and actuators for a specific engineering application
CO-3: Explainthe mechanics of smart composite materials
CO-4: Gain the knowledge on smart materials and smart structures

UNIT I:
Overview of Smart Materials: Introduction to Smart Materials, Principles of Piezoelectricity, Perovskyte Piezoceramic Materials, Single Crystals vs Polycrystalline Systems, Piezoelectric Polymers, Principles of Magnetostriction, Rare earth Magnetostrictive materials, Giant Magnetostriction and Magneto-resistance Effect, Introduction to Electro-active Materials, Electronic Materials, Electro-active Polymers, Ionic Polymer Matrix Composite (IPMC), Shape Memory Effect, Shape Memory Alloys, Shape Memory Polymers, Electro-rheological Fluids, Magneto Rheological Fluids

UNIT-II:
High-Band Width, Low Strain Smart Sensors: Piezoelectric Strain Sensors, In-plane and Out-of Plane Sensing, Shear Sensing, Accelerometers, Effect of Electrode Pattern, Active Fibre Sensing, Magnetostrictive Sensing, Villari Effect, Matteuci Effect and Nagoka-Honda Effect, Magnetic Delay Line Sensing, Application of Smart Sensors for Structural Health Monitoring (SHM), System Identification using Smart Sensors

UNIT-III:
Smart Actuators: Modelling Piezoelectric Actuators, Amplified Piezo Actuation – Internal and External Amplifications, Magnetostrictive Actuation, Joule Effect, Wiedemann Effect, Magnetovolume Effect, Magnetostrictive Mini Actuators, IPMC and Polymeric Actuators, Shape Memory Actuators, Active Vibration Control, Active Shape Control, Passive Vibration Control, Hybrid Vibration Control

UNIT –IV:

Smart Composites: Review of Composite Materials, Micro and Macro-mechanics, Modelling Laminated Composites based on Classical Laminated Plate Theory, Effect of Shear Deformation, Dynamics of Smart Composite Beam, Governing Equation of Motion, Finite Element Modelling of Smart Composite Beams

UNIT-V:

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

UNIT –VI:

Applications to Engineering Domains – Case studies

TEXT BOOKS:

1. Smart Structures: Analysis and Design, A. V. Srinivasan, D. Michael McFarland, Cambridge University Press, 2000
2. Smart Structures: Physical Behaviour, Mathematical Modelling and Applications, Paolo Gaudenzi, Wiley, 2009

REFERENCES:

1. Smart Structures and Materials, Brian Culshaw, Artech House, 2000
2. Smart Structures, Gauenzi P., Wiley, 2009
3. Piezoelectricity, Cady W. G., Dover Publication

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

(18OE1CE04) 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 2000: Recommendations for World Road Association (PIARC), Kan Paul Chen, John Miles
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**

(18OE1CE05) 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

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

(18OE1CE06) 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, Prof. Anjaneyulu
4. Hazardous Waste Management, M. LaGrega and others, McGraw-Hill Publication

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

(18OE1CE07) 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, McGraw-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 RC 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

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

(18OE1CE08) 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 Footprint (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**

(18OE1EE01) 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 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, Available energy from the sun, The apparent motion of the sun, 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, 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, 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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1EE02) 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 a.c. 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. Peak Power operation of Wind Energy conversion system.

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 calculations 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., 2nd 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**

(18OE1EE03) 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

(18OE1EE04) 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**

(18OE1ME01) 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

(18OE1ME02) 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

(18OE1ME03) 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

(18OE1ME04) REVERSE ENGINEERING

COURSE PRE-REQUISITES: Elements of CAD, Introduction to 3D Printing, 3D Printing Machines, Tooling & Systems

COURSE OBJECTIVES:
- To understand the Reverse Engineering (RE) methodology
- To disassemble products and specify the interactions between its subsystems and their functionality
- To understand Computer-Aided RE and Rapid Prototyping technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Basic understanding of engineering systems
CO-2: Understanding the terminologies related to re-engineering, forward engineering, and reverse engineering
CO-3: Understanding of reverse engineering methodologies
CO-4: Understanding of reverse engineering of systems

UNIT-I:
Introduction to Reverse Engineering: Need, Definition, The Generic Process, History of Reverse Engineering, Scopeand tasks of RE, Domain analysis, 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; Noncontact Methods- Triangulation, and Structured Light, Destructive Method; Issues involved in data acquisition techniques

UNIT-IV:
Pre-processing Techniques: Need of pre-processing, Data formats, Import of point cloud data, Reduction and filtering of data
Triangular Mesh Modeling: Need,Fltering of triangular mesh model and its definition, Topological characteristics, Euler formula for triangular mesh model, Various methods of construction of triangular mesh model.

UNIT-V:
Segmentation: Definition and need, Methods for segmentation -Edge based and face based.
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, Planar Polygon Curve Construction for a Layer, Determination of Adaptive Layer Thickness

UNIT-VI:

Applications: Automotive, Aerospace, Medical sectors

Legal Aspects: Copyright Law, Reverse Engineering, Recent Case Law Barriers in adopting RE

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

(18OE1EC01) 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: 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 actuators
CO-4: Able to select proper Transducer / Sensor for a specific measurement application
CO-5: Able to 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**

(18OE1EC02) 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, Cengage Publications 3rd Edition, 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

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

(18OE1EC03) IOT PROTOCOLS AND ITS APPLICATIONS

COURSE PRE-REQUISITES: Sensors Transducers and Actuators, Introduction to Microcontrollers and Interfacing

COURSE OBJECTIVES:
- To understand the basics of Internet of Things and Cloud of things
- To learn different protocols and connectivity technologies used in IOT
- To understand various IoT platforms
- 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 and Cloud of things
CO-2: Analyze various protocols for IoT
CO-3: 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 enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Deployment Templates, M2M, IoT vs M2M.

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, Bluetooth, NFC, RFID.
Prototyping Embedded Device: Sensors, Actuators, Embedded computing Basics, System on chips.

UNIT – IV:
IoT Platforms: IoT Platforms – Introduction to IoT Platforms (AWS IoT, IBM Watson, ARM Mbed), Cloud Storage models and communication APIs, Python web application framework Designing a RESTful web API.

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: IoT Design Methodology, 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

(18OE1EC08) 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, 1st Indian Reprint, Springer Verlag, 2010

REFERENCES:

1. Wireless Sensor Networks: An Information Processing Approach, F. Zhao and L. Guibas, Morgan Kaufmann, 1st 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, 2nd 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…

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1EC04) 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**

(18OE1EC05) 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, Pearson/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

(18OE1EC06) 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, 3^{rd} Edition, Pearson
2. Video Processing and Communication, Yao Wang, Joem Ostarmann and Ya – Quin Zhang, 1^{st} 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

(18OE1EC07) APPLICATIONS OF AR AND VR

COURSE PRE-REQUISITES: Introduction to C Sharp, Introduction to Signal Processing, Introduction to Image & Video Processing

COURSE OBJECTIVES: Throughout the course, student will be expected to develop AR VR applications by being able to do each of the following:

- A review of current Virtual Reality (VR) and Augmented Reality (AR) technologies
- The fundamentals of VR/AR modeling and programming
- 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. Virtual Reality & Augmented Reality in Industry, Ma D., Gausemeier J., Fan X., Grafe M. (Eds.) Springer, 2011

REFERENCES:

1. http://www.realitytechnologies.com/augmented-reality/vitual-reality
2. https://en.wikipedia.org/wiki/Augmented_reality/vitual-reality
3. https://computer.howstuffworks.com/augmented-reality.html
4. https://www.theguardian.com/technology/augmented-reality

ADDITIONAL RESOURCES:

1. https://jasoren.com/making-an-ar-app-with-vuforia-and-unity3d/
2. http://www.psych.purdue.edu/~willia55/120/6.S-PMM.pdf

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**

(18OE1MT02) 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**

(18OE1CS01) 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
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, Yegna Narayana B., PHI

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

(18OE1CS02) 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**

(18OE1CS03) 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, 3rd 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.

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

(18OE1CS04) 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**

(18OE1CS08) 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 data base 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**

(18OE1CS05) DISTRIBUTED DATA BASES

COURSE PRE-REQUISITES: Fundamentals of Computer Networks

COURSE OBJECTIVES:

- To introduce 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 demonstrate query optimization and its algorithms
- To enumerate 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: Describe 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

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

(18OE1CS06) 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 basics of security attacks, services, goals and mechanism of security
CO-2: Apply variety of cryptographic algorithms, Hash Functions and protocols underlying network security applications and authentication applications
CO-3: Examine and analyze various email security and web security mechanisms
CO-4: Understand the system level 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. VIII Semester	L	T/P/D	C
	3	0	3

(18OE1CS07) 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: Understand the basic concepts and characteristics of Blockchain technology
CO-2: Demonstrate 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 to provide the security and analyze the various types of blockchains
CO-4: Understand the Crypto Currency and implement, the 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 Bolckchain 0, Bolckchain 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, Second 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 -LevelAutomation**. 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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1EI01) 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**

(18OE1EI02) 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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1EI03) 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**

(18OE1EI04) 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.

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

(18OE1CS04) 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, 4^{th} Edition, McGraw-Hill Education, 2006
2. Computer Networks, Andrew S. Tanenbaum, 4^{th} Edition, Pearson Education
3. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3^{rd} 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, 2^{nd} Edition, Pearson Education
4. Understanding Communications and Networks, 3^{rd} Edition, W.A. Shay, Cengage Learning

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

(18OE1CS08) 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 data base 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 Editio,n 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

(18OE1CS06) 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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1IT01) 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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1IT02) 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

(18OE1MT03) 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 σ^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

(18OE1IT03) 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'Reilly

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**

(18OE1IT04) 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**

(18OE1IT05) 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.

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

(18OE1AE01) 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., 3rdEdition, 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., 5thEdition, 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**

(18OE1AE02) 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, 5th Edition, SAE, 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

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

(18OE1AE03) 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

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

(18OE1AE04) 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 businessesalso **use** it to inform their conclusions. **Data analysis** can assistance corporations healthier comprehend theircustomers, 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.

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

(18OE1IT06) 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**

(18OE1CS08) 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 data base 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**

(18OE1IT03) 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'Reilly, 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

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

(18OE1IT07) 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

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

(18OE1CS11) FUNDAMENTALS OF COMPUTER ALGORITHMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To reinforce algorithms analysis methods
- To analyse running time of an algorithm
- To understand different algorithm design strategies
- To familiarize 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 EvaTardos, 1st Edition, Pearson
2. Algorithm Design: Foundations, Analysis and Internet Examples, Michael T. Goodrich and Roberto Tamassia, Second 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

(18OE1HS01) 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 ofOrganizational 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**

(18OE1HS02) 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)
4. Startup Easy - Part 1: The Essentials, Shishir Gupta, StartupLanes.Com, 2017 (ISBN: 978-9386503886)

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

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

(18OE1HS03) 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

(18OE1HS04) 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)

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

(18OE1CE09) 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: Developand 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

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

(18OE1EE05) 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, 6th Edition, Khanna Publishers, 2004
2. Non-Convention Energy Resources, B.H. Khan, 3rd Edition, McGraw-Hill, 2017

REFERENCES:

1. Renewable Energy Sources, Twidell & Weir, 3rd Edition, CRC Press, 2015
2. Solar Energy, Sukhatme, 3rd 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**
	3	**0**	**3**

(18OE1ME05) 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 Binder Jetting.

UNIT – III:
Solid Based 3D Printing Systems: Introduction, Principle, Processes and Applications of Fused Deposition Modeling (FDM) and Laminated Object Manufacturing (LOM).

UNIT – IV:
Laser 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
	3	0	3

(18OE1EC09) 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: Familiar with architectural and programming issues of Embedded Systems
CO-2: Able to 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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B.Tech.	**L**	**T/P/D**	**C**
	3	**0**	**3**

(18OE1CS09) 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, McGraw-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, Yegna Narayana B., PHI

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	3	**0**	**3**

(18OE1CS10) 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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(18OE1EI05) 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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(18OE1IT08) 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 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, Advocat 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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	3	**0**	**3**

(18OE1IT09) 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 explore 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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B.Tech.	L	T/P/D	C
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(18OE1AE05) 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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B.Tech. VII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(18PC1EC30) PRINCIPLES OF DIGITAL SIGNAL PROCESSING

COURSE PRE-REQUISITES: Network Analysis, Advanced Calculus, Linear and Digital IC applications

COURSE OBJECTIVES:
- To understand 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
- To understand the features of TMS24XX processors

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and analyze discrete signals and systems
CO-2: Analyze the transformation techniques and their computation
CO-3: Design digital filters from analog filters
CO-4: Realization of digital filters and understand the architecture of DSP Processors

UNIT – I:
Introduction: Classification of continuous time Signals & Systems. Linear shift invariant systems, stability and causality-Introduction to digital signal processing, Sampling of Continuous signals- -Sampling Process-Sampling Theorem-Classification of discrete time signals and sequences- Discrete Time Systems

UNIT – II:
Fourier Analysis: Introduction to Discrete Fourier series, Discrete Fourier Transform: Properties of Discrete Fourier Transform, linear convolution and circular convolution of sequences using DFT, Computation of DFT, Relation between DFT and Z-Transform.
Fast Fourier transform: Radix -2 decimation in time and decimation in frequency FFT algorithms, Inverse FFT- Composite Radix

UNIT – III:
Z- Transform: Introduction to Z-transform, Properties of Z- Transform, Inverse Z-Transform, Application of Z- Transforms for Linear constant coefficient difference equations, Realization of Digital filters, system function – stability criterion.

UNIT – IV:
IIR Filters: Analog filter approximations-Design of Butterworth Chebyshev filters, Design of IIR digital filter from analog filter using- impulse invariant and bilinear transformation techniques, design examples, realization of IIR filters-direct, canonic, cascade, and parallel forms.

UNIT – V:

FIR Filters: Characteristics of FIR Digital Filters, Frequency response, Design of FIR filters using – Rectangular, Hamming, Bartlett- windows, frequency sampling technique, comparison of FIR and IIR filters, realization of FIR filters-direct, cascade forms.

UNIT – VI:
Digital Signal Processors: Introduction – Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial Processors- Generation of PWM Signals Using DSP Processor

TEXT BOOKS:

1. Digital Signal Processing: Principles, Algorithms and Applications, John G. Proakis, D. G. Manolakis, 3rd Edition, PHI, 2007
2. Discrete Time Signal Processing, A. V. Oppenheim and R. W. Schaffer, PHI, 2009
3. TMS 320F 24xx Manuals

REFERENCES:

1. Digital Signal Processing, Fundamentals and Applications, Litan, Elsevier, 2008
2. Fundamentals of Digital Signal Processing Using MATLAB, Robert J. Schilling, Sandra L. Harris, Thomson, 2007
3. Digital Signal Processing, S. Salivahanan, A. Vallavaraj, C. Gnanapriya, TMH, 2009
4. Discrete Systems and Digital Signal Processing With MATLAB, Taans, Elali, CRC Press,2009
5. Digital Signal Processor-Architecture, Programming & Application, P. Venkata Ramani, M. Bhaskar, Tata McGraw-Hill, 2001

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
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(18PC1EE10) SWITCHGEAR AND PROTECTION

COURSE PRE-REQUISITES: Electrical Machines – II & III, Power System-II, Circuit Theory

COURSE OBJECTIVES:
- To introduce students to power system protection and switch gear
- To introduce all kinds of circuit breakers and relays for protection of Generators, Transformers and feeder bus bars from Over voltages and other electrical hazards
- To describe neutral grounding for overall protection of electrical systems
- To explore digital protection and applications of PMUs in power system protection

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the operation of various types of circuit breakers
CO-2: Understand construction and operation of various types of electromagnetic relays
CO-3: Analyze the impact of grounding in power system
CO-4: Understand the operation of static relays
CO-5: Understand PMU and its application in power system

UNIT – I:
Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage - Restriking Phenomenon, Average and Max. RRRV Numerical Problems., CB ratings, Description and Operation of following types of circuit breakers: Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers.

UNIT – II:
Electro-magnetic Relays: Principle of Operation and Construction of Electromagnetic Attraction, Induction Disc and Induction Cup relays, Universal torque equation, Over current, Directional relays, Differential Relays and Percentage Differential Relays, Distance relays: Impedance, Reactance and Mho, Characteristics of Distance Relays and Comparison.

UNIT – III:
Equipment Protection Schemes: Protection of Generators against Stator faults, Rotor faults, and Abnormal Conditions, Restricted Earth fault Protection, Protection of Transformers: Percentage Differential Protection, Numerical Problem on Design of CT's Ratio, Buchholz relay Protection, Differential Over-Current protection of Bus bars, Three-zone distance relay protection using Impedance relays.

UNIT – IV:

Neutral Grounding: Grounded and Ungrounded Neutral Systems - Effects of Ungrounded Neutral on system performance. Methods of Neutral Grounding: Solid, Resistance, Reactance and Peterson Coil.

UNIT – V:

Digital Protection: Basic construction of Static Relays, Advantages of static relays – Instantaneous over current relay, General equation for comparators, Phase comparator, Amplitude Comparator - Duality between amplitude and phase comparators.

UNIT – VI:

System Protection: Introduction to modern power system protection- philosophy and approach- Digital protection Technology overview; Introduction to PMU and its use, Phasor measurement techniques, Fault location.

TEXT BOOKS:

1. Switchgear and Protection, J. B. Gupta, S. K. Katari & Sons, 2013
2. Static Relays, T. S. Madhava Rao, 2nd Edition, TMH, 1989
3. Computer Relaying for Power Systems, Arun G. Phadke and James S. Thorp, 2nd Edition, Wiley

REFERENCE BOOKS:

1. Power System Protection and Switch Gear, Badri Ram and D. N. Vishwakarma, McGraw – Hill Professional
2. Extra High Voltage AC Transmission Engineering, Rakosh Das Begamudre, 3rd Edition, New Age International Publishers
3. Switchgear Protection and Power System, Sunil S. Rao, 13th Edition, Khanna Book Publishing Co. (P) Ltd.
4. Fundamentals of Power Sytems, Y. G. Paitankar, S. R. Bhinde, 2nd Edition, PHI Publications

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
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(18PE1EE07) POWER SYSTEM OPERATION AND CONTROL

COURSE PRE-REQUISITES: Power Systems, Control Systems and Electrical Machines

COURSE OBJECTIVES:
- To understand the formulation of Load-Flow problems applying different methods and carryout load-flow studies and compare
- To understand the importance of Economic Operation of Power Systems including losses
- To understand the importance of Load Frequency Control in the operation of power systems
- To understand the importance of reactive power and FACTS devices for stable operation of Power systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the Optimal operation of Hydro and Thermal power plants
CO-2: Develop the transfer function models and block diagrams of single and two area systems
CO-3: Evaluate the performance of single and two area systems without and with Controllers
CO-4: Analyze the behavior of Reactive power compensation devices

UNIT – I:
Economic Operation of Power Systems: Optimal operation of Generators in Thermal Power Stations, - heat rate Curve – Cost Curve – Incremental fuel and Production costs, input-output characteristics, Optimum generation allocation with line losses neglected. Optimum generation allocation including the effect of transmission line losses – Loss Coefficients, General transmission line loss formula.

UNIT – II:
Unit Commitment and Hydrothermal Scheduling:
Optimal Unit Commitment: Constraints in unit commitment- Spinning Reserve, Thermal unit constraints and Hydro constraints. Cost function formulation: start-up cost consideration and shut-down cost consideration. Dynamic programming method for the solution of UC Problem - Algorithm.
Optimal Scheduling of Hydrothermal System: Mathematical formulation and solution Technique with Algorithm.

UNIT – III:
Modeling of Turbines and Excitation System: Basic Generator Control loops – ALFC and AVR loops and cross coupling between two loops. Modelling of Turbine: First order Turbine model, Block Diagram representation of Steam Turbines and Approximate Linear Models. Mathematical Modelling of Speed Governing System – Governor

Characteristics, Regulation of two generators, Derivation of small signal transfer function. Generator load model, Modelling of Excitation System: Fundamental components of an Excitation system, Transfer function, Block Diagram Representation of IEEE Type-1 Model.

UNIT – IV:

Single Area Load Frequency Control: Necessity of keeping frequency constant, Definitions of Control area, coherency, concept of control area, Incremental power Balance of a control area, – Single area control – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response – Uncontrolled case. Proportional plus Integral control of single area and its block diagram representation and steady state and dynamic response.

UNIT – V:

Two-Area Load Frequency Control: ALFC of Multi-Area Systems-Advantages of pool Operation. Two area system - Modelling of a tie-line, Development of block diagram of a two area system. Mechanical analog of two area system and its Static and dynamic responses. Tie-line bias control, Automatic Generation Control and Economic dispatch control.

UNIT – VI:

Reactive Power Compensation: Overview of Reactive Power control – Reactive Power compensation in transmission systems Shunt and Series Compensation, Synchronous Condenser – advantages and disadvantages of different types of compensating equipment for transmission systems. Fundamentals of FACTS Controllers: Working and VI Characteristics of TCR, FC-TCR, TSC-TCR, TCSC and STATCOM.

TEXT BOOKS:

1. Modern Power System Analysis, I. J. Nagrath and D. P. Kothari, 2nd Edition, Tata McGraw – Hill Publishing Company Ltd,
2. Electric Energy Systems Theory, O. I. Elgerd, 2nd Edition, Tata McGraw-Hill Publishing Company Ltd.
3. Operation and Control in Power Systems, P. S. R. Murthy, 2nd Edition, BS Publications, 2011

REFERENCES:

1. Power System Analysis and Design, J. Duncan Glover and M. S. Sarma, 3rd Edition Thompson
2. Power System Operation and Control, S. Sivanagaraju and G. Sreenivasan, 5th Edition, Pearson
3. Power System Analysis, Grainger and Stevenson, Tata McGraw Hill
4. Power System Analysis, Hadi Saadat, TMH Edition
5. Electrical Power Systems, C. L. Wadhwa, 3rd Edition, New Age International

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PE1EC20) SENSORS AND ACTUATORS

COURSE OBJECTIVES:

- To expose to various sensors and transducers for measuring mechanical quantities
- To familiarize with the specifications of sensors and transducers
- To identify various sensors and transducers for various applications
- To expose 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 Actuators
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

B.Tech. VII Semester

	L	T/P/D	C
	3	**0**	**3**

(18PE1EE08) ELECTRICAL DISTRIBUTION SYSTEMS AND AUTOMATION

COURSE PRE-REQUISITES: Power Systems-II, Switchgear and Protection

COURSE OBJECTIVES:

- To get awareness of distribution systems for load modeling
- To understand the design & working of substations
- To know about system protection and the coordination course outcomes
- To know about Distribution Automation

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the Electrical Distribution system for voltage drop and power loss calculations in lines
CO-2: Analyze optimal conductor selection for distribution systems
CO-3: Describe Distribution Automation objectives and SCADA
CO-4: Analyze the effect of series capacitor for voltage control

UNIT – I:
General Concepts: Introduction to distribution systems, Load modeling and characteristics. Load factor, Coincidence factor, Contribution factor and Loss factor - Relationship between the Load factor and loss factor. Classification of loads (Residential, Commercial, Agricultural and Industrial) and their characteristics.

UNIT – II:
Distribution Feeders and Substations:
Design Considerations of Distribution Feeders: Radial and loop types of primary feeders, voltage levels, feeder loading; basic design practice of the secondary distribution system. Substations, Location of Substations: Rating of distribution substation, service area with 'n' primary feeders, benefits derived through optimal location of substations.

UNIT – III:
Distribution System Analysis:
Voltage Drop and Power-loss Calculations: Derivation for voltage drop and Power loss in lines, manual methods of solution for radial networks, three phase balanced primary lines.

UNIT – IV:
Protection: Objectives of distribution system protection, types of common faults and procedure for fault calculations. Protective Devices: Principle of operation of Fuses, Circuit Reclosures, Line Sectionalizers, and Circuit Breakers, Coordination of Protective Devices: General coordination procedure, Concepts of Smart grid and Demand Side Management.

UNIT – V:

Voltage Control: Overview of power quality in distribution systems, Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop compensation.

UNIT – VI:

Distribution Automation: Need for DA, Objectives & Functions of DA, SCADA, Consumer information service, GIS, Automatic Meter Reading

TEXT BOOKS:

1. Electric Power Distribution System, Engineering, Turan Gonen, TMH
2. Electric Power Distribution, A. S. Pabla, 6th Edition, Tata McGraw-Hill Publishing Company, 1997

REFERENCES:

1. Electrical Power Distribution and Automation, S. Sivanagaraju, V. Sankar, Dhanpat Rai and Co.
2. Electrical Power Distribution Systems, V. Kamaraju, 2nd Edition, TMH Publishers

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(18PE1MT02) ESSENTIAL MATHEMATICS FOR MACHINE LEARNING

COURSE PRE-REQUISITES: Basic Calculus and Matrix Algebra

COURSE OBJECTIVES:

- To learn important classes of spaces which apply to data and operations on them: Vector Spaces, Metric Spaces, Normed spaces, and Inner Product Spaces
- To learn Matrix theory and application to find the matrix function. Methods of computing and using Eigen values and Eigen vectors
- To learn to use Calculus to build approximations to functions,
- To learn minimizing a cost function and Optimization techniques
- To learn 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, Sixth Edition, John Wiley & Sons, Inc 2008
2. An Introduction to Multivariate Analysis, T. W. Anderson, John Wiley & Sons, New York, 2003
3. An Introduction to Applied Probability, Ian F. Blake, John Wiley & Sons, 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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(18PE1EC05) 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 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: Implementation of various applications using FPGA

UNIT – I:
Introduction to Programmable Logic Devices: Programmable logic devices, Simple Programmable Logic Devices – Read Only Memories, Programmable Logic Arrays, Programmable Array Logic: 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, 2005
2. Field-Programmable Gate Arrays, Stephen D. Brown, Springer, 1992

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(18PE1EE09) FLEXIBLE AC TRANSMISSION SYSTEMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To learn the active and reactive power flow control in power system
- To understand the need for static compensators
- To develop the different control strategies used for compensation
- To understand the need of custom power devices and applications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Prioritize the FACTS Controllers with their objectives and functions
CO-2: Analyze the working and control of SVC and STATCOM
CO-3: Categorize the working and control of Series Compensators
CO-4: Understand the working of SSSC, UPQC and IPQC

UNIT – I:
Introduction To Facts Controllers: Transmission Interconnections, power and Reactive power flow control in AC Transmission system, Loading capability Limits, constraints of maximum transmission line loading and Dynamic stability considerations. Uncompensated and compensated lines, Relative importance of controllable parameters. Classification of FACTS Controllers based on type of connection, relative importance of different types of controllers and benefits of FACTS Technology.

UNIT – II:
Voltage Source Converters: High power Electronic Devices used in Power Transmission – SCR, IGBT, GTO and IGCT. Three level voltage source converter-pulse width modulation converter, basic concept of current source Converters- comparison of current source converters with voltage source converters and operating principle of VSC used as STATCOM - Internal control schemes.

UNIT – III:
Static Compensation: Objectives of Shunt compensation – midpoint voltage regulation, voltage instability prevention – importance of Transient Stability – Power Oscillation damping. Objectives of series compensation – Importance of Transient Stability and Voltage Stability – Power Oscillation Damping – Methods of controllable var generation – variable impedance type static var generations, switching converter type var generations and hybrid var generations - VI Characteristics.

UNIT – IV:
Static Var Compensator: Static versus passive VAR compensator, Variable Impedance type Static shunt compensators: The Thyristor-Contolled and Thyristor-Switched Reactor (TCR and TSR): Harmonics minimization with sequential switching of TCR. FC-

TCR type SVC and its Functional control scheme. The Thyristor-Switched Capacitor (TSC) and transient-free switching of TSC. TSC-TCR type SVC: VI Characteristics and its Functional control scheme.

UNIT – V:
Statcom: Compensator control- Internal control schemes of STATCOM-indirect output voltage control and direct output voltage control. Comparison between SVC and STATCOM – VI and VQ Characteristics, Transient Stability Improvement and response time.

UNIT – VI:
Variable Impedance Series Compensators: GTO Thyristor-Gontrolled Series Capacitor (GCSC) Harmonics minimization with sequential switching of GCSC, Functional internal control scheme for the GCSC. Thyristor-Switched Series Capacitor (TSSC) and Thyristor-Controlled Series Capacitor (TCSC) - functional internal control scheme for the TCSC

UNIT – VI:
Converter Based Compensators:
Switching Converter Type FACTS Controller: The Static Synchronous Series Compensator (SSSC) Functional Internal control schemes: Direct and indirect controls of SSSC. Functional external (system) control scheme for the SSSC.
Unified Power Flow Controller: Circuit Arrangement, Operation and control of UPFC and Interline Power Flow Controller: basic operation and characteristics.

TEXT BOOKS:

1. Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, N. G. Hingorani, L. Gyugyi, IEEE Press Book, Standard Publishers and Distributors, Delhi, 2001
2. FACTS Controllers in Power Transmission and Distribution, K. R. Padiyar, New Age International Publishers, 2007

REFERENCES:

1. Flexible AC Transmission Systems, Modeling and Control, X. P. Zhang, C. Rehtanz, B. Pal, Springer Verlag, Berlin, 2006
2. Static Reactive Power Compensation, T. J. E. Miller, John Wiley and Sons, New York, 1982
3. FACTS Controllers & Applications, K. S. Sureshkumar, S. Ashok, E-book Edition, Nalanda Digital Library, NIT Calicut, 2003

B.Tech. VII Semester

	L	T/P/D	C
	3	**0**	**3**

(18PE1EC08) INTERNET OF THINGS

COURSE OBJECTIVES:

- To understand the concepts of Internet of Things and will be able to build IoT applications
- To familiarize with design framework needed to build Internet of Things
- To apply various protocols and connectivity technologies for building IoT

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the concepts of IoT and IoT protocols
CO-2: Design IoT applications in different domains and analyze their performance
CO-3: Implement basic IoT applications on embedded platforms

UNIT – I:
Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT enabaled 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.

UNIT – IV:
Web of Things: Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture

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: IoT Design Methodology, Applications of IoT– Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

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. VII Semester	**L**	**T/P/D**	**C**
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(18PE1EE10) POWER SYSTEM DYNAMICS AND CONTROL

COURSE OBJECTIVES:

- To study of system dynamics and its physical interpretation
- To development of mathematical models for synchronous machine
- To development of the excitation, PSS and load models
- To detailed study of small signal and transient power system stability

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the modelling of synchronous machine in detail
CO-2: Develop d-axis and q-axis equivalent circuits, steady state and transient models of synchronous machine
CO-3: Analyze the power system small signal and transient stability
CO-4: Evaluate the Power System Voltage stability

UNIT – I:
Synchronous Machine Modelling: Mathematical description of a synchronous machine, stator and rotor circuits of synchronous machine. Necessary assumptions for modelling, basic equations of synchronous machine, self and mutual inductances, stator and rotor flux linkage equations.

UNIT – II:
Park's Transformation and PU Representation: dqo transformation and transformation of Stator phase quantities to direct and quadrature axis quantities. Physical interpretation of dqo transformation. Per unit representation, pu stator and rotor voltage equations and per unit electromagnetic torque.

UNIT – III:
Simplified Synchronous Machine Models: Phasor representation of voltages and currents unloaded, loaded machine and steady state performance. 3-Ph Short Circuit on machine terminals–OCC, SCC and Short Circuit Ratio, Simple sub transient, transient and steady state models.

UNIT – IV:
Analysis of Single Machine System: Classification of Power System Stability and Power System security states and state diagram. Swing equation and its block diagram representation for stability studies. Characteristic equation and application of Routh Harwith criterion for small signal stability. Synchronous and damping torque analysis, small signal model and state equations of SMIB System.

UNIT – V:

AVR and PSS: Phillips Heffron model, block diagram representation with exciter and AVR and effect of AVR on synchronising and damping torque components.
Power System Stabilizer: structure and tuning of Power System Stabilizer(PSS), block diagram with and without PSS.

UNIT – VI:
Voltage Stability: Reactive power and voltage control loop, Comparison of Voltage and angular stability of the system. Analysis of voltage stability on SMLB system. Typical scenario of voltage collapse, detailed description of voltage collapse phenomenon with p-v and q-v characteristics and Voltage Collapse Proximity Indicator(VCPI) and voltage stability margin.

TEXT BOOKS:

1. Power System Stability and Control, P. Kundur, McGraw Hill Inc., 1994
2. Power System Dynamics Stability and Control, K. R. Padiyar, BS Publications, Hyderabad, 2006

REFERENCES:

1. Power System Dynamics and Stability, J. Machowski, J. Bialek & J. R. W. Bumby, John Wiley & Sons, 1997
2. Power System Stability, E. W. Kimbark, Vol. I & III, John Wiley & Sons, New York 2002
3. Advanced Power System Analysis and Dynamics, L. P. Singh, New Age International, 2006
4. Power System Control and Stability, P. M. Anderson & A. A. Fouad Galgotia, New Delhi, 1981

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(18PE1EE11) ARTIFICIAL NEURAL NETWORKS AND FUZZY LOGIC

COURSE PRE-REQUISITES: Control Systems

COURSE OBJECTIVES:

- To cater the knowledge of Neural Networks and Fuzzy Logic Control and use these for controlling real time systems.
- To expose the students to the concepts of feed forward neural networks and about feedback neural networks.
- To teach about the concept of fuzziness involved in various systems and comprehensive knowledge of fuzzy logic control
- To teach the design of fuzzy logic controllers

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the concepts of neural networks and learning rules
CO-2: Categorize feed forward and feedback neural networks
CO-3: Analyze and appreciate the concepts of fuzzy logic over classical set theory
CO-4: Apply ANN and fuzzy logic control to real time systems

UNIT – I:
Introduction to Neural Networks: Introduction, Humans and Computers, Biological Neuron and organization of the brain, Biological and Artificial Neuron Models, Characteristics of ANN, McCulloch-Pitts Model and design of logic gates, Historical Developments, Potential Applications of ANN.
Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN ¬– Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules.

UNIT – II:
Single Layer and Multilayer Feed Forward Neural Networks: Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Radial base Networks, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem and concepts, Limitations of the Perceptron Model, Applications.
Multilayer feed forward neural networks, Generalized Delta Rule, Derivation of Back propagation (BP) Training, Summary of Back propagation Algorithm, Learning Difficulties and Improvements.

UNIT – III:
Associative Memories: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, Linear associator, basic concept of recurrent associative memory: Retrieval and Storage algorithm, performance consideration.
Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Architecture of Hopfield Network

UNIT – IV:

Classical and Fuzzy Sets: Introduction to classical sets - properties, Operations and relations; Introduction to Fuzzy set – Fuzzy versus crisp – Fuzzy sets - Membership function – Basic Fuzzy set operations – Properties of Fuzzy sets –Operations on Fuzzy relations – Min Max operations.

UNIT – V:

Fuzzy Logic System Components: Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

UNIT – VI:

Applications of Neural Network and Fuzzy Logic: Position and speed control of DC and AC Motors, fault diagnosis and load forecasting using neural network.
Fuzzy logic controller for position and speed control of DC and AC Motors.

TEXT BOOKS:

1. Neural Networks, Fuzzy logic, Genetic Algorithm - Synthesis and Applications, Rajasekharan and Rai, PHI
2. Artificial Neural Networks, B. Yegnarayana, PHI
3. Neural Networks, James A. Freeman and Davis Skapura, Pearson Education, 2002

REFERENCES:

1. Neural Networks, Simon Hakins, Pearson Education
2. Neural Engineering, C. Eliasmith and CH. Anderson, PHI
3. Neural Networks and Fuzzy Logic System, Bart Kosko, PHI Publications
4. Introduction to Artificial Neural Systems, J. M. Zurada, Jaico Publishing House
5. Introduction to Neural Networks using MATLAB 6.0, S. N. Sivanandam, S. Sumathi, S. N. Deepa, TMH, 2006

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(18PE1EC12) EMBEDDED REAL TIME OPERATING SYSTEMS

COURSE PRE-REQUISITES: Microprocessor and Microcontrollers (18PC1EC09)

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, the student should be able to
CO-1: Understand the hardware and software requirements of real time and non-real time embedded systems
CO-2: Familiarize the concepts of RTOS
CO-3: Analyse an embedded application with real time operating systems
CO-4: Interpret embedded systems design and develop process

UNIT – I:
Fundamentals of Embedded Systems: Definition - Characteristics and Design metrics of Embedded system, 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, Design issues and trends.

UNIT – II:
Embedded Hardware Development Environment: Processor Architecture- Structured units of a processor - Processor selection factors, Common memory devices - Memory selection - Memory map, I/O devices, Serial devices - Parallel port devices, Timer and Counting devices, Direct Memory Access, Communication Interface Standards.

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: Need for RTOS in embedded system, Comparison with GPOS, RTOS Architecture and Characteristics, Tasks and Task states, TCB, Context Switching, 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 - Events - Timer functions, Task Synchronization - Shared data - Priority Inversion - Inheritance and Ceiling, Dead lock, Memory management, Interrupt routines in RTOS environment.

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, Pearson, 1st Edition, 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**
	0	**2**	**1**

(18PC2EC30) PRINCIPLES OF DIGITAL SIGNAL PROCESSING LABORATORY

COURSE PRE-REQUISITES: Digital Signal Processing

COURSE OBJECTIVES:
- To 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 understand concepts to design the drives

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: To apply knowledge of digital filter design for various applications
CO-2: To analyze various signals in transform domain
CO-3: Design digital filters using different transformation techniques
CO-4: To perform real time experiments on processors such as motor control

The following experiments are to be performed using MATLAB
1. Operations on signals and sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
2. Verification of Linearity and Time Invariance Properties of a given Continuous / Discrete System.
3. Linear Convolution and Circular Convolution
4. Computation of Unit sample, Unit step and sinusoidal responses of the given LTI system and verifying its Physical realizability and stability properties.
5. Discrete Fourier Transform / Inverse Discrete Fourier Transform
6. Fast Fourier Transform
7. Sampling theorem Verification.
8. Implementation of Filters using IIR
9. Implementation of Filters using FIR

The following experiments are to be performed using DSP Processor Kit.
1. Generation of sine wave and square wave using DSP trainer kit
2. PWM generation on DSP training kit
3. To Verify Linear Convolution and Circular Convolution
4. Implementation of FIR (Low Pass/High Pass) using Windowing Technique.
    - Using Rectangular Window
    - Using Triangular Window
    - Using Kaiser Window
5. Implementation of IIR Filter (Low Pass and High pass).
6. Three phase IM speed control.

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	L	T/P/D	C
	0	**2**	**1**

(18PC2EE07) POWER SYSTEMS LABORATORY

COURSE PRE-REQUISITES: Power Systems-I, Power Systems-II, Switchgear and Protection, Power System Analysis

COURSE OBJECTIVES:

- To perform simulation experiments in various softwares
- To observe the characteristics of IDMT, OV/UV, Differential relays
- To perform fault analysis on Generators, transformers, Transmission line models

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Perform load flow solution by using various methods
CO-2: Analyze different relays
CO-3: Test CT and PT's, insulator strings
CO-4: Determine sequence impedance and fault currents of Generator, transformer and transmission line models

LIST OF EXPERIMENTS:

1. Characteristics of Electromagnetic IDMT over current relay.
2. Characteristics of Micro Processor based Over voltage/Under voltage relay.
3. Differential protection of 1-Φ transformer.
4. Testing of CT and PT's, insulator strings.
5. Fault location of underground cable.
6. Measurement of Capacitance of 3-core cables.
7. Determination of sequence impedances of a 3-Φ synchronous machine.
8. Determination of sequence impedances of a 3-Φ Transformer.
9. Fault analysis of transmission system.
10. Formation of YBUS
11. Load flow analysis with GS Method.
12. Load flow analysis with FDLF method.
13. Transient Stability Analysis for Single Machine connected to Infinite Bus by Point by Point Method.
14. Frequency and power deviation of two area load frequency control.

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

(18PE1EE12) HIGH VOLTAGE ENGINEERING

COURSE PRE-REQUISITES: Electro Magnetic Field Theory, Circuit Theory, Advanced Physics

COURSE OBJECTIVES:

- To understand the Gaseous, liquid and solid dielectric behavior under High Voltage
- To understand the generation methods of High A.C, D.C & Impulse Voltages required for various application
- To understand the measuring techniques of High A.C., D.C & Impulse voltages and currents
- To understand the testing techniques for High Voltage Equipment

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand various applications and breakdown phenomenon in dielectric medium
CO-2: Realize the necessity to generate High A.C, D.C & Impulse voltages
CO-3: Analyze the measuring and testing techniques for High A.C, D.C and Impulse voltages
CO-4: Appreciate overvoltage phenomenon and basics of insulation coordination

UNIT – I:
Introduction to High Voltage Technology and Applications: Electric Field Stresses, Gas / Vacuum as Insulator, Liquid Dielectrics, Solids and Composites, Estimation and Control of Electric Stress, Numerical methods for electric field computation, Surge voltages, their distribution and control, Applications of insulating materials in Transformers, Rotating machines, Circuit Breakers, Cables and Bushings.

UNIT – II:
Break Down in Gaseous, Liquid and Solid Dielectrics: Gases as Insulating media, Collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law. Liquid as Insulator, Breakdown in pure and commercial liquids. Intrinsic breakdown, Electromechanical breakdown, Thermal breakdown, Breakdown of solid dielectrics in practice, Breakdown in composite dielectrics.

UNIT – III:
Generation of High Voltages and Currents: Generation of High Direct Current Voltages, Generation of High Alternating Voltages, Generation of Impulse Voltages, Generation of Impulse currents, Tripping and Control of Impulse Generators.

UNIT – IV:

Measurement of High Voltages and Currents: Measurement of High Direct Current Voltages, Measurement of High Voltages Alternating and Impulse, Measurement of High Currents - Direct, Alternating and Impulse, Oscilloscope for Impulse Voltage and Current Measurements.

UNIT – V:

Non – Destructive Testing of Material and Electric Apparatus, High Voltage Testing of Electrical Apparatus: Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements.

Testing of Isolators and Circuit Breakers, Testing of Cables, Testing of Transformers, Testing of Surge Arresters, Radio Interference Measurements.

UNIT – VI:

Over Voltage Phenomenon and Insulation Coordination: Natural causes for over voltages – Lightning phenomenon, Over voltage due to switching surges, System Faults and other abnormal conditions, Principles of Insulation Coordination on High voltage and Extra High Voltage power systems.

TEXT BOOKS:

1. High Voltage Engineering, M. S. Naidu and V. Kamaraju 3rd Edition, TMH
2. High Voltage Engineering: Fundamentals, E. Kuffel, W.S. Zaengl, J. Kuffel, 2nd Edition, Elsevier

REFERENCES:

1. High Voltage Engineering, C. L. Wadhwa, New Age Internationals (P) Limited, 1997
2. High Voltage Insulation Engineering, Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited, 1995
3. Extra High Voltage A.C. Transmission Engineering, Rakosh Das Begamudre, Revised Edition,New Age International, 2007

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

(18PE1EE13) SMART GRIDS

COURSE OBJECTIVES:

- To understand concept of smart grid and its advantages over conventional grid
- To know smart metering techniques
- To learn wide area measurement techniques
- To understand the problems associated with integration of distributed generation & it's solution through smart grid

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Appreciate the difference between smart grid & conventional grid
CO-2: Apply smart metering concepts to industrial and commercial installations
CO-3: Formulate solutions in the areas of smart substations, distributed generation and wide Area measurements
CO-4: Come up with smart grid solutions using modern communication technologies

UNIT – I:
Introduction: Smart Grid: Introduction, Evolution of Electric Grid, Smart Grid Concept, Need of Smart Grid, Features-Characteristics- Key Drivers of the Smart Grid, Functions of Smart Grid, Opportunities of Smart Grid, Challenges in Implementation of Smart Grid, Technical Challenges for Development of Smart Grid in India, Smart Grid Benefits, Scope of Smart Grid, Difference between Conventional and Smart Grid, Concept of Resilient, Resilience of Smart Grid Functions, Self-Healing Grid, Smart Grid Implementation, Present Development and International policies in Smart Grid ,

UNIT – II:
Smart Grid Technologies: Introduction, Smart Substation-Technology-Drivers, Classifications of Substations, Elements of Substation, Objectives of Smart Substation, Functions of Smart Substation, Sub-Station Automation: Key Drivers - Benefits – Functions. Feeder Automation, Applications of Feeder Automation, Energy Management System (EMS), System Design, Mechanism of Smart Energy System Outage Management, Plug in Hybrid Electric Vehicles (PHEV). Vehicle to grid.

UNIT – III:
Phasor Measurement Unit: Concept of Phasor Measurement, Phasor Measurement Unit (PMU)-Features -Fundamentals, The Global Positioning Satellite (GPS) Systems, Synchrophasor Definition and Measurements, Applications of PMUs in Power Systems, Outlook of PMUs, Main strategy of PMU placement Based on Power Systems Intrinsic Characteristics, The Comparisons between SCADA system and PMUs System, Intelligent Electronic Devices-Functions-Advantages, , Wide Area Monitoring, Wide Area Monitoring Protection and Control (WAMPAC) System

UNIT – IV:

Micro-Grid: Concept of Micro grid, need & applications of Micro grid, Formation of micro grid, Inter connection, protection and control of micro grid, Plastic & Organic Solar cells, Thin film solar cells, Variable speed Wind generators, Fuel cells, micro turbines, Captive power plants, Integration of Renewable Energy Sources, Smart Storages, Battery, SMES, Pumped hydro, Compressed air storage.

UNIT – V:

Power Quality in Smart Grid: Introduction, Power Quality, Electromagnetic Compatibility (EMC), Relation Between Voltage Quality and EMC, Field Experiences with Smart Grid Technology, Voltage Quality Planning Levels, Power Quality Standard, Power Quality Issues of Grid Connected Renewable Energy Sources, Causes Of Low Power Quality, Issues ,Challenges and Solutions of RES-Grid Integration, , Power Quality Conditioner (PQC)- Principle – Control Circuit- Series Compensation Control Circuit, Power Quality Monitoring- Considerations, Permanent Power Quality Monitoring Equipment.

UNIT – VI:

Smart Meters and Advanced Metering: Introduction, Smart Meter, The Smart Grid and Smart Meter Systems, Smart Meter-Technologies-Benefits, Advanced Metering Infrastructure (AMI)-Technologies-Protocols- Benefits-Standards-Initiatives-Developments

Local Area Network (LAN): Objectives-Technologies, Home Area Network (HAN)-Components- Technologies, Wide Area Network (WAN), Types of Connection in WAN, WAN Devices, Broadband Over Power Lines (BPL)-Features-Working, IP based Protocol, Need of Internet Protocol, Goals of IP, IP Based Networks, Cloud Computing, Cyber Security for Smart Grid, Need of Secure Smart Grid, Objectives and Requirements of Cyber Security, Network Security Threats in the Smart Grid

TEXT BOOKS:

1. Smart Grid Fundamentals of Design and Analysis, James Momoh, 1st Edition
2. Introduction to the Smart Grid Concepts, Technologies and Evolution, S. K. Salman, IET Library, 2017
3. Smart Grid Technology, Harsh Tanwar, Bhavishya Mittal, Bhawana Chouhan, Genius Publications

REFERENCES:

1. Smart-Grid-Handbook: For Regulators & Policy Makers, Indian Smart Grid Forum, 2017

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	3	**0**	**3**

(18PE1EE14) HVDC TRANSMISSION

COURSE PRE-REQUISITES: Power Electronics, Power Systems

COURSE OBJECTIVES:
- To comprehend the conversion principles of HVDC transmission
- To analysis of 3, 6, 12 pulse converters, rectifier and inverter operations of HVDC converters
- To identify the different types of Harmonics and reduction by using filters
- To comprehend Interaction between HVAC and DC systems in various aspects
- To appreciate the reliable MTDC systems and protection of HVDC system

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand HVDC technology
CO-2: Apply the knowledge of modelling and analysis of HVDC system for inter-area power flow regulation
CO-3: Appreciate the reliable Multi terminal HVDC system
CO-4: Apply advanced protective schemes for HVDC systems against transient over voltages and over currents

UNIT – I:
HVDC Technology: Historical development in DC Transmission, Advantages & Disadvantages of DC Transmission over Ac Transmission, DC Transmission Systems: Mono-polar, bi-polar and homo-polar lines, back-to-back HVDC systems, Components of HDVC Transmission System, Main applications of DC Transmission.

UNIT – II:
HVDC Converters: Rectifier and Inverter operation Digital Simulation of converters, Control of HVDC converters and Systems, Individual phase control, Equidistant firing controls, higher level controls. Characteristics and non-characteristics harmonics filter design.

UNIT – III:
HVDC System Control: Constant current control, constant excitation angle control, VDCOL, constant ignition angle control, Individual phase control and equidistant pulse control; Valve blocking and by-passing; Starting, stopping and power flow reversal. Fault development and protection.

UNIT – IV:
MTDC Systems: Introduction-Potential applications of MTDC systems, Types of MTDC systems Comparison, multi-terminal HVDC systems, control of MTDC systems. MTDC system - Case study - Interaction between AC-DC power systems over voltages on AC/DC side.

UNIT – V:

Power Flow Analysis in HVDC Systems: Introduction, Modeling of DC links, Modeling of HVDC systems - Basic model of the converter, converter equations, per unit system for DC quantities, DC Network equations, DC control equations, Representation for AC-DC power flow solution, representation for stability studies. 7

UNIT – VI:

Standards for Testing & Measurements in HVDC Systems: Introduction to relevant national and international standards-IEC, IEEE, CIGRE, safe clearances for HV, Study regulations for HV tests, Digital techniques in HV measurements.

TEXT BOOKS:

1. High Voltage Direct Transmission, J. Arrillaga, Peter Peregrinus Ltd. London, 1983
2. HVDC Power Transmission Systems, K. R. Padiyar, Wiley Eastern Ltd., 1990

REFERENCES:

1. Direct Current Transmission, E. W. Kimbark, Vol. I, Wiley Interscience, 1971
2. Power Transmission, Direct Current, Erich Uhlmann, B. S. Publications, 2004
3. EHVAC and HVDC Transmission Engg. Practice, Theory, Practice and Solved Problems, Felix A. Farret, M. S. Rao, Khanna Publishers, 1990

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

(18PC1CS10) BIG DATA ANALYTICS

COURSE OBJECTIVES:

- To explore the fundamental concepts of data analytics
- To learn to analyze the data analysis techniques
- To explore the techniques related to mining streams
- To understand, explore Hadoop framework technology and its associated tools along with visualization methods

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify the major sources of data; apply pre-processing tasks and summary statistics on data
CO-2: Understand the concept of Hadoop and analyze data on HDFS and its comparison with other systems.
CO-3: Explain Hadoop framework and its components-PIG, HIVE, HBASE, ZOOKEEPER
CO-4: Examine Machine Learning algorithms and represent data using visualization tools.

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:
Data Analysis: Introduction, Terminology and concepts, Summary statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT.

UNIT – III:
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-How Map Reduce Works

UNIT – IV:
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 – V:

Machine Learning Algorithms and Mining Frequent Item Sets: Linear regression, Artificial Neural Networks, SVM, Naive Bayes and Decision Trees, Mining Frequent Item-sets, Market Based Model, A-Priori Algorithm, Handling Large Data Sets in Main Memory

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. Introduction to Data Mining, Pang-Ning Tan Vipin Kumar Michael Steinbach Pearson
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. VIII Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(18PE1EC04) DIGITAL IMAGE PROCESSING

COURSE PRE-REQUISITES: Digital Signal Processing

COURSE OBJECTIVES:
- To introduce fundamentals of digital image processing and study image transforms
- To demonstrate digital image processing techniques in spatial and frequency domains
- To study and compare various image compression algorithms
- To study advanced image analysis methods: image segmentation, morphological image processing, image restoration as well as image representation and description

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
CO-3: Analyze and compare various image compression 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 compression.
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, some basic 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, 2010

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	3	**0**	**3**

(18PE1EE15) POWER QUALITY

COURSE PRE-REQUISITES: Power Systems, Power Electronics and Electrical Drives

COURSE OBJECTIVES:
- To get the knowledge on Power quality problems and standards
- To get the knowledge on PQ effects on system equipment and loads
- To get awareness on devices introducing harmonics and mitigation methods
- To get the Knowledge of PQ improvement methods

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire knowledge on power quality issues and standards and know the severity of PQ problems
CO-2: Analyze the PQ Issues and effects on system equipment and loads
CO-3: Analyze the Harmonics and its mitigation methods
CO-4: Understand the PQ Improvement Methods

UNIT – I:
Introduction to Power Quality: Overview of power quality phenomena-classification of power quality Issues- Voltage, Sag, Swell, Surges, Harmonics, over voltages, spikes, Voltage fluctuations, Transients and Interruptions.

UNIT – II:
Voltage Sags: Voltage Sag – Characterization - Single Phase: Voltage sag – definition, causes of voltage sag, voltage sag magnitude, monitoring. Voltage sag calculation in non-radial systems, meshed systems- voltage sag duration.
Three Phase: Three phase faults, phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags.

UNIT – III:
Interruptions: Short interruptions – definition, origin of short interruptions and monitoring of short interruptions. Long Interruptions– Definition – Difference between failures, outage, Interruptions – causes of Long Interruptions – Origin of Interruptions.

UNIT – IV:
PQ Issues in Electrical Drives: Voltage sag – equipment behavior of Power electronic loads, induction motors, synchronous motors, computers, consumer electronics, adjustable speed AC drives and its operation. Mitigation of PQ problems in AC Drives, adjustable speed DC drives.

UNIT – V:

Harmonics: Harmonics, Harmonics indices, Inter harmonics, Notching – Voltage vs Current distortion – Harmonics vs Transients – Sources and effects of harmonic distortion – System response characteristics – total harmonic distortion- RMS value of a harmonic waveform, Principles of controlling harmonics – Standards and limitation – important harmonic introducing devices-SMPS-Three phase power converters-harmonic distortion of fluorescent lamps-effect of power system harmonics on power system equipment and loads.

UNIT – VI:

PQ Improvement and Custom Power Devices: Overview of mitigation methods – from fault to trip, reducing the number of faults, reducing the fault clearing time, installing mitigation equipment, improving equipment immunity, different events and mitigation methods. Voltage source converter, series voltage controller: Dynamic Voltage Restorer, shunt controller: DSTATCOM.

TEXT BOOKS:

1. Understanding Power Quality Problems, Math H. J. Bollen, IEEE Press
2. Electrical Power Systems Quality, Roger C. Durgan, Mark F. McGranaghan and H. Wayne Beaty, 2nd Edition, Tata McGraw-Hill, New York, 2008

REFERENCES:

1. Power Quality, Sankaran C., CRC Press, Washington D.C., 2002
2. Electric Power Quality, G. T. Heydt, 2nd Edition, West Lafayette, Stars in a Circle Publications, 1994
3. Power Quality Enhancement Using Custom Power Devices, A Ghosh, G. Ledwich Kluwer Academic, 2002
4. Power System Harmonic Analysis, J. Arrillaga, B.C. Smith, N.R. Watson & A. R. Wood, Wiley,1997
5. Signal Processing of Power Quality Disturbances, Math H. J. Bollen, Irene Y. H. Gu, IEEE Press, Wiley & Sons Inc.

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

(18PE1EE16) ELECTRIC VEHICLES

COURSE PRE-REQUISITES: Electrical Machines

COURSE OBJECTIVES:

- To study the different drive train configurations of electric vehicles
- To propose the various propulsion and energy storage systems for EHVs
- To know the sizing of propulsion motors and other systems involved in EH vehicles
- To carry out different design case studies of EHV and BEVs

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Assess the performance, societal and environmental impact of EHVs having known their past history
CO-2: Implement various drive train topologies and control strategies in Electric and Hybrid vehicles
CO-3: Recommend, Design/Size and Control different electric propulsion units and other components of EHVs and BEVs
CO-4: Appropriately select the energy storage system and strategize its management in EHVs

UNIT – I:
Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Conventional Vehicles: Basics of vehicle performance, Forces acting on a vehicle, vehicle power source (plant) characteristics, transmission characteristics: Manual, Hydro-dynamic and Continuously Variable Transmissions, mathematical model of vehicle.

UNIT – II:
Electric Drive-Trains: Advantages of Electric Vehicles (EVs), Basic concept of electric traction, introduction to various electric drive-train topologies (Configurations), Electric Vehicle Performance, power flow control in electric drive-train topologies, fuel efficiency analysis.

UNIT – III:
Hybrid Electric Drive-Trains: Basic architecture and concept of hybrid traction, patterns of power flow, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis

UNIT – IV:
Electric Propulsion Unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet

Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT – V:

Sizing of the Drive System: Matching the electric machine and the internal combustion engine (ICE), Sizing of the propulsion motor, Sizing of engine-generator, Sizing the power electronics based on Switch Technology - Switching Frequency and Ripple capacitor design, selecting the energy storage technology, Supporting subsystems.

UNIT – VI:

Energy Storage and Energy Management Strategies: Energy Storage Requirements in Hybrid and Electric Vehicles, batteries, fuel cell and super capacitors and flywheel based energy storage.

Introduction to energy management strategies in HEVs, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

TEXT BOOKS:

1. Electric and Hybrid Vehicles: Design Fundamentals, Iqbal Hussein, CRC Press, 2010
2. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, CRC Press, 2009
3. Electric Vehicle Technology Explained, James Larminie, John Lowry, Wiley, 2003

REFERENCES:

1. Hybrid Vehicle Propulsion, Jefferson C. M., Barnard R. H., WIT Press, Boston, 2002
2. Hybrid, Electric and Fuel Cell Vehicles, Jack Erjavec and Jeff Arias, Cengage Learning, 2012
3. Electric Vehicles - The Benefits and Barriers, Seref Soylu, InTech Publishers, Croatia, 2011
4. Alternative Fuel Technology – Electric, Hybrid and Fuel Cell Vehicles, Jack Erjavec and Jeff Arias, Cengage Learning Pvt. Ltd., New Delhi, 2007
5. Build Your Own Electric Vehicle, Seth Leitman, McGraw Hill, New York, USA 2013

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

(18PE1EE17) RELIABILITY ENGINEERING AND APPLICATIONS TO POWER SYSTEMS

COURSE PRE-REQUISITES: Control Systems, Electrical Distribution Systems and Automation

COURSE OBJECTIVES:
- To describe Rules for combining probabilities of events and Binomial distribution
- To analyze Series, Parallel, Series-Parallel and Non-series parallel networks
- To describe Markov models and Frequency and duration concepts
- To apply Reliability concepts for Generation, composite and Distribution systems
- To evaluate basic and performance indices of radial networks

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Describe reliability and unreliability rules
CO-2: Illustrate hazard rate function and expressions for different reliability functions
CO-3: Design discrete Markov chains and continuous Markov process
CO-4: Apply Reliability concepts for Generation, composite and Distribution systems

UNIT – I:
Basics of Probability Theory and Distribution: Concepts of Reliability, Unreliability, Availability, Unavailability–Rules for combining probabilities of events – Bernoulli's trials – probability density and distribution functions – Binomial distribution – expected value and standard deviation of binomial distribution.

UNIT – II:
Network Modelling and Reliability Analysis: Analysis of Series, Parallel, Series-Parallel networks, complex networks: decomposition method, Path based and Cutset based approaches.

UNIT – III:
Reliability Functions: Reliability functions f(t), F(t), R(t), h(t) and their relationships – Bath tub curve -exponential distribution – Expected value and standard deviation of exponential distribution –reliability analysis of series, parallel networks using exponential distribution – reliability measures: MTTF, MTTR and MTBF.

UNIT – IV:
Markov Modelling: Discrete Markov chains: General modeling concepts-concept of stochastic transitional probability Matrix, Evaluation of limiting state Probabilities, Continuous Markov process: one component repairable model – time dependent probability evaluation using Laplace transform approach – evaluation of limiting state probabilities using STPM
Frequency and Duration Techniques: Frequency and duration concept – Evaluation of frequency of encountering state, MTTF and MTTR of one, two component

repairable models – evaluation of cumulative probability and cumulative frequency of encountering of merged states of two component repairable model.

UNIT – V:

Generation System Reliability Analysis

Reliability Model of A Generation System: Recursive relation for unit addition and removal methods, load modeling - Merging of generation and load model – evaluation of transition rates, Probability and frequency of failure for merged state model – LOLP, LOLE.

UNIT – VI:

Composite System Reliability Analysis: Markov model-Weighted average rate model– Decomposition method – Reliability Indices.

Distribution System Reliability Analysis: Basic Concepts – Evaluation of Basic and performance indices of radial networks.

TEXT BOOKS:

1. Reliability Evaluation of Engineering System, R. Billinton, R. N. Allan, BS Publications
2. Reliability Evaluation of Power Systems, R. Billinton, R. N. Allan, BS Publications

REFERENCES:

1. Reliability Engineering: Theory and Practice, Alessandro Birolini, Springer
2. An Introduction to Reliability and Maintainability Engineering, Charles Ebeling, TMH
3. Reliability Engineering, E. Balaguruswamy, TMH
4. Reliability Engineering, Elsayed A. Elsayed, Prentice Hall
5. System Reliability Concepts, V. Sankar, Himalaya Publications

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PE1EE18) ENERGY AUDIT AND CONSERVATION

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: Conduct Energy Audit of industries
CO-2: Manage energy Systems
CO-3: Specify the methods of improving efficiency of electric motor
CO-4: Improve power factor and to design a good illumination system
CO-5: 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

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

UNIT – V:
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 – 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
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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1EC10) VLSI DESIGN

COURSE PRE-REQUISITES: Electronic Devices and Circuits, Digital System Design

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 fundamentals: Oxidation, Lithography, Diffusion, Ion implantation, Metallization and Encapsulation, NMOS 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 relationships, 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 & 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, NORA CMOS Logic and Zipper 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.

TEXTBOOKS:

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, 3rd Edition, TMH, 2011

REFERENCES:

1. CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E. Weste, David Harris, Ayan Banerjee, Pearson, 2009
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, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VII Semester	L	T/P/D	C
	0	8	4

(18PW4EE05) MAJOR PROJECT PHASE-I

B.Tech. VIII Semester	L	T/P/D	C
	0	12	6

(18PW4EE06) 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.