R19

B.Tech.
(ELECTRONICS AND INSTRUMENTATION ENGINEERING)

B.Tech. R19 CBCS Curriculum

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

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

MISSION OF THE INSTITUTE

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

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

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

DEPARTMENT OF

ELECTRONICS AND INSTRUMENTATION ENGINEERING

VISION OF THE DEPARTMENT

A resource center of academic excellence for imparting quality technical education, meeting the need of students at National and International levels and imbibing strong ethical values, to improve the standards of the society.

MISSION OF THE DEPARTMENT

- To impart quality education in the domain of Electronics and Instrumentation Engineering by Implementing learning centric processes.
- To provide specific best of breed laboratory practices to promote diverse collaborative research for meeting the changing societal needs.

B.TECH.
(ELECTRONICS AND INSTRUMENTATION ENGINEERING)

B.TECH. (EIE)

PROGRAM EDUCATIONAL OBJECTIVES

PEO-I: To provide students with a solid foundation in Mathematics, Sciences, Electronics, and Instrumentation Engineering which prepares students for wide range of career opportunities in Industries, Research, and Academics.

PEO-II: To train the students with good engineering breadth to comprehend, analyse, innovate, and design new products in core and multidisciplinary domain, to provide technical solutions and services to the needs of the society.

PEO-III: To provide students with an academic environment of excellence, proactiveness, and lifelong learning for successful professional career.

PEO-IV: To inculcate professional and ethical attitude, effective presentation skills and enhanced ability to work in multidisciplinary teams to pursue complex, open-ended investigations and research.

PEO-V: To motivate students towards becoming entrepreneurs, collaborators and innovators, leading or participating in efforts to address social, technical and business challenges.

B.TECH. (EIE)

PROGRAM OUTCOMES

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

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

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

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

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

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

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

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

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

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

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

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

B.TECH. (EIE)

PROGRAM SPECIFIC OUTCOMES

PSO-1: Specify, design, prototype and test electronic systems that perform processing as per user requirements using contemporary devices and technology.

PSO-2: Architect and implement instrumentation systems for industrial processes and biomedical applications using appropriate technologies.

PSO-3: Develop hardware and software tools / programs used in industrial and other automation systems.

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

I SEMESTER **R19**

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

II SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19BS1MT04	Linear Algebra and Advanced Calculus	3	0	0	3	3
19BS1PH02	Engineering Physics	3	0	0	3	3
19ES1CS02	Data Structures through C	3	0	0	3	3
19ES1EE06	Basic Electrical Engineering	3	1	0	4	4
19BS2PH02	Engineering Physics Laboratory	0	0	2	2	1
19ES2CS02	Data Structures through C Laboratory	0	0	2	2	1
19ES2EE04	Electrical Engineering Laboratory	0	0	2	2	1
19ES3ME02	Engineering Drawing	0	0	4	4	2
19PW4EI01	Design Sensitization	0	0	2	2	1
Total		**12**	**1**	**12**	**25**	**19**

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

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

III SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19BS1MT08	Complex Analysis and Special Functions	3	0	0	3	3
19PC1EI01	Electronics Circuits – I	3	1	0	4	4
19PC1EI02	Sensors and Signal Conditioning	3	0	0	3	3
19PC1EI03	Electronic Measurements	3	0	0	3	3
19PC1EC04	Signals and Systems	3	0	0	3	3
19PC2EI01	Electronics Circuits – I Laboratory	0	0	3	3	1.5
19PC2EI02	Sensors and Measurements Laboratory	0	0	3	3	1.5
19PC2EC02	Basic Simulation Laboratory	0	0	2	2	1
Total		**15**	**1**	**8**	**24**	**20**
19MN6HS03	Gender Sensitization	0	0	2	2	0

IV SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19HS1MG02	Engineering Economics and Accountancy	3	0	0	3	3
19PC1EI04	Electronic Circuits – II	3	1	0	4	4
19PC1EI05	Linear IC Applications	3	0	0	3	3
19PC1EE05	Control Systems	3	0	0	3	3
19PC1EC03	Digital System Design	3	0	0	3	3
19PC2EI03	Electronics Circuits – II Laboratory	0	0	3	3	1.5
19PC2EI04	IC Application Laboratory	0	0	3	3	1.5
19PC2IT02	Python Programming Laboratory	0	0	2	2	1
Total		**15**	**1**	**8**	**24**	**20**

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

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

V SEMESTER **R19**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
19PC1EI06	Industrial Process Control Instrumentation	3	1	0	4	4
19PC1EI07	Bio-Medical Instrumentation	3	0	0	3	3
19PC1EC10	Microprocessors and Microcontrollers	3	0	0	3	3
	Professional Elective -I					
19PE1EI01	Fiber Optics and Laser Instrumentation	3	0	0	3	3
19PE1EI02	Pollution Control in Process Industries					
19PC1IT03	Computer Organization					
19PC1EC20	Probability and Random Processes					
19PE1EI03	Micro Electromechanical Systems (Mems)					
	Open Elective -I	3	0	0	3	3
19PC2EI05	Process Control Instrumentation Laboratory	0	0	3	3	1.5
19PC2EC07	Microprocessors and Microcontrollers Laboratory	0	0	3	3	1.5
19PW4EI02	Internship	0	0	2	2	1
Total		**15**	**1**	**8**	**24**	**20**
19MN6HS02	Environmental Sciences	**2**	**0**	**0**	**2**	**0**

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VI SEMESTER **R19**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
19PC1EC09	Digital Signal Processing	3	1	0	4	4
19PC1EI08	Process Control Automation	2	1	0	3	3
19PC1EI09	Virtual Instrumentation	2	0	0	2	2
19PE1EC05	Internet of Things	3	0	0	3	3
	Professional Elective -II					
19PE1EI04	Robotics and Applications	3	0	0	3	3
19PE1EI05	Power Plant Instrumentation					
19PC1EC12	Computer Networks and System Approach					
19PE1EC22	Principles of Communications					
19PE1EI06	Bio Medical Equipment					
	Open Elective -II	3	0	0	3	3
19HS2EN05	Advanced English Communication Skills Laboratory	0	0	2	2	1
19PC2EI06	Process Control Automation Laboratory	0	0	2	2	1
19PW4EI03	Design Thinking	0	0	4	4	2
Total		**16**	**2**	**8**	**26**	**22**

L – Lecture T – Tutorial P – Practical

OE TRACKS BASED ON MEZZANINE TECHNOLOGIES:

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

GENERAL POOL OF OE COURSES:

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

VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
B.TECH. IV YEAR
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VII SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19PC1EI11	Analytical Instrumentation	3	0	0	3	3
19HS1MG04	Principles of Management and Organizational Behavior	3	0	0	3	3
	Professional Elective - III					
19PE1EI21	Neural Networks and Fuzzy Logic Systems	3	0	0	3	3
19PE1EI07	Instrumentation for Agricultural and Food Processing Industries					
19PE1EC12	Embedded Systems					
19PE1EC23	VLSI Technology and Design					
19PE1EI08	Biomedical Signal Processing					
	Professional Elective - IV					
19PC1EE07	Power Electronics	3	0	0	3	3
19PE1EI09	Instrumentation for Pharmaceutical Industries					
19PE1EC19	DSP Processors and Architectures					
19PE1EC08	Speech and Audio Processing					
19PE1EI10	Tele Medicine					
	Open Elective - III	3	0	0	3	3
19PC2EI07	Analytical Instrumentation Laboratory	0	0	2	2	1
19PC2EI08	IoT Laboratory - Interfacing and Applications	0	0	2	2	1
19PW4EI04	Mini-Project*	0	0	4	4	2
19PW4EI05	Major Project Phase - I	0	0	8	8	4
Total		**14**	**0**	**16**	**30**	**23**

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

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VIII SEMESTER **R19**

Course Category	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
	Professional Elective – V					
19PE1EI11	Digital Control Systems	3	0	0	3	3
19PE1EI12	Instrumentation and Control for Petrochemical Industries					
19PE1EI22	Principles and Applications of Nano Technology					
19PE1EC06	CPLD and FPGA Architecture					
19PE1EI13	Biomedical Nano Technology					
	Professional Elective – VI					
19PE1EI14	Automotive Instrumentation	3	0	0	3	3
19PE1EI15	Industrial Electronics					
19PE1EC18	Wireless Sensor Networks and Protocols					
19PE1EC04	Digital Image Processing					
19PE1EI16	Medical Imaging and Processing					
	Open Elective – IV	3	0	0	3	3
19PW4EI06	Major Project Phase - 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	L	T/P/D	C
	3	1	4

(19BS1MT01) CALCULUS FOR ENGINEERS

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

COURSE PRE-REQUISITES: Differentiation, Integration

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

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

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

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

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

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

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

UNIT-V:

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

UNIT-VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

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

COURSE PRE-REQUISITES: Basic knowledge of Mathematics and Chemistry

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

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

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

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

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

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

UNIT-IV:

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

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

UNIT-V:

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

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

UNIT-VI:

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

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19HS1EN01) ENGLISH
(Common to CE, EEE, ECE and EIE)

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

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

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

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

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

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

UNIT-IV:

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

UNTI-V:

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

UNIT-VI:

Organizational Patterns for writing

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

TEXT BOOKS:

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

RECOMMENDED BOOKS:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19ES1CS01) PROGRAMMING THROUGH C

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

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

CO-1: Understand fundamentals of computers and Illustrate the flowchart, algorithm, pseudo code for a given problem, develop programs using various datatypes and operators

CO-2: Develop conditional and iterative statements for a given problem

CO-3: Exercise on programs using arrays, pointers, dynamic memory management, structures and unions

CO-4: Develop solution for a given problem using modular approach and perform file handling

UNIT-I:

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

UNIT-II:

Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching Iteration and loops

Arrays (1-D, 2-D), Character arrays and Strings.

UNIT-III:

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

UNIT-IV:

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

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

UNIT-V:

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

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

UNIT-VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19ES1EE04) CIRCUIT THEORY

(Common to EEE, ECE and EIE)

COURSE PRE-REQUISITES: Basic Mathematics

COURSE OBJECTIVES:

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

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

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

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

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

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

UNIT-V:

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

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

UNIT-VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19BS2CH01) ENGINEERING CHEMISTRY LABORATORY

(Common to CE, EEE, ECE and EIE)

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

COURSE OBJECTIVES:

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

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

CO-1: Record the amount of hardness and chloride content in water and interpret the significance of its presence in water

CO-2: Analyze the influence of variation of concentration with time on rate constant

CO-3: Report and predict the significance of properties like absorption of light, adsorption, conductance, viscosity, pH and surface tension

CO-4: Demonstrate the technique of Thin Layer Chromatographic (TLC) and preparation of a polymer

LIST OF EXPERIMENTS:

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

TEXT BOOKS:

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

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

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

COURSE OBJECTIVES:

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

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

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

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

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

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

3. Reading Comprehension-Contextual Vocabulary

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

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

RECOMMENDED BOOKS:

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

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

(19ES2CS01) PROGRAMMING THROUGH C LABORATORY

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

COURSE PRE-REQUISITES: None

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

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

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

WEEK 1:
Familiarization with programming environment.

WEEK 2:
Simple computational problems using arithmetic expressions.

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

WEEK 4:
Iterative problems, sum of series.

WEEK 5:
1D Array manipulation.

WEEK 6:
Matrix problems, string operations.

WEEK 7:
Simple functions.

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

WEEK 10:
Recursive functions.

WEEK 11:
Pointers and structures.

WEEK 12:
File operations.

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

(19ES2ME01) WORKSHOP PRACTICES

(Common to CE, EEE, ECE and EIE)

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

CO-1: Exposed to various types of manufacturing Process

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

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

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

LECTURES & VIDEOS:

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

I. Carpentry

i. Cross lap joint
ii. Mortise & tenon joint

II. Fitting

i. Square fitting
ii. L-Fitting

III. Welding

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

IV. Smithy

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

V. Electrical & Electronics

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

VI. Machine Shop

i. Step turning on lathe
ii. Drilling & threading

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19BS1MT04) LINEAR ALGEBRA AND ADVANCED CALCULUS

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

COURSE PRE-REQUISITES: Matrices, Differentiation, Integration

COURSE OBJECTIVES:

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

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

CO-1: Compute the rank of a matrix and analyze the solution of a system of linear equations

CO-2: Calculate Eigen values and Eigen vectors

CO-3: Reduce the quadratic form to its canonical form

CO-4: Evaluate areas & volumes using multiple integrals

CO-5: Transform line integral to surface and surface to volume integrals

UNIT-I:

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

UNIT-II:

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

UNIT-III:

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

UNIT-IV:

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

UNIT-V:

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

UNIT-VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19BS1PH02) ENGINEERING PHYSICS

(Common to EEE, ECE and EIE)

COURSE PRE-REQUISITES: 10+2 Physics

COURSE OBJECTIVES:

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

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

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

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

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

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

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

UNIT-V:

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

UNIT-VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19ES1CS02) DATA STRUCTURES THROUGH C

(Common to CE, EEE, ME, EIE 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: Apply the operations of creation, insertion, deletion on non-linear data structures

CO-4: Develop the 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, Post order.

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, Third Edition, Cengage Learning.
2. Data Structures Using C (Paperback), Aaron M. Tenenbaum.

REFERENCES:

1. C & Data Structures, P. Padmanabham, Third Edition, 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. II Semester	**L**	**T/P/D**	**C**
	3	**1**	**4**

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

COURSE PRE-REQUISITES: Circuit Theory, Calculus for Engineers

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

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

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

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

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

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

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

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

UNIT-VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19BS2PH02) ENGINEERING PHYSICS LABORATORY
(Common to EEE, ECE and EIE)

COURSE OBJECTIVES:

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the optical phenomena with formation of Newton Rings, pure spectrum through prism and to evaluate grating parameters
CO-2: Illustrate charging & discharging of a capacitor
CO-3: Asses the various characteristics of semiconductor devices
CO-4: Realize tangent law of magnetism and resonance phenomenon in Melde's and Sonometer experiment
CO-5: Correlate the experimental results with the class room learning

LIST OF EXPERIMENTS:

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

REFERENCES:

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

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

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

(19ES2CS02) DATA STRUCTURES THROUGH C LABORATORY

(Common to CE, EEE, ME, EIE, 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. Merge Sort

WEEK 2:

2. Quick Sort
3. Radix Sort

WEEK 3:

4. SLL creation, insertion, deletion, searching, display operations.

WEEK 4:

5. CLL creation, insertion, deletion, searching, display operations.

WEEK 5:

6. DLL creation, insertion, deletion, searching, display operations.

WEEK 6:

7. STACK operations using arrays and Linked list.

WEEK 7:

8. Infix to postfix conversion.

WEEK 8:

9. Postfix evaluation.
10. Towers of Hanoi problem

WEEK 9:

11. QUEUE operations using arrays and LL.

WEEK 10:
12. CIRCULAR QUEUE operations using arrays.

WEEK 11:
13. DEQUEUE operations using arrays.

WEEK 12:
14. Binary tree traversals using recursion.

WEEK 13:
15. Graph traversals (BFS and DFS).

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

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

COURSE PRE-REQUISITES: Circuit Theory

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

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

LIST OF EXPERIMENTS:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

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

COURSE PRE-REQUISITES: None

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

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

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

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

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

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

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

UNIT-V:

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

UNIT-VI:

Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions
Introduction to Solid Modelling: Creation of simple solid models relevant to the domain.

TEXT BOOKS:

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

REFERENCES:

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

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

(19PW4EI01) DESIGN SENSITISATION

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

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

STUDENTS' RESPONSIBILITIES:

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

MODULE-1: Design Overview and Motivation

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

MODULE-2: Understanding Design

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

MODULE-3: Doing Design: Discover Phase

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

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

MODULE-4: Designing Customer Service Experience

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

MODULE-5: Communication Skills for Design

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

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

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

MODULE-6: Sustainable Design Approaches

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

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

COURRSE PREREQUISITES: Integral and Differential Calculus

COURSE OBJECTIVES: To Learn

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

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

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

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

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

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

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19PC1EI01) ELECTRONIC CIRCUITS-I

COURSE PREREQUISITES: Engineering Physics

COURSE OBJECTIVES:

- To learn principle of operation, construction and characteristics of various electronic devices
- To study the applications of various electronic devices
- To understand the concepts of amplifiers and oscillators
- To provide the concepts involved in developing of electronic circuits

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the operation and characteristics of various electronic devices
CO-2: Understand the need of biasing and stabilization
CO-3: Develop few applications using electronic devices
CO-4: Design & analyze amplifiers and oscillators

UNIT – I:
P-N 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.
The DC and AC Load lines, Quiescent operating point, Need for Biasing, Analysis of Fixed Bias, Collector Feedback Bias, Emitter Feedback Bias, Collector-Emitter Feedback Bias, Voltage Divider Bias, Bias Stability, Stabilization Factors, Stabilization against variations in VBE, β and ICO, Thermal Runaway, Thermal Stability.

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 and CC amplifiers.

UNIT – V:

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.

UNIT – VI:

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.

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, 2006

REFERENCES:

1. Integrated Electronics - J. Millman, Christos. C. Halkias, and Satyabratha Jit, Tata McGraw-Hill, 2nd Edition, 2008
2. Electronic Devices and Circuits – T.F. Bogart Jr., J. S. Beasley and G. Rico, Pearson Education, 6th Edition, 2004
3. Electronic Devices and Circuits – David A. Bell, Oxford University Press, 5th Edition, 2008

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

(19PC1EI02) SENSORS AND SIGNAL CONDITIONING

COURSE PREREQUISITES: Physics, Mathematics

COURSE OBJECTIVES:
- To provide basic knowledge in transduction principles, sensors and transducer technology and measurement systems
- To provide better familiarity with the Theoretical and Practical concepts of Transducers
- To provide familiarity with different sensors and their application in real life
- To provide the knowledge of various measurement methods of physical parameters like velocity, acceleration, torque, pressure, flow, temperature etc., and their relevance to Industry

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify suitable sensors and transducers for real world applications such as level, temperature, vibration, light etc.,
CO-2: Translate theoretical concepts into working models
CO-3: Design the experimental applications to engineering modules and practices
CO-4: Design engineering solution to the Industry/Society needs and develop products

UNIT – I:
Introduction to Measurement Systems: General concepts and terminology, measurement systems, sensor classifications: Analog Input and Output, Digital Input and Output, General input-output configuration, methods of correction.

UNIT – II:
Passive Sensors – I:
Resistive Sensors: Potentiometers, Strain Gauges, Resistive Temperature Detectors (RTDs): Three wire and Four wire, Thermistors, Light-dependent Resistors (LDRs), Resistive Hygrometers.

UNIT – III:
Passive Sensors – II:
Capacitive Sensors: Variable capacitor and Differential capacitor, Capacitive Touch sensors.
Inductive Sensors: Reluctance variation sensors, Eddy current sensors, Linear Variable Differential Transformers (LVDTs), Magneto elastic sensors, Electromagnetic Sensor based on Faraday's law of Electromagnetic induction-search coil magnetometers. Introduction to proximity sensors.

UNIT – IV:
Self-generating Sensors:
Thermoelectric Sensors: Thermocouples-Thermo electric effects, Common thermocouples, Practical thermocouple laws, Cold junction compensation in thermocouple circuits. Thermowell.
Piezoelectric Sensors: Piezoelectric effect, piezoelectric materials, applications. Pyroelectric Sensors: Pyroelectric effect, pyroelectric materials, Radiation laws: Plank, Wein and Stefan-Boltzmann, Applications.
Photovoltaic Sensors: Photovoltaic effect, materials and applications. Hall Effect Sensors

UNIT – V:
Digital Sensors: Position Encoders, Incremental position encoders, absolute position encoders, Variable frequency sensors-Quartz digital thermometers, vibrating cylinder sensors, SAW sensors.
Introduction to Smart Sensors: Introduction to MEMS Sensors.

UNIT – VI:
Signal Conditioning: Voltage dividers, Wheatstone bridge, Instrumentation amplifier, Programmable gain amplifier, linearization of resistive bridge sensor, Electrostatic shield, Noise elimination using filters, Introduction to Synchros and Resolvers.

TEXT BOOKS:

1. Sensors and Signal Conditioning, Ramon Pallas-Areny, John G. Webster, 2nd Edition
2. Sensors and Transducers, D. Patranabis, TMH, 2003

REFERENCES:

1. Sensor Technology Hand Book, Jon Wilson, Newne 2004
2. Instrument Transducers, An Introduction to their Performance and Design – Herman K. P. Neubrat, Oxford University Press
3. Measurement System: Applications and Design, E. O. Doeblin, McGraw-Hill Publications
4. Electronic Instrumentation, H. S. Kalsi
5. Microsensors, MEMS and Smart Devices, Julian Garder, Vijay K. Varadan, John Wiley & Sons Ltd., 2006

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

(19PC1EI03) ELECTRONIC MEASUREMENTS

COURSE OBJECTIVES:

- To understand different measurement methods and errors associated with them
- To know the different standards and calibration methodologies adopted in the measurement systems
- To know different AC and DC bridges for the measurement of R, L and C
- To know different types of Oscilloscopes and Analyzers (Analog and Digital)
- To acquire clear concepts about the DC and AC voltage and current measurements

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the different methods of measurement
CO-2: Calibrate different instruments
CO-3: Find the unknown values of R, L and C through bridges circuits
CO-4: To display the waveforms in an oscilloscope and analyze any complex waveforms through analog and digital techniques

UNIT – I:
Introduction to Measuring System: Static Characteristics, Error in measurement, Type of static errors, Dynamic characteristics, Statistical analysis, Probability of errors, Limiting errors, Standards - International standards, Primary standards, Secondary standards, Working standards.

UNIT – II:
Bridge Circuit and Measurements: Bridge Measurement – Wheatstone bridge, Kelvin bridge, AC bridges - Conditions for bridge balance, Maxwell's bridge, Anderson bridge, Hays bridge, Schering bridge, Wien bridge, Wagner ground connection, Q-meter, Vector impedance meter.

UNIT – III:
Voltage, Current and Power Measurements: DC Ammeters and DC Voltmeters, AC voltmeter using rectifier, True RMS responding voltmeters, Electronic multimeters, Digital Voltmeters - General characteristics, Ramp type DVM, Integrating type DVM, Successive approximation type DVM, Calibration of voltmeter and ammeter, Wattmeter for power measurement, Watt-hour meter (Energy Meter), Power factor meters.

UNIT – IV:
Frequency and Time Measurements: Digital Frequency Meter: Principle of operation, Basic circuit of digital frequency meter, frequency measurement, High frequency measurements, Digital measurement of Time-Time base selector, Period measurement, Ratio and multiple ratio measurements, Electronic Counter - Totalizing, Frequency mode, Ratio mode, Period mode, Time interval mode.

UNIT – V:

Analyzers: Basic Wave Analyzer - Frequency selective wave analyzer and Heterodyne wave analyzer, Harmonic distortion analyzer - Tuned circuit and heterodyne, Spectrum analyzer, Logic analyzers.

UNIT – VI:

Oscilloscope and Some Display Devices: Oscilloscopes: Basic CRO circuits, Lissajous patterns, Multi input oscilloscopes - Dual trace and Dual beam, Sampling oscilloscopes, Storage oscilloscope - Analog and Digital.

Display Devices: Segmental Display - 7 segment, 14 segment and Dot Matrix, LED and LCD.

TEXT BOOKS:

1. Electronic Instrumentation and Measurements Techniques by Helfrick and W.D. Cooper, PHI Publications
2. Network Analysis by A. Sudhakar, Shyammohan Palli, McGraw-Hill Company
3. Electronic Instrumentation by H. S. Kalsi, Tata McGraw-Hill, 2004

REFERENCES:

1. Electrical and Electronic Measurements by Shawney, Khanna Pub
2. Electronic Measurements and Instrumentation by Bernard Oliver, John Cage
3. Principles of Measurement Systems by John P. Bentley: 3rd Edition, Addison Wesley Longman, 2000
4. Electronic Instrumentation and Measurements: David A. Bell, 2nd Edition, PHI, 2003
5. Electronic Instruments and Instrumentation Technology by M. M. S. Anand, Prentice-Hall of India

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

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

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

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

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

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

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

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

UNIT – IV:

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

UNIT – V:

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

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC2EI01) ELECTRONIC CIRCUITS-I 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: Appreciate the effect of feedback on the systems' performance

PART A: (Only for viva-voce examination)

ELECTRONIC WORKSHOP PRACTICE (in 2 lab sessions):

1. Identification, specification, testing of R,L,C components (color codes), Potentiometers (SPDT, DPDT and DIP), Coils, Gang Condensers, Relays, Bread Board, PCB.
2. Identification, specification, testing of active devices : Diodes, BJT, Low power JFET, MOSFET, Power Transistors, LED, LCD, SCR, UJT.
3. Study and operation of:
   a) Multimeters (Analog and Digital)
   b) Function Generator
   c) Regulated Power Supplies
   d) CRO

PART B:

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

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

(19PC2EI02) SENSORS AND MEASUREMENTS LABORATORY

COURSE OBJECTIVES:

- To make student acquire hands on experience in active and passive sensors/transducers
- To make students understand different signal conditioners
- To make students design basic measuring devices like bridges

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Appreciate the use of sensors
CO-2: Identify the sensors required for any specific application
CO-3: Design and develop a simple measuring device employing appropriate sensors

LIST OF EXPERIMENTS:

1. Measurement of Load using Strain Gauge bridge and obtain the strain gauge characteristics.
2. Measurement of Temperature using Thermistor and RTD and obtain the temperature Vs Resistance Characteristics
3. Measurement of Temperature using Thermocouple and obtain the temperature Vs Voltage Characteristics.
4. Measurement of Displacement using LVDT and obtain the displacement Vs Voltage Characteristics of LVDT.
5. Measurement of Liquid level using capacitive transducer.
6. Measurement of Resistance using Wheatstone bridge.
7. Measurement of Low Resistances using Kelvin Bridge.
8. Measurement of Capacitance using Schering Bridge.
9. Measurement of Inductance using Maxwell‘s Bridge.
10. Measurement of L, C and R using Q-Meter.
11. Obtain the Characteristics of Opto-Electric Transducers - Photo Transistor and Photo Diode.
12. Obtain the Characteristics of LDR.
13. Pressure measurement using Bourdon Tube and obtain the characteristics.
14. Measurement of temperature using optical Pyrometers.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC2EC02) BASIC SIMULATION LABORATORY

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

COURSE OBJECTIVES: Using simulation tool

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

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

The experiments are to be software simulated using suitable software.

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

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

Experiments over and above the curriculum:

1. Verification of the properties of FS and FT.
2. Verification of Wiener-Khinchine relation.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19MN6HS03) GENDER SENSITIZATION

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

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

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

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

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

MODULE 2: Gender Roles and Relations

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

MODULE 3: Gender Development Issues

- Identifying Gender Issues
- Gender Sensitive Language
- Gender, Governance and Sustainable Development
- Gender and Human Rights
- Gender and Mainstreaming

MODULE 4: Gender-based Violence

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

MODULE 5: Gender and Culture

- Gender and Film
- Gender and Electronic Media
- Gender and Advertisement
- Gender and Popular Literature

MODULE 6: Gender and Studies

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

TEXT BOOK:

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

REFERENCES:

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

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

(19HS1MG02) ENGINEERING ECONOMICS AND ACCOUNTANCY

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 of 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 commerce and carryon 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: Analyze overall position of the business enterprise, therefore, take appropriate measures to improve the situation.

UNIT – I:
Introduction to Economics & Managerial Economics: 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:
Forms of organizing Private and Public-Sector Business Enterprises:
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, Product Life-Cycle (PLC), Pricing and Financial Accounting: 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: 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 by Aryasri, 2009; Tata McGraw-Hill
2. Managerial Economics by Varshney & Maheswari, 2009; Sultan Chand
3. Principles of Marketing: A South Asian Perspective by Kotler Philip, Gary Armstrong, Prafulla Y. Agnihotri and Eshan ul Haque, 2010, 13th Edition, Pearson Education/ Prentice Hall of India

REFERENCES:

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

Website:
https://www.amazon.com/exec/obidos/tg/detail/-
/0879547030/ref=ase_learnerassoci-20/102-4728473-7056968?v=glance&s=books

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

(19PC1EI04) ELECTRONIC CIRCUITS – II

COURSE PREREQUISITES: Electronic Devices and Circuits

COURSE OBJECTIVES:
- To understand the principle of multi stage amplification
- To understand the difference between Power amplification and voltage amplification
- To study the principle and working of various electronic devices
- To understand the principle and applications of SCR
- To understand the various processes required for industrial applications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Design and implement cascade stage of amplifiers and their coupling mechanisms
CO-2: Appreciate the design considerations of various large signal amplifiers
CO-3: Apply the knowledge of various electronic devices
CO-4: Apply the knowledge of deferent industrial processes to real time industry applications

UNIT – I:
Linear and Non-Linear Wave Shaping: High pass, Low pass RC circuits and their response for sinusoidal, step, pulse, square inputs. RC network as differentiator and integrator. Attenuators.
Diode clippers, clipping at two independent levels, Transfer characteristics of clippers, clamping operation, clamping circuits, Clamping circuit theorem.

UNIT – II:
Multistage Amplifiers: Introduction, Methods of inter-stage coupling, BJT: n-stage RC coupled amplifier, Equivalent circuits, Miller's Theorem, Amplifier analysis, Darlington Pair.

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, Distortion in power amplifiers, Heat sinks.

UNIT – IV:
Special Purpose Electronic Devices: Principle of Operation and Characteristics of Tunnel Diode (with the help of Energy Band Diagram), Varactor Diode and Schottky barrier diode. Principle of Operation and Characteristics of UJT, UJT Relaxation Oscillator. Principle of Operation of SCR, Schockley diode DIAC and TRIAC. Principle of Operation of Semiconductor Photo Diode, PIN Diode, Photo Transistor, LED and LCD.

UNIT – V:

SCR, Thyristor and its Applications: Triggering of Thyristors, Commutation Techniques of Thyristors—Classes A, B, C, D, E and F, Ratings of SCR. Static circuit breaker, Protection of SCR, Inverters—Classification, Single Phase inverters, Converters – single phase Half wave and Full wave.

UNIT – VI:

Industrial Applications: Industrial timers -Classification, types, Electronic Timers – Classification, RC and Digital timers, Time base Generators. Electric Welding – Classification, types and methods of Resistance and ARC wielding, Electronic DC Motor Control. High Frequency heating – principle, merits, applications, High frequency Source for Induction heating. Dielectric Heating – principle, material properties, Electrodes and their Coupling to RF generator, Thermal losses and Applications. Ultrasonic – Generation and Applications.

TEXT BOOKS:

1. Pulse, Digital and Switching Waveforms J. Millman and H. Taub, McGraw-Hill, 1991
2. Integrated Electronics - Jacob Millman and Christos C. Halkias, Tata McGraw-Hill Education, 2008
3. Industrial and Power Electronics – G. K. Mithal and Maneesha Gupta, Khanna Publishers, 19th Edition, 2003

REFERENCES:

1. Electronic Circuit Analysis - S. Salivahanan, N. Suresh Kumar, Tata McGraw-Hill Education, 2nd Edition, 2012
2. Thyristors and Applications – M. Rammurthy, East-West Press, 1977
3. Integrated Circuits and Semiconductor Devices – Deboo and Burroughs, ISE
4. Micro Electronic Circuits–Sedra and Smith, Oxford University Press, 5th Edition, 2009

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

(19PC1EI05) LINEAR IC APPLICATIONS

COURSE OBJECTIVES:

- To study about electrical properties of analog ICs like Op-Amps, IC 555 timer, PLL
- To analyze and know the design concepts of various applications of ICs
- To describe the analog to digital and digital to analog techniques
- To study the design concepts of analog circuits using ICs and its applications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the characteristics of Op-Amps & ICs
CO-2: Design linear and non-linear applications of Op-Amps
CO-3: Design applications using linear ICs
CO-4: Design A/D and D/A Converters using ICs

UNIT – I:
Integrated Circuits: Differential Amplifier- DC and AC analysis of Dual input Balanced output Configuration, Properties of other differential amplifier configuration (Dual Input Unbalanced Output, Single Ended Input – Balanced/ Unbalanced Output), DC Coupling and Cascade Differential Amplifier Stages, Level translator.

UNIT – II:
Characteristics of Op-Amps & Integrated Circuits: Types, Classification, Package Types and Temperature ranges, Power supplies, Op-amp Block Diagram, ideal and practical Op-amp Specifications, DC and AC characteristics, 741 op-amp & its features, Op-Amp parameters & Measurement, Input & Out put Off set voltages & currents, slew rate, CMRR, PSRR, drift, Frequency Compensation techniques.

UNIT – III:
Linear and Non-linear Applications of Op-Amps: Inverting and Non-inverting amplifier, Integrator and differentiator, Difference amplifier, Instrumentation amplifier, AC amplifier, V to I, I to V converters, Buffers. Non- Linear function generation, Comparators, Multivibrators, Triangular and Square wave generators, Log and Anti log Amplifiers.

UNIT – IV:
Active Filters, Analog Multipliers and Modulators: Design & Analysis of Butterworth active filters – 1st order, 2nd order LPF, HPF filters. Band pass, Band reject and all pass filters. Four Quadrant Multiplier, IC 1496, Sample & Hold circuits.

UNIT – V:
Timers & Phase Locked Loops: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger; PLL - introduction, block schematic, principles and description of individual blocks, 565 PLL, Applications of PLL – frequency multiplication, frequency translation, AM, FM & FSK demodulators. Applications of VCO (566).

UNIT – VI:

Digital to Analog and Analog to Digital Converters: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC.DAC and ADC Specifications, Specifications AD 574 (12 bit ADC).

TEXT BOOKS:

1. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition, 2003
2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 1987
3. Operational Amplifiers – C. G. Clayton, Butterworth Company Public Ltd / Elsevier, 1971

REFERENCES:

1. Operational Amplifiers & Linear Integrated Circuits –Sanjay Sharma; S. K. Kataria & Sons; 2nd Edition,2010
2. Design with Operational Amplifiers & Analog Integrated Circuits – Sergio Franco, McGraw-Hill, 1988
3. OP AMPS and Linear Integrated Circuits Concepts and Applications, James M. Fiore, Cengage Learning India Ltd
4. Operational Amplifiers & Linear Integrated Circuits– R. F. Coughlin & Fredrick Driscoll, PHI, 6th Edition
5. Operational Amplifiers & Linear ICs – David A. Bell, Oxford Uni. Press, 3rd Edition

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

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

COURSE PREREQUISITES: Ordinary Differential Equations and Laplace Transform

COURSE OBJECTIVES:
- To understand the different ways of system representations 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", by J. Nagrath and M. Gopal, New Age International, 2009
2. "Modern Control Engineering", by K. Ogata, Prentice Hall, 1991

REFERENCES:

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

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

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

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

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

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

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

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

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

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

UNIT – V:

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

UNIT – VI:

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19PC2EI03) ELECTRONIC CIRCUITS - II LABORATORY

COURSE OBJECTIVES:

- To understand the linear and non-linear wave shaping
- To explain the operation, design and Analysis of multistage amplifiers using BJT and MOS
- To develop power amplifiers and controlled rectifiers with desirable efficiency

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Design linear and nonlinear wave shapers for desired specifications
CO-2: Design multistage amplifiers to suit impedance and gain parameters requirements
CO-3: Design power amplifiers and controlled rectifiers for suitable efficiencies

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

1. Linear wave shaping.
2. Non Linear wave shaping – Clippers.
3. Non Linear wave shaping – Clampers
4. Two stage RC coupled BJT Amplifier
5. Darlington pair.
6. Cascode amplifier
7. Characteristics of UJT and UJT Relaxation Oscillator.
8. Class A power Amplifier (Transformer less and with transformer load).
9. Class B Complementary Symmetry Amplifier.
10. Class C Tuned Amplifier.
11. MOS Amplifier.
12. SCR characteristics.

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

(19PC2EI04) IC APPLICATION LABORATORY

COURSE OBJECTIVES:
- To understand the application of OP-AMP and manipulate the signals
- To understand to generate controlled oscillations using OP-AMP
- To understand the procedure to select IC that can chose any required inputs at any instances and generate required output voltage

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Design different signal manipulators using OP-AMP
CO-2: Design oscillators using OP-AMP and other ICs to suit both various modes of operations
CO-3: Design systems using OP-AMP to yield high input impedance and controlled oscillations

1. Verification of Logic Gates, Flip flops, Counters and Multiplexers
2. Adder, Subtractor and Comparator using IC 741 OP-AMP
3. Integrator and Differentiator using IC 741 OP-AMP
4. Square Wave Generator and Triangular Wave Generator using OP-AMP
5. Low pass and High Pass Filtersusing IC 741 OP-AMP
6. Wien Bridge Oscillators using IC 741 OP-AMP
7. 4-bit Digital to Analog converter using OP-AMP
8. Schmitt Trigger circuits using IC 741
9. Mono-stable Multivibrator using IC 555
10. AstableMultivibrator using IC 555.
11. Three terminal voltage regulators-7805, 7809, 7912.
12. Instrumentation Amplifier
13. Voltage controlled oscillator

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

(19PC2IT02) PYTHON PROGRAMMING LABORATORY
(Common to CSE, ECE, EIE, IT & AME)

COURSE OBJECTIVES:

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

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

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

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

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

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

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

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

Exercise -7 Strings Continued
Python program to split and join a string
Python Program to Sort Words in Alphabetic Order

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19PC1EI06) INDUSTRIAL PROCESS CONTROL INSTRUMENTATION

COURSE OBJECTIVES:

- To understand the measurement of significant process parameters
- To apply the Control actions and operate the actuators
- To recognize the appropriate tuning of Controllers for various applications
- To understand the single and Multivariable Control Schemes for industrial process application

COURSE OUTCOMES: After completion of the course, the student should be able to
CO1- Measure the Process parameter for operating the system at desired point
CO2: Control the Process parameters with appropriate control actions and able to run the system with absolute stability
CO3: Calibrate and install the devices with transmitters, actuators and Controllers
CO4: Regulate both single and Multivariable process system with optimum Tuning parameters

UNIT – I:
Process Pressure Measurement- Manometers, Bellows, Diaphragm, pressure gauge (Bourdon Tube), McLeod gauge, Ionization Gauge, thermal conductivity gauge, P-I Converter, I-P Converter, Pressure Transmitter, Calibration and Installation. Mathematical Modeling of Pressure system, piping diagram.

UNIT – II:
Process Flow Measurement – Orifice meter, DP-Transmitter, Venturi meter, Electromagnetic flow meter, Ultrasonic Flow meter, Turbine Flow meter, Hot wire anemometer, Vertex Flow meter, Pitot Tube, Variable area Flow Meters, Flow Transmitter, Calibration and Installation. Mathematical Modeling of flow system, piping diagram.
Density and Viscosity Measurement.
Level Measurement- Contact Type- Hydrostatic, Capacitance, Resistance, Non Contact Type- Ultrasonic and Radar, Calibration and Installation. Mathematical Modeling of level system.

UNIT – III:
Process Temperature measurement: Temperature Transmitter Installation considerations in a pipe, Thermal Lag, Mathematical modeling of Thermal System, Relative Humidity Measurement
Angular Velocity Measurement: Electrical Tachometer, Stroboscope Tachometer, Photo Electric tachometer, Gyroscope.

UNIT – IV:
Process Controllers- Interactive and Non Interactive system, Mathematical modeling, Continuous and Batch Process Control, Servo Control, ON-OFF Control, PI Control, Integral wind up, PD Control ,PID Control actions, Pneumatic PID Control, Electronic PID Control.

PID Controller Tuning- Quarter amplitude Tuning, Ziegler's Nichols Tuning methods-Process Reaction Curve method, Continues Oscillation Method, PID Tuning with bode stability criterion. IAE, ISE, ISTE, ITAE

UNIT – V:
Final Control Elements- Pneumatic Actuators, Hydraulic actuators, Globe valve, Ball Valve, Butterfly valve, Ideal characteristics of control valve, Control valve sizing, Flashing and Caviation in control valve, Control Valve Position Transmitter, Stroke Test of Control Valve, Valve installation, Directional Control valves, Solenoid valve

UNIT – VI:
Multi Loop Control - Cascade Control, Feed forward control with Trim (feedback),Ratio Control, Split range Control, Adaptive Control, Model Predictive Control, Auctioneering Control.

TEXT BOOKS:

1. A Course in Mechanical Measurements and Instrumentation & Control, A. K. Sawhney, Dhanpat Rai & Co
2. Process Control, K.Krishnaswamy, New age international, 2007

REFERENCES:

1. Instrument Engineers handbook Process control , Liptok

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

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

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

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

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

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

UNIT – III:
Cardiovascular Instrumentation: Heart and cardiovascular system Heart electrical activity, blood pressure and heart sounds. Cardiovascular measurements Electro Cardio Graphy (ECG) – electrocardiogram, ECG Amplifier, Electrodes and leads, ECG recorder principles. Types of ECG recorders. Principles of blood pressure and blood flow measurement.

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

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

1. Biomedical Instrumentation and Measurements, Leslie Cromwell, F.J. Weibell, E.A. Pfeiffer, PHI
2. Principles of Applied Biomedical Instrumentation, L.A. Geoddes and L.E. Baker, John Wiley and Sons
3. Introduction to Biomedical Equipment Technology, Joseph Carr and Brown, 4^{th} Edition, Pearson Education, 2000

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

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

COURSE PRE-REQUISITES: Digital System Design, Computer Organization

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

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

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

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

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

UNIT – IV:
ARM Processors
Introduction to ARM Processors: ARM Cortex-M3 Processor, Background of ARM and ARM Architecture - Architecture Versions, Processor Naming, Instruction Set Development, Thumb-2 Technology and Instruction Set Architecture, Applications

ARM Cortex-M3 Organization: ARM Cortex-M3 Block diagram, Bus Interfaces, Core Registers, Special Registers, Operation Modes, Nested Vectored Interrupt Controller, Exceptions and Interrupts, Memory map, Stack implementation, Two-Stack Model, Reset Sequence

UNIT – V:

ARM Cortex-M3 Instruction Set and Memory System

Instruction Sets: ARM Cortex-M3 16-bit and 32-bit Instruction Set, Unified Assembler Language, Data Processing Instructions, Branch Instructions, Load and Store Instructions

Memory System: Memory Maps, Memory Access Attributes, Default Memory Access Permissions, Bit-Band Operations, Unaligned Transfers, Exclusive accesses, Pipeline

UNIT – VI:

ARM Cortex-M3 Firmware Development Ecosystem

Cortex-M3 Programming:

Overview, Typical Development Flow, C Programming for Cortex-M3, Using C and Assembly, CMSIS (Cortex Microcontroller Software Interface Standard) -Organization of CMSIS, Benefits of CMSIS.

Exception Programming: Using Interrupts, Exception/Interrupt Handlers, Software Interrupts, Vector Table Relocation

TEXT BOOKS:

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

REFERENCES:

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

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

(19PE1EI01) FIBER OPTICS AND LASER INSTRUMENTATION

COURSE OBJECTIVES:
- To understand the principles of optics, lasing action and design of lasers
- To apply the knowledge of Optics to fibers and understand the different industrial applications of Optical Fibers
- To learn the various applications of Lasers in Instrumentation
- To understand the Opto-Electronic devices and their principles of operation along with their applications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply fundamental knowledge of Optics and lasers to design application-specific optical fiber
CO-2: Use lasers for the measurement of Industrial parameters like Pressure, Temperature and Level
CO-3: Understand the advantages of using Lasers in the measurements
CO-4: Understand the applications of Lasers in medicine

UNIT – I:
Optical Fibers: Elements of an Optical Fiber Transmission Link, wave guiding. The Nature of Light: Linear Polarization, Elliptical and Circular Polarization, The quantum Nature of Light. Basic Optical Laws and Definitions, fiber types, Rays and Modes, Step and Graded Index fiber structure, mode theory for circular wave guides.

UNIT – II:
Signal Degradation in Optical Fibers and Waveguides:
Attenuation: attenuation units, Absorption, Scattering Losses, Bending Losses, core and cladding Losses.
Information Capacity Determination, Group delay, Material Dispersion, Waveguide Dispersion, Signal Distortion in signal-Mode fibers, Mode Dispersion and Inter modal Distortion. Pulse Broadening in Graded-Index waveguides.

UNIT – III:
Sensors:
Intensity-Modulated Sensors: Introduction, Transmissive Concept, Reflective Concept, Micro bending Concept, Intrinsic Concept.
Phase-Modulated Sensors: Introduction and Interferometer Techniques. Wavelength-Modulated Sensors: Introduction, Bragg Grating Concept and Bragg Grating Technology.
Temperature Sensors: Introduction, Reflective concept, Micro bending Concept, Interferometric Concept and Bragg Grating concept.
Pressure Sensors: Introduction, Transmissive Concept, Micro bending and Intrinsic concepts, Interferometer concepts and Bragg Grating concept.

UNIT – IV:

Radiation Sources and Detector: Luminescence, Photo Luminescence, cathodoluminescence, Injection Luminescence and Light Emitting diodes-Radioactive recombination processes, LED materials, Commercial LED materials, LED structure, Response times of LEDs, LED drive circuitry, Plasma displays, Display brightness, LCDs, Numeric displays.

Photodetectors: Photodetector- performance characteristics, Photo emissive detectors, Image intensifiers, Photo multiplier, optrons

UNIT – V:

Principles of Lasers: Emission and Absorption of radiation, Einstein relations, Absorption of radiation, population Inversion, optical feedback, Threshold conditions-Laser losses, Line shape function, Laser modes-Axial and Transverse modes.

Classes of Lasers: Doped Insulator lasers, Semiconductor Lasers, Gas Lasers, Liquid dye lasers, Parametric lasers, The free electron laser.

UNIT – VI:

Operation and Applications:

Operation: Mode locking of Lasers-Active mode locking, passive mode locking, Q-switching- Methods of Q-Switching.

Laser Applications: Measurement of distance-Interferometric methods, Beam modulation Telemetry, Pulse echo techniques.

Holography-Principle and applications of Holography, Holographic computer memories, High energy Applications-Industrial applications, Medical application, Laser-Induced nuclear fusion.

TEXT BOOKS:

1. Optical Fiber Communications, Gerd Keiser, 5th Edition, McGraw Hill, 2017
2. Optical Communication Systems, John Gowar, Prentice Hall, 1993
3. Optical Fiber Communications: Principles and Practice, John Senior, 3rd Edition, Pearson Education, 2010

REFERENCES:

1. Fiber Optic Sensors, B.D. Gupta, New India Publishing, 2006
2. Optoelectronics - An Introduction, Wilson and Hawkes, 3rd Edition, Prentice Hall, 1997

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

(19PE1EI02) POLLUTION CONTROL IN PROCESS INDUSTRIES

COURSE OBJECTIVES:

- To identify the different pollutants that cause serious problems in industries
- To understand the causes of pollutions from various emission reactions
- To recognize the origin of hazardous pollution gases in environment
- Treatment methods of specific pollutant arising out of industrial process

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Plan strategies to control and reduce pollution
CO-2: Select the most appropriate technique to control and treat industrial pollution
CO-3: Apply environmental management systems (EMS) to an industrial activity
CO-4: Design and develop anti-pollution monitoring systems

UNIT – I:
Industrial Pollution Emissions and Indian Standards: Introduction-Man and environment, types of pollution, pollution control aspects, Industrial emissions-Gases, and Industrial emissions Liquids, water quality management in India.

UNIT – II:
Analysis of Pollutants: Industrial wastewater analysis, industrial gaseous effluent analysis, particle size distribution, water quality regulations and policy development, water quality standards.

UNIT – III:
Pollution Control for Specific Pollutants-I: Removals of BOD-biological oxidation-anaerobic treatment-Removal of Chromium-control methods, reduction precipitation, Ion exchange, reverse osmosis-lime coagulation and adsorption.

UNIT – IV:
Pollution Control for Specific Pollutants-II: Removal of mercury, measurement of mercury, mercury losses in chloro-alkali industries removal of mercury from gaseous streams, removal of mercury from liquid streams, Removal of oxides of nitrogen, analysis of NOx control measures.

UNIT – V:
Pollution Control Aspects in Selected Process Industries: Pollution control in chemical industries, pollution control aspects of fertilizer industries ammonia plant effluents, ammonium sulphate plant, phosphoric acid plant, complex fertilizer plant.

UNIT – VI:
Pollution Control in Petroleum Refineries and Petrochemical Units: Characteristics of liquid effluent-refinery, liquid waste treatment methods, treatment of liquid effluents from petrochemical industries, air pollution control, pollution control in pulp and paper industries.

TEXT BOOKS:

1. Pollution Control in Process Industries, S.P. Mahajan, Tata McGraw Hill Edition
2. Water Quality Concepts, Sampling, and Analyses, Edited by Yuncong Li, Kati Migliaccio

REFERENCES:

1. Industrial Pollution Prevention Handbook. Harry M. Freeman
2. Industrial Pollution (A Reference to Small Scale Industries), N. Saradha, N. Dhulasi Birundha

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

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

COURSE OBJECTIVES:

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

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

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

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

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

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

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

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19PC1EC20) PROBABILITY AND RANDOM PROCESSES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To provide mathematical background and sufficient experience on probability theory as well as solve Probabilistic problems in signal processing
- To introduce students to the basic methodology of "probabilistic thinking" and to apply it to problems
- To understand basic concepts and to deal with multiple random variables, Conditional probability and conditional expectation, joint distribution and independence, mean square estimation
- To understand the difference between time averages and statistical averages
- Analysis of random process and application to the signal processing

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

CO-1: Apply the concepts of probability to experiments that have Random outcomes

CO-2: Mathematically model the random phenomena and solve simple probabilistic problems

CO-3: Characterize different types of random variables and compute statistical averages of these random variables

CO-4: Characterize the random processes in the time and frequency domains

CO-5: Analyze the LTI systems with random inputs

UNIT – I:

Probability and Random Variable: Probability introduced through Sets and Relative Frequency, Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Baye's Theorem, and Independent Events.

Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous, and Mixed Random Variables

UNIT – II:

Distribution & Density Functions: Distribution and Density functions and their Properties - Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh and Conditional Distribution, Methods of defining Conditional Event, Conditional Density, and Properties.

Operation on One Random Variable:

Expectations: Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function,

UNIT – III:

Multiple Random Variables: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Conditional Distribution and Density – Interval conditioning, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem (Proof not expected),

Operations on Multiple Random Variables:

Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties

UNIT – IV:

Transformations of Random Variables: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable, Transformation of a Discrete Random Variable. Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT – V:

Stochastic Processes – Temporal Characteristics: The Stochastic Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence, First-Order Stationary Processes, Second-Order and Wide-Sense Stationarity, Nth Order and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance and its Properties, Linear System Response of Mean and Mean-squared Value, Autocorrelation Function, Cross Correlation Functions, Gaussian Random Processes, Poisson Random Process.

UNIT – VI:

Stochastic Processes – Spectral Characteristics: Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function,

Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Spectral Density of Input and Output of a Linear System.

TEXT BOOKS:

1. Probability, Random Variables & Random Signal Principles, Peyton Z. Peebles, 4th Edition, TMH, 2001
2. Probability and Random Processes, Scott Miller, Donald Childers, 2nd Edition, Elsevier, 2012
3. Statistical Theory of Communication, S.P. Eugene Xavier, New Age Publications, 1997

REFERENCES:

1. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S. Unnikrishna Pillai, 4th Edition, TMH
2. Theory of Probability and Stochastic Processes, Pradip Kumar Gosh, University Press

3. Probability and Random Processes with Application to Signal Processing, Henry Stark and John W. Woods, 3rd Edition, PE

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

(19PE1EI03) MICRO ELECTROMECHANICAL SYSTEMS (MEMS)

COURSE OBJECTIVES:

- To acquire knowledge about MEMS devices and their applications in various domains
- To understand the techniques to fabricate MEMS devices
- To learn the design considerations for MEMS devices and Microsystems
- To learning to characterize Microsystems using optical and electron microscopy and other techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply fundamental knowledge of physics and chemistry to design microsystems for various applications
CO-2: Select appropriate tools and techniques for Microfabrication and MEMS characterization
CO-3: Realize the need for advancement of technology towards microsystems for better living in the society
CO-4: Understand the need to keep oneself updated constantly to understand the ease of use of emerging technologies

UNIT – I:
Overview of MEMS and Microsystems: Evolution of microfabrication; Applications of MEMS in optical devices (Micro-Opto-Electro- Mechanical Systems or MOEMS), healthcare and biomedicine (including Bio-MEMS and Bio- MOEMS), aerospace, telecommunications, consumer products, automotive, and industrial products.

UNIT – II:
Working Principles of Microsystems: Microsensors – acoustic wave, bio-, chemical, optical, pressure, thermal; Microactuation – thermal, shape-memory alloys, piezoelectric, electrostatic; MEMS devices – Microgrippers; Micromotors; Microfluidics – Micropumps, Microvalves; Micro accelerometers.

UNIT – III:
Materials for MEMS and Microsystems: Substrates and Wafers; Silicon as a Substrate, Silicon Compounds, Silicon piezoresistors, Non- silicon-based materials: Gallium Arsenide, Gallium Nitride, Quartz, Piezeoelectric Crystals, Polymers.

UNIT – IV:
Basics of Micromanufacturing: Photolithography; Cleanroom Environment; Deposition techniques: Ion implantation, Diffusion, Vapour Deposition (PVD, CVD, PECVD), Oxidation, Epitaxial growth; Etching techniques: Chemical (Wet) Etching, Plasma (Dry) Etching

UNIT – V:
Fabrication of MEMS: Bulk micromachining, Surface micromachining, LIGA Process, Deep X-Ray Lithography (DXRL)

Design considerations; Process Design; Photomask layout using CAD; Mechanical design overview.

UNIT – VI:

Characterization of MEMS: Characterization Techniques: Principle of working and operation of: Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Atomic Force Microscope (AFM), X-Ray Diffraction (XRD), Optical microscope

TEXT BOOKS:

1. MEMS and Microsystems Design and Manufacture, Tai-Ran Hsu, Tata McGraw-Hill, 2002, ISBN: 978-0070487093
2. MEMS, N. Mahalik, McGraw-Hill Education (India) Pvt. Ltd., 2007, ISBN: 978-0070634459

REFERENCES:

1. Fundamentals of Microfabrication: The Science of Miniaturization, Marc J. Madou, CRC Press, 2002, ISBN: 978-0849308260
2. Microsystem Design, Stephen D. Senturia, Springer, 2004, ISBN: 978-8181285461
3. Practical MEMS, Ville Kaajakari, Small Gear Publishing, 2009, ISBN: 978- 0982299104

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

(19PC2EI05) PROCESS CONTROL INSTRUMENTATION LABORATORY

COURSE OBJECTIVES:

- To identify and obtain process parameters of various processes
- To understand the working of Actuators, Converters, Controllers and Control Valves
- To acquire the working knowledge of different controller types, modes of control actions, tuning of controllers and control schemes
- To learn controller design methodologies to solve practical process control problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply mathematical modeling of different process to analyze its time response
CO-2: Apply the control system knowledge to monitor and control industrial parameters like flow, level, pressure, temperature, pH problems
CO-3: Identify design methods for PID controller in different applications
CO-4: Learn to apply analytical tools and advanced control schemes for various applications

LIST OF EXPERIMENTS:

1. Experimental modeling of Interacting and non-interacting systems.
2. Time response analysis of Second Order System.
3. Tuning of controllers with open loop method.
4. Tuning of controllers with closed loop method.
5. Servo and Regulator operation for Speed Control of DC Servo motor.
6. Realization of control actions with Pneumatic and Hydraulic Actuation.
7. Study of Installed characteristics of Control valves.
8. Pressure Process control with ON-OFF, P, PI & PID Controllers.
9. Level Process control with ON-OFF, P, PI & PID Controllers.
10. Flow Process control with ON-OFF, P, PI & PID Controllers.
11. Temperature control process with PID Control Action.
12. Multi loop flow control systems using Ratio Control.
13. Multi loop level control systems using Cascade Control.

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

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

COURSE PRE-REQUISITES: Digital System Design

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

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

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

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

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

(19PW4EI02) INTERNSHIP

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

COURSE OUTLINE:

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

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

(19MN6HS02) ENVIRONMENTAL SCIENCE

COURSE PREREQUISITES: Basic knowledge of environmental issues

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

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

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

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

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

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

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

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

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

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

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

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

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

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

COURSE PRE-REQUISITES: Signals and Systems

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

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

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

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

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

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

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

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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B.Tech. VI Semester	**L**	**T/P/D**	**C**
	2	**1**	**3**

(19PC1EI08) PROCESS CONTROL AUTOMATION

COURSE OBJECTIVES:
- To have a comprehensive understanding of PLCs in measurement and control
- To know about data acquisition from field instruments
- To understand the basic need of SCADA in industries, its design and Applications
- To understand the working and design of applications based on PLC and SCADA real time systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand working of PLC, I/O modules, Ladder logic and instructions of PLC, design & development of PLC based application using ladder logic
CO-2: Describe the main functional units in a PLC and be able to explain how they interact
CO-3: Know different communication protocols used between Process Station and PLC & SCADA in automation industries
CO-4: SCADA architecture, communication in SCADA, developing GUI application in SCADA software and linking (Tags) with ladder program

UNIT – I:
Programmable Logic Controller: Introduction, Overview of PLC systems, PLC hardware components – IO Section, Discrete IO modules, Analog IO modules, Special IO modules, IO Specifications, Memory types. Concept of sinking and sourcing, IO Devices – Input Devices, Output Devices.

UNIT – II:
Basic PLC Programming: Program Scan, PLC Ladder programming - Bit level Instructions, Instruction Addressing, Branch Instructions, Basic switching applications – Logic Functions, Latching, Interlocks, Boolean algebra to ladder programming, Conversion examples. Creating ladder diagrams from process control description.

UNIT – III:
PLC Intermediate and Advanced Instructions: Timers – Types of Timers, Sequential Programming Examples, Counters – Types of Counters, PLC Instructions - Math, Data Manipulation, Data move, Skip, MCR and Sequencer Instructions. Analog PLC operation, Networking of PLC.

UNIT – IV:
Application of PLC: Controlling of Robot using PLC, PID control of continuous processes, Continuous Bottle-filling system, Batch mixing system, 3-stage air conditioning system, Automatic frequency control of Induction heating Alternate programming languages of PLC, PLC installation, troubleshooting and maintenance, Data Communications – Field bus, HART protocol. Smart transmitters, smart valves, and smart actuators.

UNIT – V:

SCADA: Introduction and Overview, Definition of SCADA, SCADA Hardware and software, Safety Instrumented Systems (SIS), Landlines for SCADA, Human Machine Interface – HMI, Advantages of SCADA.

UNIT – VI:

Scada Components: Master Terminal Units (MTUs), Remote Terminal Units (RTUs), Communication Interface,
Applications. Operator Interface: HMI, Alarming, Control Screens, Status Screens, Graphics and Trending, Reports. Identifying process area field signals, creating and documenting application database.

TEXT BOOKS:

1. Programmable Logic Controllers, Frank D. Petruzella, 5th Edition, McGraw Hill, New York, 2017
2. Designing SCADA Application Software, Stuart G. McCrady, 1st Edition, Elsevier 2013

REFERENCES:

1. Programmable Logic Controllers – Principles and Applications, John. W. Webb, Ronald A Reis, Fourth Edition, Prentice Hall Inc., New Jersey, 1998
2. Programmable Logic Controllers, W. Bolton, 6th Edition, Elsevier Ltd., 2009
3. Introduction to Programmable Logic Controllers, Gary Dunning, Thomson Delmar, 2nd Edition, Second Reprint, 2003
4. Practical Data Acquisition for Instrumentation and Control Systems, John Park and Steve Mackay

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

(19PC1EI09) VIRTUAL INSTRUMENTATION

COURSE OBJECTIVES:

- To develop virtual instruments for specific application using graphical programming
- To understand the control of an external device by interfacing a computer
- To become competent in data acquisition and instrument control
- To gain knowledge in developing different applications in Digital image processing, control system, signal processing, and simulation

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire knowledge on how virtual instrumentation can be applied for data acquisition and instrument control
CO-2: Identify salient traits of a virtual instrument and incorporate these traits in their projects
CO-3: Experiment, analyze and document in the laboratory prototype measurement.
CO-4: Acquire knowledge on developing different applications in Digital image processing, control system, signal processing and in simulation systems

UNIT – I:
Virtual Instrumentation: An introduction, Historical perspective, advantages, blocks diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT – II:
VI Programming Techniques: VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case structure, sequence structure and event structure, formula node, local and global variables, string and file I/O, mathscript node.

UNIT – III:
Common Instrument Interfaces: RS 232C/ RS485, GPIB, Instrument Control using RS-232C and IEEE488, VISA, Instrument Drivers. Bus Interfaces: USB, Firewire. PXI controllers.

UNIT – IV:
Data Acquisition System: Introduction to data acquisition systems, data acquisition requirements, sampling theorem, signal conditioning,
Analog and digital input acquisition, Analog and digital output generation, DAQ assistant and DAQmx.

UNIT – V:

Application of Virtual Instrumentation: Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC client and server, publishing measurement data in the web.

UNIT – VI:

VI toolsets: Distributed I/O modules, Control Design and Simulation, Digital Signal processing tool kit, Image acquisition and processing, Motion control.

TEXT BOOKS:

1. LabVIEW Graphical Programming, Gary Johnson, 2nd Edition, McGraw-Hill, New York, 1997
2. LabVIEW for Everyone, Lisa K. Wells & Jeffrey Travis, Prentice Hall, New Jersey, 1997

REFERENCES:

1. Virtual Instrumentation using LabVIEW, Jovitha Jerome, 1st Edition, PHI, 2001
2. PC Interfacing and Data Acquisition: Techniques for Measurement, Kevin James, Instrumentation and Control, Newnes, 2000
3. LabVIEW Advanced Programming Technique, Rick Bitter, 2nd Edition, CRC Press, 2005

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

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

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

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

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

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

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

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

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

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

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

Design Methodology for Home Automation and Weather Monitoring.

TEXT BOOKS:

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

REFERENCES:

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

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

(19PE1EI04) ROBOTICS AND APPLICATIONS

COURSE OBJECTIVES:

- To understand the Robot coordinate system and control system
- To learn different types of Robot sensors, actuators and grippers
- To acquire Knowledge on kinematics and vision systems used for different Robots
- To identify different types of Robot applications

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 actuators, sensors and grippers in Robotics
CO-3: Analyze the direct and the inverse kinematic problems
CO-4: Able to examine the applications of robots in different process operations

UNIT – I:
Basic Concepts & Power Sources: 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.
Actuators: Characteristics of actuating system, comparison of actuating system Hydraulic actuators, Pneumatic devices, electric motors, magneto strictive actuators.

UNIT – II:
Sensors and Grippers:
Sensors: Sensor characteristics, Position sensors, velocity sensors, acceleration sensors, torque sensors, micro switches, lighten infrared sensors, touch and tactile sensors, proximity sensors, range finders.
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 – III:
Kinematics: Matrix representation of translational and Rotational motion – Homogeneous Transformation, D-H representation of standard configuration Robots-Inverse Kinematics. Joint space vs. Cartesian space-Basics of Trajectory planning in joint and Cartesian space.

UNIT – IV:
Low Level and High Level Vision: Image acquisition, Illumination Techniques, Imaging Geometry, Basic Relationships between Pixels, Segmentation, Description, Segmentation and Description of 3-D Structures, Recognition, Interpretation.

UNIT – V:
Robot Assembly and Inspection: Assembly and Robot Assembly automation, Parts Presentation methods, Assembly operations, Compliance and the Remote Center

Compliance (RCC) Device, Assembly system configurations, Adaptable-Programmable assembly system, Designing for Robotic Assembly, Inspection Automation.

UNIT – VI:

Robot Applications: Material Transfer and Machine loading/unloading: General Considerations in Robot Material Handling, Material Transfer application, Machine loading and unloading. Liquid handling and pumping. Processing operations: Spot welding, Continuous Arc Welding, Spray Coating, other processing operations using Robots.

TEXT BOOKS:

1. Introduction to Robotics: Analysis, Control, Applications, Saeed B. Niku, Wiley, 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, USA,1992
2. Robotic Engineering – An Integrated Approach, Klafter R.D, Chimielewski T.A, Negin M, Prentice Hall of India, New Delhi, 1994
3. Robotics Control, Sensing, Vision and Intelligence, Fu. K. S., Gonzalez. R. C. & Lee C.S.G., McGraw Hill Book Co., 1987

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

(19PE1EI05) POWER PLANT INSTRUMENTATION

COURSE OBJECTIVES:

- To understand the working model and layouts of different power plants
- To understand the Necessity of a instrumentation engineer in a power plant
- To understand Different measurements and controls associated with power plants
- To understand operation of nuclear power plants and protection of equipment

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

CO-1: Appreciate the power generation technique used in different types of power plants

CO-2: Appreciate different parameters calculations and their control in the power plant

CO-3: Understand and identify various control loops in power plants

CO-4: Understand the concepts of Nuclear power plants

UNIT – I:

An Overview of Power Generation: Introduction-various sources of Electrical Energy - Non-conventional Energy sources- Wind power, solar power, tidal power, geothermal power, magneto hydrodynamic (MHD) Power, Fuel Cells, Biomass Power, Conventional and Non-conventional energy sources- hydropower, nuclear power, gas power, steam power (Thermal Power), comparison of various conventional power plants, Importance of instrumentation and control in power Generation – Classification of Instruments in a power plant, objectives of Instrumentation and control. Piping and Instrumentation diagram (P and I Diagram) – Examples of ISA Instrumentation diagram symbols, examples of SAMA instrumentation diagram symbols, examples of ISA and SAMA diagram, piping and instrumentation diagramming, Cogeneration of Power-back pressure turbine, pass-out turbine process heat unit, control rooms, thermal or boiler control room, electrical control room, plan of control rooms

UNIT – II:

Instrumentation and Control in Water Circuit: Water circuit, boiler feed water circulation- natural circulation, forced circulation, combined circulation, Measurements in Water Circuit- Water Flow Measurement, Differential Pressure transmitter (DPT), steam flow measurement, water and steam pressure measurements, drum water level measurement. Controls in water circuit-boiler drum level control, superheated steam temperature control, steam pressure control, impurities in water and steam- impurities in Raw Water, Effects of Impurities, Measurement of Impurities, feed water treatment.

UNIT – III:

Instrumentation and Control in Air-Fuel Circuit: Air-Fuel Circuit – Fuels, combustion air, flue gases, waste gases, Measurements in Air-Fuel Circuit – Measurement of flow/quantity, Measurement of Pressures, Measurement of Temperatures, Measurement of level. Controls in Air-Fuel Circuit – Combustion control, furnace Draft Control, Analytical Measurement – Oxygen Measurement in Flue Gas, Measurement of carbon dioxide in flue gas, combustibles analyzer (CO+H2), Infrared flue gas analyzer, smoke detector, dust monitor, closed circuit television, fuel analyzers, chromatography, pollution monitoring instruments.

UNIT – IV:

Turbine Monitoring and Control: Introduction – Classification, instrumentation control points of View, Principal parts of steam turbines, Turbine Steam Inlet System – Inlet valve arrangements, inlet measurements, Governors, Turbine Measurements – Process Parameters, mechanical parameters, electrical parameters, Turbine control system – safety control systems, process control systems, Lubrication for turbo-alternator – Lubrication system, Controls in Lubrication system, Turbo-Alternator Cooling System – Lube Oil cooling system, Alternator/Generator cooling system.

UNIT – V:

Nuclear Power Plant Instrumentation: Introduction – Instrumentation and Control for Nuclear Power Plant - Important Components of I&C System - Evolution of I&C in NPP – Reactor Control – Methods of Control, Control loops, Functions of control system, Pressurized water reactor (PWR) controls, boiler water reactor (BWR) controls, Liquid metal cooled reactor (LMCR) Control, role of reactor controls during start-up, normal operation and shut down.

Digital Architectures in Nuclear Power Plants: System level Instrumentation and control architecture, safety related systems, non-safety-related systems, man machine interface system (MMIS), and Instrumentation and controls architecture platform.

UNIT – VI:

Radiation Protection and Monitoring: accident at three mile Island, USA, disaster at Chernobyl nuclear power plant, Ukraine, calamity at Fukushima, Daiichi nuclear power plant, Japan, Radiation Units, Biological Effects of Radiation, Radiation Monitoring, Nuclear Reactor Safety - Reactor protection system, Reactor Tripping, Engineered Safety Features, Surveillance, Diagnostics and Prognostics – Surveillance, Diagnosis, Prognosis.

TEXT BOOKS:

1. Power Plant Instrumentation by Prof. K. Krishna Swamy, New age International Publisher
2. Modern Power Station Practice, Volume.6, Instrumentation, Controls and Testing, Pergamon Press, Oxford, 1971

REFERENCES:

1. Power Plant Technology, Wakil M.M., McGraw Hill
2. Standard Boiler operations-Questions and Answers, Elonka S.M and Kohal A.L.,– Tata McGraw Hill, New Delhi, 1994

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

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

COURSE PRE-REQUISITES: Analog and Digital Communications

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

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

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19PE1EC22) PRINCIPLES OF COMMUNICATIONS

COURSE OBJECTIVES:

- To make students understand different modulation techniques
- To make students understand basics of satellite and optical communications
- To make students understand basics of wireless communication
- To make students understand basics of cellular communication

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

CO-1: Analyze the techniques used for signal modulation and demodulation

CO-2: Distinguish the need for PPM, PWM, Multiplexing

CO-3: Understand the basics of satellite and optical communications

CO-4: Understand the fundamental concepts of Cellular & Mobile communications

UNIT – I:

Introduction: Block diagram of Electrical communication system, Radio communication

Analog Modulation: Need for modulation, Types of Analog modulation, Amplitude Modulation, Angle Modulation: Frequency & Phase modulations. Generation and Demodulation techniques, Advantages of FM over AM, Bandwidth consideration, Narrow band and Wide band FM.

UNIT – II:

Pulse Modulation: Sampling, Nyquist rate of sampling, Sampling theorem for Band limited signals, PAM, regeneration of base band signal, PWM and PPM, Time Divison Multiplexing, Frequency Divison Multiplexing

UNIT – III:

Digital Communication: Advantages, Block diagram of PCM, Quantization, effect of quantization, quantization error, Base band digital signal, DM, ADM, ADPCM and comparison. Digital Modulation: ASK, FSK, PSK, DPSK, QPSK demodulation, offset and non-offset QPSK

UNIT – IV:

Satellite Communication: Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations, Satellite Applications, Global Positioning systems.

Optical Communication: Optical Principles, Block Diagram of Optical Communication System, classification of Fibers, losses in fiber optic communication, Wavelength Division Multiplexing.

UNIT – V:

Introduction to Wireless Networking: Introduction, Difference between wireless and fixed telephone networks, Development of wireless networks, Traffic routing in wireless networks.

UNIT – VI:

Cellular Mobile Radio Systems: Introduction to Cellular Mobile System, concept of frequency reuse, Performance criteria, operation of cellular systems, Hexagonal shaped cells, Cell splitting.

Handoffs and Dropped Calls: Handoff, dropped calls and cell splitting, types of handoff, handoff initiation, delaying handoff, forced handoff, mobile assisted handoff, Intersystem handoff, micro cells, dropped call rates and their evaluation.

TEXT BOOKS:

1. Communication Systems Analog and Digital, R.P. Singh and S.D. Sapre, TMH, 20th Reprint, 2004
2. Wireless Communications, Principles, Practice, Theodore, S. Rappaport, 2nd Edition, 2002, PHI
3. Optical Fiber Communications, Gerd Keiser, TMH, 4th Edition, 2008

REFERENCES:

1. Principles of Electronic Communication Systems, Louis E. Frenzel, 3rd Edition, McGraw Hill
2. Electronic Communication Systems, Kennedy and Davis, 4th Edition, TMH, 2004
3. Communication Systems Engineering, John. G. Proakis and Masoud Salehi, 2nd Edition, PHI, 2004
4. Wireless Communication and Networking, William Stallings, 2003, PHI
5. Fundamentals of Satellite Communications, K.N. Raja Rao, PHI, 2004

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

(19PE1EI06) BIOMEDICAL EQUIPMENT

COURSE OBJECTIVES:
- To state the Physiological reasons for using a particular piece of Biomedical Equipment
- To describe the operating principles of a wide range of Biomedical equipment
- To enable the students to gain knowledge on the working of Surgical equipment
- To familiarize the latest technologies of Modern Medicine

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: To perceive the governing principles and functionality of various Critical Care equipment
CO-2: To make use of electrical stimulation principles to overcome cardiac rhythm disturbances
CO-3: Understanding the functionality of equipment used in surgery, physiotherapy and ophthalmology
CO-4: To interpret the safe operating procedure of all medical equipment

UNIT – I:
Introduction: Critical physiological parameters to be monitored. Intensive coronary care unit layout.
Hospital power distribution system: Design and layout, power factor improvement, maximum demand, safety, metering, booster transformers, isolators.

UNIT – II:
Pacemakers:
Cardiac Pacemakers: Need for a Pacemaker, Types-Asynchronous, Synchronous, External and implantable. Asynchronous pacemakers: Working principle, block diagram.
Synchronous/Demand Pacemaker: Modes of triggering-ventricular triggered and atrio ventricular synchronized pacemaker, Programmable pacemaker.
Implantable Pacemaker: Technical and qualitative requirements of power supplies, lead wires and electrodes, packaging. Microprocessor based implantable pacemaker, Rate responsive pacemaker.

UNIT – III:
Defibrillators: Need for Defibrillators, D.C. Defibrillator, Need for Synchronous Defibrillators, Types of electrodes and their features, Types of Waveforms, Automatic/Advisory External Defibrillators (AED), Implantable defibrillators.

UNIT – IV:
Heart Lung Machine: Governing principles. Qualitative requirements. Functional details of Bubble, Thin Film and membrane-type of blood oxygenators. Respiratory measurements: Principles and techniques of impedance Pnuemography and pneumotachograph.
Ventilators: Artificial Ventilation, Types of ventilators, Modern Ventilators, High frequency Ventilators.

UNIT – V:

Haemodialyzer: Artificial Kidney, Dialyzers, Membranes for Haemodialysis, Haemodialysis Machine, Monitoring circuits for haemodialysis machine, Portable Kidney Machines.

Physiotherapy Equipment: Short Wave, Microwave and Ultrasound Diathermy.

UNIT – VI:

Ophthalmic Instruments: Introduction to EOG, ERG, Intraocular Pressure Measurement Contacting and Non-Contacting Types, Refractometer, Ophthalmoscope, Retinoscope, Keratometer.

TEXT BOOKS:

1. Medical Instrumentation-Application and Design, John G. Webster, 3rd Edition, John Wiley, 2003
2. Handbook of Biomedical Instrumentation, Khandpur R.S., 2nd Edition, Tata McGraw Hill, 2003

REFERENCES:

1. Introduction to Biomedical Equipment Technology, Joseph J. Carr and John M. Brown, Pearson Education, 2001
2. Gerald E. Miller, Artificial Organs, Morgan and Claypool, 2006
3. Handbook of Biomedical Engineering, Bronzino Joseph D, CRC Press, 1995
4. Electrical Technology, Cotton H., AHW & Co., 1983

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

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

COURSE OBJECTIVES:

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

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

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

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

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

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

UNIT – I:
The Concept of Technical Communication:

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

UNIT – II:
Application Writing:

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

UNIT – III:
Presentation Skills:

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

UNIT – IV:

Report Writing:

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

UNIT – V:

Employability Skills-1:

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

UNIT – VI:

Employability Skills-2:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19PC2EI06) PROCESS CONTROL AUTOMATION LABORATORY

COURSE OBJECTIVES:

- To give a novice an understanding of PLC programming, ladder logic and the inner workings of a PLC modules
- To learn the difference between digital and analog signals and how to bring them into a PLC, process them, and send them back out
- Understand the role of each components (RTU, HMI & Drives) of automation in industry
- The importance of data acquisition and management

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explore basic, standard control techniques for things like HOA control, level control, pressure control, and PID control loops
CO-2: Be introduced to HMI development and given a general understanding of how an HMI program works
CO-3: Learn the applications of SCADA software, SCADA features, creating applications, creating database tags, developing graphic displays, trending, communication with PLC and other hardware
CO-4: Design Develop and Commissioning of PLC, RTU, Drives and SCADA programs for desired applications

LIST OF EXPERIMENTS:

1. Design and development of basic ladder logic programming for PLC.
2. Ladder logic programming for industrial application using timers and counters of PLC.
3. Ladder logic programming using advanced functions of PLC.
4. Interfacing of PLC with level process station.
5. Interfacing of PLC with flow process station.
6. Interfacing of PLC with pressure process station.
7. Interfacing of PLC and RTU for remote monitoring and control.
8. Design and development of SCADA programming for industrial application.
9. Implementation of SCADA interfaced PLCs to Flow Process Station
10. Implementation of SCADA interfaced PLCs to Pressure Process Station
11. Implementation of SCADA interfaced PLCs to Level Process Station
12. Design and development of HMI programming for industrial application.
13. RPM control of AC Motor using PLC through VFD.

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

(19PW4EI03) DESIGN THINKING

COURSE OBJECTIVES:

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

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

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

OPEN ELECTIVE COURSES

SMART CITIES

SMART CITIES

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

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

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

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

What is the concept of a smart city?

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

Growth in Global population continues to drive citizens from rural areas to cities. With rapid expansion of urban areas, cities need to become intelligent to handle this large scale urbanization. This is driving city operators to look at smarter ways to manage complexities, increase efficiencies and improve quality of life. Today we need cities that monitor& integrate infrastructure to better optimize resources while maximizing service to its citizens. So to meet all the needs we need our cities to be smarter which brings a concept "**Smart cities**" Smart cities optimize the use of technology in the design & operation of infrastructure and buildings in such a way which meets the current and future needs of their citizens. To be truly smart they also require consideration of governance &growth, urban development and infrastructure, the environment & natural resources, society and community.

Smart city programs provide a range of technologies that can be applied to solve infrastructure problems associated with ageing infrastructure and increasing demands. The potential for infrastructure and urban improvement remains unrealized, however, due to technical, financial, and social constraints and criticisms that limit the implementation of smart cities concepts for infrastructure management. The discussion presented here provides a review of smart technologies including sensors, crowdsourcing and citizen science, actuators, data transmission, Internet of Things, big data analytics, data visualization, and blockchain, which can be used for infrastructure management. Smart infrastructure programs are reviewed to explore how enabling technologies have been applied across civil engineering domains, including transportation systems, water systems, air quality, energy infrastructure, solid waste management, construction engineering and management, structures, and geotechnical systems.

Making cities "smarter" by efficient management of resources and infrastructure, greener environment, and smart governance resulting in a better quality of living of its citizens. This can be enabled by the effective use of information and communication technologies (ICTs) tools, which have the ability to provide eco-friendly and economically viable solutions for cities.

Setting up a smart city is more than improving the old system with technology by simply adding sensors, remote supervision, and control to essential city services. It should be a complete shift of a paradigm in daily life when using new technologies, especially new ICT leading to smart outcomes.

Smart solutions

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

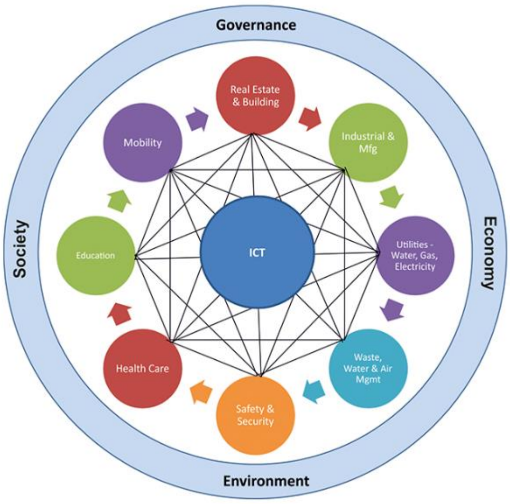
- Public information systems
- Redressal of grievances
- Electronic service delivery
- Maximum engagement of citizens
- Reduced energy and fuel usage
- Reduces the development of wastes
- Smart water monitoring
- Treatment of wastewater
- Sustainable monitoring water quality
- Maximum utilization of renewable energy sources
- Usage of green building techniques
- Smart parking to reduce clutter
- Intelligent traffic management system.

Advantages of a smart cities,

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

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

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



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

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

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

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

Conclusion

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1CE01) SMART CITIES PLANNING AND DEVELOPMENT

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

CO-1: Recognize smart city concepts and their international and national standards

CO-2: Recognize smart community, transportation and building concepts

CO-3: Develop and calibrate energy demand and their capacity limits

CO-4: Predict the various smart urban transportation systems and the transition from existing city towards a smart city

UNIT – I:

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

UNIT – II:

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

UNIT – III

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

UNIT – IV:

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

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19OE1CE02) GREEN BUILDING TECHNOLOGY

COURSE PRE-REQUISITES: Smart Cities Planning and Development

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the importance, features and requisites of a green building
CO-2: Identify suitable sustainable building materials for construction of green building
CO-3: Plan and design various systems for green buildings
CO-4: Explain various codal provisions of green buildings and accordingly rate a building

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

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

UNIT – III:
Design of Green Buildings: Indoor environmental quality requirement and management: Thermal comfort - HVAC - Visual perception - Illumination requirement - Auditory requirement – Energy Efficiency - Lighting and day lighting - Steady and non-steady heat transfer through the glazed window and the wall – Indoor air

quality - Local climatic conditions – temperature, humidity, wind speed and direction.

UNIT – IV:

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

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19OE1CE03) SMART MATERIALS AND STRUCTURES

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

COURSE OBJECTIVES:

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

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

CO-1: Explain the different smart materials and their principles

CO-2: Explain and understand different measuring techniques

CO-3: Identify suitable smart sensors and actuators for a specific engineering application

CO-4: Gain the knowledge on data acquisition and processing and advantages in smart materials and smart structures

UNIT – I:

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

UNIT – II:

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

UNIT – III:

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

UNIT – IV:

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

UNIT-V:

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

UNIT –VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19OE1CE04) INTELLIGENT TRANSPORTATION SYSTEM

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

COURSE OBJECTIVES:

- To understand ITS architecture and standards
- To apply appropriate ITS technology depending upon site specific conditions
- To design and implement ITS components
- To understand concept and application of Automated Highway Systems

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

CO-1: Differentiate different ITS user Services

CO-2: Apply ITS for road user safety

CO-3: Interpret importance of AHS in ITS

CO-4: Extend future research and special project

UNIT – I:

Introduction To ITS: System Architecture, Standards, Database – Tracking Database – Commercial Vehicle Operations – Intelligent Vehicle Initiative - Metropolitan ITS – Rural ITS – ITS for Rail network.

UNIT – II:

ITS Travel Management: Autonomous Route Guidance System – Infrastructure based systems – Telecommunications – Vehicle – Roadside communication – Vehicle Positioning System – Electronic Toll Collection – Electronic Car Parking

UNIT – III:

ITS Designs: Modeling and Simulation Techniques - Peer – to – Peer Program – ITS for Road Network – System Design – Mobile Navigation Assistant – Traffic Information Center – Public Safety Program.

UNIT – IV:

Introduction to Automated Highway Systems: Evolution of AHS and Current Vehicle Trends - Vehicles in Platoons – Aerodynamic Benefits - Integration of Automated Highway Systems – System Configurations - Step by Step to an Automated Highway System.

UNIT – V:

Evaluation and Assessment of AHS: Spacing and Capacity for Different AHS Concepts – Communication Technologies for AHS - The Effects of AHS on the Environment – Regional Mobility - Impact Assessment of Highway Automation.

UNIT – VI:

Implementation of ITS: ITS programs globally- overview of ITS in developed countries and developing countries – ITS at Toll Plazas – Parking lots – Highways.

TEXT BOOKS:

1. Intelligent Transport Systems Handbook: Recommendations for World Road Association (PIARC), Kan Paul Chen, John Miles, 2000
2. Intelligent Transport Systems – Cases and Policies, Roger R. Stough, Edward Elgar, 2001
3. Intermodal Freight Transport, David Lowe, Elsevier Butterworth-Heinemann Publishers, 2005

REFERENCES:

1. Positioning Systems in Intelligent Transportation Systems, Chris Drane and Chris Rizos, Artech House Publishers, London, 2000
2. Perspectives on Intelligent Transport Systems, Joseph M. Sussman, Springer Publishers, 2000
3. Intelligent Transport System, Intelligent Transportation Primer, Washington, US, 2001

WASTE MANAGEMENT

WASTE MANAGEMENT

The courses such as solid waste management (SWM), hazardous waste management (HWM), waste to energy (WTE) and intelligent waste management and recycling system (IWM&RS) are the courses available in the waste management track stream which having a potential syllabus content to meet out the industrial and research needs.

Solid waste management is an interesting track course which actual highlights the day-to-day problems where everybody is facing due to the improper management of industrial, domestic and household waste. Further, the enthusiastic aspects involved in the track courses such as: awareness on its impact over on environment, formal or scientific way of handling and management of waste and disposal scenarios.

In hazardous waste management course, handling and management of nuclear waste at national and international level have been highlighted. Further, the content enlightens about the legal process of state, central and industrial responses toward any emergency situations arise by hazardous waste. Finally, it deals about natural resource damage assessment and restoration.

Waste to energy is a pioneering course available in the track; it is one of the interesting and mindboggling course in the track which highlights the importance of converting the waste materials into wealth. It gives enough space to understand the basic process technologies in a theoretical and industrial way such as: thermal, chemical and biological conversion process. From the above, biological conversion process is in its embryonic state and having potential to expands its technological wings in the near future and having enormous scope of industrial applications where students can be benefited. Finally, conversion devices is an innovative module have been framed to explore the young minds in the line of designing and creating a demand based conversion device products which even lays an entrepreneurial pathway to them.

First of its kind, even at both international and national level a dedicated and extensive course for intelligent waste management and recycling system have been framed with conventional and advanced modules. It is really an interesting course where a student can apply his/her innovative creations to solve the existing and futuristic problems in a smart way with the help of smart tools. Optimistic modules such as: life cycle assessment and carbon-footprint-based IWMS, principles of systems engineering and regulatory frameworks have been incorporated to meet out the international requirements.

In the pathway of exploring the fundamentals and basic knowledges about the course, the six units of all the courses have been formulated keeping in the mind that the students can be able to competitive among the international community at the end of semester. In this context, comprehensive theoretical and industrial processes have been incorporated in each and every module of courses. Further, it is highly believed that the framed syllabus modules having 100% industrial applications which can make the students to feel motivated, satisfied and confidence to compete with the international community.

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

(19OE1CE05) SOLID WASTE MANAGEMENT

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand the concepts of solid waste management
- To remember the characteristics of solid waste and source reduction techniques
- To acquire the knowledge & skills in the collection, storage, transport and engineering principles of solid waste
- To remember and understand the treatment, disposal and recycling and various laws and regulation of solid waste management

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

CO-1: Apply the fundamental concepts of solid waste management

CO-2: Apply the acquired knowledge to resolve the practical problems on source reduction

CO-3: Apply the knowledge on collection, storage, transport and waste processing of solid waste in real time situation

CO-4: Impart the gained knowledge and skills and various laws & regulations on treatment of SW in real time societal problems

UNIT – I:

Sources and Classification: Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management – Elements of integrated waste management and roles of stakeholders - Financing and Public Private Participation for waste management- Integrated solid waste management.

UNIT – II:

Waste Characterization and Source Reduction: Waste generation rates and variation - Composition, physical, chemical and biological properties of solid wastes – Hazardous Characteristics – TCLP tests – waste sampling and characterization plan - Source reduction of wastes –Waste exchange - Extended producer responsibility - Recycling and reuse.

UNIT – III:

Storage, Collection and Transport of Wastes: Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations Optimizing waste allocation– compatibility, storage, labeling and handling of hazardous wastes – hazardous waste manifests and transport.

UNIT – IV:

Waste Processing Technologies: Objectives of waste processing – material separation and processing technologies – biological and chemical conversion technologies – methods and controls of Composting - thermal conversion technologies and energy recovery – incineration – solidification and stabilization of hazardous wastes- treatment of biomedical wastes - Health considerations in the context of operation of facilities.

UNIT – V:

Waste Disposal: Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – Rehabilitation of open dumps-remediation of contaminated sites.

UNIT – VI:

Regulatory Frameworks: Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, nuclear wastes - lead acid batteries, electronic wastes, plastics waste, bio-medical waste, construction and demolition waste and fly ash waste.

TEXT BOOKS:

1. Integrated Solid Waste Management, George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, McGraw Hill International Edition, New York, 1993
2. CPHEEO, Manual on Municipal Solid Waste Management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2014

REFERENCES:

1. Handbook of Solid Waste Management, Frank Kreith, George Tchobanoglous, McGraw Hill, 2002
2. Waste Management Practices, John Pitchtel, CRC Press, Taylor and Francis Group, 2014
3. Municipal Solid Waste Management, Processing, Energy Recovery, Global Examples, P. Jayarama Reddy, BS Publications, CRC Press, Taylor and Francis Group, 2011
4. GoI, Ministry of Environment and Forest and Climate Change, Various Recent Laws and Rules of Solid Waste Management

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

(19OE1CE06) HAZARDOUS WASTE MANAGEMENT

COURSE PRE-REQUISITES: Solid Waste Management

COURSE OBJECTIVES:
- To understand the concepts of hazardous waste management
- To understand the principle of waste characterization, storage, transport and processing
- To understand the principles of nuclear waste and Hazardous Management (HM) and emergency Response
- To understand the principle and process of landfills and natural resource Damage Assessment & Restoration

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the fundamental concepts of hazardous waste management
CO-2: Apply the knowledge to resolve the problems on storage, transport and processing
CO-3: Apply the knowledge to resolve the practical problems on nuclear waste and HM & emergency response
CO-4: Impart the gained knowledge and skills to resolve the practical problems on landfills and natural resource damage assessment & restoration on field

UNIT – I:
Introduction: Need for hazardous waste management – Sources of hazardous wastes – Effects on community – terminology and classification – Storage and collection of hazardous wastes – Problems in developing countries – Protection of public health and the environment.

UNIT – II:
Waste Characterization, Storage, Transport and Processing: Hazardous Waste Characterization and Definable Properties - Analytical– Analytical methods – Hazardous waste inventory- Source reduction of hazardous wastes - Handling and storage of Hazardous wastes –Waste Compatibility Chart – Hazardous Waste Transport- Manifest system – Transboundary movement of wastes – Basal Convention – Hazardous waste treatment technologies – Physical, chemical and thermal treatment of hazardous waste – Solidification – Chemical fixation – Encapsulation – Incineration.

UNIT – III:
Nuclear Waste: Characteristics – Types – Nuclear waste – Uranium mining and processing – Power reactors – Refinery and fuel fabrication wastes – spent fuel – Management of nuclear wastes – Decommissioning of Nuclear power reactors – Health and environmental effects.

UNIT – IV:

Management of Hazardous Wastes: Identifying a hazardous waste – methods – Quantities of hazardous waste generated – Components of a hazardous waste management plan – Hazardous waste minimization – Disposal practices in Indian Industries – Future challenges - Emergency Response - National Response Team and Regional Response Teams; National Contingency Plan and Regional Contingency Plans; National Response Center; State, Local and Industry Response Systems.

UNIT – V:

Secure Landfills: Hazardous waste landfills – Site selections – landfill design and operation – Regulatory aspects – Liner System- Liners: clay, geomembrane, HDPE, geonet, geotextile – Cover system- Leachate Collection and Management – Environmental Monitoring System- Landfill Closure and post closure care - Underground Injection Wells.

UNIT – VI:

Natural Resource Damage Assessment and Restoration: Natural Resource Damage Assessment Laws and Regulations - Central and State government agencies - Damage Assessment and Restoration Procedures - Groundwater Hydrology and Contamination Processes - Groundwater Contamination Detection, Analysis and Monitoring - Overview of CERCLA - Remedial Action Process and RCRA Correction Action Program - Preliminary Assessments and Site Inspections - Hazard Ranking System - National Priorities List - State Priorities List - Remedial Investigations and Feasibility Studies - Records of Decision and the Administrative Process - Remedial Design - Remedial Action - NPL Deletion Process.

TEXT BOOKS:

1. Hazardous Waste Management, Charles A. Wentz., 2nd Edition, McGraw Hill International, 1995
2. Standard Handbook of Hazardous Waste Treatment and Disposal, Harry M. Freeman, McGraw Hill, 1997

REFERENCES:

1. Hazardous Waste (Management and Transboundary Movement) Rules, Ministry of Environment and Forests, Government of India, New Delhi
2. Guidelines and Criteria for Hazardous Waste Landfills and Hazardous Waste Treatment Disposal Facilities, Central Pollution Control Board, New Delhi, 2010
3. Hazardous Waste Management, Anjaneyulu
4. Hazardous Waste Management, M. LaGrega and others, McGraw-Hill Publication

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

(19OE1CE07) WASTE TO ENERGY

COURSE PRE-REQUISITES: Solid Waste Management, Hazardous Waste Management

COURSE OBJECTIVES:
- To understand the concepts of energy from waste
- To understand the principle and process of thermal conversion technology (TCT)
- To understand the principle and process of chemical and biological conversion technology (CCT & BCT)
- To understand the principles and processes of biomass energy technology (BET) and conversion process and devices (P&D) for solid wastes

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the fundamental concepts of energy from waste
CO-2: Apply the acquired knowledge to resolve the practical problems on TCT
CO-3: Apply the knowledge to resolve the practical problems on CCT and BCT
CO-4: Impart the gained knowledge and skills to resolve the practical problems on BET and P&D

UNIT – I:
Introduction to Energy from Waste: Classification of waste as fuel – agro based, forest residue, industrial waste, MSW – conversion devices – incinerators, gasifiers, digesters, Environmental monitoring system for land fill gases, Environmental impacts; Measures to mitigate environmental effects due to incineration.

UNIT – II:
Thermal Conversion Technologies: Fundamentals of thermal processing – combustion system – pyrolysis system – gasification system – environmental control system – energy recovery system – incineration.

UNIT – III:
Chemical Conversion Technologies: Acid & Alkaline hydrolysis – hydrogenation; solvent extraction of hydrocarbons; solvolysis of wood; biocrude; biodiesel production via chemical process; catalytic distillation; transesterification methods; Fischer-Tropsch diesel: chemicals from biomass - various chemical conversion processes for oil, gas, cellulose acetate.

UNIT – IV:
Biological Conversion Technologies: Nutritional requirement for microbial growth – types of microbial metabolism – types of microorganisms – environmental requirements – aerobic biological transformation – anaerobic biological transformation – aerobic composting – low solid anaerobic digestion – high solid

anaerobic digestion – development of anaerobic digestion processes and technologies for treatment of the organic fraction of MSW – Biodegradation and biodegradability of substrate; biochemistry and process parameters of biomethanation - other biological transformation processes.

UNIT – V:

Biomass Energy Technologies: Biomass energy resources – types and potential; Energy crops - Biomass characterization (proximate and ultimate analysis); Biomass pyrolysis and gasification; Biofuels – biodiesel, bioethanol, Biobutanol; Algae and biofuels; Pellets and bricks of biomass; Biomass as boiler fuel; Social, economic and ecological implications of biomass energy.

UNIT – VI:

Conversion Devices: Combustors (Spreader Stokes, Moving grate type, fluidized bed), gasifier, digesters. Briqueting technology: Production of RDF and briquetted fuel. Properties of fuels derived from waste to energy technology: Producer gas, Biogas, Ethanol and Briquettes – conversion process with basic device formulation for agricultural residues and wastes including animal wastes; industrial wastes; municipal solid wastes; E-waste; Bio-medical waste; C&D waste; plastic waste and batteries waste.

TEXT BOOKS:

1. Integrated Solid Waste Management, George Tchobanoglous, Hilary Theisen and Samuel A., Vigil, Mc-Graw Hill International Edition, New York, 1993
2. Energy from Waste - An Evaluation of Conversion Technologies, C. Parker and T. Roberts (Ed.), Elsevier Applied Science, London, 1985

REFERENCES:

1. Introduction to Biomass Energy Conversion, Capareda S., CRC Press, 2013
2. Thermo-chemical Processing of Biomass: Conversion into Fuels, Chemicals and Power, Brown R. C. and Stevens C., Wiley and Sons, 2011
3. Biomass Conversion Processes for Energy and Fuels, Sofer, Samir S. (Ed.), Zaborsky, R. (Ed.), New York, Plenum Press, 1981
4. Energy Recovery from Municipal Solid Waste Thermal Conversion Technologies, P. Jayarama Reddy, CRC Press, Taylor & Francis Group, London, UK, 2016

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

(19OE1CE08) INTELLIGENT WASTE MANAGEMENT SYSTEM AND RECYCLING SYSTEM

COURSE PRE-REQUISITES: Solid Waste Management, Hazardous Waste Management, Waste to Energy

COURSE OBJECTIVES:

- To understand the concepts of Solid waste
- To understand the principle and process of IWMS Tools
- To understand the applications of IoT, ML, DL, BC and LCA & Carbon Foot Print (CFP) based SWM
- To understand the principles of Process Systems Engineering (PSE) and various laws and regulation of SWM

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

CO-1: Apply the fundamental concepts of Solid waste

CO-2: Apply the knowledge to resolve the practical problems with the help of IWMS Tools

CO-3: Apply the knowledge of IoT, ML, DL, BC and LCA & CFP to resolve the practical problems in SWM

CO-4: Impart the PSE knowledge and various laws and regulation to resolve the practical problems in SWM

UNIT – I:

Introduction to Solid Waste: Sources, Generation, Classification and Types of Solid Waste – Biomedical Waste – E-Waste – Construction and Demolition Waste – Plastic Waste – Batteries Waste – Hazardous Waste - Waste Management Through Waste Hierarchy: Reduce, Reuse, Recycle, Recover, and Disposal - Waste Operational Units: Equipment and Facilities: Collection and Transportation - Mechanical Treatment - Biological Treatment - Thermal Treatment – Disposal.

UNIT – II:

Introduction to IWMS Tools: Introduction – Need of the IWMS – functional elements of IWMS – Ultrasonic Sensor, Arduino Board, GSM Module, Bread Board, Power Supply (Battery) – Jump Wires - Navigation system – Cloud Services - Zero Waste Principle.

UNIT – III:

Applications in Intelligent Waste Management System: Introductory Applications of IoT, Machine Learning, Deep Learning and Block Chain Technology in Waste Characterization and Source Reduction, Storage, Collection and Transport of Wastes, Waste Processing Technologies and Waste Disposal.

UNIT – IV:

Life Cycle Assessment and Carbon-Footprint-Based IWMS: Phases of Life Cycle Assessment: Goal and Scope Definition - Life Cycle Inventory - Life Cycle Impact Assessment – Interpretation - LCA Waste Management Software - Umberto Software - SimaPro Software - LCA Assessment Methodology: Life Cycle Inventory Analysis - Life Cycle Impact Assessment – Interpretation - Sensitivity Analysis - Carbon-Footprint-Based SWM - The Global-Warming Potential Impact - GHG Accounting - GWP Assessment for Solid Waste Management.

UNIT – V:

Principles of Systems Engineering: Systems Engineering Principles and Tools for SWM - Planning Regional Material Recovery Facilities - Optimal Planning for Solid Waste Collection, Recycling, and Vehicle Routing - Multiattribute Decision Making with Sustainability Considerations - Decision Analysis for Optimal Balance between Solid Waste Incineration and Recycling Programs - Environmental Informatics for Integrated Solid Waste Management - Future Perspectives.

UNIT – VI:

Regulatory Frameworks: Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, nuclear wastes - lead acid batteries, electronic wastes, plastics waste, bio-medical waste, construction and demolition waste and fly ash waste.

TEXT BOOKS:

1. Sustainable Solid Waste Management - A Systems Engineering Approach, Ni-Bin Chang and Ana Pires, IEEE & John Wiley & Sons, Inc., Hoboken, New Jersey, 2015
2. Integrated Solid Waste Management, George Tchobanoglous, Hilary Theisen and Samuel A., Vigil, McGraw Hill International Edition, New York, 1993

REFERENCES:

1. Manual on Municipal Solid Waste Management, CPHEEO, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2014
2. Smart Waste Management-Nutshell, Vishal Gupta, Amazon.com Services LLC, September 11, 2017
3. Recyclable Household Waste Management System for Smart Home in IOT, Manpreet Kaur & Dr. Kamaljit Singh Saini, Independently Published, June 12, 2018
4. GoI, Ministry of Environment and Forest and Climate Change, Various Recent Laws and Rules of Solid Waste Management

GREEN ENERGY

1. RENEWABLE ENERGY SOURCES

What we are studying?

The climate landscape is changing rapidly, and new technologies and solutions keep arising to respond to global and local challenges.

Renewable energy sources course makes you discover how Solar Thermal Energy conversion system works. It makes you understand how a Solar Photo voltaic generation system generates electricity. Scope of the course also includes wind energy generation. It also navigates you through Biomass and geo thermal energy generation systems.

Job opportunities:

When it comes to the hottest and most buzzing careers in the 21st century, the majority of people think of hardcore technical domains such as data science, machine learning & artificial intelligence. Few people might also come up with biotechnology (or biosciences). But, quite often people forget about one of the dark horses – the Renewable Energy sector. Even Bill Gates lobbied for the Energy sector as one of the top three career choices for making an impactful career.

Reference:

https://www.stoodnt.com/blog/careers-in-renewable-energy-job-opportunities-fields-of-study-and-top-universities/

2. RENEWABLE ENERGY TECHNOLOGIES

Within Crisis, there are seeds of opportunity..! We are at the wedge of fossil fuel end. After few years you can witness fuel crisis all over the world, as an engineer one must aware of the solution. To design sustainable systems those last for decades, one must use renewable energy as main or auxiliary source of energy. The application may be electrical or mechanical or chemical, one must convert energy from renewable source into electricity for ease of use.

Renewable Energy Technologies course will introduce you to Different types of Solar PV systems and their characteristics. Students will know the functionality of Power Converters such as Inverters etc., through block diagram approach. Fuel cell technology, which is one of the solutions for energy crisis will be discussed in detail. Course will conclude by discussing impact of PV panel production on environment and disposal of it.

Job Opportunities:

Green jobs in the renewable energy sector are expected to touch new figures with 6 digit monthly income. Following link may describe the interesting interdisciplinary careers for budding engineers.

Reference:

https://www.businessinsider.in/slideshows/miscellaneous/21-high-paying-careers-for-people-who-want-to-save-the-planet-and-also-have-job-security/slidelist/70677782.cms#slideid=70677804

3. ENERGY STORAGE TECHNOLOGIES

Battery technology is an essential skill for every engineer in present scenario. Course on energy storage technologies will enable student to, Design storage system Residential loads integrated to Renewable and storage systems for Electric Vehicles. It will make student to understand various electrochemical storages such as Lead acid, Li Ion cell etc. and their characteristics. The course enables student to compare non-electric, electric storage systems and analyze application of them to various domains.

Job opportunities:

Upon successful completion of course student will enhance the chances of getting into EV industry , which almost open fact. Job Profiles include

i. Battery algorithms engineer
ii. Battery management engineer
iii. Battery modeling expert
iv. Design engineer – EV

4. ENERGY MANAGEMENT AND CONSERVATION

Energy Management And Conservation course is mainly intended to monitor Energy consumption of industries and to manage energy systems. This course also deals with methods of improving efficiency of electric machinery and to design a good illumination system. It also teaches student calculate pay back periods for energy saving equipment.

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

(19OE1EE01) RENEWABLE ENERGY SOURCES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the role of solar power
- To know components of PV system conversion
- To learn Operation of windmills
- To understand the principle operation of biomass and geo thermal energy systems

COURSE OUT COMES: After completion of the course, the student should be able to
CO-1: Understand Solar Thermal Energy conversion systems
CO-2: Understand Solar Photo voltaic systems
CO-3: Analyze wind energy conversion system
CO-4: Understand the principle operation of Biomass and geo thermal energy systems

UNIT – I:
Principles of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, The apparent motion of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sunshine, solar radiation data.

UNIT – II:
Solar Thermal Energy Conversion:
Solar Heating: Some basic calculations, The performance of solar heating devices, Evaluation of sunlight received by a collector, Flat solar panels - Different technologies of thermal solar collectors-Evaluation of the performance of solar collectors- Selective coatings for collectors and glazing, Solar heating systems - Individual and collective solar water heaters- Combined solar systems for the heating of buildings
Power Stations: Concentric Solar Power Plants- Concentrating systems- Components for production of heat and conversion into electricity

UNIT – III:
Solar PV Conversion: The PV Cell-Crystalline Solar cells-Thin film solar cell, Module, Array, Equivalent Electrical circuit, Open circuit voltage and Short circuit current, I-V, P-V Corves, Array design- Sun angle- effect of Temperature-Sun tracking, PV system components

UNIT – IV:
Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria, Maximum power Tracking of wind mills, and peak power operation Site selection of Wind mills, working Induction generator (Principle only)

UNIT – V:

Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.

UNIT – VI:

Geothermal & Ocean Energy: Resources, types of wells, methods of harnessing the energy (brief discussion) potential in India. OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

TEXT BOOKS:

1. Non-Conventional Energy Sources, G. D. Rai, Khanna Publishers
2. Renewable Energies, John Claude Sabbonedere, ISTE & John Wiley Publishers, 2007
3. Renewable Energy Resources, Twidell & Wier, CRC Press (Taylor & Francis), 2016

REFERENCE:

1. Wind & Solar Power Systems, Mukund R. Patel, CRC Press, 2003

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1EE02) RENEWABLE ENERGY TECHNOLOGIES

COURSE PRE-REQUISITES: Renewable Energy Sources

COURSE OBJECTIVES:

- To provide necessary knowledge about the modeling, design and analysis of various PV systems
- To show that PV is an economically viable, environmentally sustainable alternative to the world's energy supplies
- To understand the power conditioning of PV and WEC system's power output

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Model, analyze and design various photovoltaic systems
CO-2: Know the feasibility of PV systems as an alternative to the fossil fuels
CO-3: Design efficient stand alone and grid connected PV and WEC power systems

UNIT – I:
Behavior of Solar Cells-Basic Structure and Characteristics: Types - equivalent circuit-modeling of solar cells including the effects of temperature, irradiation and series/shunt resistances on the open-circuit voltage and short-circuit current-Solar cell arrays- PV modules-PV generators- shadow effects and bypass diodes- hot spot problem in a PV module and safe operating area.

UNIT – II:
Types of PV Systems: Grid connected PV systems- Net-metering- Estimation of actual AC output power from PV systems
Stand-alone system- Approach to designing an off-grid PV system with battery- with battery and diesel generator- Stand-alone solar water pumping system-Sizing/designing PV water pumping system- Problems

UNIT – III:
Power Converters for PV and Wind: Basic switching devices, AC-DC Rectifier, DC-AC inverter (Basic operation), DC-DC converter - Buck, Boost converters Basic operation, Battery charger (Basic operation), grid interface requirements in Renewable energy integration

UNIT – IV:
Maximum Power Point Tracking: Various Sources of Losses is PV system, Charge Control in Battery Backed PV Systems, Maximum Power Point Tracking (MPPT)- Role of DC-DC converter in MPP tracking- Perturb and Observe Method-pseudo program for P&O method, Advanced Issues & Algorithms- search steps-variable step size algorithm.

UNIT – V:
Fuel Cell Technology: History of Fuel cells, Fuel Cell Vehicle Emissions, Hydrogen safety factors, Principle of Operation- Fuel cell Model- cell voltage, Power and

efficiency of fuel cell, Various types of fuel cells, Various storage systems for Hydrogen, Applications

UNIT – VI:
Solar Thermal Electricity Generation: Sterling Engine, Solar Pond, Solar Chimney
Solar PV System Environment Impact: Potential Hazards in production of PV cell, Energy payback and CO2 emission of PV systems, Procedure for decommissioning of PV plant, Future Trends of Wind Energy system

TEXT BOOKS:

1. Handbook of Renewable Energy Technology, Ahmed F. Zobaa, World Scientific Publishing Company, 2011
2. Wind and Solar Power Systems Design, Analysis, and Operation, Patel M. R., 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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1EE03) ENERGY STORAGE TECHNOLOGIES

COURSE PRE-REQUISITES: Renewable Energy Sources, Renewable Energy Technologies

COURSE OBJECTIVES:

- To understand Techno economic analysis of various storage systems
- To know Feasibility of different storage technologies
- To learn operation of several electrochemical storage systems
- To understand Functionality of non-electric storage systems

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

CO-1: Design storage system Residential loads integrated to Renewable and storage systems for Electric Vehicles

CO-2: Understand various electrochemical storage system

CO-3: Understand terminology and characteristics of Electro chemical systems

CO-4: Compare non-electric and electric storage system

CO-5: Analyze application of storage systems to various domains

UNIT – I:

Techno-economic Analysis of Various Energy Storage Technologies: Electrical Energy Storage (EES)-Definition-Role, Energy storage components, Applications and Technical support, Financial Benefits of EES, Techno economic analysis, Classification of Energy Storage systems, Comparison

UNIT – II:

Estimation of Energy Storage and Feasibility Analysis: Background-Solar Power-Wind Power (Brief discussion), Estimation-daily residential load-daily available solar energy-daily available wind energy-Importance, Estimation of Storage sizing- Steps for Storage sizing- Grid connected residential PV-grid connected residential Wind-hybrid system, Feasibility analysis of Storage systems- Various Terms involved- Case study of comparison between Off grid and grid connected systems

UNIT – III:

Electro Chemical Storage: Standard Batteries- Lead Acid- VRLA - Ni-cd, Modern Batteries- Ni MH- Li Ion, Flow Batteries – Br2 Zn-Vanadium Redox, Battery composition, construction, Principle of operation, Types, Advantages and disadvantages to above batteries.

UNIT – IV:

Terminology & Characteristics: Battery Terminology, Capacities, Definitions of various characteristics, Different States of charge-DOD-SOC-SOE-SOH-SOF, Resistance, Battery Design, Battery Charging, Charge Regulators, Battery Management, General Equivalent Electrical Circuit, Performance Characteristics

UNIT – V:

Non-Electric Storage Technologies: Flywheel, Energy Relations, Flywheel System Components, Benefits of Flywheel over Battery, Superconducting Magnet Energy Storage, Compressed Air Energy storage, Overview Thermal Energy Storage. Capacitor bank storage, Comparison of storage Technologies

UNIT –VI:

Applications: Domains of applications of Energy storage- Starter-Traction-stationary-mobile or nomadic, Review of storage requirements, Storage for Electric Vehicle application, Storage for hybrid vehicle-Regenerative Braking-Super capacitor-hybrid capacitor

TEXT BOOKS:

1. Energy Storage Technologies and Applications, Ahmed Faheem Zobaa, InTech Publishers, 2013
2. Lithium Batteries and Other Electrochemical Storage Systems, Christian Glaize, Sylvie Geniès, ISTE & John Wiley, 2013
3. Wind and Solar Power Systems, Mukund R. Patel, 2nd Edition, CRC Press, 2006

REFERENCES:

1. Rechargeable Batteries Applications Handbook, EDN Series for Design Engineers, Elsevier

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

(19OE1EE04) ENERGY MANAGEMENT AND CONSERVATION

COURSE PRE-REQUISITES: Renewable Energy sources, Renewable Energy Technologies, Energy Storage Technologies

COURSE OBJECTIVES:
- To understand the necessity of conservation of Energy
- To Know the methods of Energy management
- To identity the factors to increase the efficiency of electrical equipment
- To know the benefits of carrying out energy Audits

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: To conduct Energy Audit of industries
CO-2: To manage energy Systems
CO-3: To specify the methods of improving efficiency of electric motor
CO-4: To improve power factor and to design a good illumination system
CO-5: To calculate pay back periods for energy saving equipment

UNIT – I:
Basic Principles of Energy Audit: Energy audit- definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit

UNIT – II:
Energy Management: Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting- Energy manager, Qualities and functions, language, Questionnaire - check list for top management

UNIT – III:
Energy Efficient Motors: Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed, variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit

UNIT – IV:
Power Factor Improvement, Lighting and Energy Instruments: Power factor – methods of improvement, location of capacitors, p.f with non-linear loads, effect of harmonics on p.f., p.f motor controllers – simple problems
Lighting Energy Audit and Energy Instruments: Good lighting system design and practice, lighting control, lighting energy audit - Energy Instruments- watt meter, data loggers, thermocouples, pyrometers, flux meters, tongue testers, application of PLC's

UNIT – V:

Economic Aspects and Analysis: Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis.

UNIT – VI:

Analysis of Energy Efficient Motor: Energy efficient motors- calculation of simple payback method, net present worth method- Power factor correction, lighting - Applications of life cycle costing analysis, return on investment.

TEXT BOOKS:

1. Energy Management, W. R. Murphy & G. Mckay, Butterworth-Heinemann Publications
2. Energy Management, Paul o' Callaghan, 1st Edition, McGraw Hill Book Company, 1998

REFERENCES:

1. Energy Efficient Electric Motors, John C. Andreas, 2nd Edition, Marcel Dekker Inc. Ltd., 1995
2. Energy Management Handbook, W. C. Turner, John Wiley and Sons
3. Energy Management and Good Lighting Practice: Fuel Efficiency Booklet12-EEO

3D PRINTING AND DESIGN

3D PRINTING AND DESIGN

3D Printing is a process for making a physical object from a three-dimensional digital model by laying down many successive thin layers of a material. It brings a digital CAD model into its physical form by adding layer by layer of materials. Thus called 'Additive Manufacturing'. It is the opposite of subtractive manufacturing i.e., removing material from an object using a mechanical machine. It enables to produce complex shapes using less material than traditional manufacturing methods. There are several different techniques to 3D print an object. It saves time through prototyping and is also responsible for manufacturing impossible shapes. Due to these, it has many applications in different fields like consumer products (eyewear, footwear, design, furniture, industrial products (manufacturing tools, prototypes, functional end-use parts, dental products, prosthetics, architectural scale models, reconstructing fossils, replicating ancient artefacts, reconstructing evidence in forensic pathology etc.

3D printing has good prospects from career perspective. Various positions that could be available are CAD designers, engineers, technical developers, software developers, electronics engineers, etc.

This OE track consists of 04 courses and is designed with an objective to provide an overview of all the constituents of 3D Printing starting from elements of CAD that are needed to create CAD models, followed by basics of 3D Printing required for setting the parameters, then the machines and tools used in 3D Printing for thorough understanding of systems and processes and finally the reverse engineering of 3D printing models from actual objects.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1ME01) ELEMENTS OF CAD

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand the basics of CAD and devices used
- To know the various types of modeling used in CAD
- To appreciate the concept of feature-based modeling and geometric transformations
- To comprehend the assembly modeling procedure and data exchange formats

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

CO-1: Know the fundamentals of CAD and devices used

CO-2: Identify the types of CAD modeling techniques and utilize them

CO-3: Evaluate the objects or models using geometric transformations and manipulations

CO-4: Perform the assembly modeling and asses the various data exchange formats

UNIT – I:

Fundamentals of CAD: Introduction to Computer Aided Design (CAD), Design process, Application of computers for Design and Manufacturing, Benefits of CAD, Brief overview of computer peripherals for CAD.

UNIT – II:

Geometric Modeling: Introduction to Geometric Model, Types of modeling, Curve representation

Wireframe Modeling: Introduction, advantages, limitations and applications, Wire frame entities-analytic and synthetic, Basic definitions of Cubic, Bezier and B-spline curves

UNIT – III:

Surface Modeling: Introduction, advantages, limitations and applications, surface entities, Basic definitions of analytic surfaces - planar surface, ruled surface, tabulated cylinder, surface of revolution; Basic definitions of synthetic surfaces - Bezier surface, B-spline surface

UNIT – IV:

Solid Modeling: Introduction, advantages, limitations and applications, Solid Entities, Solid Representation schemes – Boundary Representation (B-Rep) scheme, Constructive Solid Geometry (CSG) scheme.

Feature-based Modeling: Introduction, Feature entities, Feature representation, 3D Sketching, Parameter, Relations and Constraints

UNIT – V:

Geometric Transformations: Introduction to 2D & 3D transformations, Brief treatment on Translation, Scaling, Reflection and Rotation using Homogeneous and concatenated transformations

Manipulations: Displaying, Segmentation, Trimming, Intersection, Projection

UNIT – VI:

Assembly Modeling: Introduction, Assembly modeling, Assembly Tree, Mating Conditions, Bottom-up and Top-down approach

Product Data Exchange: Introduction, Graphics Standards, Types of translators, Importance of formats in 3D Printing, Data exchange formats - IGES, STEP and STL

TEXT BOOKS:

1. CAD/CAM Theory and Practice, Ibrahim Zeid, Tata McGraw Hill
2. Mastering CAD/CAM, Ibrahim Zeid, Tata McGraw Hill
3. CAD/CAM-Computer Aided Design and Manufacturing, Mikell P. Groover, E. W. Zimmers, Pearson Education/Prentice Hall

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1ME02) INTRODUCTION TO 3D PRINTING

COURSE PRE-REQUISITES: Elements of CAD

COURSE OBJECTIVES:

- To understand the need of 3D Printing
- To understand about the process chain involved in 3D Printing
- To know about the two-dimensional layer by layer techniques, solid based systems & 3D Printing data exchange formats
- To know the post processing methods involved in 3D Printing

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

CO-1: Summarize the importance of 3D Printing

CO-2: Explain the process chain involved in 3D Printing

CO-3: Explain about two-dimensional layer-by-layer techniques, solid based systems and 3D printing data exchange formats

CO-4: Apply the knowledge gained in the post-processing methods

UNIT – I:

Introduction to 3D Printing: Introduction to 3D Printing, 3D Printing evolution, Classification of 3D Printing, Distinction between 3D Printing & CNC Machining, Advantages of 3D Printing

UNIT – II:

Generalized 3D Printing Process Chain: Process chain, Materials for 3D Printing, Design for 3D Printing and Overview of Medical Modeling & Reverse Engineering.

UNIT – III:

Two-Dimensional Layer-By-Layer Techniques: Stereolithography (SL), Selective Laser Sintering (SLS), Selective Powder Building (SPB), Advantages and Applications.

UNIT – IV:

Solid Based Systems: Introduction, basic principles, Fused Deposition Modeling, Multi-Jet Modeling, Laminated Object Manufacturing (LOM), Advantages and Applications.

UNIT – V:

3D Printing Data Exchange Formats: STL Format, STL File Problems, Brief Overview of other translations like IGES File, HP/GL File and CT data only.

UNIT – VI:

Post-Processing: Introduction, Support Material Removal, Surface Texture Improvements, Accuracy Improvements, Aesthetic Improvements.

TEXT BOOKS:

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W Rosen, Brent Stucker, Springer, 2010
2. Rapid Prototyping: Principles & Applications, Chuaa Chee Kai, Leong Kah Fai, World Scientific, 2010

REFERENCES:

1. Rapid Prototyping: Theory and Practice, Ali K. Karmani, Emand Abouel Nasr, Springer, 2006
2. Understanding Additive Manufacture: Rapid Prototyping, Rapid Tooling and Rapid Manufacture, Andreas Gebhardt, Hanser Publishers, 2013
3. Rapid Manufacturing: Advanced Research in Virtual and Rapid Prototyping, Hopkinson, N. Haque, and Dickens, Taylor and Francis, 2007

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1ME03) 3D PRINTING-MACHINES, TOOLING AND SYSTEMS

COURSE PRE-REQUISITES: Elements of CAD, Introduction to 3D Printing

COURSE OBJECTIVES:
- To understand the need of prototyping
- To understand about the liquid and solid based 3D printing systems
- To know about the liquid-based 3D printing systems & rapid tooling
- To know the applications of 3D Printing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize the importance of 3D Printing
CO-2: Explain the process involved in liquid and solid based 3D printing systems
CO-3: Explain about the liquid-based 3D printing systems and rapid tooling
CO-4: Adapt the knowledge gained in applications of 3D Printing

UNIT – I:
Introduction: Prototype Fundamentals, Types of Prototypes, Roles of Prototypes, Phases of Development Leading to Rapid Prototyping, Fundamentals of Rapid Prototyping.

UNIT – II:
Liquid Based 3D Printing Systems: Introduction, Principles, Processes and Applications of Solid Ground Curing, Material Jetting & Binder Jetting

UNIT – III:
Solid Based 3D Printing Systems: Introduction, Principles, Processes and Applications of Fused Deposition Modelling (FDM), Paper Lamination Technology (PLT) and Laminated Object Manufacturing (LOM)

UNIT – IV:
Laser Based 3D Printing Systems: Selective Laser Sintering (SLS)-Principle, Process and Applications, Three-Dimensional Printing- Principle, Process and Applications, Laser Engineered Net Shaping (LENS)- Principle, Process and Applications

UNIT – V:
Rapid Tooling: Introduction and need for Rapid Tooling, Overview of Indirect and Direct Processes, Applications

UNIT – VI:
3D Printing Applications: Brief overview of Applications in Design, Engineering, Aerospace Industry, Automotive Industry and Biomedical Industry

TEXT BOOKS:

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W Rosen, Brent Stucker, Springer, 2010

2. Rapid Prototyping: Principles & Applications, Chuaa Chee Kai, Leong Kah Fai, World Scientific, 2010

REFERENCES:

1. Rapid Prototyping: Theory and Practice, Ali K. Karmani, Emand Abouel Nasr, Springer, 2006
2. Understanding Additive Manufacture: Rapid Prototyping, Rapid Tooling and Rapid Manufacture, Andreas Gebhardt, Hanser Publishers, 2013
3. Rapid Manufacturing: Advanced Research in Virtual and Rapid Prototyping, Hopkinson, N. Haque, and Dickens, Taylor and Francis, 2007

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1ME04) REVERSE ENGINEERING

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

COURSE OBJECTIVES:
- To understand Reverse Engineering (RE) and its methodologies
- To comprehend Data Acquisition Techniques for Reverse Engineering
- To understand Integration Between Reverse Engineering and Additive manufacturing
- To know the applications of reverse engineering

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Basic understanding of Reverse Engineering and its methodologies
CO-2: Understanding the data acquisition techniques for reverse engineering
CO-3: Understanding of amalgamation Between Reverse Engineering and Additive manufacturing
CO-4: Adapt the knowledge gained in reverse engineering for various applications

UNIT – I:
Introduction to Reverse Engineering: Need, Definition, The Generic Process, History of Reverse Engineering, Overview of Applications

UNIT – II:
Methodologies and Techniques: Potential for Automation with 3-D Laser Scanners, Computer-aided (Forward) Engineering, Computer-aided Reverse Engineering, Computer Vision and Reverse Engineering

UNIT – III:
Data Acquisition Techniques: Contact Methods: Coordinate Measurement Machine and Robotic Arms

UNIT – IV:
Data Acquisition Techniques: Noncontact Methods: Triangulation, Structured Light and Destructive Method

UNIT – V:
Integration Between Reverse Engineering and Additive manufacturing: Modeling Cloud Data, Integration of RE and AM for Layer-based Model Generation, Adaptive Slicing Approach for Cloud Data Modeling.

UNIT – VI:
Applications:
Automotive: Workflow for Automotive Body Design, Reverse Engineering for Better Quality
Aerospace: RE in Aerospace–A Work in Progress, Reducing Costs of Hard Tooling
Medical: Orthodontics, Hearing Instruments, Knee Replacement

TEXT BOOKS:

1. Reverse Engineering: An Industrial Perspective, V. Raja and K. Fernandes, Springer- Verlag
2. Reverse Engineering, K. A. Ingle, McGraw-Hill
3. Reverse Engineering, L. Wills and P. Newcomb, 1st Edition, Springer-Verlag

REFERENCES

1. Smart Product Engineering, Michael Abramovici, Rainer stark, Springer Berlin Heidelberg
2. Product Design: Techniques in Reverse Engineering and New Product Development, K. Otto and K. Wood, Prentice Hall, 2001

INTERNET OF THINGS

INTERNET OF THINGS

Internet of Things: The IoT creates opportunities for more direct integration of the physical world into computer-based systems, resulting in efficiency improvements, economic benefits, and reduced human exertions. *IoT* **is changing how we live, work, travel, and do business. It is even the basis of a new industrial transformation, known as** Industry 4.0**, and key in the** digital transformation **of organizations, cities, and society overall.** The IoT track helps students to learn about how to

- Learn different protocols and connectivity technologies used in IOT.
- Expose the various sensors and transducers for measuring mechanical quantities.
- Develop simple applications using 8051 microcontrollers.
- Understand the key routing protocols for sensor networks and their design issues.

Some of the more common career paths in the Internet of Things path are

- IoT Developer. ...
- IoT Architect…
- IoT Embedded Systems Designer…
- IoT Solutions Engineer…
- Professional in Sensors and Actuators…
- Embedded Programs Engineer…
- Safety Engineer…

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

(19OE1EC01) SENSORS TRANSDUCERS AND ACTUATORS

COURSE PRE-REQUISITES: Engineering Physics, Electronic Measuring Instruments

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Classify and characterize various sensors and transducers
CO-2: Be familiar with the principle and working of various sensors and transducers
CO-3: Be familiar with the principle and working of various actuators
CO-4: Select proper Transducer / Sensor for a specific measurement application
CO-5: Select proper Actuator for a specific measurement application

UNIT – I:
Primary Sensing Elements and Transducers: Mechanical devices as primary detectors, mechanical spring devices, pressure sensitive primary devices, flow rate sensing elements, Transducers-electrical Transducers, classification of Transducers, characteristics and choice of Transducers, factors influencing the choice of Transducers.

UNIT – II:
Electric Transducers: Resistive transducers, Potentiometers, Strain gauges, Types of Strain gauges, Resistance thermometers, Thermistors, Thermocouples, variable Inductance Transducers, Linear Variable Differential Transformer, Synchros, Resolvers, Capacitive Transducers, Piezo electric Transducers.

UNIT – III:
Magnetic and Optical Transducers: Hall Effect Transducers, Magneto resistors, Magneto-Elastic and Magneto-Strictive Transducers, Opto electronic Transducers, Digital Encoding Transducers, Photo Optic Transducers.

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

UNIT – V:

Mechanical and Electrical Actuators: Mechanical Actuation Systems-Types of motion, Kinematic chains, Cams, Gears, Ratchet and pawl, Belt and chain drives, Bearings, Mechanical aspects of motor selection, Electrical Actuation Systems, Electrical systems, Mechanical switches, Solid-state switches, Solenoids, D.C. Motors, A.C. Motors, Stepper motors.

UNIT – VI:

Pneumatic and Hydraulic Actuators: Pneumatic and Hydraulic Actuation Systems-Actuation systems, Pneumatic and hydraulic systems, Directional Control valves, Pressure control valves, Cylinders, Servo and proportional control valves, Process control valves, Rotary actuators.

TEXT BOOKS:

1. A Course in Electrical and Electronic Measurements and Instrumentation, A. K. Sawhney, Puneet Sawhney, 19^{th} Edition, 2011
2. Sensors and Transducers, D. Patranabis, 2^{nd} Edition, PHI Learning Private Limited, 2013
3. Mechatronics, W. Bolton, 7^{th} Edition, Pearson Education Limited, 2018

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1EC02) INTRODUCTION TO MICROCONTROLLER AND INTERFACING

COURSE PRE-REQUISITES: Sensors Transducers and Actuators

COURSE OBJECTIVES:
- To differentiate various number systems
- To understanding programming concepts
- To develop simple applications using 8051 microcontrollers

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand basic computing concepts
CO-2: Know architecture of 8051 microcontrollers
CO-3: Program internal resources of 8051 microcontroller
CO-4: Interface peripherals to 8051 microcontroller

UNIT – I:
Introduction to Computing: Numbering and Coding Systems: Binary, Decimal, Hexadecimal and conversions, Binary and Hexadecimal Arithmetic, Complements, Alphanumeric codes. Digital Premier, Inside the Computer

UNIT – II:
Embedded System Design: Embedded system - Definition, Characteristics of embedded computing applications, Design challenges, Requirements, Specification, Architecture design, Designing hardware and software components, system integration, Design example: Model train controller.

UNIT – III:
8051 Microcontroller: Microcontrollers and Embedded Processors, Architecture and Programming Model of 8051, Special Function Register formats, Memory Organization, Timers and Counters- Operating modes, Serial port, Interrupts

UNIT – IV:
8051 Programming in C: Data types, software delay generation, Logical operations, Accessing code and data space in 8051, I/O port programming, Timer/counter programming.

UNIT – V:
8051 Programming: Serial IO modes and their programming in C, interrupts programming in C: serial, timer and external interrupts.

UNIT – VI:
Introduction to Arduino: Features of Arduino, Arduino components and IDE, Interfacing: Seven Segment Display, Pulse Width Modulation, Analog Digital Converter, Wireless connectivity to Arduino. Case study: From BT To WiFi: Creating WiFi Controlled Arduino Robot Car.

TEXT BOOKS:

1. The 8051 Microcontroller: Programming, Architecture, Ayala & Gadre, 3rd Edition, Cengage Publications, 2008
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, 2nd Edition, 2005

REFERENCES:

1. Digital Design, Morris Mano, PHI, 3rd Edition, 2006
2. Embedded Systems: Architecture, Programming and Design, 2nd Edition, TMH

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1EC03) FUNDAMENTALS OF INTERNET OF THINGS

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

COURSE OBJECTIVES:
- To understand the basics of Internet of Things
- To learn about IOT and M2M
- To understand Cloud of Things
- To learn different applications with IoT

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the concepts of Internet of Things
CO-2: Understand the IOT, M2M
CO-3: Understand the concepts Cloud of Things
CO-4: Apply IOT to different applications in the real world

UNIT – I:
Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT-IoT Functional Blocks, IoT Communication Models, IoT Communication API's

UNIT – II:
IoT-enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Deployment Templates

UNIT – III:
IoT Platforms Design Methodology: Introduction, IoT Design Methodology- Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specification, IoT Level Specifications, Functional view Specification, Operational View Specification, Device & component Integration, Application Development

UNIT – IV:
IoT and M2M: Introduction, M2M, Difference between IoT and M2M – Communication Protocols, Machines in M2M Vs things in IoT, Hardware Vs Software emphasis, Data collection and analysis, applications, SDN and NFV for IoT

UNIT – V:
Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

UNIT – VI:
Domain Specific Applications of IoT: Applications of IoT– Home, Health, Environment, Energy, Agriculture, Industry and Smart City.

TEXT BOOKS:

1. Internet of Things: A Hands-On Approach, Vijay Madisetti, Arshdeep Bahga, Universities Press, 2015
2. The Internet of Things – Key Applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi, Wiley, 2012
3. The Internet of Things in the Cloud: A Middleware Perspective, Honbo Zhou, CRC Press, 2012

REFERENCES:

1. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers, 2013
2. Building the Internet of Things, Sara Cordoba, Wimer Hazenberg, Menno Huisman, BIS Publishers, 2011
3. Designing the Internet of Things, Adrian Mcewen, Hakin Cassimally, John Wiley and Sons, 2015

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

(19OE1EC08) WIRELESS SENSOR NETWORKS

COURSE PRE-REQUISITES: Sensors Transducers and Actuators, Introduction to Microcontrollers and Interfacing, IoT Protocols and its Applications

COURSE OBJECTIVES:

- To expose basic concepts of wireless sensor network technology
- To study medium access control protocols and various issues in a physical layer
- To understand the key routing protocols for sensor networks and their design issues
- To understand sensor management in networks and design requirements

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Appreciate various design issues of wireless sensor networks
CO-2: Understand the hardware details of different types of sensors and select the application specific sensor
CO-3: Understand radio standards and communication protocols to be used for wireless sensor networks

UNIT – I:
Introduction: Overview of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.

UNIT – II:
Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (Operating Systems): TinyOS, MANTIS, Contiki, and RetOS.

UNIT – III:
Programming Tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet, NetSim)

UNIT – IV:
Overview of Sensor Network Protocols (Details of at least 2 important protocol per layer): Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi- hop and cluster-based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

UNIT – V:
Data Dissemination and Processing: Differences compared with other database management systems, Query models, In-network data aggregation, data storage; query processing.

UNIT – VI:
Specialized Features: Energy preservation and efficiency; security challenges; Fault tolerance, Issues related to Localization, connectivity and topology, Sensor

deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

TEXT BOOKS:

1. Wireless Sensor Networks Technology, Protocols, and Applications, Kazem Sohraby, Daniel Minoli, Taieb Znati, John Wiley & Sons, 2007
2. Protocols and Architectures for Wireless Sensor Networks, H. Karl and A. Willig, John Wiley & Sons, India, 2012
3. Wireless Sensor Networks, C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, 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…

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

(19OE1EC04) INTRODUCTION TO C-SHARP

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the foundations of CLR execution
- To learn the technologies of the .NET framework and object-oriented aspects of C#
- To be aware of application development in .NET
- To learn web-based applications on .NET (ASP.NET)

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain how C# fits into the .NET platform
CO-2: Analyze the basic structure of a C# application
CO-3: Develop programs using C# on .NET
CO-4: Design and develop Web based applications on .NET

UNIT – I:
Introduction to C#: Introducing C#, Understanding .NET, overview of C#, Literals, Variables, Data Types, Operators, checked and unchecked operators, Expressions, Branching, Looping, Methods, implicit and explicit casting, Constant, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing.

UNIT – II:
Object Oriented Aspects of C#: Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism, sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, events, errors and exception, Threading.

UNIT – III:
Application Development on .NET: Building windows application, Creating our own window forms with events and controls, menu creation, inheriting window forms, SDI and MDI application, Dialog Box (Modal and Modeless), accessing data with ADO.NET, DataSet, typed dataset, Data Adapter, updating database using stored procedures

UNIT – IV:
SQL Server with ADO.NET, handling exceptions, validating controls, windows application configuration.

UNIT – V:
Web Based Application Development on .NET: Programming web application with web forms, ASP.NET introduction, working with XML and .NET, Creating Virtual Directory and Web Application, session management techniques, web.config, web services, passing datasets, returning datasets from web services, handling transaction, handling exceptions, returning exceptions from SQL Server.

UNIT – VI:

CLR and .NET Framework: Assemblies, Versoning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, remoting, security in .NET

TEXT BOOKS:

1. The Complete Reference: C# 4.0, Herbert Schildt, Tata McGraw Hill, 2012
2. Professional C# 2012 with .NET 4.5, Christian Nagel et al. Wiley India, 2012

REFERENCES:

1. Pro C# 2010 and the .NET 4 Platform, Andrew Troelsen, 5th Edition, A Press, 2010
2. Programming C# 4.0, Ian Griffiths, Matthew Adams, Jesse Liberty, 6th Edition, O"Reilly, 2010

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

(19OE1EC05) INTRODUCTION TO SIGNAL PROCESSING

COURSE PRE-REQUISITES: Introduction to C Sharp

COURSE OBJECTIVES:
- To understand various fundamental characteristics of signals and systems
- To analyze signals in frequency domain
- To know principles of signal transmission through systems
- To understand fundamentals of digital signal

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Classify signals and implement various operations on signals
CO-2: Analyze the characteristics of signals and systems
CO-3: Understand the basics of filter design
CO-4: Appreciate the processes of Multirate systems

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

UNIT – II:
Representation of Systems: Classification of discrete time Systems, impulse response, Concept of convolution in time domain and frequency domain, response of a linear system, System function, Signal bandwidth, system bandwidth. Ideal filter characteristics.

UNIT – III:
Sampling Theorem: Representation of continuous time signals by its samples - Sampling theorem – Reconstruction of a Signal from its samples, aliasing
Z –Transform: Basic principles of z-transform, region of convergence, properties of ROC, Inverse z-transform using Partial fraction.

UNIT – IV:
Introduction to Digital Signal Processing: Applications of Z-Transforms- Solution of Linear Constant Coefficient Difference equations (LCCD), System function, Frequency Response of the system.

UNIT – V:
Discrete Fourier Transforms: Circular convolution, Comparison between linear and circular convolution, Computation of DFT.
IIR Digital Filters: Design of IIR Digital filters (H(s) to be given) - Impulse invariance transformation techniques, Bilinear transformation method.

UNIT – VI:

FIR Digital Filters: Characteristics of linear phase FIR filters and its frequency response, Comparison of IIR and FIR filters. Design of FIR filters using Fourier Method and Windowing Technique (only Hanning).

Realization of IIR and FIR Filters: Direct and Cascade forms.

TEXT BOOKS:

1. Signals, Systems and Communications, B. P. Lathi, BS Publications, 2009
2. Signals and Systems, Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, 2nd Edition, PHI
3. Digital Signal Processing: Principles, Algorithms and Applications, John G. Proakis, D. G. Manolakis, 4th Edition, Perason/PHI, 2009

REFERENCES:

1. Signals and Systems, Simon Haykin and Barry Van Veen, 2nd Edition, John Wiley
2. Signals, Systems and Transforms, C. L. Philips, J. M. Parr and Eve A. Riskin, 3rd Edition, Pearson, 2004
3. Signals and Systems, Schaum's Outlines, Hwei P. Hsu, Tata McGraw Hill, 2004
4. Digital Signal Processing – A Practical Approach, Emmanuel C. Ifeacher, Barrie W. Jervis, 2nd Edition, Pearson Education

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

(19OE1EC06) INTRODUCTION TO IMAGE AND VIDEO PROCESSING

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

COURSE OBJECTIVES:

- To introduce fundamentals of digital image and video processing
- To demonstrate digital signal processing techniques in spatial and frequency domains
- To study and compare various image and video compression algorithms
- To study applications of motion estimation in video processing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire, represent the digital image and transforms
CO-2: Apply various pixel position and intensity-based image processing techniques
CO-3: Understand and analyze the performance of block matching algorithms in MPEG video coding standards

UNIT – I:
Fundamentals of Image Processing and Image Transforms: Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels, 2–D Discrete Fourier Transform, Discrete Cosine Transform, Introduction to Wavelet transforms.

UNIT – II:
Image Enhancement-Spatial Domain Methods: Point Processing, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters.

UNIT – III:
Image Enhancement-Frequency Domain Methods: Basics of filtering in frequency domain, Image Smoothing, Image Sharpening, Selective Filtering.
Image Segmentation: Segmentation Concepts, Point, Line and Edge Detection, Thresholding, Region Based Segmentation.

UNIT – IV:
Image Compression: Image compression fundamentals – coding Redundancy, spatial and temporal redundancy.
Compression Models: Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding.

UNIT – V:
Basic Steps of Video Processing: Analog video, Digital Video, Time varying Image Formation models: 3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals.

UNIT – VI:

2-D Motion Estimation: Optical flow, pixel-based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Application of motion estimation in video coding.

TEXT BOOKS:

1. Digital Image Processing, Gonzaleze and Woods, 3rd Edition, Pearson
2. Video Processing and Communication, Yao Wang, Joem Ostarmann and Ya – Quin Zhang, 1st Edition, PHI

REFERENCES:

1. Digital Video Processing, M. Tekalp, Prentice Hall International
2. Image Acquisition and Processing with LabVIEW, Relf, Christopher G., CRC Press
3. Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms, Aner Ozdemi R., John Wiley & Sons
4. Fundamentals of Digital Image Processing, A Practical Approach with Examples in Matlab, Chris Solomon, Toby Breckon, John Wiley & Sons

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

(19OE1EC07) FUNDAMENTALS OF AUGMENTED REALITY AND VIRTUAL REALITY

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

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

- To a review of current Virtual Reality (VR) and Augmented Reality (AR) technologies
- To the fundamentals of VR/AR modeling and programming
- To provides a detailed analysis of engineering scientific and functional aspects of VR/AR

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire knowledge in main applications VR / AR technologies
CO-2: Analyze different tools for VR/AR applications
CO-3: Developing VR/AR applications

UNIT – I:
Augmented Reality and Virtual Reality:
Augmented Reality: Introduction to Augmented Reality (AR), Fundamentals, Chronicle order of AR, features
Virtual Reality: Introduction to Virtual Reality (VR), Features of VR and Chronicle order of VR; Difference between AR and VR.

UNIT – II:
Types of Augmented Reality: Marker based AR, Marker less AR, Projection based AR, Super Imposition based AR, Applications of AR.

UNIT – III:
Types of Virtual Reality: Non- immersive simulation, Semi-immersive simulations, Fully immersive simulations; Applications VR.

UNIT – IV:
Making an AR App with Simple CUBE: Introduction to Unity, Installation steps, Fundamentals while implementing Project, importing a cube, Create an account in Vuforia, license manager, target manager, downloading database and uploading target database in unity.

UNIT – V:
AR App with Interaction: Introduction to C#, Scripting interactive objects, implementation C# Script using unity, uploading target object, deploying application into ANDROID Device.

UNIT – VI:

Creating an Virtual Reality: Creating an Virtual Reality Scene in unity, adding colliders, Settings of Unity to make the application compatible with Google cardboard.

TEXT BOOKS:

1. Augmented Reality for Developers, Build Practical Augmented Reality Applications with Unity, ARCore, ARKit, and Vuforia. Linowes, J., Babilinski, K United Kingdom, Packt Publishing, 2017
2. Building Virtual Reality with Unity and Steam VR, Murray, J. W., United Kingdom, CRC Press, 2020

REFERENCES:

1. Virtual Reality & Augmented Reality in Industry, Ma, D., Gausemeier, J., Fan, X., Grafe, M. (Eds.) Springer, 2011
2. Unity 2020 Virtual Reality Projects: Learn VR Development by Building Immersive Applications and Games with Unity 2019.4 and Later Versions, Linowes J 3rd Edition, United Kingdom, Packt Publishing, 2020

ARTIFICIAL INTELLIGENCE

ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) is a cognitive science with highly research activities in the major areas like Machine Learning, Robotics, Natural Language Processing and image processing. This track will cover basic foundations of artificial intelligence it will make the students industry-ready for artificial intelligence and data science job roles. Artificial intelligence is used in wide range of industrial applications such as healthcare, transportation, entertainment, insurance, transport and logistics, and customer service.

Future applications of AI would be utilized in automated transportation, cyborg technology, solving problems associated with climate change, deep-sea and space exploration.

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

(19OE1MT01) MATHEMATICS FOR ARTIFICIAL INTELLIGENCE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To introduce the basic concepts of probability and matrices in the field of Artificial Intelligence
- To identify, explore the complex problem-solving strategies
- To develop problem solving skills related to algorithmic analysis required for AI
- To apply and build mathematical model to solve real-world problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explore and demonstrate practical approaches related to implementation of the AI algorithms using probability concepts
CO-2: Formulate and solve the Artificial intelligence related problems by using the knowledge of matrices and vectors
CO-3: Demonstrate the understanding of mathematical ideas from artificial intelligence perspective and machine learning
CO-4: Analyze and solve the complexity of a given problem with suitable optimization techniques

UNIT – I:
Probability: Basic rules and axioms, events, sample space, frequentist approach, dependent and independent events, conditional probability, Random variables, continuous and discrete, expectation, variance, distributions - joint and conditional, Bayes' theorem, Popular distributions - Bernoulli, Binomial, Poisson, Normal.

UNIT – II:
Descriptive Statistics & Linear Regression: Classification and tabulation of univariate data, graphical representation, Frequency curves. Descriptive measures - Central tendency and Dispersion. Simple Linear Regression Models.

UNIT – III:
Vector Space: Vectors, definition, scalars, addition, scalar multiplication, inner product (dot product), vector projection, cosine similarity, orthogonal vectors, normal and orthonormal vectors, vector norm, vector space, linear combination, linear span, linear independence, basis vectors.

UNIT – IV:

Matrices: Matrices definition, rank, System of equations: Direct methods - LU decomposition method, Tri-diagonal system; Applications of linear systems - Network flows and Mechanical systems.

UNIT – V:

Eigen Values & Eigen Vectors: Eigen values & eigen vectors, concept, intuition, significance, how to find principle component analysis, concept, properties, applications, Singular value decomposition, concept, properties, applications.

UNIT – VI:

Multivariate Calculus: Functions, Scalar derivative, partial derivatives, Gradient, chain rule, properties, method for derivative of vector-valued function with respect to scalar, vector four combinations - Jacobian, Hessian, Gradient of vector valued function, Gradient of matrices. Local/global maxima and minima, saddle point, convex functions, gradient descent algorithms - Learning rate, momentum, stochastic, Constrained optimization (Lagrange Multiplier method), convex optimization.

TEXT BOOKS:

1. Mathematics for Machine Learning, Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Cambridge University Press, 2020
2. Linear Algebra and it's Applications, David C. Lay, 3rd Edition, Pearson Publications
3. Probability and Statistics for Engineers, Richard A. Johanson, 5th Edition, Prentice-Hall, 1995

REFERENCES:

1. Math for Machine Learning: Open Doors to Data Science and Artificial Intelligence, Richard Han, Paperback, 2018
2. Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning, James V Stone
3. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006

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

(19OE1CS01) FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence

COURSE OBJECTIVES:

- To understand and analyze the importance and basic concepts of artificial intelligence and the use of agents
- To identify, explore the complex problem-solving strategies and approaches
- To analyze the concepts of basic concepts of neural networks and learning process
- To explore and analyze the methodology used in machine learning

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

CO-1: Understand the basic concepts of artificial intelligence and the use of agents into the real-world scenario

CO-2: Design and formulate complex problem solutions with the use of various searching techniques

CO-3: Estimate the skill for representing knowledge using the appropriate technique for a given problem

CO-4: Apply AI techniques to solve problems of game playing, and machine learning

UNIT – I:

Introduction to AI: Foundations of AI – History of AI - Applications of AI, Intelligent Agents – Agents and Environments – Nature of Environments – Structure of Agents – Problem solving Agents – Problem formulation – Example Problems.

UNIT – II:

Searching Techniques: Uninformed Search Strategies – Breadth first search – Depth first search – Depth limited search - Bidirectional search – comparison – Search with partial information - Heuristic search – Greedy best first search – A* search – Memory bounded heuristic search - Heuristic functions - Local search- Hill climbing – Simulated annealing search - Local beam search, Genetic algorithms.

UNIT – III:

Constraint Satisfaction Problems: Backtracking search for CSP’s - local search for constraint satisfaction problem. *Adversarial search* – Games - Minimax algorithm, Alpha beta pruning, cutting-off search.

UNIT – IV:

Knowledge Representation and Reasoning: Propositional Logic, Rules of Inference, First Order Logic (FOL) Syntax, Semantics, Entailment.

UNIT – V:

Classical Planning: Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches.

UNIT – VI:

Planning and Acting in the Real World: Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent Planning.

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall, 2010
2. Machine Learning, Tom M. Mitchell, McGraw Hill Publications
3. Neural Networks A Comprehensive Foundation, Simon Haykin, Pearson Education, 2nd Edition, 2004

REFERENCES:

1. Artificial Intelligence, Elaine Rich & Kevin Knight, 2nd Edition, TMH
2. Artificial Intelligence-A New Synthesis, Nils J. Nilsson, Elsevier
3. Artificial Neural Networks, Yegnanarayana B., PHI

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

(19OE1CS02) MACHINE LEARNING TECHNIQUES

COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence, Fundamentals of Artificial Intelligence

COURSE OBJECTIVES:
- To understand applications in computational learning theory
- To analyse the pattern comparison techniques

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

CO-1: Understand and Familiarize the basics concept, notations used in machine learning and mathematics behind machine learning algorithms

CO-2: Demonstrate different types of machine learning algorithms

CO-3: Apply the suitable machine learning techniques and construct a machine learning model to solve real world applications

CO-4: Evaluate model accuracy and familiarize with advanced learning algorithms

UNIT – I:

Introduction to Machine Learning: Perspectives and issues in machine learning, Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation.

UNIT – II:

Supervised Learning: Classification, decision boundaries; nearest neighbor methods, Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, Linear classifiers Bayes' Rule and Naive Baye's classification

Regression: Regression types, gradient descent; features of Over fitting and complexity; training, validation, test data, Logistic regression and applications.

UNIT -III:

Unsupervised Learning: Clustering, k-means, hierarchical, partition-based clustering, overlapping clustering, Support vector machines, Support vector regression.

UNIT -IV:

Reinforcement Learning: Introduction to Reinforcement learning, the learning task, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

UNIT- V:

Instance-Based Learning: Introduction, k-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT – VI:

Neural Networks: Introduction to neural networks, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and Convolution neural networks.

TEXT BOOKS:

1. Machine Learning, Tom M. Mitchell, McGraw-Hill
2. Neural Networks and Learning Machines, S. Haykin, Pearson, 2008

REFERENCES:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis
2. Machine Learning: The Art and Science of Algorithms that make Sense of Data, Peter Flash, Cambridge, University Press
3. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, MIT Press, 2012

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

(19OE1CS03) DEEP LEARNING

COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence, Fundamentals of Artificial Intelligence, Machine Learning Techniques

COURSE OBJECTIVES:
- To introduce the foundations of deep learning
- To acquire the knowledge on Deep Learning Concepts

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify and select appropriate learning network models required for real world problems
CO-2: Design an efficient model with various deep learning techniques
CO-3: Implement deep learning algorithms and solve real-world problems
CO-4: Apply optimization strategies necessary for problem solving required for large scale applications

UNIT – I:
Introduction to Deep Learning: History of Deep Learning, Deep Learning Success Stories, Biological Neuron, Idea of computational units, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm and Convergence.

UNIT – II:
Feedforward Networks: Multilayer Perceptron, Gradient Descent, Back-propagation, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks.

UNIT – III:
Regularization for Deep Learning: Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, Multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier.

UNIT – IV:
Optimization for Training Deep Models: Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithm.

UNIT – V:
Convolutional Neural Networks: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Markov Networks, Object Detection, RCNN, Fast RCNN, Faster RCNN, YOLO

UNIT – VI:

Auto-Encoders: Regularization in auto-encoders, De-noising auto-encoders, Sparse auto-encoders, Contractive auto-encoders, Structured probabilistic models of deep learning.

TEXT BOOKS:

1. Deep Learning: An MIT Press Book, Ian Goodfellow and Yoshua Bengio and Aaron Courville
2. Neural Networks and Learning Machines, Simon Haykin, 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**
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(19OE1CS04) FUNDAMENTALS OF COMPUTER NETWORKS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To introduce the fundamental various types of computer networks
- To demonstrate the TCP/IP and OSI models with merits and demerits
- To explore the various layers of OSI model
- To introduce UDP and TCP models
- To have the concept of different routing techniques for data communications

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

CO-1: Understand and explore the basics of Computer Networks reference models and the functionalities of physical layer

CO-2: Learn major concepts, principles involved in Data Link Layer and Network Layer

CO-3: Analyze how to maintain QoS in Network and maintaining of Congestion Control

CO-4: Demonstrate the Application Layer functionalities and importance of Security in the Network

UNIT – I:

Introduction to Networks: Internet, Protocols and Standards, The OSI Model, Layers in OSI Model, TCP/IP Suite, Addressing.

Physical Layer: Multiplexing, Transmission Media, Circuit Switched Networks, Datagram Networks, and Virtual Circuit Networks.

UNIT – II:

Data Link Layer: Introduction, Checksum, Framing, Flow and Error Control, Noiseless Channels, Noisy Channels, Random Access Controlled Access, Channelization, IEEE Standards, Ethernet, Giga-Bit Ethernet, Wireless LANs, SONET-SDH, Frame Relay and ATM.

UNIT – III:

Network Layer: Logical Addressing, Internetworking, Tunneling, Address Mapping, ICMP, IGMP, Forwarding, Routing-Flooding, Bellman& Ford, Disjkstra's routing protocols, RIP, OSPF, BGP and Multicast Routing Protocols. Connecting Devices-Passive Hubs, Repeaters, Active Hubs, Bridges, Routers.

UNIT – IV:

Transport Layer: Process to Process Delivery, UDP, TCP and SCTP Protocols, Congestion, Congestion Control, Quality of Service.

UNIT – V:

Application Layer: Domain Name Space, DNS in Internet, Electronic Mail, File Transfer Protocol, WWW, HTTP, SNMP, Multi-Media.

UNIT – VI:

Network Security: Security services, mechanisms and attacks, IPSec, SSL, VPN, Firewall. Bluetooth, Zigbee, IPv4, IPv6.

TEXT BOOKS:

1. Data Communications and Networking, Behrouz A. Forouzan, 4th Edition, McGraw Hill Education, 2006
2. Computer Networks, Andrew S. Tanenbaum, 4th Edition, Pearson Education
3. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education

REFERENCES:

1. Data Communications and Networks, William Stallings
2. Data Communication and Networks, Bhusan Trivedi, Oxford University Press, 2016
3. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education
4. Understanding Communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning

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

(19OE1CS08) RELATIONAL DATABASE MANAGEMENT SYSTEMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the basic elements of a relational database management system
CO-2: Identify the data models for relevant problems
CO-3: Design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data
CO-4: Apply normalization for the development of application software

UNIT – I:
Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.
Introduction to Database Design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.
Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data.
Logical database Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT – II:
Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.
SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

UNIT – III:
Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of

Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

UNIT – IV:

Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

UNIT – V:

Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.
Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

UNIT – VI:

Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.
Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.
Hash-Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw Hill Education (India) Private Limited
2. Database System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, 6th Edition, McGraw Hill Education (India) Private Limited,
3. Database Systems, R. Elmasri, Shamkant B. Navathe, 6th Edition, Pearson Education

REFERENCES:

1. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning
2. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Introduction to Database Systems, C. J. Date, Pearson Education

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

(19OE1CS05) DISTRIBUTED DATA BASES

COURSE PRE-REQUISITES: Fundamentals of Computer Networks

COURSE OBJECTIVES:
- To introducing distributed databases and exploring several algorithms for processing queries and be able to use them
- To describe the methods to translate complex conceptual data models into logical and Physical database designs
- To demonstrating query optimization and its algorithms
- To enumerating the concepts behind distributed transaction processing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze issues related to distributed database design
CO-2: Apply Partitioning techniques to databases
CO-3: Design and develop query processing strategies
CO-4: Demonstrate transaction processing and concurrency control in distributed databases

UNIT – I:
Introduction: Features of Distributed versus Centralized Databases,
Levels of Distribution Transparency: Reference Architecture for Distributed Databases, Types of Data Fragmentation, Distribution transparency for Read – only Applications, Distribution transparency for update Applications, Distributed database Access primitives, Integrity Constraints in Distributed Databases.

UNIT – II:
Distributed Database Design: A framework, the design of database fragmentation, the allocation of fragments.
Translation of Global Queries to Fragment Queries: Equivalence Transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries.

UNIT – III:
Optimization of Access Strategies: A Framework for Query Optimization, Join Queries, General Queries.

UNIT – IV:
The Management of Distributed Transactions: A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural aspects of Distributed Transactions.

UNIT – V:
Concurrency Control: Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.

UNIT – VI:

Reliability: Basic Concepts, Nonblocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart.

TEXT BOOKS:

1. Principles of Distributed Database Systems, M. Tamer OZSU and Patuck Valduriez, Pearson Education Asia, 2001
2. Distributed Databases, Stefano Ceri and Willipse Pelagatti, McGraw Hill

REFERENCES:

1. Database System Concepts, Henry F. Korth, A. Silberchatz and Sudershan, MGH
2. Database Management Systems, Raghuramakrishnan and Johhanes Gehrke, MGH

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

(19OE1CS06) CRYPTOGRAPHY AND NETWORK SECURITY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases

COURSE OBJECTIVES:

- To outline security concepts, threats, attacks, services and mechanisms
- To describe various cryptosystems-symmetric key cryptography, public key cryptography
- To apply authentication services and Secure hash functions
- To discuss the concepts of IP Security, web security, viruses and firewalls

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

CO-1: Analyze the security attacks, services, goals and mechanism of security

CO-2: Develop a security model using conventional approach to prevent the attacks

CO-3: Apply public key cryptography principles, examine authenticity and integrity of the messages in the communication

CO-4: Build a model for IP security, firewall and test the security issues

UNIT – I:

Security Attacks: Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

UNIT – II:

Conventional Encryption: Classical Encryption techniques, Fiestel Cipher Structure, Data Encryption Standard, Block Cipher Design Principles and Modes of Operation, Triple DES, RC-4, Evaluation criteria for AES, AES Cipher, Placement of Encryption Function, Traffic Confidentiality.

UNIT – III:

Public Key Cryptography and Authentication: Confidentiality using Symmetric Encryption – Principles of Public key Cryptosystems, RSA algorithm, Key Management, Diffie-Hellman key Exchange, Elliptic Curve Cryptography.

Authentication requirements, Authentication functions, Message Authentication Codes

UNIT – IV:

Hash Functions: Hash Functions, Security of Hash Functions and MACs, MD5 message Digest algorithm, Secure Hash Algorithm, HMAC, Digital Signatures, Authentication Protocols, Digital Signature Standard, Authentication Applications: Kerberos, X.509 Authentication Service

UNIT – V:

Network Security: Email Security and Web Security

Electronic Mail Security – PGP/ SMIME, IP security- Architecture, Authentication Header, Encapsulating Security Payload, Key Management, Web Security- Secure Socket Layer, Transport Layer Security and Secure Electronic Transaction

UNIT – VI:

System Level Security: Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

TEXT BOOKS:

1. Cryptography and Network Security – Principles and Practices, William Stallings, Prentice Hall of India, 4th Edition, 2005
2. Hack Proofing Your Network, Ryan Russell, Dan Kaminsky, Rain Forest, Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W. Manzuik and Ryan Permeh, Wiley Dreamtech

REFERENCES:

1. Network Security Essentials: Applications and Standards, William Stallings Prentice Hall,1999, ISBN 0130160938
2. Security in Computing, Charles B. Pfleeger, Shari Lawrence Pfleeger, 3rd Edition, Pearson Education, 2003

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

(19OE1CS07) BLOCKCHAIN TECHNOLOGY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases, Cryptography and Network Security

COURSE OBJECTIVES:

- To get the terminologies and overview of blockchain technologies
- To study the concepts and foundation of blockchain technology
- To understand security mechanism and consensus in blockchain
- To design use cases and architecture blockchain technology

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

CO-1: Gain a clear understanding of the concepts that underlie digital distributed ledger

CO-2: Understand key mechanisms like Decentralization, Transparency and trust, Immutability, High availability, Highly secure and different types of Blockchain

CO-3: Apply the concept of Hash Function and Related Hash Algorithm

CO-4: Design and implement applications using Blockchain Technology

UNIT – I:

Introduction to Blockchain Part I: Introduction to Centralized, Decentralized and Distributed system, History of Blockchain, Various technical definitions of Blockchain.

Introduction to Blockchain Technology Part II: Generic elements of a blockchain: Block, Transaction, Peer-to-peer network, Node, Smart contract, Why It's Called "Blockchain", Characteristics of Blockchain Technology, Advantages of blockchain technology.

UNIT – II:

Concept of Blockchain Technology Part I: Cryptography, Hashing, Nonce, Distributed database, Consensus, Smart Contract, Component of block, Structure of Block chain, Technical Characteristics of the Blockchain.

Concept of Blockchain Technology Part II: Applications of blockchain technology, Tiers of blockchain technology Blockchain 0, Blockchain 1, Blockchain 2, Blockchain 3, Generation of Blockchain X.

UNIT – III:

Technical Foundations Part I: Cryptography, Confidentiality, Integrity, Authentication, Cryptographic primitives, Public and private keys, RSA, Discrete logarithm problem, Hash Function: Message Digest (MD), Secure Hash Algorithms (SHAs), Design of Secure Hash Algorithms (SHA), SHA-256, Design of SHA3, Elliptic Curve Digital signature algorithm.

Technical Foundations Part II: Consensus algorithm: Proof of work (PoW), Proof-of-Stake (PoS), Byzantine Fault Tolerance (BFT)

UNIT – IV:

Types of Blockchain: Public blockchains, Private blockchains, Semi-private blockchains, Side chains, Permissioned ledger, Distributed ledger, Shared ledger, Fully private and proprietary blockchains, Tokenized blockchains, Tokenless blockchains, CAP theorem and blockchain

UNIT – V:

Financial markets and trading, Trading, Exchanges, Trade life cycle, Order anticipators, Market manipulation.

Crypto-Currency: Bitcoin, Bitcoin definition, Keys and addresses, Public keys in Bitcoin, Private keys in Bitcoin, Bitcoin currency units

UNIT – VI:

Implementation Platforms: Hyperledger as a protocol, Reference architecture, Hyperledger Fabric, Transaction Flow, Hyperledger Fabric Details, Fabric Membership, Fabric Membership

TEXT BOOKS:

1. Mastering Blockchain, Imaran Bashir, 2nd Edition, Packt
2. Blockchain Basic, Daniel Drescher, A Press

REFERENCES:

1. Blockchain For Dummies®, IBM Limited Edition, John Wiley & Sons Inc.

ROBOTICS

ROBOTICS

Robotics is a field of study that involves the design, construction and operation of robots. This field overlaps with electronics, computer science, mechatronics and artificial intelligence. Robotic companies are booming all over the world and are seeking engineers with skills for implementing **Next -Level Automation**. This Open Elective Track for Robotics consists of four courses and is intended for making students industry ready in the field of robotics.

The First course in this track" Fundamentals **of Robotics"** introduces various physical aspects of building a robot, exploring topics like how a robot perceives its environment using Sensors and how it interacts with its environment through various Actuators & Grippers. This course also inspects a variety of robot applications in different domains. Second Course in this track" Kinematics **& Dynamics of robots"** delves a level deeper discussing analysis and control of robots. It establishes strong mathematical foundation for describing and controlling robot movement. In this course students will learn in detail about Forward Kinematics, Inverse Kinematics, Workspace Analysis and Trajectory planning for robots.

Third Course in the Robotics track **"Drives and Control System for Robots"** explores in detail various Drive Mechanisms used in robotics such as Hydraulic, Pneumatic & Electric drives. After completing this course students will be able to analyze operational aspects of a drive system for a given robotic application. Fourth Course in the track **"Robot Programming and Intelligent Control System"** expands on Robot Programming, discussing various aspects of Robot Programming Languages and their functions. This course also dives deep into advanced topics like Artificial Intelligence, Neural Networks and Fuzzy control for robots.

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

(19OE1EI01) FUNDAMENTALS OF ROBOTICS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand the basic components of a Robot
- To learn different types of Robot sensors and actuators used in Robotics
- To identify different types of Robot grippers and their applications
- To acquire basic Knowledge on Robot kinematics
- To expose to various application fields of Robotics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain knowledge about basic concepts of robots
CO-2: Appreciate the usage of different sensors and actuators in Robotics
CO-3: Select appropriate Gripping mechanism for a particular application
CO-4: Analyze the direct and the inverse kinematic problems
CO-5: Appreciate robot design deference's for various applications

UNIT – I:
Basic Concepts: An overview of Robotics, classification of Robots, Robot Components, Robot degrees of freedom, Robot Joints, Robot Coordinates, Robot reference frames, Programming modes, Robot Characteristics.

UNIT – II:
Sensors: Sensor characteristics, Position sensors, Velocity sensors, Acceleration sensors, Force and Pressure sensors, Torque sensors, Microswitches, Light and infrared sensors, Touch and tactile sensors, Proximity sensors, Range finders.

UNIT – III:
Actuators: Characteristics of actuating system, Comparison of actuating systems, Hydraulic actuators, Pneumatic devices, Electric motors, Magneto-strictive actuators, Shape-Memory Metals, Electro-active Polymer Actuators.

UNIT – IV:
Grippers: Classification of Grippers, Drive system for Grippers, Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Adhesive Grippers, Hooks and Scoops, Gripper Force analysis and design, Active and Passive Grippers.

UNIT – V:
Kinematics: Robots as Mechanisms, Matrix Representation, Homogeneous Transformation Matrices, Representation of Transformations, Inverse of Transformation Matrices, Forward and Inverse Kinematics with Equations.

UNIT – VI:
Applications: Industrial applications, material handling, processing, assembly application, inspection application, application planning, justification of robots, non-industrial applications, Robot safety.

TEXT BOOKS:

1. Introduction to Robotics: Analysis, Control, Applications, Saeed B. Niku, Wiley, 2nd Edition
2. Robotics Technology and Flexible Automation, Deb S. R., John Wiley
3. Robotics and Control, R. K. Mittal, I. J. Nagrath, McGraw Hill Education

REFERENCES:

1. Industrial Robotics, Technology programming and Applications, Mikell P. Groover, Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, McGraw Hill, 2012
2. Robotics-Control, Sensing, Vision and Intelligence, K. S. Fu, R. C. Gonzalez, C. S. G Lee, McGraw-Hill International Edition
3. Robotic Engineering–An Integrated Approach, Klafter R. D., Chimielewski T. A., Negin M., Prentice Hall of India, New Delhi, 2009

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

(19OE1EI02) KINEMATICS AND DYNAMICS OF ROBOTS

COURSE PRE-REQUISITES: Fundamentals of Robotics

COURSE OBJECTIVES:
- To understand the basics of robot coordinate frames and their representation
- To obtain knowledge about direct kinematics and inverse kinematics for a robot manipulator
- To examine techniques for planning robot motion in a workspace
- To understand various methods for developing dynamic models for manipulator
- To learn control techniques applied to robot manipulators

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Mathematically represent a Robot system
CO-2: Calculate robot hand position and orientation for specific joint angles
CO-3: Calculate joint angles to achieve a particular hand position
CO-4: Plan trajectories for robot tool to do meaningful tasks
CO-5: Analyze different controlling techniques used for robot manipulators

UNIT – I:
Introduction: Introduction, position and orientation of objects, objects coordinate frame Rotation matrix, Euler angles Roll, pitch and yaw angles coordinate Transformations, Joint variables and position of end effector, Dot and cross products.

UNIT – II:
Direct Kinematics: Coordinate frames, Rotations, Homogeneous coordinates, Link coordinates D-H Representation, The ARM equation. Direct kinematic analysis for Four axis SCARA Robot and three, five and six axis Articulated Robots.

UNIT – III:
Inverse Kinematics: The inverse kinematics problem, General properties of solutions. Tool configuration, Inverse kinematics of four axis SCARA robot and three and five axis Articulated robot.

UNIT – IV:
Workspace Analysis and Trajectory Planning: Workspace Analysis, work envelope of a Four axis SCARA robot and five axis articulated robot workspace fixtures, the pick and place operations, Joint space technique - continuous path motion, Interpolated motion, straight line motion and Cartesian space technique in trajectory planning.

UNIT – V:
Manipulator Dynamics: Introduction, Lagrange's equation kinetic and potential energy. Link inertia Tensor, link Jacobian Manipulator inertia tensor. Gravity, Generalized forces, Lagrange-Euler Dynamic model, Dynamic model of a Two-axis planar robot, Newton Euler formulation, Lagrange - Euler formulation, problems.

UNIT – VI:

Robot Control: The Control Problem, State Equations: one axis robot; three axis SCARA robot, Constant solutions, Linear Feedback Systems, Single Axis PID Control, PD- Gravity Control.

TEXT BOOKS:

1. Fundamentals of Robotics: Analysis & Control, Robert J. Schilling, Prentice Hall of India
2. Robotics and Control, R. K. Mittal, I. J. Nagrath, McGraw Hill Education

REFERENCES:

1. Robotic Engineering–An Integrated Approach, Klafter. R. D., Chimielewski. T. A., Negin M, Prentice Hall of India, New Delhi, 2009
2. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover & Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, Tata McGraw-Hill Education, 2012
3. Robotics-Control, Sensing, Vision and Intelligence, K. S. Fu, R. C. Gonzalez, C. S. G. Lee, McGraw-Hill International Edition

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

(19OE1EI03) DRIVES AND CONTROL SYSTEM FOR ROBOTICS

COURSE PRE-REQUISITES: Fundamentals of Robotics, Kinematics and Dynamics of Robotics

COURSE OBJECTIVES:
- To get acquainted with different robot drive mechanisms
- To understand in detail, working of hydraulic and pneumatic drives used in robotics
- To learn working principles of various electric drive systems for robotics
- To acquire basic Knowledge on servo systems for robot control

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Categorize various drive systems for robot movement
CO-2: Select appropriate drive system for a particular application
CO-3: Inspect different electric drives and their applications in robotics
CO-4: Analyze accurate positioning of robot end effector by servo control

UNIT – I:
Introduction: Objectives, motivation, open loop control, closed loop control with velocity and position feedback, Types of drive systems. Functions of drive system.

UNIT – II:
Robot Drive Mechanism: Lead Screws, Ball Screws, Chain & linkage drives, Belt drives, Gear drives, Precision gear boxes, Harmonic drives, Cyclo speed reducers.

UNIT – III:
Hydraulic Drives: Introduction, Requirements, Hydraulic piston and transfer valve, hydraulic circuit incorporating control amplifier, hydraulic fluid considerations, hydraulic actuators Rotary and linear actuators. Hydraulic components in robots.

UNIT – IV:
Pneumatic Drives: Introduction, Advantages, pistons-Linear Pistons, Rotary pistons, Motors-Flapper motor, Geared motor, Components used in pneumatic control. Pneumatic proportional controller, pneumatically controlled prismatic joint.

UNIT – V:
Electric Drives: Introduction, Types, DC electric motor, AC electric motor, stepper motors, half step mode operation, micro step mode. Types of stepper motors, Direct drive actuator.

UNIT – VI:
Servo Mechanism for Robot: Mathematical modeling of robot servos, error responses and steady state errors in robot servos, feedback and feed forward compensations, hydraulic position servo, computer-controlled servo system for robot applications, selection of robot drive systems.

TEXT BOOKS:

1. Engineering Foundation of Robotics, Francis N-Nagy Andras Siegler, Prentice Hall Inc.
2. Robotics Engineering - An Integrated Approach, Richard D. Klafter, Thomas A., Chri Elewski, Michael Negin, PHI Learning, 2009

REFERENCES:

1. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover & Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, Tata McGraw-Hill Education, 2012
2. Industrial Robotics, Bernard Hodges, 2nd Edition, Jaico Publishing House, 1993
3. Fundamentals of Robotics Analysis and Control, Robert J. Schilling, PHI Learning, 2009
4. Foundations of Robotics Analysis and Control, Tsuneo Yohikwa, MIT Press, 2003
5. Introduction to Robotics Mechanics and Control, John J. Craig, 3rd Edition, Pearson, 2008

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

(19OE1EI04) ROBOT PROGRAMMING AND INTELLIGENT CONTROL SYSTEM

COURSE PRE-REQUISITES: Fundamentals of Robotics, Kinematics and Dynamics of Robotics, Drives and Control Systems for Robotics

COURSE OBJECTIVES:

- To understand the fundamentals of robot programming
- To learn robot textual languages that are in common use
- To expose to artificial intelligence in robotics
- To acquire basic Knowledge on neural networks in robotics
- To acquire basic Knowledge on fuzzy logic in robotics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain knowledge about different methods of robot programming
CO-2: Examine various robot language elements and their functions
CO-3: Analyze different AI techniques employed in robotics
CO-4: Design basic neuro-controller for robot motion control
CO-5: Apply fuzzy logic to robot control systems

UNIT – I:
Robot Programming: Methods of robot programming, leadthrough programming methods, robot program as a path in space - defining position in space, speed control, motion interpolation, WAIT, SIGNAL, DELAY commands, Branching.

UNIT – II:
Robot Languages: Textual robot language, generations of robot languages, robot language structure, operating systems, Robot language Elements and functions, constraints and variables, aggregates and location variables.

UNIT – III:
Basic Commands and Operations: Motion commands- move and related statements, speed control, points in workspace, paths and frames. End effector and sensor commands- end effector operation, sensor operation, REACT statement. Computations and operation. Program control and subroutines. Communications and data processing. Monitor mode commands.

UNIT – IV:
AI for Robotics: Introduction to Artificial Intelligence, goals of AI research, AI techniques- knowledge representation, problem representation, search techniques. LISP programming. AI and Robotics. LISP in the factory. Robotic Paradigms.

UNIT – V:

Neural Network Approach in Robotics: Introduction, Connectionist Models, Learning Principles and Learning Rules: Supervised, unsupervised, reinforcement learning. Sensor based robot learning, Neural Network in Robotics: Control of robot hands by neural network, neural set approach to robot motion coordination, robotic motor control using reinforcement learning optimization.

UNIT – VI:

Fuzzy Logic Approach in Robotics: Introduction, Fuzzy sets, Operation of Fuzzy sets, Fuzzy relations, Fuzzy rule formation, Control rules, Fuzzy algorithm in robotics, Robot obstacle avoidance using fuzzy logic, Fuzzy logic for robot path tracking and behavior coordination, fuzzy control system in mobile robots, fuzzy controller design for robot systems, Case study of fuzzy logic in robotics.

TEXT BOOKS:

1. Industrial Robotics Technology, Programming and Applications, Mikell. P. Groover, McGraw Hill, 2012
2. Robotics Technology and Flexible Automation, Deb S. R., Tata McGraw Hill Publishing Company Limited

REFERENCES:

1. Design and Control of Intelligent Robotic Systems, (Studies in Computational Intelligence 177) M. Begum, F. Karray (auth.), Dikai Liu, Lingfeng Wang, Kay Chen Tan (eds.), Springer
2. Neural Networks in Robotics, Edited by George Bekey, Kenneth Y. Goldberg, Springer US, 2012
3. Neural Networks, Fuzzy Logic, Genetic Algorithm - Synthesis and Applications, Rajasekharan and Rai, PHI Publications
4. Introduction to Neural Networks using MATLAB 6.0, S. N. Sivanandam, S. Sumathi, S. N. Deepa, TMH, 2006

CYBER SECURITY

CYBER SECURITY

Cybersecurity is **important** because it incorporates everything that relates to protecting our sensitive data, personally identifiable information (PII), protected health information (PHI), personal information, intellectual property, data, and governmental and **industry** information systems from stealing and destruction endeavoured. The cyber security track helps students to learn about how to

- Defend networks and data from unapproved access.
- Enhanced information security and business endurance supervision.
- Upgraded stakeholder confidence in your information security preparations.
- Developed company authorizations with the correct security controls in place.

Some of the more common career paths in the cyber security path are

- Chief Information Security Officer. ...
- Forensic Computer Analyst. ...
- Information Security Analyst. ...
- Penetration Tester. ...
- Security Architect. ...
- IT Security Engineer. ...
- Security Systems Administrator. ...
- IT Security Consultant.

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

(19OE1CS04) FUNDAMENTALS OF COMPUTER NETWORKS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce the fundamental various types of computer networks
- To demonstrate the TCP/IP and OSI models with merits and demerits
- To explore the various layers of OSI model
- To introduce UDP and TCP models
- To have the concept of different routing techniques for data communications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and explore the basics of Computer Networks and Various Protocols and in a position to understand the World Wide Web concepts
CO-2: Administrate a network and flow of information
CO-3: Understand easily the concepts of network security, Mobile and ad-hoc networks

UNIT – I:
Introduction to Networks: Internet, Protocols and Standards, The OSI Model, Layers in OSI Model, TCP/IP Suite, Addressing.
Physical Layer: Multiplexing, Transmission Media, Circuit Switched Networks, Datagram Networks, and Virtual Circuit Networks.

UNIT – II:
Data Link Layer: Introduction, Checksum, Framing, Flow and Error Control, Noiseless Channels, Noisy Channels, Random Access Controlled Access, Channelization, IEEE Standards, Ethernet, Giga-Bit Ethernet, Wireless LANs, SONET-SDH, Frame Relay and ATM.

UNIT – III:
Network Layer: Logical Addressing, Internetworking, Tunneling, Address Mapping, ICMP, IGMP, Forwarding, Routing-Flooding, Bellman& Ford, Disjkstra's routing protocols, RIP, OSPF, BGP,- and Multicast Routing Protocols. Connecting Devices-Passive Hubs, Repeaters, Active Hubs, Bridges, Routers.

UNIT – IV:
Transport Layer: Process to Process Delivery, UDP, TCP and SCTP Protocols, Congestion, Congestion Control, Quality of Service.

UNIT – V:

Application Layer: Domain Name Space, DNS in Internet, Electronic Mail, File Transfer Protocol, WWW, HTTP, SNMP, Multi-Media.

UNIT – VI:

Network Security: Security services, mechanisms and attacks, IPSec, SSL, VPN, Firewall, Bluetooth, Zigbee, IPv4, IPv6.

TEXT BOOKS:

1. Data Communications and Networking, Behrouz A. Forouzan, 4th Edition, McGraw Hill Education, 2006
2. Computer Networks, Andrew S. Tanenbaum, 4th Edition, Pearson Education
3. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education

REFERENCES:

1. Data Communications and Networks, William Stallings
2. Data Communication and Networks, Bhusan Trivedi, Oxford University Press, 2016
3. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education
4. Understanding Communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1CS08) RELATIONAL DATABASE MANAGEMENT SYSTEMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the basic elements of a relational database management system
CO-2: Identify the data models for relevant problems
CO-3: Design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data
CO-4: Apply normalization for the development of application software

UNIT – I:
Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.
Introduction to Database Design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.
Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data,
Logical Database Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT – II:
Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.
SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

UNIT – III:
Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of

Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

UNIT – IV:

Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

UNIT – V:

Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.
Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

UNIT – VI:

Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.
Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.
Hash-Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw Hill Education (India) Private Limited
2. Database System Concepts, A. Silberschatz, Henry F. Korth, S. Sudarshan, 6th Edition, McGraw Hill Education (India) Private Limited
3. Database Systems, R. Elmasri, Shamkant B. Navathe, 6th Edition, Pearson Education

REFERENCES:

1. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning
2. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Introduction to Database Systems, C. J. Date, Pearson Education

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

(19OE1CS06) CRYPTOGRAPHY AND NETWORK SECURITY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases

COURSE OBJECTIVES:

- To outline security concepts, threats, attacks, services and mechanisms
- To describe various cryptosystems- symmetric key cryptography, public key cryptography
- To apply authentication services and Secure hash functions
- To discuss the concepts of IP Security, web security, viruses and firewalls

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the security attacks, services, goals and mechanism of security
CO-2: Develop a security model using conventional approach to prevent the attacks
CO-3: Apply public key cryptography principles, examine authenticity and integrity of the messages in the communication
CO-4: Build a model for IP security, firewall and test the security issues

UNIT – I:
Security Attacks: Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

UNIT – II:
Conventional Encryption: Classical Encryption techniques, Fiestel Cipher Structure, Data Encryption Standard, Block Cipher Design Principles and Modes of Operation, Triple DES, RC-4, Evaluation criteria for AES, AES Cipher, Placement of Encryption Function, Traffic Confidentiality.

UNIT – III:
Public Key Cryptography and Authentication: Confidentiality using Symmetric Encryption – Principles of Public key Cryptosystems, RSA algorithm, Key Management, Diffie-Hellman key Exchange, Elliptic Curve Cryptography.
Authentication requirements, Authentication functions, Message Authentication Codes

UNIT – IV:

Hash Functions: Hash Functions, Security of Hash Functions and MACs, MD5 message Digest algorithm, Secure Hash Algorithm, HMAC, Digital Signatures, Authentication Protocols, Digital Signature Standard, Authentication Applications: Kerberos, X.509 Authentication Service

UNIT – V:

Network Security: Email Security and Web Security

Electronic Mail Security – PGP/ SMIME, IP security- Architecture, Authentication Header, Encapsulating Security Payload, Key Management, Web Security- Secure Socket Layer, Transport Layer Security and Secure Electronic Transaction

UNIT – VI:

System Level Security: Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

TEXT BOOKS:

1. Cryptography and Network Security – Principles and Practices, William Stallings, 4th Edition, Prentice Hall of India, 2005
2. Hack Proofing your Network, Ryan Russell, Dan Kaminsky, Rain Forest, Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W. Manzuik and Ryan Permeh, Wiley Dreamtech

REFERENCES:

1. Network Security Essentials: Applications and Standards, William Stallings Prentice Hall,1999, ISBN 0130160938
2. Security in Computing, Charles B. Pfleeger, Shari Lawrence Pfleeger, 3rd Edition, Pearson Education, 2003

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

(19OE1IT01) ESSENTIALS OF CYBER SECURITY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Cryptography and Network Security

COURSE OBJECTIVES:
- To identify the key components of cyber security in network
- To describe various security levels and categories, operating system security
- To define authentication issues and network security
- To describe memory management and protection measures

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Categorize cyber-crime and an understand social, political, ethical and psychological dimensions cyber security
CO-2: Demonstrate security levels and models with objects and access control
CO-3: Analyse tools and methods used in cybercrime
CO-4: Understand Organizational Implications and security risks

UNIT – I:
Introduction to Cybercrime: Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT – II:
Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT – III:
Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies an Measures in Mobile Computing Era, Laptops.

UNIT – IV:
Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan

Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT – V:

Cyber Security: Organizational Implications

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications.

UNIT – VI:

Social Media Marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

TEXT BOOKS:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley India

REFERENCES:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press
2. Introduction to Cyber Security, Chwan-Hwa (John) Wu, J. David Irwin, CRC Press T&F Group

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

(19OE1IT02) COMPUTER FORENSICS

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Cryptography and Network Security, Essentials of Cyber Security

COURSE OBJECTIVES:
- To provide an understanding of computer forensics fundamentals
- To analyze various computer forensics technologies and to provide computer forensics systems
- To identify methods for data recovery
- To apply the methods for preservation of digital evidence

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Define and discuss the concepts of computer forensics
CO-2: Explain and apply the concepts of computer investigations
CO-3: Select and apply current computer forensics tools
CO-4: Identify and apply current practices for processing crime and incident scenes

UNIT – I:
Computer Forensics Fundamentals: What is Computer Forensics? Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists.

UNIT – II:
Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement — Computer Forensic Technology — Types of Business Computer Forensic Technology Computer Forensics Evidence and Capture: Data Recovery Defined — Data Back-up and Recovery — The Role of Back-up in Data Recovery — The Data-Recovery Solution.

UNIT – III:
Evidence Collection and Data Seizure: Why Collect Evidence? Collection Options — Obstacles — Types of Evidence — The Rules of Evidence — Volatile Evidence — General Procedure — Collection and Archiving — Methods of Collection — Artifacts — Collection Steps — Controlling Contamination: The Chain of Custody Duplication and Preservation of Digital Evidence: Preserving the Digital Crime Scene — Computer Evidence Processing Steps — Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer Image Verification and Authentication: Special Needs of Evidential Authentication — Practical Consideration —Practical Implementation.

UNIT – IV:

Computer Forensics Analysis and Validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project. Processing Crime and Incident Scenes: Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case.

UNIT – V:

Current Computer Forensic Tools: Evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.

Cell Phone and Mobile Device Forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

UNIT – VI:

Working with Windows and DOS Systems: understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

TEXT BOOKS:

1. Computer Forensics, Computer Crime Investigation, John R. Vacca, Firewall Media, New Delhi
2. Computer Forensics and Investigations, Nelson, Phillips Enfinger, Steuart, Cengage Learning
3. Real Digital Forensics, Keith J. Jones, Richard Bejtiich, Curtis W. Rose, Addison Wesley, Pearson Education

REFERENCES:

1. Forensic Compiling, A Practitioners Guide, Tony Sammes and Brian Jenkinson, Springer International Edition
2. Computer Evidence Collection & Presentation, Christopher L. T. Brown, Firewall Media
3. Homeland Security, Techniques & Technologies, Jesus Mena, Firewall Media
4. Software Forensics Collecting Evidence from the Scene of a Digital Crime, Robert M. Slade, TMH 2005
5. Windows Forensics, Chad Steel, Wiley India Edition

DATA SCIENCES / BIG DATA AND ANALYTICS

DATA SCIENCES / BIG DATA AND ANALYTICS

Data science helps in risk evaluation and observing, possible deceitful comportment, payments, customer analysis, and experience, among much other exploitation. The capability to make **data**-driven choices generates a steadier financial situation and **data scientists** make the strength of the **industry.**

As such, **data science** track helps students to apply business concepts in banking, finance, manufacturing, transport, e-commerce, education, etc. that use **data science**. As a consequence, there are numerous **Data Science** Applications associated to it

Job Roles in Data Science Track

- Data Analyst
- Data Engineers
- Database Administrator
- Machine Learning Engineer
- Data Scientist
- Data Architect
- Statistician
- Business Analyst
- Data and Analytics Manager

Big Data analytics track helps the students to learn the process of gathering, establishing and examining large sets of **data** (called **Big Data**) to determine patterns and other beneficial information. Analysts occupied with **Big Data** characteristically want the acquaintance that comes from investigating the **data**.

Big data analytics is the practice of mining useful information by examining different **types** of big data sets. Big data analytics is utilized to determine concealed patterns, market developments and consumer favorites, for the advantage of organizational decision making.

Job responsibilities in a Big Data Analytics Track are

- To gather and accumulate data from disparate sources, clean it, organize it, process it, and analyse it to extract valuable insights and information.
- To identify new sources of data and develop methods to improve data mining, analysis, and reporting.
- To create data definitions for new database files or alterations made to the already existing ones for analysis purposes.
- To present the findings in reports (in table, chart, or graph format) to help the management team in the decision-making process.
- To apply statistical analysis methods for consumer data research and analysis purposes.
- To keep track of the trends and correlational patterns among complex data sets.
- To perform routine analysis tasks to support day-to-day business functioning and decision making.
- To collaborate with Data Scientists to develop innovative analytical tools.

- To work in close collaboration with both the IT team and the business management team to accomplish company goals.

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

(19OE1MT02) STATISTICAL METHODS FOR DATA SCIENCE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To provide insights about the basic roles of various statistical methods in building computer applications
- To develop a greater understanding of the importance of Data Visualization techniques
- To develop problem-solving skills
- To make inferences about the population parameters using sample data
- To provide an understanding on the importance and techniques of predicting a relationship between the two sets of data and determine the goodness of fitted model

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

CO-1: Analyze an extremely large data set and perform exploratory data analysis to extract meaningful insights

CO-2: Develop various visualizations of the data in hand and communicate results of analysis effectively (visually and verbally)

CO-3: Examine a real-world problem and solve the same with the knowledge gained from various distributions study

CO-4: Use and fit a linear regression model to data and use it for prediction

CO-5: Fit a polynomial regression model to data and use it for prediction

UNIT – I:

Introduction to Statistics: Definition of statistics, basic objectives, applications in various branches of science with examples, collection of data: internal and external data, primary and secondary data, population and sample, representative sample.

UNIT – II:

Descriptive Statistics: Classification and tabulation of univariate data, graphical representation, frequency curves, descriptive measures - central tendency and dispersion, bivariate data, summarization, marginal and conditional frequency distribution.

UNIT – III:

Introduction to R: Introduction, Installing R and data types in R, programming using R: operators, conditional statements, looping, scripts, function creation, creating list, list operations, recursive list, creating a data frame, operations on data frames.

UNIT – IV:

Data Visualization using R: Import - export of data, measures of central tendency and measures of dispersion, data visualization – scatter plot, pie chart, histogram, bar chart, box plot, absolute and relative frequencies, frequency distribution.

UNIT – V:

Correlation & Linear Regression:

Correlation: Correlation, types of correlation, coefficient of correlation, rank correlation coefficient.

Linear Regression: Introduction, regression model, interval estimation, estimation of parameters of β_0 and β_1, Estimation of $\sigma^{2.}$

UNIT – VI:

Non-Linear Regression: Regression of second-degree polynomial (non-linear least square method for polynomial function), power function, exponential, estimation of coefficients, linear and polynomial regressions in R.

TEXT BOOKS:

1. Introductory Statistics, Thomas H. Wonnacott & Ronald J. Wonnacot, John Wiley & Sons Inc., 1969
2. Applied Statistics and Probability for Engineers, Douglas C. Montgomery, George C. Runger, 3rd Edition, John Wiley & Sons, Inc., 2003
3. R for Beginners, Sandip Rakshit, 1st Edition, McGraw-Hill Education, 2017

REFERENCES:

1. R-The Statistical Programming Language, Dr. Mark Gardner, Wiley India Pvt. Ltd, 2013
2. Introduction to the Theory of Statistics, A. M. Mood, F. A. Graybill and D. C. Boes, 3rd Edition, McGraw Hill Education, 2017
3. Introduction of Probability Models, S. M. Ross, 11th Edition, Academic Press, N.Y., 2014
4. Statistical Methods, S. P. Gupta, 42nd Revised Edition, Sultan Chand & Sons, 2012

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1IT03) COMPUTATIONAL THINKING USING PYTHON

COURSE PRE-REQUISITES: Statistical Methods for Data Science

COURSE OBJECTIVES:

- To understand why Python is a useful scripting language for developers
- To create and execute Python programs and to Learn how to use lists, tuples, and dictionaries in Python programs
- To learn how to build and package Python modules for reusability
- To learn how to design object-oriented programs with Python classes
- To learn how to use exception handling in Python applications for error handling

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms)
CO-2: Adequately use standard programming constructs: repetition, selection, functions, composition, modules, aggregated data (arrays, lists, etc.)
CO-3: Explain what a given program (in Python) does identify and repair coding errors in a program
CO-4: Understand and use object-based software concepts (constructing OO software will be dealt with in the course Software Engineering)
CO-5: Use library software for (e.g.) building a graphical user interface, web application, or mathematical software

UNIT – I:
Introduction: History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator, Conditional Statements-If
If- else Nested if-else Looping for While Nested loops Control Statements Break
Continue Pass String Manipulation Accessing Strings Basic Operations String slices Function.

UNIT – II:
Methods, Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods,
Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods
Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties.

UNIT – III:
Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.

Modules: Creation, Importing module, Math module, Random module, Packages.

UNIT – IV:

Composition: Input-Output-Printing on screen, Reading data from keyboard, Opening and closing file Reading and writing files, Functions.

Exception Handling: Exception, Exception Handling, Except clause, Try? Finally clause, User Defined Exceptions

UNIT – V:

OOPs Concept: Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding, Regular expressions- Match function, Search function, Matching VS Searching, Modifiers, Patterns.

Multithreading: Thread, Starting a thread, Threading module, Synchronizing threads.

CGI: Introduction, Architecture, CGI environment variable, GET and POST methods, Cookies, File upload.

UNIT – VI:

Database: Introduction, Connections, Executing queries, Transactions Handling error,

Networking: Socket, Socket Module, Methods, Client and server, Internet modules, Sending email.

TEXT BOOKS:

1. Learning Python, David Ascher and Mark Lutz, O'Relly

REFERENCES:

1. Python Programming: An Introduction to Computer Science, John M. Zelle, 2nd Edition, Kindle Edition
2. Python Essential Reference, David M. Beazley, 4th Edition, Developer's Library

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

(19OE1IT04) FUNDAMENTALS OF DATA MINING

COURSE PRE-REQUISITES: Statistical Methods for Data Science, Computational Thinking using Python

COURSE OBJECTIVES:
- To introduce the basic concepts and techniques in building a Data Warehouse
- To apply preprocessing methods for any given raw data
- To develop skills of using recent data mining software for solving practical problems
- To implement and apply basic algorithms for supervised and unsupervised learning

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Assess raw input data and process it to provide suitable input for a range of data mining algorithms.
CO-2: Discover and measure interesting patterns from different kinds of databases
CO-3: Evaluate and select appropriate data-mining algorithms and apply, interpret and report the output appropriately
CO-4: Design and implement data-mining applications using sample, realistic data sets and modern tools

UNIT – I:
Data Warehousing & Modeling: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading.

UNIT – II:
Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.

UNIT – III:
Data Warehouse Implementation & Data Mining: Data Warehouse Architecture, What is data mining, Challenges, From Data Warehousing and Data Mining, Data Mining Tasks, Data Mining Functionalities, Major Issues in Data Mining. Data: Types of Data, Data Quality, Data Pre-processing, Measures of Similarity and Dissimilarity.

UNIT – IV:

Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.

UNIT – V:

Classification: Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.

UNIT – VI:

Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph- Based Clustering, Scalable Clustering Algorithms.

TEXT BOOKS:

1. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, First Impression, Pearson, 2014
2. Data Mining-Concepts and Techniques, Jiawei Han, Micheline Kamber, Jian Pei, 3rd Edition, Morgan Kaufmann, 2012

REFERENCES:

1. Data Warehousing in the Real World, Sam Anahory, Dennis Murray, Tenth Impression, Pearson, 2012
2. Mastering Data Mining, Michael J. Berry, Gordon S. Linoff, 2nd Edtion, Wiley, 2012

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

(19OE1IT05) DATA ANALYSIS AND VISUALIZATION

COURSE PRE-REQUISITES: Statistical Methods for Data Science, Computational Thinking using Python, Fundamentals of Data Mining

COURSE OBJECTIVES:

- To introduce concept and characteristics of probability distribution
- To introduce underlying design principles, properties and assumptions of linear and non-linear regression modelling
- To introduce design principles involved in identifying interesting classification and prediction of data patterns
- To introduce properties of time series data and perform time series analysis

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply probability distribution concepts to identify univariate data patterns
CO-2: Apply regression modelling to build efficient mathematical models for prediction and classification
CO-3: Apply decision and regression trees for supervised learning
CO-4: Visualize time series data by applying time series techniques

UNIT – I:
Data Definitions and Analysis Techniques: Elements, Variables, and Data categorization, Introduction to statistical learning, Descriptive Statistics: Measures of central tendency, Measures of location of dispersions.

UNIT – II:
Basic Analysis Techniques: Basic analysis techniques, Statistical hypothesis generation and testing, Chi-Square test, t-Test Analysis of variance, Correlation analysis, Maximum likelihood test.

UNIT – III:
Data Analysis Techniques: Regression analysis and visualization, Classification techniques and visualization, Clustering and visualization, Association rules analysis and visualization

UNIT – IV:
Time-series Analysis and Forecasting – Time-series components, Variation in Time Series, Cyclic Variation, Seasonal Variation, Irregular Variation.

UNIT – V:

Smoothing Techniques: A problem involving all four components of time series, Introduction to forecasting, forecasting models, Trend and Seasonal effects, Trend Analysis

UNIT – VI:

Case-studies and Projects: Understanding business scenarios, Feature engineering and visualization, Sensitivity Analysis.

TEXT BOOKS:

1. Data Mining and Analysis, Mohammed J. Zaki, Wagner Meira, Cambridge, 2012
2. Data Mining: Theories, Algorithms, and Examples, Nong Ye, CRC Press Taylor & Francis Group, 2014
3. Statistics for Management, David S. Rubin, Sanjay Rastogi, Masood Husain Siddiqui Richard I. Levin, 7th Edition, Pearson Learning

REFERENCES:

1. Probability & Statistics for Engineers & Scientists, Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, 9th Edition, Prentice Hall Inc.
2. The Elements of Statistical Learning, Data Mining, Inference and Prediction, Trevor Hastie, Robert Tibshirani, Jerome Friedman, 2nd Edition, Springer, 2014
3. An Introduction to Statistical Learning Mining Massive Data Sets, A. Rajaraman and J. Ullman, Cambridge University Press, 2012
4. Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers, Springer

AUTONOMOUS VEHICLES

AUTONOMOUS VEHICLES

The invention of the wheel marked a large step in the evolution of mankind. With mobility, man experienced a newfound freedom that opened the doors for several other inventions. Automobile engineering or automotive engineering is one of the most challenging careers in the field of engineering with a wide scope. This branch deals with the designing, developing, manufacturing, testing and servicing automobiles such as cars, trucks, motorcycles, scooters, etc. and the related engineering sub systems. For the perfect blend of designing and manufacturing automobiles, automobile engineering uses the features of different elements of engineering such as mechanical, electrical, electronic, instrumentation, civil, software and safety engineering. Exploring the topic from an interdisciplinary perspective is indispensable. Globalization and incredible growth of automobile industry have resulted in numerous opportunities for engineers both in India and abroad.

The 17^{th} and 18^{th} centuries were mostly about steam-powered vehicles transporting people and goods. While electric cars enjoyed popularity in the 19^{th} and early 20^{th} centuries, the later period saw the accelerated adoption of the petrol car, due to its advantages of power, mass production, cost and advances in the internal combustion engine. It is only in the 21^{st} century that interest in electric cars has come back, given the need for cleaner, greener modes of transport. The modern period is associated with several path breaking technologies. Over the last couple of decades, there has been an explosion of electronics in vehicles. Connected cars that include technology features are ever more popular. These smart cars come with internet access, GPS, wi-fi, superior infotainment, advanced telematics and navigation capabilities. More innovations in in-vehicle infotainment and electronics promise to give car users even more enhanced capabilities in the near future.

Today, safety has become a larger concern than ever before. While entertainment and infotainment have made car driving a pleasure, this has also given rise to a growing tribe of distracted drivers. Add to this, underdeveloped roads, which take a toll on drivers today. Increased distractions and fatigue can also contribute to human fatalities. The future certainly points in the direction of driverless cars, which promise to alleviate concerns of traffic congestion and road safety. Driverless cars, also known as autonomous cars, will usher in a paradigm shift in the evolution of the modern automobile. Self-driving cars can sense the environment and traffic with the help of RADAR, LIDAR, GPS and computer vision and navigate without human intervention. Autonomous cars are claimed to have greater accuracy, reliability and faster reaction time compared to human drivers. This would lead to fewer traffic collisions and less road congestion.

Autonomous driving is a popular subject of today's discussion and automakers are developing complex systems that allow cars to drive themselves. If technology continues on its current course, car will do the concentrating for you.

Self-parking, automatic emergency braking, adaptive cruise control and lane keeping are just some of the technologies that have leapt into the market in the past few years. Put them all together, get a picture of driving to assisted driving to fully autonomous cars. The open elective track “Autonomous Vehicles” offered by the department of automobile engineering trains the students to meet the technological challenges and diverse needs of the industry and society in various areas of automobile engineering and equips them to excel in a truly competitive industry. With through knowledge in this filed, engineering graduates get opportunity to serve many top-notch automobile companies and IT companies as well.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1AE01) PRINCIPLES OF AUTOMOBILE ENGINEERING

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the layout of an automobile and functionalities subsystems
- To provide overview on concepts of engine, cooling, lubrication and fuel systems
- To present constructional features and working of automotive driveline and running systems
- To study the fundamentals and principles of automotive electrical systems

COURSE OUTCOMES After completion of the course, the student should be able to
CO-1: Explain the functionalities of automotive systems and subsystems
CO-2: Give an overview on engine and engine subsystems.
CO-3: Describe working of automotive driveline and running systems
CO-4: Discuss the concepts of automotive starting, ignition and charging systems

UNIT – I:
Introduction: Classification of automobiles, layout of an automobile, automobile sub systems and their role. Types of chassis, role and requirement of a chassis frame, types of frames, materials, loading points and types of bodies.

UNIT – II:
Engine: Classification and components of an engine, principle and working of four stoke and two stroke SI and CI engines, petrol fuel system - carburetor, diesel fuel system - diesel fuel pump, injectors, introduction to electronic fuel injection system – MPFI and CRDI.

UNIT – III:
Cooling and Lubrication: Necessity of cooling, air-cooling, water cooling - thermosyphon and pump cooling, radiator, pump, thermostat, antifreeze solution and radiator fan. Mist, splash and forced lubrication, oil filters and oil pumps.

UNIT – IV:
Drive Line: Clutches, principle, single plate clutch, multi plate clutch and centrifugal clutch. Gear box - Need, sliding mesh, constant mesh and synchromesh gear box. Propeller shaft, universal joint, differential, wheels and tyres.

UNIT – V:
Running Systems: Suspension systems – Objective, rigid axle and independent suspension system and torsion bar. Steering system – Layout, steering mechanism, steering geometry and steering gear boxes. Brake system –Principle, stopping distance, types of brakes and actuation.

UNIT – VI:
Electrical Systems: Starting system - Principle, working of different starter drive units and solenoid switches. Ignition system **-** Conventional ignition system types, ignition

advance and retarding mechanisms. Charging system – Alternator principle, construction and working, cut-outs and regulators.

TEXT BOOKS:

1. Advanced Vehicle Technology, Heinz Heisler, Butterworth Heinemann Publishers, 2002
2. Automobile Electrical Equipment, Crouse W. H., 3rd Edition, McGraw Hill Book Co., Inc., New York,1986

REFERENCES:

1. Motor Vehicle, Garrett T. K., Newton K. and Steeds W. ButterWorths & Co. Publishers Ltd., New Delhi, 2001
2. Automotive Electrical Equipment, Kohli P. L., Tata McGraw Hill Co., Ltd., New Delhi, 1975
3. Automotive Chassis and Body, Crouse W. H., McGraw Hill Book Co., 5th Edition, 1976
4. Automotive Mechanics, Giri N. K., Khanna Publications, 2006

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1AE02) MODERN AUTOMOTIVE TECHNOLOGIES

COURSE PRE-REQUISITES: Principles of Automobile Engineering

COURSE OBJECTIVES:
- To provide an overview on advanced engine control system concepts
- To know the interdisciplinary concepts and intelligent automotive systems
- To understand the interdisciplinary concepts and GPS-enabled applications in automobile
- To present intelligent vehicle technologies like comfort, safety and security systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply advanced engine control system concepts in engineering
CO-2: Discuss the need for implementation intelligent vehicle technologies
CO-3: Address the key technologies in automotive navigation
CO-4: Appreciate the technological advancements driver assistance systems

UNIT – I:
Advanced Engine Controls: Concept of an electronic engine control system, engine control module, powertrain control module, electronic fuel injection - throttle body fuel injection, multi-point fuel injection, gasoline direct injection, common rail direct injection, electronic ignition control, engine mapping, on-board diagnostics.

UNIT – II:
Introduction to Intelligent Vehicles: Driver information, driver perception, driver convenience, driver monitoring, general vehicle control, longitudinal and lateral control, collision avoidance, vehicle monitoring.

UNIT – III:
Telematics: Global positioning system, geographical information systems, navigation system, architecture, automotive vision system, road recognition.

UNIT – IV:
Comfort Systems: Adaptive cruise control system, active suspension system, power steering, collapsible and tiltable steering column, power windows.

UNIT – V:
Safety Systems: Active and passive safety, airbags, seat belt tightening system, forward collision warning systems, child lock, anti-lock braking systems, traction control system, lane departure warning system.

UNIT – VI:
Security Systems: Anti-theft technologies – mechanical, electromechanical and electronic immobilizers, alarm system, stolen vehicle tracking system, remote keyless entry, smart card system, number plate coding.

TEXT BOOKS:

1. Understanding Automotive Electronics, William B. Ribbens, 5th Edition, Butterworth Heinemann Woburn,1998
2. Intelligent Vehicle Technologies: Theory and Applications, Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann Publications, Oxford, 2001

REFERENCES:

1. Automotive Handbook, Robert Bosch, SAE, 5th Edition, 2000
2. Navigation and Intelligent Transportation Systems – Progress in Technology, Ronald K. Jurgen, Automotive Electronics Series, SAE, USA, 1998
3. Understanding Automotive Electronics, Bechhold, SAE, 1998

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1AE03) ELECTRIC, HYBRID AND FUEL CELL VEHICLES

COURSE PRE-REQUISITES: Principles of Automobile Engineering, Modern Automotive Technologies

COURSE OBJECTIVES:
- To study the concepts and drivetrain configurations of electric and hybrid vehicles
- To understand about electric propulsion system
- To provide various energy storage devices
- To present principle, working and automotive applications of fuel cell and solar technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the concepts and drivetrain configurations of electric and hybrid vehicles
CO-2: Discuss various electric motors and controls
CO-3: Present various energy storage devices
CO-4: Describe automotive applications of fuel cell and solar technology

UNIT – I:
Electric Vehicles: Layout of an electric vehicle, system components, traction motor characteristics, transmission, electronic control system, advantage and limitations, performance and energy consumption of electric vehicles.

UNIT – II:
Hybrid Vehicles: Concepts of hybrid electric drivetrain based on hybridization and powertrain configuration, architecture of series, parallel and series-parallel hybrid electric drivetrains, modes of operation, merits and demerits, plug-in hybrid architecture, speed and torque coupling of hybrid electric drivetrains.

UNIT – III:
Electric Motors: Review of technology suited to automotive propulsion, requirements, DC motors, Induction motors, permanent magnet brushless DC motors and switched reluctance motors.

UNIT – IV:
Motor Drives: Speed and torque control, DC motor - Chopper based four quadrant operations, induction motor, permanent magnet motor and switched reluctance motor.

UNIT – V:
Energy Storages: Electromechanical batteries - Types, parameters, lead acid batteries, nickel-based batteries, lithium-based batteries, battery management system and ultracapacitors.

UNIT – VI:

Fuel Cell and Solar Vehicles: Fuel cell vehicle – Operating principle, types of fuel cells, fuel cell options for fuel cell vehicle and fuel cell hybrid vehicle. Solar vehicle - Solar photovoltaic cell, solar array, solar car electrical system and drive train.

TEXT BOOKS:

1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, CRC Press, 2004
2. Electric Vehicle Technology-Explained, James Larminie and John Loury, John Wiley & Sons Ltd., 2003

REFERENCES:

1. Electric and Hybrid Vehicles – Design Fundamentals, Iqbal Husain, CRC Press, 2010
2. Electric Vehicle Battery Systems, Sandeep Dhameja, Butterworth–Heinemann, 2002
3. Electric and Hybrid – Electric Vehicles, Ronald K. Jurgen, SAE, 2002
4. Light Weight Electric/Hybrid Vehicle Design, Ron Hodkinson and John Fenton, Butterworth–Heinemann

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1AE04) CONNECTED AND AUTONOMOUS VEHICLES

COURSE PRE-REQUISITES: Principles of Automobile Engineering, Modern Automotive Technologies, Electric, Hybrid and Fuel Cell Vehicles

COURSE OBJECTIVES:
- To understand the fundamentals of vehicle communication and networking
- To provide state-of-the-art in wireless communication technology within and between vehicles
- To know various levels of vehicle autonomy and intelligent automotive systems
- To provide an overview on driver-assist and self-driving processes

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Present the fundamentals of vehicle communication and networking
CO-2: Appreciate intra-vehicle and inter-vehicle communication technologies
CO-3: Describe various levels of vehicle autonomy
CO-4: Discuss the driver-assist and self-driving processes

UNIT – I:
Introduction to Vehicle Communications: Intra-vehicle communications - communications protocols, systems and sensors (Braking, steering, power train, chassis systems, body electronics, instrument clusters, infotainment systems), inter-vehicle communications - cooperative driving (accident warning, frontal/rear collision prevention, lane change, assistance). Consumer assistance – traffic information, multimedia support and smart parking

UNIT – II:
Communication Fundamentals and Controller Area Network: Communication fundamentals – Frequency, bandwidth, power measurement, signal to noise ratio, transmission rate constraints, radio frequency spectrum allocation, RADAR operation and types of RADAR. CAN evolution, versions, types of controllers, layered architecture. CAN bus, message frames and error handling.

UNIT – III:
Intra-Vehicle Communications: Wired communication – Network comparison, two tier approach, LIN applications - Localized vehicle area support, general support areas, CAN applications - In vehicle operation, infotainment, wireless communication – Bluetooth vehicle applications, satellite services – satellite radio, vehicle care and traffic status.

UNIT – IV:
Inter-Vehicle Communication: Adhoc Communications –Applications in Vehicle traffic Monitoring, Collision and congestion avoidance, Highway lane reservation, Emission Control, Vehicle Frequency Utilization – AM Radio, Bluetooth, FM Radio, GPS, Short range RADAR, Wireless LAN, Intelligent Roadway-Infrastructure to vehicle and vehicle to vehicle communications. Evolving smart vehicle – ECU, wireless

networking, forward RADAR, side RADAR, GPS, cellular transmission and event Recorder.

UNIT – V:

Autonomous Vehicles: Importance, levels of automation, policy making, social costs, safety and crashes, congestion, land use, energy and emissions, costs and disadvantages

UNIT – VI:

Current State of Autonomous Vehicles: Research, challenges, commercial development, sensor systems, sensor suits, environmental challenges, graceful degradation, V2V and V2I communication, sharing the drive, integrity, security, verification and policy implications.

TEXT BOOKS:

1. Inter and Intra Vehicle Communications, Gilbert Held Auerbach Publications, 2008
2. Autonomous Vehicle Technology-A Guide for Policymakers, James M. Anderson, Nidhi Kalra, Karlyn D. Stanley, Paul Sorensen, Constantine Samaras, Oluwatobi A. Oluwatola, RAND Corporation, Santa Monica, Calif., 2016
3. Autonomous Driving - Technical, Legal and Social Aspects, Markus Maurer, J. Christian Gerdes, Barbara Lenz, Hermann Winner, Editors, Springer, 2016

REFERENCES:

1. Intelligent Vehicle Technologies: Theory and Applications, Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann Publications, Oxford, 2001
2. Navigation and Intelligent Transportation Systems – Progress in Technology, Ronald K. Jurgen, Automotive Electronics Series, SAE, USA, 1998
3. Automotive In–vehicle Networks, J. Gabrielleen, Wiley-Blackwell, 2008
4. In-Vehicle Network Architecture for the Next-Generation Vehicles, Syed Masud Mahmud, IGI
5. Communication Technologies for Vehicles, Mohamed Kassab Springer, 2015

GENERAL - COMPUTING

1. PROGRAMMING THROUGH JAVA

Java is an extensively **used** programming language specifically intended for use in the distributed environment of the internet. **Java** help students to create wide-ranging applications that possibly will run on a single workstation or be distributed among servers and clients in a network.

Java is an extremely fruitful language and an upper option for many developers for many years. The motive that it has remained so prevalent is since it still happens the needs of functioning across networks.

Students will have different roles and responsibilities by learning Java Programming

- Designing, implementing, and maintaining Java applications that are often high-volume and low-latency, required for mission-critical systems.
- Delivering high availability and performance.
- Contributing in all phases of the development lifecycle.
- Writing well-designed, efficient, and testable code.

2. RELATIONAL DATABASE MANAGEMENT SYSTEMS

A relational database permits you to effortlessly find precise information. It also consents you to sort based on any field and produce reports that comprise only definite fields from each record. With features like, Data Accuracy, Easy Access to Data, Data Integrity, Flexibility, Normalization, High Security, Feasible for Future Modifications

By learning RDBMS Students will have different roles in Database environment

- Data Administrator,
- Database Administrator
- Database Designer
- Application Programmer

3. COMPUTATIONAL THINKING USING PYTHON

The **python** language is one of the utmost accessible programming languages available because it has streamlined syntax and not complex, which gives more importance on natural language. Due to its comfort of learning and practice, **python** codes can be readily written and executed much quicker than former programming languages.

Data Science: The libraries and frameworks Python offers, e.g. PyBrain, PyMySQL, and NumPy are one of the big reasons. Another reason is diversity. Python experience allows you to do a lot more than any other language, e.g. you can create scripts to automate stuff, go into web development, and so much more.

Students will have various Job Profiles by learning Python

- Software Engineer.
- Python Developer.
- Research Analyst.
- Data Analyst.
- Data Scientist.
- Software Developer.

4. INTRODUCTION TO DATA ANALYTICS

Data Scientists and Analysts **use data analytics** techniques in their research, and businesses also **use** it to inform their conclusions. **Data analysis** can assistance corporations healthier comprehend their customers, assess their ad-campaigns, personalize gratified, create content approaches and progress products.

By learning Data Analytics students will get Jobs with different designations

- IT Systems Analyst. Systems analysts use and design systems to solve problems in information technology. ...
- Healthcare Data Analyst. ...
- Operations Analyst. ...
- Data Scientist. ...
- Data Engineer. ...
- Quantitative Analyst. ...
- Data Analytics Consultant. ...
- Digital Marketing Manager.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1IT06) PROGRAMMING THROUGH JAVA

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce object-oriented programming concepts using the Java language
- To introduce the principles of inheritance and polymorphism; and demonstrates how they relate to the design of abstract classes
- To introduce the implementation of packages and interfaces
- To introduce exception handling, event handling and multithreading

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Develop applications for range of problems using object-oriented programming techniques
CO-2: Design simple graphical user interface applications
CO-3: Explore the design of graphical user interface using applets and swings

UNIT – I:
Object Oriented Thinking and Java Basics: Need for OOP Paradigm, Summary of OOP Concepts, Coping with Complexity, Abstraction Mechanisms, A Way of Viewing World – Agents, Responsibility, Messages, Methods, History of Java, Java Buzzwords, Data Types, Variables, Scope and Life Time of Variables, Arrays, Operators, Expressions, Control Statements, Type Conversion and Casting, Simple Java Program, Concepts of Classes, Objects, Constructors, Methods, Access Control, This Keyword, Garbage Collection, Overloading Methods and Constructors, Method Binding, Inheritance, Overriding and Exceptions, Parameter Passing, Recursion, Nested and Inner Classes, Exploring String Class.

UNIT – II:
Inheritance, Packages and Interfaces: Hierarchical Abstractions, Base Class Object, Subclass, Subtype, Substitutability, Forms of Inheritance- Specialization, Specification, Construction, Extension, Limitation, Combination, Benefits of Inheritance, Costs of Inheritance. Member Access Rules, Super Uses, Using Final with Inheritance, Polymorphism- Method Overriding, Abstract Classes, The Object Class.
Defining, Creating and Accessing a Package, Understanding Classpath, Importing Packages, Differences between Classes and Interfaces, Defining an Interface, Implementing Interface, Applying Interfaces, Variables in Interface and Extending Interfaces, Exploring Java.IO.

UNIT – III:
Exception Handling and Multi-threading: Concepts of Exception Handling, Benefits of Exception Handling, Termination or Resumptive Models, Exception Hierarchy, Usage of Try, Catch, Throw, Throws and Finally, Built in Exceptions, Creating Own Exception Sub Classes.
String Handling, Exploring Java. Util, Differences between Multi-Threading and Multitasking, Thread Life Cycle, Creating Threads, Thread Priorities, Synchronizing

Threads, Interthread Communication, Thread Groups, Daemon Threads. Enumerations, Autoboxing, Annotations, Generics.

UNIT – IV:
Event Handling: Events, Event Sources, Event Classes, Event Listeners, Delegation Event Model, Handling Mouse and Keyboard Events, Adapter Classes.
The AWT Class Hierarchy, User Interface Components- Labels, Button, Canvas, Scrollbars, Text Components, Check Box, Check Box Groups, Choices, Lists Panels – Scrollpane, Dialogs, Menubar, Graphics, Layout Manager – Layout Manager Types – Border, Grid, Flow, Card and Grid Bag.

UNIT – V:
Applets: Concepts f Applets, Differences between Applets and Applications, Life Cycle of an Applet, Types of Applets, Creating Applets, Passing Parameters to Applets.

UNIT – VI:
Swing: Introduction, Limitations of AWT, MVC Architecture, Components, Containers, Exploring Swing- Japplet, Jframe and Jcomponent, Icons and Labels, Text Fields, Buttons – The Jbutton Class, Check Boxes, Radio Buttons, Combo Boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

TEXT BOOKS:

1. Java The Complete Reference, Herbert Schildt, 7th Edition, TMH
2. Understanding OOP with Java Updated Edition, T. Budd, Pearson Education
3. An Introduction to Programming and OO Design using Java, J. Nino and F.A. Hosch, John Wiley & Sons

REFERENCES:

1. Introduction to Java Programming, Y. Daniel Liang, Pearson Education
2. An Introduction to Java Programming and Object-Oriented Application Development, R. A. Johnson, Thomson
3. Core Java 2, Vol. 1 - Fundamentals, Cay. S. Horstmann and Gary Cornell, 8th Edition, Pearson Education
4. Core Java 2, Vol. 2 - Advanced Features, Cay. S. Horstmann and Gary Cornell, 8th Edition, Pearson Education

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1CS08) RELATIONAL DATABASE MANAGEMENT SYSTEMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

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

CO-1: Demonstrate the basic elements of a relational database management system

CO-2: Ability to identify the data models for relevant problems

CO-3: Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data

CO-4: Apply normalization for the development of application software

UNIT – I:

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.

Introduction to Database design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.

Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data

Logical Database Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT – II:

Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.

SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

UNIT – III:

Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of

Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

UNIT – IV:

Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

UNIT – V:

Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

UNIT – VI:

Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.

Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.

Hash-Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw Hill Education (India) Private Limited
2. Database System Concepts, A. Silberschatz, Henry F. Korth, S. Sudarshan, 6th Edition, McGraw Hill Education (India) Private Limited
3. Database Systems, R. Elmasri, Shamkant B. Navathe, 6th Edition, Pearson Education

REFERENCES:

1. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning
2. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Introduction to Database Systems, C. J. Date, Pearson Education

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1IT03) COMPUTATIONAL THINKING USING PYTHON

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand why Python is a useful scripting language for developers
- To create and execute Python programs and to Learn how to use lists, tuples, and dictionaries in Python programs
- To learn how to build and package Python modules for reusability
- To learn how to design object-oriented programs with Python classes
- To learn how to use exception handling in Python applications for error handling

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms)
CO-2: Adequately use standard programming constructs: repetition, selection, functions, composition, modules, aggregated data (arrays, lists, etc.)
CO-3: Explain what a given program (in Python) does identify and repair coding errors in a program
CO-4: Understand and use object-based software concepts (constructing OO software will be dealt with in the course Software Engineering)
CO-5: Use library software for (e.g.) building a graphical user interface, web application, or mathematical software

UNIT – I:
Introduction: History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator, Conditional Statements-If
If- else Nested if-else Looping for While Nested loops Control Statements Break
Continue Pass String Manipulation Accessing Strings Basic Operations String slices Function.

UNIT – II:
Methods, Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods, Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods
Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties.

UNIT – III:
Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.
Modules: Creation, Importing module, Math module, Random module, Packages.

UNIT – IV:

Composition: Input-Output-Printing on screen, Reading data from keyboard, Opening and closing file Reading and writing files, Functions.

Exception Handling: Exception, Exception Handling, Except clause, Try? Finally clause, User Defined Exceptions

UNIT – V:

OOPs Concept: Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding, Regular expressions- Match function, Search function, Matching VS Searching, Modifiers, Patterns.

Multithreading: Thread, Starting a thread, Threading module, Synchronizing threads.

CGI: Introduction, Architecture, CGI environment variable, GET and POST methods, Cookies, File upload.

UNIT – VI:

Database: Introduction, Connections, Executing queries, Transactions Handling error,

Networking: Socket, Socket Module, Methods, Client and server, Internet modules, Sending email.

TEXT BOOKS:

1. Learning Python, David Ascher and Mark Lutz, 2nd Edition, O'Relly, 2003

REFERENCES:

1. Python Programming: An Introduction to Computer Science, John M. Zelle, 2nd Edition, Kindle Edition
2. Python Essential Reference, David M. Beazley, 4th Edition, Developer's Library

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1IT07) INTRODUCTION TO DATA ANALYTICS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To be exposed to conceptual framework of big data
- To understand different techniques of data analysis
- To be familiar with concepts of data streams
- To be exposed to item sets, clustering, frame works and Visualization

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand big data fundamentals
CO-2: Learn various data analysis techniques
CO-3: Implement various data streams
CO-4: Understand item sets, clustering, frame works & Visualizations

UNIT – I:
Introduction to Big Data: Introduction to Big Data Platform – Challenges of Conventional systems – Web data – Evolution of Analytic scalability, analytic process and tools, Analysis vs Reporting – Modern data analytic tools,
Statistical Concepts: Sampling distributions, resampling, statistical inference, prediction error.

UNIT – II:
Data Analysis: Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and Kernel methods
Analysis of Time Series: Linear systems analysis, nonlinear dynamics – Rule induction –
Neural Networks: Learning and and Generalisation, competitive learning, Principal component analysis and neural networks
Fuzzy Logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.

UNIT – III:
Mining Data Streams: Introduction to Streams Concepts – Stream data model and architecture – Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a Window – Decaying window – Real time Analytics Platform (RTAP) applications – case studies – real time sentiment analysis, stock market predictions.

UNIT – IV:
Frequent Itemsets and Clustering: Mining Frequent itemsets – Market based Modeling – Apriori Algorithm – Handling large data sets in Main Memory – Limited Pass Algorithm – Counting frequent itemsets in a Stream – Clustering Techniques – Hierarchical – K-Means.

UNIT – V:
Clustering high dimensional data – CLIQUE and ProCLUS – Frequent pattern-based clustering methods – Clustering in non-Euclidean space – Clustering for streams and Parallelism.

UNIT – VI:
Frameworks and Visualization: MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – S3 – Hadoop Distributed file systems – Visualizations – Visual data analysis techniques,
Interaction Techniques: Systems and Applications

TEXT BOOKS:

1. Intelligent Data Analysis, Michael Berthold, David J. Hand, Springer, 2007
2. Mining of Massive Datasets, Anand Rajaraman and Jeffrey David Ullman, Cambridge University Press, 2012

REFERENCES:

1. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks, John Wiley & Sons, 2012
2. Big Data Glossary, Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, Pete Warden, O'Reilly, 2011
3. Data Mining Concepts and Techniques, Jiawei Han, Micheline Kamber, 2nd Edition, Elsevier, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1CS11) FUNDAMENTALS OF COMPUTER ALGORITHMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To reinforce algorithms analysis methods
- To ability to analyse running time of an algorithm
- To understand different algorithm design strategies
- To familiarity with an assortment of important algorithms

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply algorithm design techniques and concepts to solve given engineering problem
CO-2: Analyze running times of algorithms using asymptotic analysis
CO-3: Develop efficient algorithms for computational tasks
CO-4: Computing complexity measures of algorithms

UNIT – I:
Introduction: Characteristics of algorithm. Analysis of algorithms: Asymptotic analysis of complexity bounds – best, average and worst-case behaviour; Performance measurements of Algorithm, Time and space trade-offs.

UNIT – II:
Divide and Conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication. Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

UNIT – III:
Greedy Method: General method, applications-Job sequencing with deadlines, 0/1 knapsack problem, Minimum cost spanning trees, Single source shortest path problem, Huffman Codes.

UNIT – IV:
Dynamic Programming-I: General method, Principle of optimality, applications-Multistage graphs, Matrix chain multiplication, Optimal binary search trees.

UNIT – V:
Dynamic Programming-II: 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem, Reliability design.

UNIT – VI:
Backtracking: General method, applications- N-Queen problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles.

TEXT BOOKS:
1. Fundamentals of Computer Algorithms, E. Horowitz et al, Galgotia Publications

2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Lieserson, Ronald L. Rivest and Clifford Stein, 4^{th} Edition, MIT Press/McGraw-Hill

REFERENCES:

1. Algorithm Design, Jon Kleinberg and Eva Tardos, 1^{st} Edition, Pearson
2. Algorithm Design: Foundations, Analysis and Internet Examples, Michael T. Goodrich and Roberto Tamassia, 2^{nd} Edition, Wiley
3. Algorithms – A Creative Approach, Udi Manber, 3^{rd} Edition, Addison-Wesley, Reading, MA
4. Introduction to the Design and Analysis of Algorithms, Anany Levitin, 3^{rd} Edition, Pearson Publications

GENERAL

PROFESSIONAL ETHICS AND HUMAN VALUES

Ethics is a necessary and listed Graduate Attribute for all engineers according to the Washington Accord. As engineers deal with the society and provide for the society, it is important that the ethical concerns pertaining to technology are well-understood and addressed. Human Values form the basis for all Ethics and ethical theories help resolve professional dilemmas too. This course aims to create an appreciation for normative and applied ethics with special focus on professionalism and technology education and practice. Given the diverse set of roles an engineer or computer scientist may play in the society, there is an inherent societal need for engineers, technologists, and computer scientists to be ethical. The formative years of students of engineering are the best time to impress upon them the practical importance and application aspects of ethics. The curriculum is designed to include an inherent appreciation for the Indian Ethos and cover a wide variety of topics with suitable case studies and examples all through, so as to enable the learners to find practical contexts in global and contemporary careers of their future. The course also leads to attaining two other Graduate Attributes majorly, along with Ethics, *viz.* Engineer and Society, and Lifelong Learning.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1HS01) PROFESSIONAL ETHICS AND HUMAN VALUES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To emphasize on the importance of ethics for engineers and computer scientists
- To provide a toolkit for ethical behaviour in personal and professional settings
- To relate the profession of engineering to sociocultural as well as ethical and moral contexts in India and globally
- To develop more socially conscious engineers who create and conceive a better society and a better world without sacrificing or ignoring public good

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Distinguish morals, values, and ethics in Indian and global contexts
CO-2: Resolve moral and ethical dilemmas through ethical inquiries and appropriate ethical theories
CO-3: Realize the professional role of engineers in society and the support available in creating safe solutions for the society focusing on public welfare
CO-4: Conduct themselves ethically in various roles that present themselves in professional and business environments

UNIT – I:
Motivation and Introduction to Human Values: Motivation to study ethics in engineering with justifying case studies, historical events, and current affairs; Morals, Values, and Ethics – Definitions; Moral Judgement vs. Value Judgement; Moral Character and Moral Autonomy – Conscientiousness, Integrity, Empathy as basic building blocks; The Golden Rule; Maslow's Theory of Needs; Universal Human Values and Theories; Conventional and Constitutional Values in Indian Ethos; Anomie vs. Civic Virtue as a foundation for an ideal society; Ethics as a basis of legal framework; Privacy and Confidentiality – Increasing emphasis in personal and professional lives, technological considerations and examples; Profession, Professionalism – Definitions, Engineering as a Profession

UNIT – II:
Ethics, Ethical Theories, and Professionalism: Ethics through Spirituality, Religion, and beyond; Indian Philosophy and Ethos, ancient to modern – Family System, Ethical Pluralism, Unity in Diversity; Ethics as application of values and as moral philosophy – Kohlberg's theory vs. Gilligan's theory of moral development leading to ethics, examples; Moral and Ethical Dilemmas – Definition, Causes, Case Studies and Examples; Resolution of Ethical Dilemmas through Ethical Inquiries – Normative, Conceptual, and Factual Inquiries, Classification of Ethics by Character and

Conduct – Consequentialism/ Utilitarianism, Deontological Ethics, Virtue Ethics and Theories, Rights Theories; Ethical Frameworks and examples; Practical application of ethical theories for decision-making in personal life

UNIT – III:

Professionalism, Engineering in the Societal Context: Professionalism – Professional Traits, Rights, Responsibilities, Roles, Virtues; Business Ethics; Engineering as Social Experimentation – Context with examples, Comparison with standard experiments, Application of Ethical Inquiries to gain knowledge and to gather relevant information, Responsibility of Experimenters, Accountability and Answerability, Consensus and Need for Informed Consent – how to address exceptions; Responsible Innovation – Social Context of Innovation, Responsible Research and Innovation, Data Privacy and Protection of Individual Rights, being Ethical by Design; Trust in the context of professionalism – confidentiality, non-disclosure agreements (NDA); Intellectual Property (IP) – IP Rights (IPR) as Professional Rights, Law, Moral Rights and Economic Rights, Patenting; Diverse roles of Engineers as Professionals – Manager, Leader, Consultant, and Expert Witness

UNIT – IV:

Professional Ethics, Ethics at Workplace and Roles of Engineers: Overview of Organizational Behaviour; Collegiality, Loyalty, Trust in professional context; Respect for Authority vs. Moral Autonomy, Moral Responsibility; Organizational context of Ethics – Minor, interpersonal, severe, organizational workplace deviances; Occupational Crime, Culpable mistakes, Collateral damage; Gifts and bribes; Industrial Ethics for non-professionals; Code of ethics and Code of Conduct – Role of professional societies in guiding, promoting, and protecting professionals and professions, Examples of common professional societies in Engineering and Science; Decision-making in professional context – Choosing the right guidance, choosing the right ethical theory; Conflicts in profession and at workplace - Employee Relations and Discrimination, Conflict of Interest, Conflict Management and Resolution, Framework for Conflict Resolution; Multinational Companies and Corporates – Work Culture and Respect for Diversity and Pluralism; Employee Rights vs. Professional Rights; Whistleblowing – Social, Organizational, and Legal context with examples

UNIT – V:

Public Welfare, Safety & Risk: Impact of engineering activities and technology on Public Welfare; Ethical Concerns of Public welfare in the context of Emerging Technologies – Artificial Intelligence, Machine Learning, Internet of Things, Cybersecurity and Cybercrime; Issues of Public Concern – Informed Consent, Health and environmental aspects, data security; Safety and Risk – Definitions; Risk Assessment – Known and Unintended consequences, Risk-Benefit Analysis, Reducing Risk, Optimum Level of Safety, Capability Curves, Safe Exit; Learning from the Past – Case Studies in Ethics Context: Titanic, Bhopal, Chernobyl; Environmental Ethics and Sustainable Development Goals; Computer Ethics and various Technology Ethics; Ethics in the context of War and Weapon Development; Ethics and Economics – Fair

Trade, Capitalism vs. Communism, Developed vs. Developing vs. Underdeveloped economies

UNIT – VI:

Ethics for Lifelong Learning: Ethics in the context of Globalization; Moral Character and Ethical Leadership – Case Studies and Examples of success and failure; Overview and comparison of different schools of thought, comparison of the works of pioneering philosophers and social scientists – Immanuel Kant, John Rawls, Martin Heidegger, Swami Vivekananda, Jiddu Krishnamurti, Dr. Abdul Kalam, *etc.*; Impact of Ethical and Unethical Behaviour in personal and professional lives, developing and maintaining ethical behaviour, threats to moral autonomy and how to continue to be ethical in personal and professional lives

TEXT BOOKS:

1. Ethics in Engineering, Mike W. Martin, Roland Schinzinger, McGraw Hill Education, 2017 (ISBN: 978-9339204457)
2. Business Ethics: An Indian Perspective, A. C. Fernando, K. P. Muralidheeran, E. K. Satheesh, Pearson Education, 2019 (ISBN: 978-9353437442)
3. Professional Ethics, R. Subramanian, Oxford University Press, 2017 (ISBN: 978-0199475070)

REFERENCES:

1. Engineering Ethics: Concepts & Cases, Charles E. Harris, Jr., Michael S. Pritchard, Michael J. Rabins, Cengage Learning, 2012 (ISBN: 978-8131517291)
2. Classical Indian Ethical Thought: A Philosophical Study of Hindu, Jaina and Bauddha Morals, Kedar Nath Tiwari, Motilal Banarsidass Publishers, 2017 (ISBN: 978-8120816084)
3. The Manual for Indian Start-Ups, Dalai Lama, Ethics for the Whole World 978-9351360803 Vijay Kumar Ivaturi et al., Penguin Random House India, 2017 (ISBN: 978-0143428527)
4. To Be Human, Jiddu Krishnamurti, Shambhala, 2000 (ISBN: 978-1570625961)
5. On Ethics and Economics, Amartya Sen, Oxford India, 1999 (ISBN: 978-0195627619)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1HS02) ENTREPRENEURSHIP

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To motivate the engineers to inculcate the skills thereof in any professional role and to consider intrapreneurship or entrepreneurship as career choices for personal and societal growth
- To impart lean management principles and practices to plan, execute, and convert one's own idea into a sustainable business model
- To gain practical knowledge to design one's own lean startup
- To identify and avoid the potential pitfalls in validation, design, production, and marketing phases of an innovative product or service

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

CO-1: Discover societal problems as entrepreneurial opportunities and ideate to develop solutions through systematic and creative approaches to innovation and business strategy

CO-2: Apply lean methodology to startup ideas using Business Model Canvas and Lean Canvas and be able to create Business Plan

CO-3: Validate ideas, design, production, and marketing systematically using techniques such as 5 Whys, Innovation Accounting, Value and Growth Propositions

CO-4: To strategize during ideation, production, market research, marketing and facing competition

UNIT – I:

Entrepreneurial Skills and Opportunities : Role of Entrepreneurs in Indian and World Economy; Entrepreneurship as a career for engineers, scientists, and technologists; Personality and Skill Set of an Entrepreneur; Need for Ethics and Empathy for Entrepreneurs; Stories of Successful and Failed Enterprises; Current Business Trends; Entrepreneurial Management vs. Corporate Management – Roles and Scope; Concepts of Intrapreneurship, Social Entrepreneurship, Technopreneurship, Studentpreneurship; Opportunities in Telangana State and India – incubators, schemes, accelerators

UNIT – II:

Introduction to Lean Startup Methodology: Overview, Principles of Lean Startup, Lean vs. Traditional Startup; Vision-to-Steering, Start-Define-Learn-Experiment, Leap-Test-Measure-Pivot, Build-Measure-Learn

UNIT – III:

Business Model Concepts: Components of Business Plan; Business Model Canvas (BMC); Lean Canvas (LC); Pitch Deck; Elevator Pitch; Financial Aspects – Financing, Funding Stages, Inflows, Outflows; Market Research and Marketing

UNIT – IV:

Building Your Business Model: Desirability, Feasibility, and Viability; Minimum Viable Product (MVP), Proof of Concept (PoC), Prototype; Early Adopters; Value Proposition; Overview of opportunities in India – Financing and Support Schemes, Online and Offline Resources, Entrepreneurial Networks

UNIT – V:

Evaluating Your Business Model: Three Learning Milestones of Innovation; Root Cause Analysis (RCA) through 5 Whys; Pivot or Persevere; The Engines of Growth: Sticky, Viral, and Paid; Kan-ban Diagram for Project Planning and Resource Allocation

UNIT – VI:

Strengthen Your Business Model: Why startups fail? Value and Waste; Design Thinking for Business; Analogs and Antilogs; Paralysis by Analysis and Extinct by Instinct; The three A's: Actionable, Accessible, and Auditable Metrics and Vanity Metrics

TEXT BOOKS:

1. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Eric Ries, Penguin Portfolio, 2015 (ISBN: 978-0670921607)
2. Entrepreneurship, Robert D. Hisrich, Michael P. Peters and Dean A. Shepherd, Tata McGraw Hill, 11th Ed., 2020 (ISBN: 978-9390113316)
3. Entrepreneurship Simplified: From Idea to IPO, Ashok Soota, S R Gopalan, Penguin Random House India, 2016 (ISBN: 978-0670088959)

REFERENCES:

1. Measure What Matters: OKRs: The Simple Idea that Drives 10x Growth, John Doerr, Penguin Portfolio, 2018 (ISBN: 978-0241348482)
2. Entrepreneurship Development and Business Ethics, Abhik Kumar Mukherjee, Shaunae Roy, Oxford University Press, 2019 (ISBN: 978-0199494460)
3. The Manual for Indian Start-Ups, Vijay Kumar Ivaturi et al., Penguin Random House India, 2017 (ISBN: 978-0143428527)
4. Social Entrepreneurship in India: Quarter Idealism and a Pound of Pragmatism, Madhukar Shukla, SAGE Publications India Pvt Ltd, 2020 (ISBN: 978-9353882372)
5. Entrepreneurship: A South Asian perspective. Donald F Kuratko, T.V Rao. Cengage Learning, 2012

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

(19OE1HS03) PERSONALITY DEVELOPMENT AND PUBLIC SPEAKING

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To develop skills and techniques for Effective Communication and Public Speaking
- To develop Leadership qualities and increase Self – confidence
- To get along with people and Team-Building
- To enhance career opportunities by Goal setting
- To develop an acceptable PERSONALITY

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Communicate better and speak with confidence
CO-2: Exhibit Leadership qualities and increased Self – confidence
CO-3: Work towards Team-Building
CO-4: Use career opportunities by Goal setting
CO-5: Acquire a forceful personality to maintain a pleasant relationship between the seniors and subordinates and other stakeholders

UNIT – I:
EFECTIVE COMMUNICATION
i. Fundamentals of Effective Communication
ii. How to sell your ideas
iii. Communication within Industry (awareness of motivation, ego states, games, etc.)
iv. Guidelines on: Listening, Reading and Writing
v. Non-verbal Communication (Body Language)
vi. Barriers of Communication

UNIT – II:
PUBLIC SPEAKING (SPEECH COMMUNICATION)
i. How to develop courage and self-confidence
ii. Speech purposes, preparation patterns and outlining of speech
iii. Fundamentals and secrets of good delivery
iv. How to make your meaning clear and convince an audience / client
v. How to close effectively and get action?
vi. How to participate in conferences, group discussions and office meetings

UNIT – III:
PERSONALITY DEVELOPMENT -1
i. Leadership - qualities of a successful leader ; Leadership Styles; Leadership in Administration; Problem-solving & Decision-making
ii. Group Dynamics and Team Building
iii. Importance of groups in organization; Interactions in group, Group Decision Taking, Team Building, Interaction with the Team, Building a good team

UNIT – IV:
PERSONALITY DEVELOPMENT -2

i. Interpersonal Relations- Introduction; Transactional Analysis in communication Awareness of Ego states and their application in communication
ii. Conflict Management- Introduction & Causes of Conflict; Managing Conflict

UNIT – V:
PERSONALITY DEVELOPMENT -3

i. Positive Attitude & Ways to develop positive attitude
   Self Esteem & Confidence Building
ii. Motivation- Importance of self-motivation;
iii. Stress -Causes of Stress & Impact of Stress; Managing Stress

UNIT – VI:
PERSONALITY DEVELOPMENT -4

i. Goal Setting-Meaning; Short, medium and Long Term Goals;
   Importance of Goal setting & Steps for Goal Setting
ii. Creativity-Meaning; Barriers to Creativity & Steps to stimulate Creativity
   Understanding and Importance of Human Values; Ideals in Life; Becoming a Role Model
iii. Time Management - Time as a Resource; Techniques for better Time Management.

TEXT BOOKS:

1. Advance Speaking Skills, Jeremy Harmar & John Arnold, Essex, Longman Group Limited, 1978
2. Developing Soft Skills, Sherfield, R.M., Montgomery, R.J., Moody, P.G. 4th Edition, Pearson, 2010
3. Personality Development and Soft Skills, Barun K. Mitra, Oxford University Press, 2016

REFERENCES:

1. Body Language: A Guide for Professionals, Hedwig Lewis, Response Books (a division of Sage Publications India, Pvt. Ltd.,) New Delhi, 1998
2. Emotional Intelligence, Daniel Goldman, Bantam Books, 1995
3. Personality Development, Rajiv Mishra, Rupa & Co., 2004

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1HS04) FOREIGN LANGUAGE – FRENCH

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To communicate verbally in a simple way by asking and responding to simple questions related to everyday language needs
- To read and comprehend different kinds of texts (notices, informal letters, catalogues, menus etc.)
- To write clear, concise, and correct sentences and paragraphs on familiar topics.
- To recognize and use basic syntax and structures in French including articles, prepositions and connecting words as well as master basic vocabulary

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Use vocabulary contextually and effectively
CO-2: Use reading skills to comprehend different kinds of texts
CO-3: Understand everyday expressions dealing with simple and concrete everyday needs, in clear, slow and well-articulated speech and manage very short mini dialogues /conversations
CO-4: Demonstrate basic competence in Written French including grammar, sentence and paragraph structure, coherence

UNIT – I: Introduce oneself and introduce someone:
Reading: Read and understand an introduction about someone
Grammar: Question words, Subject verb agreement, Mas/fem and prepositions with cities and countries
Vocabulary: professions, nationalities, countries numbers, days of the week and verbs
Writing: Build basic sentences and Write about oneself
Life Skills: Greetings, Formal and Informal way of asking questions

UNIT – II: Express likes and dislikes and Talk about your locality:
Reading: Read and understand description of a place
Grammar: Articles, prepositions, possessive adjectives, basic connecting words such as **"like, and, but",** and Negation
Vocabulary: Adjectives, verbs of preference, different places, and basic vocabulary on leisure and sports activities.
Writing: Write about hobbies and pastimes
Life Skills: Conversation fillers

UNIT – III: Take / Fix an appointment with someone:
Reading: Understand propositions and counters

Grammar: How to say time, Interrogative adjectives
Vocabulary: Irregular verbs, days of the week, Fixed expressions with Etre and Avoir and expressions to ask for appointment or refuse/accept a proposed time
Life Skills: Telephone etiquette and colloquial expressions in French

UNIT – IV: Talk about your routine / Invite someone and Accept or refuse an invitation
Reading: Read and understand an invitation on basic info: date and time, venue, occasion, type of invitation etc.
Grammar: Question word Why, Connecting word "because", partitive and contracted articles, reflexive verbs
Vocabulary: Expressions to propose, thank / apologize and accept or refuse an invitation,
Writing: Respond to an invitation (Accept or refuse)
Life Skills: At the table

UNIT – V: Ask for information (timings, price, etc) and Ask for/ Give Directions
Reading: Understand signboards and instructions
Grammar: Imperative mode and prepositions.
Vocabulary: Directions, Expressions to ask information or seek precision
Writing: Give instructions and fill a form

UNIT – VI: Vacation (plan vacation, choose destination, visit, and appreciate)
Reading: Read and understand travel brochures for basic info on offers, locations, touristic attractions hotels and so on
Grammar: demonstrative adjectives and near future tense
Vocabulary: Weather forecast, modes of transport, and vacation activities
Writing: Write a post card
Life Skills: Types of vacation in France

TEXT BOOKS:

1. Painless French, Carol Chitin, M.S., Lynn Gore, Barrons Educational Series, 2016 (ISBN: 978-1438007700)
2. Language Learning University, French: Learn French for Beginners Including French Grammar, French Short Stories and 1000+ French Phrases, Createspace Independent Publications, 2018 (ISBN: 978-1726415002)
3. Language School, French Language for Beginners, 2019 (ISBN: 978-1700175700)

REFERENCES:

1. Practice Makes Perfect: Complete French All-in-One, Annie Heminway, McGraw-Hill Education, 2018 (ISBN: 978-1260121032)
2. Easy French Step-by-Step, Myrna Bell Rochester, McGraw-Hill Education, 2008 (ISBN: 978-0071453875)
3. Contacts: Langue et Culture Françaises, Jean-Paul Valette, Rebecca Valette, Wadsworth Publishing Co. Inc., 2012 (ISBN: 978-1133309581)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1CE09) SMART CITIES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

CO-1: Explain and elaborate smart city concepts and their international and national standards

CO-2: Conceptualize smart community, transportation and building concepts

CO-3: Develop and calibrate energy demand and their capacity limits

CO-4: Predict the various smart urban transportation systems and the transition from existing city towards a smart city

UNIT – I:

Introduction to Smart Cities: Introduction to Smart Cities - Understanding Smart Cities -Dimensions of Smart Cities – World urbanization, Global Experience of Smart Cities, Smart City case studies-Indian scenario - India “100 Smart Cities” Policy and Mission.

UNIT – II:

City as a System of Systems: Systems thinking – Developing a smart city approach – Core elements of a smart city – Relevant open data for a smart city – Sustainability – Privacy and Ethics – Energy systems for smarter cities.

UNIT – III

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

UNIT – IV:

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

UNIT – V:

Smart Transportation Systems: Smart Transportation Technologies - Driverless and connected vehicles - ride sharing solutions - The "improve" pathway - The "shift" pathway – Smart Roads and Pavement systems – Relevant case studies

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1EE05) TRENDS IN ENERGY SOURCES FOR SUSTAINABLE DEVLOPMENT

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the role of sustainable energy
- To know components of solar PV and wind energy conversion systems
- To understand the principles of Biomass, geo-thermal and wave energy systems
- To learn various energy storage methods

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand various sources for sustainable energy
CO-2: Understand Solar Photo voltaic and wind energy systems
CO-3: Learnt the harnessing techniques of Biomass, geothermal and ocean energy
CO-4: Familiarize with energy storage methods

UNIT – I:
Introduction: Trends in energy consumption - Conventional and renewable sources, Energy sources and their availability, Energy Conservation status in India -need of new energies for sustainable development.

UNIT – II:
Fundamentals of Solar Radiation: Introduction-The Sun as Source of Energy, Extraterrestrial and Terrestrial Radiations, Spectral Power Distribution of Solar Radiation, instruments for measuring solar radiation and sunshine recorder.
Solar PV Conversion: The PV Cell-Crystalline Solar cells -Thin film and amorphous solar cells, Module, Array, Equivalent Electrical circuit- Open circuit voltage and Short circuit current, I-V, P-V Curves. Developments in efficient non silicon solar cells

UNIT – III:
Wind Energy: origin of winds-Global (or Planetary) Winds- Local Winds-Factors Affecting the Distribution of Wind Energy on the Surface of Earth, Wind Turbine – Types, construction of HAWT, VAWT, performance characteristics, Betz criteria.

UNIT – IV:
Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Biogas digesters, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.

UNIT – V:
Geothermal Energy: Resources, types of wells, methods of harnessing the energy

Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles.

Tidal and Wave Energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT – VI:

Energy Storage:

Electro Chemical Storage: lead-acid- nickel cadmium-nickel-metal-hydride and lithium type batteries-Principle of operation, Types, Advantages and disadvantages.

Non-Electric Storage: Methods of Energy storage –Pumped Energy Storage – Compressed air Energy Storage, Superconducting Magnet Energy Storage.

TEXT BOOKS:

1. Non-Conventional Energy Sources, G.D. Rai, 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**

(19OE1ME05) 3D PRINTING AND DESIGN

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the need and know about the applications of 3D Printing
- To understand the need of liquid and solid based 3D Printing systems
- To know about the laser-based 3D Printing systems and importance of CAD for 3D Printing
- To understand post-processing, inspection and testing involved in 3D Printing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize the importance of 3D Printing
CO-2: Explain the process involved in liquid and solid based 3D Printing Systems
CO-3: Explain about the laser-based 3D Printing systems and CAD for 3D Printing
CO-4: Plan post-processing techniques and perform inspection and testing in 3D Printing

UNIT – I:
Introduction: Introduction to 3D Printing, Classification, 3D Printing Process Chain, Materials for 3D Printing, Distinction between 3D Printing & Conventional Manufacturing.
Applications: Brief overview of applications in Aerospace, Automotive, Biomedical, Defense, Construction, Jewelry, Coin and Tableware Industry.

UNIT – II:
Liquid Based 3D Printing Systems: Introduction, Principle, Processes and Applications of Material Jetting and Stereolithography.

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

UNIT – IV:
Powder Based 3D Printing Systems: Introduction, Principle, Processes and Applications of Selective Laser Sintering (SLS), Three-Dimensional Printing (3DP).

UNIT – V:
CAD for 3D Printing: CAD data formats, CAD model preparation, Part orientation and support generation, Overview of 3D Printing softwares like MAGICS and MIMICS only.

UNIT – VI:

Post Processing: Introduction, Post Processing Techniques like Support material removal, Cleaning, Sanding and Polishing.

Inspection: Introduction, Significance, Inspection techniques like Dimensional measurement along X, Y and Z axes, visual inspection of the surface finish (overall aesthetics and intact features), flatness or warp check, and FOD (foreign objects or debris) check.

TEXT BOOKS:

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W. Rosen, Brent Stucker, Springer, 2010
2. Rapid Prototyping: Principles and Applications, Chua C. K., Leong K. F., and Lim C. S., 3rd Edition, World Scientific, 2010

REFERENCES:

1. Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development, Liou L. W. and Liou F. W., CRC Press, 2007
2. Rapid Prototyping: Theory and Practice, Kamrani A. K. and Nasr E. A., Springer, 2006
3. Rapid Tooling: Technologies and Industrial Applications, Hilton P. D. and Jacobs P. F., CRC Press, 2000
4. Rapid Prototyping, Gebhardt A. Hanser, Gardener Publications, 2003

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(19OE1EC09) EMBEDDED SYSTEMS FOR IOT

COURSE PRE-REQUISITES: Programming through C

COURSE OBJECTIVES:

- To understand the basics of computing with embedded Systems
- To expose the students to various smart sensors
- To make the students familiar with the programming concepts of Embedded development board
- To understand the basics of Internet of Things and Cloud of things

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

CO-1: Familiarize with architectural and programming issues of Embedded Systems

CO-2: Select proper smart Sensor for a specific measurement application

CO-3: Analyze various protocols for Internet of Things

CO-4: Apply Internet of Things to different applications in the real world

UNIT – I:

Embedded System Design: Numbering and Coding Systems, Digital Premier, Inside the Computer

Embedded System: Definition, Characteristics of embedded computing applications, Design challenges, Requirements, Specification, Architecture design, Designing hardware and software components, system integration.

UNIT – II:

Smart Sensors & Applications: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation.

UNIT – III:

Sensors Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring.

UNIT – IV:

Micro Controller Board: Features of Arduino, Arduino components and IDE, Interfacing: Seven Segment Display, Pulse Width Modulation, Analog Digital Converter, Wireless connectivity to Arduino. Case study: From BT To WiFi: Creating WiFi Controlled Arduino Robot Car.

UNIT – V:

Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Deployment Templates, M2M, IoT vs M2M.

UNIT – VI:

Domain Specific Applications of IoT: IoT Design Methodology, Applications of IoT– Home, Health, Environment, Energy, Agriculture, Industry and Smart City.

TEXT BOOKS:

1. The 8051 Microcontroller: Programming, Architecture, Ayala & Gadre, 3rd Edition, Cengage Publications, 2008
2. Sensors and Transducers, D. Patranabis, 2nd Edition, PHI Learning Private Limited, 2013
3. Internet of Things: A Hands-On Approach, Vijay Madisetti, Arshdeep Bahga, Universities Press, 2015

REFERENCES:

1. Embedded Systems: Architecture, Programming and Design, 2nd Edition, TMH
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, 2nd Edition, 2005
3. Internet of Things with Raspberry Pi and Arduino, Singh R., Gehlot A., Gupta L., Singh B., Swain M., Boca Raton, CRC Press, 2020

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(19OE1CS09) ARTIFICIAL INTELLIGENCE – A BEGINNER'S GUIDE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand and analyze the basic concepts of artificial intelligence
- To identify, explore the complex problem-solving strategies and approaches
- To analyze the concepts of basic concepts of neural networks and learning process
- To explore and analyze the methodology used in machine learning and computer vision

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and apply the basic concepts of artificial intelligence and its use cases. lives
CO-2: Explore the various search strategies and approaches for problem solving
CO-3: Correlate the fields related to AI, and articulate various learning paradigms
CO-4: Describe several issues and ethical concerns surrounding AI

UNIT – I:
Introduction to AI: What is AI-On Overview, History of AI, Applications and Examples of AI, AI Concepts, Terminology, Key fields of AI. AI Issues, Concerns, and Ethical Considerations.

UNIT – II:
AI as Search Process: On overview of Search Strategy. Types of Searches-Uninformed, Informed, Bidirectional search, Heuristic search. Local search, Local beam search, Adversarial Search.

UNIT – III:
AI as Knowledge Exploration: Introduction to Propositional Logic, Rules of Inference, First Order Logic (FOL) Syntax, Semantics, Entailment, Tools to represent knowledge.

UNIT – IV:
AI as a Learning Task: Introduction to Learning, Learning types -Supervised, Unsupervised, Reinforcement Learning, Machine learning, Deep Learning, The link between AI, ML, DL.

UNIT – V:

AI as Neural Networks: Introduction to biological neural networks. Link between biological neuron and artificial neuron. Architecture of artificial neural network, Types of Neural networks-single layer, multilayer, Back propagation networks.

UNIT – VI:

The Future of AI: Computer Vision - Seeing the World Through AI, Bots - Conversation as a Platform, AI and the society, AI in action-the Use Cases, Building AI Projects.

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall, 2010
2. Machine Learning, Tom M. Mitchell, M. C. Graw Hill Publications
3. Neural Networks-A Comprehensive Foundation, Simon Haykin, 2nd Edition, Pearson Education, 2004

REFERENCES:

1. Artificial Intelligence, Elaine Rich & Kevin Knight, 2nd Edition, TMH
2. Artificial Intelligence, A New Synthesis, Nils J. Nilsson, Elsevier
3. Artificial Neural Networks, Yegnanarayana B., PHI

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(19OE1CS10) BLOCKCHAIN TECHNOLOGY ESSENTIALS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce and get the technological overview of blockchain technologies
- To Study the foundation of Blockchain Technology and demonstrate the various types of Blockchain
- To explore the application area of Blockchain Technology
- To introduce smart contract, consensus algorithm and Security Mechanism
- Introduction to available platforms to implement Blockchain Technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and explore the Blockchain Technology
CO-2: Describe smart contract concepts
CO-3: Explore different types of Blockchain
CO-4: Develop the platforms to implement Blockchain Technology

UNIT – I:
Fundamental of Blockchain Part I: Introduction to Centralized, Decentralized and Distributed system, computer network peer to peer connection
Fundamental of Blockchain Part II: History of Blockchain, Various technical definitions of Blockchain. Generic elements of a blockchain: Block, Transaction, Node, Why It's Called "Blockchain", Characteristics of Blockchain Technology, Advantages of blockchain technology, Limitations of blockchain as a technology

UNIT – II:
Concept of Blockchain Technology Part I: Applications of blockchain technology, Tiers of blockchain technology Blockchain 0, Blockchain 1, Blockchain 2, Blockchain 3, Generation of Blockchain X, smart contract
Concept of Blockchain Technology Part II: Types of blockchain: Public blockchain, private blockchain, hybrid blockchain, examples of Public, private, hybrid blockchain and it merit and demerit.

UNIT – III:
Technical Foundations Part I: Component of block, Structure of Block chain, Technical Characteristics of the Blockchain, genesis block, Nonce
Technical Foundations Part II: Cryptography, Hashing, Distributed database, Consensus mechanisms, and basic of Cryptographic primitives, Technical Characteristics of Secure Hash Algorithms (SHA), Digital signature.

UNIT – IV:

Consensus Algorithm: Proof of work (PoW), Proof-of-Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of authority (PoA), Confidentiality, Integrity, Authentication, Permissioned ledger, Distributed ledger, Shared ledger, Fully private and proprietary blockchains, Tokenized blockchains, Tokenless blockchains, CAP theorem and blockchain

UNIT – V:

E-Governance and other contract enforcement mechanisms, Financial markets and trading, Trading, Exchanges, Trade life cycle, Order anticipators, Market manipulation.

Crypto Currency: Bitcoin, Bitcoin definition, Keys and addresses, Public keys in Bitcoin, Private keys in Bitcoin, Bitcoin currency units

UNIT – VI:

Implementation Platforms: Hyperledger as a protocol, Reference architecture, Hyperledger Fabric, Transaction Flow, Hyperledger Fabric Details, Fabric Membership, Fabric Membership

TEXT BOOKS:

1. Mastering Blockchain, Imaran Bashir, 2nd Edition, Packt
2. Blockchain Basic, Daniel Drescher, A Press

REFERENCES:

1. Blockchain For Dummies®, IBM Limited Edition, John Wiley & Sons, Inc

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(19OE1EI05) FUNDAMENTALS OF ROBOTICS AND DRONES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To classify by coordinate system and control system
- To acquire knowledge on different types Power Sources and Sensors
- To classify different types of Manipulators, Actuators and Grippers
- To acquire knowledge on kinematics and Vision systems used for different Robots
- To acquire knowledge on the basics of Drones

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire knowledge on different types of Power Sources (actuators) and Sensors, Manipulators, Actuators and Grippers
CO-2: Acquire knowledge on different applications of various types of robots
CO-3: Analyze the direct and the inverse kinematic problems and calculate the manipulator dynamics
CO-4: Acquire knowledge on the applications of Machine Vision in Robotics
CO-5: Acquire Knowledge on the basics of Drones

UNIT – I:
Basic Concepts & Fundamentals: An overview of Robotics, classification of Robots, Robot Components, Robot degrees of freedom, Robot Joints, Robot Coordinates, Robot reference frames, Programming modes, Robot Characteristics.

UNIT – II:
Sensors and Actuators:
Sensors: Sensors characteristics, Position sensors, velocity sensors, acceleration sensors, torque sensors, micro switches, lighten infrared sensors, touch and tactile sensors, proximity sensors, range finders.
Actuators: Characteristics of activating system, comparison of activating system Hydraulic devices, Pneumatic devices, electric motors, magneto-strictive actuators.

UNIT – III:
Manipulators and Grippers:
Grippers: Robot end effectors, Classification, drive system for Gripper, Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Adhesive Grippers, Hooks, Scoops and other Miscellaneous Devices, Gripper force Analysis and Gripper Design, Active and passive Grippers.

UNIT – IV:
Kinematics: Matrix representation of translational and Rotational motion – Homogeneous Transformation-DH representation of standard configuration Robots-Inverse Kinematics. Joint space vs. Cartesian space-Basics of Trajectory planning in joint and Cartesian space.

UNIT – V:

Robot Vision: Low level and High-level vision

Image acquisition, Illumination Techniques, Imaging Geometry, Some Basic Relationships between Pixels, Segmentation, Description, Segmentation and Description of 3-D Structures, Recognition, Interpretation.

UNIT – VI:

Basics of Drones: Theory behind how drones work, individual components that makeup a drone, basic concepts involved radio-controlled model flying, building a complete quad copter drone from scratch

TEXT BOOKS:

1. Introduction To Robotics: Analysis, Control, Applications, Wiley, Saeed B. Niku, 2nd Edition
2. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover, Nicholas G Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, McGraw Hill, 2012

REFERENCES:

1. Robotics Technology and Flexible Automation, Deb S. R., John Wiley
2. Robots and Manufacturing Automation, Asfahl C. R., John Wiley
3. Robotic Engineering–An Integrated Approach, Klafter. R. D., Chimielewski. T. A., Negin. M, Prentice Hall of India, New Delhi
4. Drones for Beginners, Udemy

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(19OE1IT08) FUNDAMENTALS OF CYBER SECURITY

COURSE PRE-REQUISITES: Basic Knowledge of Computers, Basic Knowledge of Networking and Internet

COURSE OBJECTIVES:
- To identify the key components of cyber security in network
- To describe the techniques in protecting Information security
- To define types of analyzing and monitoring potential threats and attacks
- To access additional external resources to supplement knowledge of cyber forensics and laws

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand, appreciate, employ, design and implement appropriate security technologies
CO-2: Demonstrate policies to protect computers and digital information
CO-3: Identify & Evaluate Information Security threats and vulnerabilities in Information Systems
CO-4: Understanding computer forensics and analyzing them

UNIT – I:
Introduction: Introduction to Cybersecurity, Cybersecurity objectives, Cybersecurity roles, Differences between Information Security & Cybersecurity, Cybersecurity Principles - Confidentiality, integrity, & availability, Authentication & nonrepudiation, The Trinity of IT Security (CIA), Computer Protocols, Cookies, The TCP/IP

UNIT – II:
Who are the cyber criminals, Classification of cybercrimes, E-mail Spoofing, Spamming, Cyber defamation, Internet Time Theft, Salami Attack/ Salami Technique, Data Diddling, Forgery, Web Jacking, Newsgroup Spam/ Crimes Emanating from Usenet Newsgroup, Industrial Spying/Industrial Espionage, Hacking, Online Frauds, Pornographic Offenses, Software Piracy, Computer Sabotage, E-mail Bombing/Mail Bombs, UseNet Newsgroup as the Source of Cybercrimes, Computer Network Intrusions, Password Sniffing, Credit Card Frauds, Identity Theft.

UNIT – III:
Cyber Offenses: How Criminals Plan Them: Introduction, Categories of Cybercrime, How Criminals Plan the Attacks, Reconnaissance, Passive Attacks, Active Attacks, Scamming and Scrutinizing Gathered Information, Attack (Gaining and Maintaining the System Access), Social Engineering, Classification of Social Engineering, Cyber stalking, Types of Stalkers, Cases Reported on Cyber stalking, How Stalking Works?, Real-Life Incident of Cyber stalking, Cyber cafe and Cybercrimes,

UNIT – IV:
Security Threats: Introduction to security threats-Virus, Worms, Trojan horse, Bombs, Trap Door, E-Mail Virus, Virus Life cycle, How virus works?, Malware, Network and

Services attack- Dos attacks, Types of Dos attacks, Methods of attacks, Examples of attacks-SYN flooding, TCP flooding ,UDP flooding ,ICMP flooding ,Smurf, Ping of death, Tear drop, Security threats to E-commerce-Electronic payment system, Credit card/Debit cards, Smart cards, E- money, Electronic Fund Transfer, E-commerce security System, Electronic Cash, Digital Signatures

UNIT – V:

Introduction to Computer Forensics: computer crimes, evidence, extraction, preservation, etc. Overview of hardware and operating systems: structure of storage media/devices; windows/Macintosh/ Linux -- registry, boot process, file systems, file metadata. Data recovery: identifying hidden data, Encryption/Decryption, Steganography, recovering deleted files. Digital evidence controls: uncovering attacks that evade detection by Event Viewer, Task Manager, and other Windows GUI tools, data acquisition, disk imaging, recovering swap files, temporary &cache files, Computer Forensic tools, Network Forensic. Computer crime and Legal issues: Intellectual property, privacy issues, Criminal Justice system for forensic, audit/investigative situations and digital crime scene, investigative procedure/standards for extraction, preservation, and deposition of legal evidence in a court of law.

UNIT – VI:

Fundamentals of Cyber Law: Evolution of the IT Act, Genesis and Necessity , Salient features of the IT Act, 2000, various authorities under IT Act and their powers, Penalties & Offences, amendments, Impact on other related Acts Cyber Space Jurisdiction - Jurisdiction issues under IT Act, 2000- Traditional principals of Jurisdiction - Extra-terrestrial Jurisdiction- Case Laws on Cyber Space Jurisdiction Sensitive Personal Data or Information (SPDI) in Cyber Law (a) SPDI Definition and Reasonable Security Practices in India (b) Reasonable Security Practices – International perspective

TEXT BOOKS:

1. Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunit Belpure, Wiley
2. Fundamentals of Cyber Security, Mayank Bhusan, Rajkumar Singh Rathore, Aatif Jamshed, BPB Publications
3. Cyber Law & Cyber Crimes, Advocate Prashant Mali, Snow White Publications, Mumbai

REFERENCES:

1. Computer Forensics and Cyber Crime: An Introduction, Marjie T. Britz, 3rd Edition, 2013
2. Digital Forensics with Open-Source Tools. Cory Altheide and Harlan Carvey, Elsevier, 2011(ISBN: 978-1-59749- 586-8)
3. Network Forensics: Tracking Hackers Through Cyberspace, Sherri Davidoff, Jonathan Ham Prentice Hall, 2012
4. Cyber Law in India, Farooq Ahmad, Pioneer Books
5. Information Technology Law and Practice, Vakul Sharma, Universal Law Publishing Co. Pvt. Ltd.

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(19OE1IT09) FUNDAMENTALS OF DATA SCIENCE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration
- To exploring data analysis, predictive modeling, descriptive modeling, data product creation, evaluation, and effective communication
- To understand the basic knowledge of algorithms and reasonable programming experience and some familiarity with basic linear algebra and basic probability and statistics
- To identify the importance of recommendation systems and data visualization techniques

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

CO-1: Understand basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data

CO-2: Discuss the significance of exploratory data analysis (EDA) in data science and to apply basic tools (plots, graphs, summary statistics) to carry out EDA

CO-3: Apply basic machine learning algorithms and to identify common approaches used for Feature Generation

CO-4: Analyze fundamental mathematical and algorithmic ingredients that constitute a Recommendation Engine and to Build their own recommendation system using existing components

UNIT – I:

Introduction: What is Data Science? - Big Data and Data Science hype – and getting past the hype - Why now? – Datafication - Current landscape of perspectives - Skill sets needed - Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model - Intro to R

UNIT – II:

Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - **Case Study:** Real Direct (online real estate firm) - Three Basic Machine Learning Algorithms-Linear Regression - k-Nearest Neighbors (k-NN) - k-means

UNIT – III:

One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam

UNIT – IV:

Data Wrangling: APIs and other tools for scrapping the Web - Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests

UNIT – V:

Recommendation Systems: Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis - Exercise: build your own recommendation system - Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighbourhood properties in graphs

UNIT – VI:

Data Visualization: Basic principles, ideas and tools for data visualization 3 - Examples of inspiring (industry) projects - Exercise: create your own visualization of a complex dataset - Data Science and Ethical Issues - Discussions on privacy, security, ethics - A look back at Data Science - Next-generation data scientists

TEXT BOOKS:

1. Doing Data Science, Straight Talk From The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014
2. Mining of Massive Datasets v2.1, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, Cambridge University Press, 2014
3. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, 2013 (ISBN 0262018020)

REFERENCES:

1. Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani and Jerome Friedman, 2nd Edition, 2009 (ISBN 0387952845)
2. Foundations of Data Science, Avrim Blum, John Hopcroft and Ravindran Kannan
3. Data Mining and Analysis: Fundamental Concepts and Algorithms, Mohammed J. Zaki and Wagner Miera Jr. Cambridge University Press, 2014
4. Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, 3rd Edition, 2011 (ISBN 0123814790)

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(19OE1AE05) INTRODUCTION TO ADVANCED VEHICLE TECHNOLOGIES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the layout of an automobile and functionalities chassis elements
- To provide the concepts of automotive electrical systems and electric & hybrid vehicles
- To present various intelligent automotive systems and levels of vehicle autonomy

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the functionalities of automotive systems and subsystems
CO-2: Discuss the concepts of automotive electrical systems and electric & hybrid vehicles
CO-3: Describe various intelligent automotive systems and levels of vehicle autonomy

UNIT – I:
Introduction: Classification of automobiles, layout of an automobile and types of bodies.
Automotive Chassis: Introduction to chassis systems - engine, cooling, lubrication, fuel feed, ignition, electrical, driveline - clutch, transmission, propeller shaft, differential, axles, wheels and tyres, steering, suspension and braking.

UNIT – II:
Engine: Working principle of four stoke and two stroke SI and CI engines, fuel system – layout of petrol and diesel fuel systems, electronic fuel injection - multi-point fuel injection, gasoline direct injection, common rail direct injection.

UNIT – III:
Electrical System: Simple automotive wiring diagram and components of electrical system, starting system – starter circuit, standard Bendix and over running clutch drive, charging system – alternator, cut-outs and regulators, ignition system - conventional and electronic ignition system.

UNIT – IV:
Electric and Hybrid Vehicles: Electric vehicle – Layout, components, configurations, advantages and limitations. Hybrid vehicle - Concepts of hybrid electric drivetrain based on hybridization and powertrain configuration, architecture of series, parallel and series-parallel hybrid electric drivetrains, modes of operation, merits and demerits.

UNIT – V:
Intelligent Vehicle Systems: Automotive navigation, night vision, head-up display, airbag, seat belt tightening system, immobilizers, adaptive cruise control, forward collision warning, lane departure warning and anti-lock braking system.

UNIT – VI:

Autonomous Vehicles: Levels of automation, research, challenges, commercial development, sensor systems, sensor suits, environmental challenges, graceful degradation, V2V and V2I communication, sharing the drive, integrity, security, verification and policy implications.

TEXT BOOKS:

1. Advanced Vehicle Technology, Heinz Heisler, Butterworth Heinemann, 2002
2. Intelligent Vehicle Technologies: Theory and Applications, Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann, Oxford, 2001
3. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, CRS Press, 2004

REFERENCES:

1. Automotive Mechanics, Giri N. K., Khanna Publications, 2006
2. Automotive Electrical Equipment, Kohli P. L., Tata McGraw Hill Co., Ltd., New Delhi, 1975
3. Electric and Hybrid Vehicles – Design Fundamentals, Iqbal Husain, CRC Press, 2010
4. Autonomous Vehicle Technology-A Guide for Policymakers, James M. Anderson, Nidhi Kalra, Karlyn D. Stanley, Paul Sorensen, Constantine Samaras, Oluwatobi A. Oluwatola, RAND Corporation, Santa Monica, Calif., 2016

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(19OE1CS12) INTRODUCTION TO APPLICATION DEVELOPMENT WITH C#

COURSE OBJECTIVES:

- To create an integrated development environment for object-oriented C# programs
- To build website menus with CSS and JavaScript
- To relate programming language constructs and problem solving techniques
- To analyze and Apply modifications to C# programs that solve real-world problems

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

CO-1: Understand the fundamentals of HTML5 and define the styles for web pages using CSS

CO-2: Create web pages and add dynamic behavior to web pages using Javascript

CO-3: Communicate with the database using SQL

CO-4: Develop a simple CUI [Character User Interface] based application using C# & SQL

UNIT – I:

Computer, Software Engineering Fundamentals & OOP: Introduction to Computer Basics, Basics of Network, Networking Levels and Layers and Protocols, Protocol Stacks, Networking and Internet Service, Software Engineering Fundamentals - Overview of Requirement Analysis, Overview of Software Design, Overview of Software Implementation, Overview of Testing, Overview of Software Maintenance, Overview of Configuration management and version

Control, Agile Basics, OOP - Object Oriented Concepts, Objects and Classes, Principles in Object-

Oriented technology

Usecase: Create a class for BankAccount

UNIT – II:

HTML & CSS: Introduction to Web Technology, Introduction to HTML5, HTML5 Elements, Semantic Elements, Table, List, Working with Links, Image Handling, Form-Input Elements, HTML5 Form elements, HTML5 Attributes, Video & Audio, iframes, CSS - Introduction to CSS3, CSS Syntax, CSS Styling, Text and Fonts properties, CSS Selectors, Different color schemes, CSS Borders, CSS Margins, CSS Backgrounds

Use Case: Create a website for college

UNIT – III:

JavaScript, RDBMS Concepts and SQL: JavaScript basics, Functions in Javascript, Javascript validation, Events, Javascript event handling, JavaScript Strings, JavaScript Dates, Array in Javascript, Document Object Model (Window, Frame, Navigator Objects), Working with Document Object (Its Properties and methods, Cookie handling), Introduction to RDBMS Concepts, Introduction to SQL, Creating and Managing Tables, Data Manipulation, Basic SQL SELECT Statements, Scalar & Aggregate Functions, Joins & Subqueries, Views & Index

Use Case: Apply validations for Telephone Complaint Registration Form

Use Case: Create student table for College Management System(CMS)

UNIT – IV:

Introduction to C# Programming: Introduction to .NET Framework 4.5 - What is .NET Framework, .NET Framework, Languages, and Tools, .NET Framework Major Components, Common Language Runtime (CLR), Compilation and Execution in .NET, Understand the .NET Framework 4.5stack, Exploring VS2017, Introduction to C# 6.0 - Features of C#, C# Compilation and Execution, General Structure of a C# Program, Creating and Using a DLL

Use Case: Create a Console Application (.exe) project called CalcClientApp

UNIT – V:

Language Fundamentals of C#: Language Fundamentals - Keywords, Value Types and Reference Types, Implicit and explicit type conversions, Boxing and Unboxing, Enum, Operators and Assignments,Variables and Literals, Flow

Control: C# Control Statements, Nullable, Classes and Objects, Strings, Array, Generic Collections

Use Case: Store employee objects using Generic Collections

UNIT – VI:

Basics of ADO.NET: Various Connection Architectures, Understanding ADO.NET and its class library, Important Classes in ADO.NET, Connection Class, Command Class, DataReader Class, DataAdapter Class, DataSet Class

Use Case: Implement ADO.NET classes that belong to both Connected and Disconnected Architectures

TEXT BOOKS:

1. Web Programming, Building Internet Applications, Chris Bates, 2nd Edition, Wiley Dreamtech
2. Introduction to Database Systems, C. J. Date, Pearson Education
3. Professional C# 2012 with .NET 4.5, Christian Nagel et al. Wiley India, 2012

REFERENCES:

1. Programming World Wide Web, Sebesta, Pearson
2. Internet and World Wide Web – How to Program, Dietel and Nieto PHI/Pearson Education Asia

3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Pro C# 2010 and the .NET 4 Platform, Andrew Troelsen, 5th Edition, A Press, 2010
5. Programming C# 4.0, Ian Griffiths, Matthew Adams, Jesse Liberty, 6th Edition, O"Reilly, 2010

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1CS13) INTRODUCTION TO APPLICATION DEVELOPMENT WITH JAVA

COURSE OBJECTIVES:

- To create an integrated development environment for object-oriented Java programs
- To build website menus with CSS and JavaScript
- To relate programming language constructs and problem solving techniques
- To analyze and Apply modifications to Java programs that solve real-world problems

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

CO-1: Understand the fundamentals of HTML5 and define the styles for web pages using CSS

CO-2: Create web pages and add dynamic behavior to web pages using Javascript

CO-3: Communicate with the database using SQL

CO-4: Develop a simple CUI [Character User Interface] based application using Java & SQL

UNIT – I:

Computer: Computer Fundamentals, Preface to Networks, Networking Levels, Layers of Computer Networks, Protocol Stacks, Networking, and Internet Service

Software Engineering Fundamentals: Introduction, Requirements Collection & Analysis, Fundamentals of Software Design, Software Implementation, Types of Testing, Software Maintenance, Overview of Configuration management and version Control Tools, Basics of Agile Process

Object Oriented Programming: Object Oriented Paradigm, Classes and Objects, Principles in Object- Oriented technology

Use Case: Create a class for Bank Account

UNIT – II:

HTML: Introduction to Web Technology, HTML5 Introduction, HTML5 Elements, Semantic Elements, Table, List, Links in HTML5, Handling of Images, Form Elements, HTML5 Form elements and Attributes, Video & Audio, iframes

Style Sheets:

Introduction to CascadingStyleSheet3, CSS Syntax, CSS Styling, Text and Fonts properties, CSS Selectors, Color schemes, CSS Borders, CSS Margins, CSS Backgrounds

Use Case: Design a website for college

UNIT – III:

JavaScript: Introduction to JavaScript, JavaScript Functions, JavaScript validation, Event handling in JavaScript, JavaScript Strings, JavaScript Dates, Array in JavaScript, Document Object Model (Window, Frame, Navigator Objects), Document Object (Its Properties and methods, Cookie handling),

RDBMS Concepts and SQL: Introduction to RDBMS Concepts, Introduction to SQL, Creating and Managing Tables, Data Manipulation, Basic SQL SELECT Statements, Scalar & Aggregate Functions, Joins & Subqueries, Views & Index

Use Case: Check the validations for Telephone Complaint Registration Form

Use Case: Create student table for College Management System (CMS)

UNIT – IV:

Introduction to Java: Java Environment, Java Fundamentals - Keywords, Primitive Data Types, Operators and Assignments, Java's Control Statements, Wrapper Classes, Using Scanner Class, Strings - String Handling functions, Array - One dimensional array, Array of Objects, Using Arrays class, variable length arguments

Use Case: To keep track of customers data who are buying products from a store

UNIT – V:

The Collection Framework: Lists – Array List, LinkedList, Stack, Vector, Set – HashSet, Linked Hash Set, Tree Set, Map – HashMap, Linked HashMap, Hash table. Retrieving Elements from Collections – Enumeration, Iterator, List Iterator, String Tokenizer – Sorting using Comparable and Comparator.

Use Case: Store employee objects using collection framework

UNIT – VI:

JDBC: Overview of JDBC, JDBC Architecture, Types of JDBC Drivers. Process SQL with JDBC - Create Connection, Query, Update

Use Case: Write the menu driven program using JDBC which will have following options

a. Store

b. Display by id

c. Delete by id

d. Update salary by id

e. Exit

TEXT BOOKS:

1. Web Programming, Building Internet Applications, Chris Bates, 2nd Edition, Wiley Dreamtech
2. Introduction to Database Systems, C. J. Date, Pearson Education
3. Big Java, Cay Horstmann, John Wiley and Sons, 2nd Edition

REFERENCES:

1. Programming World Wide Web, Sebesta, Pearson
2. Internet and World Wide Web – How to program, Dietel and Nieto PHI/Pearson Education Asia

3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Java How to Program, H. M. Dietel and P. J. Dietel, 6th Edition, Pearson Education/PHI
5. Core Java 2, Vol. 1, Fundamentals, CayS. Horstmann and Gary Cornell, 7th Edition, Pearson Education

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

(19OE1CS14) INTRODUCTION TO APPLICATION DEVELOPMENT WITH PYTHON

COURSE OBJECTIVES:
- To create an integrated development environment for object-oriented Python programs
- To build website menus with CSS and JavaScript
- To relate programming language constructs and problem solving techniques
- To analyze and Apply modifications to Python programs that solve real-world problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the fundamentals of HTML5 and define the styles for web pages using CSS
CO-2: Create web pages and add dynamic behavior to web pages using Javascript
CO-3: Communicate with the database using SQL
CO-4: Develop a simple CUI [Character User Interface] based application using Python & SQL

UNIT – I:
Concepts of Networks, Overview of Software Engineering & OOP: Computer Basics, Network basics, Networking Levels, Layers and Protocols, Protocol Stacks, Networking and services of Internet
Software Engineering lifecycle - Overview of Requirement Analysis, Software Design, Implementation of software, Outline of Testing, Maintenance, Configuration management and version Control, Agile fundamentals
OOP - Object Oriented Concepts, OOP Principles
Use Case: Create a class for Employee Account

UNIT – II:
Introduction to Web Technology: Overview of Web Technology, Introduction to HTML5, HTML5 Elements, Semantic Elements, Table, List, Links, Image Handling, Form-Input Elements, HTML5 Form elements, HTML5 Attributes, Video & Audio, iframes,
CSS - Introduction to CSS3, CSS Syntax, CSS Styling, Text and Fonts properties, CSS Selectors, Different color schemes, CSS Borders, Margins, Backgrounds
Use Case: Create a website for an institution

UNIT – III:
Outline of JavaScript, RDBMS Concepts and SQL: JavaScript basics, Functions ,validations, Events, handling events ,Strings, Dates, Arrays, DOM(Window, Frame, Navigator Objects), Document Object -Properties and methods, handling of Cookies,
RDBMS Concepts, SQL, Management of Tables, Manipulation of tables, SQL SELECT Statements, Scalar & Aggregate Functions, Joins &Sub queries, Views & Index
Use Case: Apply validations for Telephone Complaint Registration Form
Use Case: Create student table for College Management System (CMS)

UNIT – IV:

Introduction to Python: Introduction, Features of Python, Versions, Keywords and Identifiers, Statements & Comments, Variables, Datatypes, Type Conversion, I/O and import, Language Fundamentals - Operators, Namespace, Modules in Python, Python DateTime

Use Case: Develop an application using Python for accepting your personal details and display the same

UNIT – V:

Classes and Objects: Classes and Objects in Python? Advantages of Using Classes in Python, Defining a Class in Python, Creating an Object in Python, The self, The_init_() function in Python, class and instance variables, Python Inheritance and its Types, Strings, Lists, Sets, Tuples, Dictionary

Use Case: Store employee objects using various data structures

UNIT – VI:

Advance Concepts in Python: Array - What is an Array, Difference between Array and List in Python, Creating an Array, Accessing a Python Array Element, Basic Operations of Arrays, Functions - Creating a Function, Calling a Function, Pass by reference vs value, Required arguments, Keyword arguments, Default arguments, Variable-length arguments, The Anonymous Functions, The return Statement, Global vs. Local variables, Modules - What is a Module?, Create a Module, Use a Module, Variables in Module, Naming a Module, Renaming a Module, Built-in Modules, Using the dir() Function, Import From Module, Packages, NumPy

Use Case: Develop an application for Hospital Management System(HMS)

TEXT BOOKS:

1. Web Programming, Building Internet Applications, Chris Bates, 2nd Edition, Wiley Dreamtech
2. Introduction to Database Systems, C. J. Date, Pearson Education
3. Python Programming: A Modern Approach, Vamsi Kurama, Pearson

REFERENCES:

1. Programming World Wide Web, Sebesta, Pearson
2. Internet and World Wide Web – How to Program, Dietel and Nieto, PHI/Pearson Education Asia
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Core Python Programming, W. Chun, Pearson
5. Introduction to Python, Kenneth A. Lambert, Cengage

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
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(19PC1EI11) ANALYTICAL INSTRUMENTATION

COURSE OBJECTIVES:
- To introduce the whole array of modern analytical instruments to implement statical analysis tools
- To emphasize hands-on approach with sample preparation, application, method development, data analysis and interpretation being key elements
- To introduce methods to Interpret data derived from any analytical instrument
- To familiarize with the basic concepts, principles and terms of chromatography, Spectroscopy and gas analyzers

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Examine the relevant methods and techniques for different Analytical Parameters
CO-2: Demonstrate proficiency in using statistical methods for evaluating and interpreting data using spectroscopy, chromatography and gas analyzers
CO-3: Identify tools to apply principles of spectroscopy, chromatography and gas analyzers
CO-4: Apply analytical techniques for day to day and industrial applications

UNIT – I:
Electrochemical Instruments: Basic concepts of Analytical Instrumentation, Electro chemical instruments- pH meter, Conductivity meter, Dissolved oxygen analyzers, sodium analyzers, silica analyzers

UNIT – II:
Absorption Spectroscopy: Concepts of Spectrometry, Beer- Lambert's law-Derivation of Beer Lamberts Law- Numerical exercises associated with the Law. UV, VIS spectrophotometers – single beam and double beam instruments – Instrumentation associated with the above spectrophotometers – sources and detectors.
IR Spectrometers: sources and detector, Instrumentation associated with the above spectrophotometers, FTIR. Interpretation and Analysis.
Emission Spectroscopy: Flame emission and Atomic emission spectrophotometers – Sources for Flame Photometers, Online calorific value measurements.

UNIT – III:
Chromatography: Chromatography – types- Basic principles of gas chromatography, liquid chromatography (HPLC) ---- different types of columns, detectors, recorders and associated equipment for Gas and Liquid Chromatographs and their applications, Interpretation and Analysis.

UNIT – IV:
Nuclear Magnetic Resonance Spectrometry: Instrumentation associated with NMR spectrophotometer – Introduction to mass spectrophotometers, Introduction and Working Principle of Electron Spin Resonance (ESR), Interpretation and Analysis.

UNIT – V:

Gas Analyzers: Analysis using Thermal conductivity principle, Katharometer – oxygen analyzers using paramagnetic principle, H2S analyzer system, CO monitors, NOx analyzers, Industrial analyzer circuits, Pollution Monitoring systems

UNIT – VI:

Thermal Analyzers and Nuclear Radiation Detectors: Differential Scanning Calorimetry (DSC), Derivative Thermo Gravimetric Analyzers (DTGA). Gas filled Detectors- GM counters, Scintillation counter, Ionization chamber, Proportional counter, solid state detector.

TEXT BOOKS:

1. Handbook of Analytical Instrumentation, R. S. Khandpur, TMH
2. Instrumental Method of Analysis, Willard H. H., MerritL L. Dean, D. VanNostrand, 6^{th} Edition, CBS Publishing and Distributors, 1995

REFERENCES:

1. Process Measurement and Analysis, B. G. Liptak, CRC Press
2. Principles of Instrumental Analysis, Skoog D. A. and West D. M., Holt Sounder Publication, Philadelphia,1985
3. Instrument Technology, Jones B. E., Butterworth Scientific Publications, London, 1987

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(19HS1MG04) PRINCIPLES OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR

COURSE PRE-REQUISITES: Engineering Economics and Accounting

COURSE OBJECTIVES:
- To understand the principles, functions and theories of management and expose with a systematic and critical understanding of organizational theory, structures and design
- To comprehend the conceptual knowledge relating to Organizational Behaviour
- To provide a basic understanding of the behavior of individuals and groups in the organizations
- To develop theoretical and practical insights and problem-solving capabilities for effectively managing the organizational processes

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Apply theories to improve the practice of management and describe and assess the basic design elements of organizational structure and evaluate their impact on employees
CO-2: Analyse the behaviour of individuals and groups in organizations in terms of the key factors that influence organizational behaviour
CO-3: Appreciate the management challenges associated with high levels of change in the organizations
CO-4: Evaluate the appropriateness of various leadership styles, conflict management strategies and motivational strategies used in a variety of organizational settings

UNIT – I:
Introduction to Management:
Concepts of Management - Nature, Importance, and Functions of management; Taylor's Scientific Management Theory; Fayol's Principles of Management; Social Responsibilities of Management; Planning-definition and types of plans; decision making-definition and process
Organizing – Definition and Principles of Organization; Organization chart; Types of mechanistic and organic structures of organization - Line Organization, Line And Staff Organization, Functional Organization, Committee Organization, Matrix Organization, Virtual Organization, Cellular Organization, Team Structure, Boundaryless Organization, Inverted Pyramid Structure, And Lean And Flat Organization Structure; features and suitability.

UNIT – II:
Motivation and Leadership:
Motivation - Definition; Theories: Maslow's need of Hierarchy, Herzberg two Factor, Mc Gregor Theory X and theory Y and Alderfer's ERG.
Leadership - Definition; Styles and Theories: Trait, Behavioural and Contingency.

UNIT – III:

Introduction to Organizational Behaviour:

Organizational Behaviour - Definition; Historical Background; Nature, Scope and Importance; Linkages with other social Sciences; Approaches and Models.

UNIT – IV:

Perception and Personality:

Perception - Definition; Factors influencing; Perceptual Selectivity; Perceptual Organisation and Social Perception.

Personality - Definition; Determinants; Theories; Traits; Big Five Personality Model.

UNIT – V:

Interpersonal Skills:

Communication - Definition; Process; Direction; Interpersonal and Organizational and Barriers.

Teams and Groups - Definition; Types of teams and groups; Five-Stage Model; Characteristics of an effective teams; Johari Window & Transactional Analysis

UNIT – VI:

Organizational – Conflict, Stress Management, Change and Development:

Organizational Conflict- Definition; Reasons; Types and Levels; Handling Styles.

Stress Management-Definition; Types; Model; Consequences and Strategies to manage

Organizational Change - Definition; Types; Resistance; Overcoming and Approaches: Lewin's Three-Step Change Model, Kotter's Eight-Step Plan for Implementing Change.

Organizational Development - Definition; Nature and Interventions.

TEXT BOOKS:

1. Management, James Arthur, Finch Stoner, R. Edward Freeman, and Daniel R. Gilbert, 6th Edition, Pearson Education/Prentice Hall
2. Organizational Behaviour, Stephen P. Robbins, Prentice Hall, 2013
3. Organizational Behaviour, Fred Luthans, McGraw-Hill, 2013

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
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(19PE1EI21) NEURAL NETWORKS AND FUZZY LOGIC SYSTEMS

COURSE OBJECTIVES:

- To cater the knowledge of Neural Networks and Fuzzy Logic Control and use these for industrial applications
- To expose to the concepts of feedforward Neural Networks and about feedback Neural Networks
- To teach about the concepts of Supervised and Unsupervised Neural Networks
- To teach about the concepts of Fuzziness involved in various systems and comprehensive knowledge of Fuzzy logic control and to design the Fuzzy control

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Demonstrate the Fundamental concepts of Neural Networks, Convolutional neural networks and Fuzzy Logic Systems
CO-2: Interpret adequate knowledge on feedforward and feedback neural networks
CO-3: Categorize Supervised and Unsupervised Neural Networks
CO-4: Apply the knowledge of Neural networks and Fuzzy systems to real time applications

UNIT – I:
Fundamentals of Neural Networks: Basic concepts of neural networks, Human brain, model of an artificial neuron, Neural network architectures: Single layer feedforward network, Multilayer feedforward network, Characteristics of neural networks, McCulloch-Pitts Model, learning methods, Taxonomy of neural network architectures, Early neural network architectures: Rosenblatt's Perceptron, Perceptron and linearly separable tasks ,XOR problem.

UNIT – II:
Backpropagation Networks: Backpropagation architecture, Backpropagation algorithm, Backpropagation learning:input layer computation, hidden layer computation, output layer computation, calculation of error, generalized delta rule, Training of the neural network, Method of steepest descent, The effect of learning rate 'η', Selection of various parameters in BPN

UNIT – III:
Associative Memories: Auto Associative memory, Hetero Associative Memory Neural Network, Bidirectional Associative Memory (BAM) Architecture, BAM training algorithms: storage and recall algorithm, Autocorrelators, Heterocorrelators kosko's discrete bam, BAM energy function, Proof of BAM stability theorem.

UNIT – IV:
Convolution Neural Networks: History of CNNs, Convolutional neural networks, Deriving Convolution from a Fully Connected Layer, Pooling, Other types of Layers, Designing Using Textfiles, Training a CNN, Model performance optimization.

UNIT – V:

Fuzzy Logic: Introduction to Fuzzy logic.Fuzzy sets and membership functions. Operations on Fuzzy Sets. Fuzzy relations, rules, propositions, implications, and inferences. Defuzzification techniques.Some applications of Fuzzy logic.

UNIT – VI:

Applications: Fuzzy Logic models for dynamic systems, Sensor Fault Detection, Automation with LSTM, Soil Classification, Facial Recognition, Fuzzy and Neuro-Fuzzy control schemes: Temperature and Level Control Applications.

TEXTBOOKS:

1. Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications, R. Rajasekaran and G. A. Vijayalakshmi, Prentice Hall of India
2. Soft Computing, D. K. Pratihar, Narosa Publishing House, 2014

REFERENCES:

1. Fuzzy Logic with Engineering Applications, Timothy J. Ross, 3rd Edition, Wiley, 2010
2. Introduction to Artificial Neural Networks, M Paul Raj & S. N. Sivanandam, Vikas Publishing, 2003
3. Neural Networks, Simon Haykins, Pearson Education
4. Practical Convolutional Neural Networks, Mohit Sewak, Md. Rezaul Karim Pradeep Pujari, Packt Publishing Ltd.
5. Guide to Convolutional Neural Networks, Hamed Habibi Aghdam, Elnaz Jahani Heravi, Springer International Publishing AG, 2017

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B.Tech. VII Semester	L	T/P/D	C
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(19PE1EI07) INSTRUMENTATION FOR AGRICULTURAL AND FOOD PROCESSING INDUSTRIES

COURSE OBJECTIVES:

- To know the necessity of instrumentation for food processing and agriculture
- To study the science behind soil analysis and working of related sensors
- To know the different industrial processes & instrumentation and control behind it
- To study green house effect and instrumentation to overcome the problem

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Demonstrate need for instrumentation in food processing, agriculture, Packing and Greenhouses
CO-2: Analyze the soil and condition the environmental condition for seed growth
CO-3: Appreciate the instrumentation in food processing industries
CO-4: Appreciate the instrumentation in agricultural industries

UNIT – I:
Introduction: Necessity of instrumentation and control for agricultural and food processing Industries.
Soil Science and Sensors: pH, conductivity, resistivity, temperature, soil moisture and salinity, ion concentration, measurements, methods of soil analysis. Instrumentation for environmental conditioning of seed germination and growth

UNIT – II:
Agrichemical Industries: Introduction, Pesticides, Insecticides, Plant-Growth Modifiers, Plant Nutrients and Regulators – flow diagram of fertilizer plant, sensors, and instrumentation set-up.

UNIT – III:
Greenhouses and Instrumentation: Ventilation, cooling and heating wind speed, temperature and humidity, rain gauge, carbon dioxide enrichment measurement and control. Leaf area, length, evapo-transpiration, temperature, wetness and respiration measurement and data logging. Electromagnetic, radiation, photosynthesis, infrared and bio sensor methods in agriculture. Agro meteorological instrumentation weather stations.

UNIT – IV:
Food Processing: Introduction, Types of Food Processing- Refining & Milling, Canning, Concentration, Freezing, Drying, pasteurizations and sterilization, fermentation, irradiation, packaging, Flow diagrams and instrumentation set-up. Food Processing Equipment – Sanitary Design and Materials of construction, cleaning, controls.

UNIT – V:
Food Processing Industries-I: Sugar industries: Introduction, Manufacturing of Sugar-Cane, Cane-sugar refining, Decolorization -Char Filtration, Flow diagram of sugar plant, sensors and instrumentation set-up.

UNIT – VI:

Food Processing Industries-II: Starch and Related product industries: Introduction, Manufacture of Starch, dextrin and dextrose from corn, Miscellaneous Starches, Flow diagram of plant, sensors and instrumentation set-up.

Vegetable Oil Industries: Oil extraction and processing, flow diagram of plant and instrumentation set-up.

TEXT BOOKS:

1. Shreves Chemical Process Industries, George T. Austin, 5th Edition, McGraw Hill publications
2. Agricultural Processing and Food Engineering, Mukesh N. Dabhi & N. K. Dhamsania, 2010
3. Process Control Instrumentation Technology, Johnson C. D., 7th Edition, Pearson Education, New Delhi, 2003

REFERENCES:

1. Industrial Instrumentation, D. Patranabis, Tata McGraw Hill Publications, New Delhi
2. DMGH: Lesson 1 & 18, History, Types, Cooling, Shedding and Ventilation Systems of Greenhouse
3. Handbook of Agricultural Engineering, ICAR, 2012
4. Principles of Agricultural Engineering, Michael A. M., Volume 2, 2013
5. Manual on Instrumentation and Operations for Automatic Weather Stations for Agrometeorological

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
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(19PE1EC12) EMBEDDED SYSTEMS

COURSE PRE-REQUISITES: Microprocessor and Microcontrollers (19PC1EC10)

COURSE OBJECTIVES:
- To learn the general embedded system concepts
- To understand design of embedded hardware and software development tools
- To learn the basics of OS and RTOS
- To describe key issues such as CPU scheduling, memory management, task synchronization, and file system in the context of real-time embedded systems

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand the basic requirements of embedded systems
CO-2: Identify the hardware to develop the Embedded System
CO-3: Apply the software tools for Real time Embedded Applications
CO-4: Analyze the RTOS concepts to develop the Embedded Applications

UNIT – I:
Fundamentals of Embedded Systems: Embedded System-Definition, Characteristics, Design metrics, Classification of Embedded Systems, Real Time Systems - Need for Real-time systems, Hard and Soft Real-time systems, Processors in the system, Other Hardware units, Software components, Examples for embedded systems, Challenges in Embedded System Design.

UNIT – II:
Embedded Hardware Development Environment: Processor Architecture- Structured units of a processor - Processor selection factors, Common memory devices - Memory selection, Watch dog timer, Serial Communication Protocols.

UNIT – III:
Embedded Software Development Environment: Embedded System Development Process, Programming languages, Software Development tools - Host and Target machines, Linkers/Locators for embedded software, getting embedded software into the target system, Testing on host machine.

UNIT – IV:
Real Time Operating Systems Concepts–I: Basics of Operating system, Need for RTOS in embedded system, GPOS versus RTOS, RTOS Architecture and Characteristics, Tasks and Task states, Task scheduling, Scheduling algorithms - Rate Monotonic, EDF, Round Robin, Round Robin with Interrupts, Priority driven – Preemptive and Non-preemptive scheduling.

UNIT – V:
Real Time Operating Systems Concepts–II: Inter-Process Communication mechanisms – Semaphores, Message queues, Mailboxes, Pipes, Task Synchronization - Shared data - Priority Inversion - Inheritance and Ceiling, Dead lock, Memory management, Interrupt routines in RTOS environment, Device driver.

UNIT – VI:

Design Examples and Case Studies: Case study of embedded system design and coding for Automatic Chocolate Vending machine using µCOS RTOS, Case study of Digital Camera Hardware and Software architecture.

TEXTBOOKS:

1. Embedded systems Architecture, programming and design, Raj Kamal, 2nd Edition, Tata McGraw Hill, 2011
2. An Embedded Software Primer, David E. Simon, 1st Edition, Pearson,2005

REFERENCES:

1. Real time Systems, J. W. S. Liu, Pearson, 2009
2. Real-Time Embedded Systems: Design Principles and Engineering Practices, 1st Edition, Newnes, 2015
3. Computers as Components - Principles of Embedded Computing System Design, Wayne Wolf, 2nd Edition, Morgan Kaufmann Publisher, 2008

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(19PE1EC23) VLSI TECHNOLOGY AND DESIGN

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

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

COURSE OUTCOMES: After completion of the course, students 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 VLSI design, Moore's Law, VLSI Design flow, Basic MOS Transistors, Operation of Enhancement and Depletion Mode Transistors, Fabrication Process: nMOS, pMOS, and CMOS fabrication. BiCMOS technology.

UNIT – II:
Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, Transconductance, and Output conductance, Figure of merit, Pass transistor, pull-up to pull-down ratio for nMOS inverter-driven through one or more pass transistors, NMOS Inverter, and Bi-CMOS Inverters.

UNIT – III:
VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Transistors Layout Diagrams for nMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

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

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

UNIT – VI:

Subsystem Design: Adders, Multipliers, Multiplexer, Parity generator, Dynamic shift register, ALU subsystem, Comparator, Up/Down Counter.

TEXT BOOKS:

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

REFERENCES:

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

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B.Tech. VII Semester	L	T/P/D	C
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(19PE1EI08) BIOMEDICAL SIGNAL PROCESSING

COURSE OBJECTIVES:

- To interpret the essential bio signals such as ECG and EEG
- To apply signal and data processing techniques to bio signals and applications in biomedicine
- To illustrate the use of wavelets in medical applications
- To grasp the advancements of biomedical engineering with the help of emerging technologies like BCI

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Reflect on biological systems from a signals and systems viewpoint and apply suitable signal processing techniques
CO-2: Apply advanced data compressing, modelling, and signal processing techniques to ECG and EEG signals
CO-3: Design and implement digital filters for noise reduction in electrophysiological data
CO-4: Demonstrate real-world applications of BCI

UNIT – I:
Cardiological Signal Processing: preprocessing of ECG signal, QRS detection methods-Differentiation based and template based, Rhythm analysis and Arrhythmia detection algorithms. Automated ECG analysis.

UNIT – II:
Data Compression Techniques: Turning Point algorithm, AZTEC, CORTES, KL transform, Adaptive filters, Weiner filter principles, LMS & RLS, medical Applications of Adaptive Noise Cancellation.

UNIT – III:
Neurological Signal Processing: Stochastic process, Linear prediction, Yule-Walker equations, Auto Regressive Modeling of EEG signal, Detection of EEG Rhythms, Template matching for EEG spike and wave detection, Detection of EEG spike and wave complexes, Coherence analysis of EEG channels, Adaptive segmentation of EEG signals.

UNIT – IV:
Sleep EEG: Data Acquisition and Classification of Sleep stages, The Markov Model and Markov Chains, Dynamics of Sleep-Wake Transitions, Hypnogram Model Parameters.
PRONY'S Method: Exponential Modelling, Exponential Parameter Estimation, The original Prony Problem, Least Squares Prony Method, The Covariance Method of Linear Prediction.

UNIT – V:

Wavelets in Medicine: Need for wavelets, Types of wavelets, Selection of a wavelet for an application, Decomposition and reconstruction of signals using wavelets, Denoising using wavelets, typical medical applications.

UNIT – VI:

Brain-Computer Interface: Brain signals for BCIs, Generic setup for a BCI, Feature extraction and Feature translation involved in BCIs. Typical medical applications.

TEXTBOOKS:

1. Biomedical Signal Analysis: A Case-Study Approach, Rangaraj M. Rangayyan, John Wiley & Sons, 2005
2. Biomedical Signal Processing, D. C .Reddy, The McGraw-Hill Companies, 2005

REFERENCES:

1. Biomedical Digital Signal Processing, Willis J. Tompkins, Prentice-Hall of India Pvt. Ltd., 2012
2. Statistical Digital Signal Processing and Modeling, Monson H. Hayes, Wiley-India, 2009
3. Brain-Computer Interfaces: Principles and Practice, Jonathan Wolpaw and Elizabeth Winter Wolpaw, Oxford University Press, 2012
4. Wavelet Tour of Signal Processing: The Sparse Way, Stephan Stephane Mallat, 3rd Edition, Academic Press, 2008

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

(19PC1EE07) 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, students should be able to
CO-1: Understand the operating characteristics of various power electronic devices and their protection
CO-2: Analyze operating principles of different converters and find their applications
CO-3: Understand the control range/ control methodologies for various power electronic converters

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 average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage.
DC-DC Boost Converter: Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage.

UNIT – V:

Single-Phase Voltage Source Inverter: Power circuit of single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and uni-polar sinusoidal modulation, modulation index and output voltage.

Three-Phase Voltage Source Inverter: Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, 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, Applications and 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

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B.Tech. VII Semester

L	T/P/D	C
3	0	3

(19PE1EI09) INSTRUMENTATION FOR PHARMACEUTICAL INDUSTRY

COURSE OBJECTIVES:

- To learn the sequence of operations in pharmaceutical industry
- To know the necessity of precision instrumentation in pharmaceutical industry
- To study the different processes that are performed in pharmaceutical industry
- To know the different components and equipment required to processes and control various parameters in pharmaceutical industry

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

CO-1: Identify and interpret various filters and centrifuge devices in pharmaceutical process applications

CO-2: Analyze the instrumentation for crystallization, vaporization and distillation process in pharmaceutical process applications

CO-3: Analyze the procedure to control humidity and refrigeration, crystallization and vaporization

CO-4: Interpret different methods and devices used for size reduction, separation and homogenization in pharmaceutical process applications

UNIT – I:

Introduction to Pharma Industries: Basic Processors and Instrumentation Techniques, Process Analysis Technology (PAT).

Filtration: Classification of Filtration, Mechanism of Filtration, Filter media, Filter Aids, Pre treatment of materials, small scale filtration methods, filtration equipment, filter presses, Leaf filters, stacked disc filters, meta filters, Rotary continuous filters, other methods, ceramic filters, seitz filters, sintered (fritted) Glass filters, Membrane filters, factors affecting the rate of filtration, industrial filters including rotary filter, edge filter, etc. mathematical problems on filtration, optimum-cleaning cycle in batch filters, Limitations of filter theory.

Centrifugation: General principles, theoretical aspects, classification, Laboratory equipment, Large scale equipment, Semi continuous centrifuge, equipment with non-perforated basket, de laval clarifier, vertical solid bowl centrifuges, continuous centrifuges, Principles of centrifugation, industrial centrifugal filters, centrifugal filters, and centrifugal sedimeters

UNIT – II:

Crystallization: Introduction, Crystal forms and crystal Habit, classification of crystallizers, tank crystallizers, agitated batch crystallizers, Swenson Walker Crystallizer, Krystal Crystallizer, Vacuum Crystallizer without External Classifying seed Bed, theoretical aspects of Crystallization, Calculation of yields, theory of Crystallization. The miers super saturation theory, limitations of the miers theory, rate of crystal growth. Characteristics of crystals like; purity, size, shape, geometry, habit, forms, size and factors affecting it. Solubility curves and calculation of yields, Material, and heat balances around Swenson Walker Crystallizer. Super saturation theory and its limitations, Nucleation mechanisms, crystal growth. Study of various types of crystallizers, tanks, agitated batch, single vacuum, circulating magma and crystal crystallizers. Caking of crystals and its prevention. Numerical problems on yields.

UNIT – III:

Evaporation and Distillation Heat Processes: Factors affecting evaporation, study of evaporating stills and evaporating pans, heat transferring evaporators, vapor compression evaporators and evaporation under reduced pressure. Distillation: Importance of distillation in Pharmacy, methods of distillation. Brief introduction to freeze drying, sublimation, desiccation and exsiccation, efflorescence and its importance.

UNIT – IV:

Humidity Control and Refrigeration: Basic concepts and definition, wet bulb temperature, adiabatic cooling lines, use of Humidity chart, determination of humidity, air conditioning, humidification and humidifying equipment, dehumidifiers. Introduction, refrigeration equipment, coefficient of performance and refrigerants, Brine systems, refrigeration load, absorption systems.

UNIT – V:

Size Reduction and Separation: Introduction, mechanism and principles of size reduction, classification of size reduction equipment, law of size reduction, large equipment, mills using impact force for size reduction, cage mills, pin mills, fluid energy or jet mills, attrition and grinding mills tumbling mills. Ball mills and tube mills, practical size classifiers used with grinding mills, wet classifiers, non-rotary ball and bead mills, dry vs wet grinding, end runner mill, edge runner mills, disc attrition mills, dispersion and colloid mills, roller mills, size reduction combined with other operations, factors influencing choice of size reduction machinery, changes resulting in the material due to size reduction.

Size separation sieving, Screening equipment, sedimentation, screen analysis Definition, objectives of size reduction, factors affecting size reduction, laws governing energy and power requirements of a mill, types of mills including ball mill, hammer mill, fluid energy mill etc. Various methods and equipments employed for size separation, centrifugal elutriation, microscopic methods.

UNIT – VI:

Mixing and Homogenization: Introduction, equipment for mixing of miscible liquids, mixing of a soluble solid with a low viscous liquid etc., mixing solids with solids, equipment, consideration while choosing solids mixing equipment, mixing solids with liquids, mixing miscible liquids, mixing viscous masses, mixing of immiscible liquids, equipment for emulsification. Theory of mixing- solid solid, solid liquid and liquid liquid mixing equipment, double cone, twinshell, silverson mixer, colloid mill, sigma blade mixer, planetary mixer, propeller mixer and turbine mixer. Semi solid mixing, Triple roller mill.

TEXT BOOKS:

1. Pharmaceutical Engineering, K. Samba Murthy
2. Pharmaceutical Engineering C. V. S. Subhramanyam
3. Tutorial Pharmacy, S. J. Carter, Cooper and Gunn's, 6th Edition, CBS Publisher, Delhi

REFERENCES:

1. Perry's Handbook of Chemical Engineering
2. Unit Operations, McCabe & Smith

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

(19PE1EC19) DSP PROCESSORS AND ARCHITECTURES

COURSE PRE-REQUISITES: Digital Signal Processing (19PC1EC09), Microprocessors and Microcontrollers (19PC1EC10)

COURSE OBJECTIVES:
- To study the Architectural features of programmable DSPs
- To analyze the importance of numeric formats and sources of errors in DSP implementation
- To understand the concepts of Memory & I/O interfacing
- To develop various DSP algorithms and their implementation

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand and Identify various DSP Architectures
CO-2: Discriminate different number representations and their effects
CO-3: Demonstrate the features of on-chip peripheral devices and memory-I/O interfacing along with its programming
CO-4: Demonstrate the features of Real Time, Fixed point and Floating-point DSP architectures

UNIT – I:
Introduction to DSP Processors: Digital Signal Processors, various architectures: VLIW Architecture, Multiprocessor DSPs, SHARC, SIMD, MIMD, RISC and CISC.
Implementation considerations - Data representations and arithmetic, finite word length effects, real time implementation considerations.

UNIT – II:
Execution Control and Pipelining: Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branch effects, Interrupt effects, Pipeline Programming models.

UNIT – III:
Typical Real-Time DSP system: Data representations and arithmetic, Analog - to – digital conversion process, Uniform and non-uniform quantization and encoding, Oversampling in A/D conversion, Digital to analog conversion process: signal recovery, the DAC, Anti-imaging filtering, Oversampling in D/A conversion, Analog I/O interface for real-time DSP systems, sources of errors in DSP implementation, real time implementation considerations.

UNIT – IV:
Fixed-Point DSP processors: Architecture of TMS 320C 5X, C54X Processors, addressing modes, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline operation of TMS320C54XX Processors, speed issues.

UNIT – V:

Memory and I/O Interfacing: External bus interfacing signals, Memory interface, Parallel I/O interface: Programmed I/O, Interrupts and I/O, Direct memory access (DMA). Hardware interfacing, Multichannel Buffered Serial Port (McBSP), CODEC interface circuit.

Implementation of DSP Algorithms: The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, FFT Algorithm, Adaptive Filters, 2-D Signal Processing.

UNIT – VI:

Floating-Point DSP Processors: TMS320C6000 series, architecture study, Central processing UNIT and data paths, Functional UNITs and its operations, Addressing modes in C6X, memory architecture, Peripherals, Assembly Instructions for arithmetic, logical operations

TEXTBOOKS:

1. Digital Signal Processing, Avtar Singh and S. Srinivasan, Thomson Publications, 2016
2. Digital Signal Processing A Practical approach, Emmanuel C. Ifeachor, Barrie W Jervis, 2nd Edition, Pearson Publications, 2002
3. Digital Signal Processing and Applications with the C6713 and C6416 DSK, Rulph Chassaing, Wiley, 2005

REFERENCES:

1. Digital Signal processors Architectures, implementations and Applications, Sen M. Kuo, Woon-Seng S. Gan, Pearson Publications, 2009
2. Digital Signal Processors, Architecture, Programming and Applications, B. Venkata Ramani and M. Bhaskar, TMH, 2007
3. DSP Processor Fundamentals, Architectures and Features, Lapsley, S. Chand, 2003
4. DSP Applications with TMS 320 Family, K. Shin, Prentice Hall, 1987

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

(19PE1EC08) SPEECH AND AUDIO PROCESSING

COURSE PRE-REQUISITES: Signal and Systems (19PC1EC04), Digital Signal Processing (19PC1EC09)

COURSE OBJECTIVES:
- To provide the knowledge of basic characteristics of speech signal in relation to production and perception of speech by humans
- To describe basic algorithms of speech analysis common to many applications of speech signal processing
- To give foundation for applications of speech signal processing (enhancement, and coding)
- To get an overview of implementation aspects of Voice and Speech Recognition Technology
- To familiarize with different Audio processing and editing tools and open-source software

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify the basic components and parameters of speech
CO-2: Analyze different processes for speech modeling and recognition
CO-3: Design a speech recognition system and to use different speech synthesis techniques
CO-4: Familiarize with speech coding and diverse Speech Processing applications

UNIT – I:
Speech Production: Speech signal; Speech Production process: Lungs, Larynx and Vocal folds, Vocal tract; Acoustic Phonetics: Vowels, Diphthongs, Semi vowels, Nasals, Unvoiced fricatives, Voiced fricatives, Voiced and unvoiced stops; Acoustic theory of speech production; Digital model for speech signals, Deep Learning.

UNIT – II:
Time Domain Methods for Speech Processing: Time domain parameters of Speech signal, Methods for extracting the speech parameters (Energy, Average Magnitude, Zero crossing Rate), Silence Discrimination using Zero crossing Rate and energy, Short Time Auto Correlation Function, Pitch period estimation using Auto Correlation Function.

UNIT – III:
Frequency Domain Methods for Speech Processing: Short-Time Fourier Transform (STFT), Sampling the STFT in Time and Frequency, The Speech Spectrogram, homomorphic speech analysis: homomorphic systems for convolution, Definition of the Cepstrum and complex Cepstrums, pitch extraction using homomorphic speech processing.

UNIT – IV:

Linear Predictive Analysis of Speech: Linear prediction of speech, auto correlation, formulation of Linear prediction coding equations, Solution of Linear prediction coding equations, Levinson Durbin recursion, Application of Linear prediction coding parameters: Pitch detection using Linear prediction coding parameters, Deriving acoustic parameters PLPs, LPCCs, and MFCCs from LPCs

UNIT – V:

Speech Enhancement: Nature of Interfering Sounds; Speech Enhancement (SE) Techniques: Basic principles of Spectral Subtraction; Wiener Filtering; Wiener filtering for noise reduction; Statistical-Model-based method: Maximum-likelihood estimator for speech enhancement; Applications of speech enhancement.

UNIT – VI:

Speech Coding: Closed-Loop Coders: Predictive Coding, Delta Modulation, Adaptive Differential PCM Systems, Analysis-by-Synthesis Coding, Multi-Pulse Excitation Linear Prediction (MPLP), Code-Excited Linear Prediction (CELP).

Speech Systems: Introduction to Feature extraction; Classifiers for automatic speaker recognition and automatic speaker identification.

TEXTBOOKS:

1. Introduction to Digital Speech Processing, Lawrence R. Rabiner and Ronald W. Schafer, now Publishers Inc, Hanover, USA, 2007
2. Discrete Time Speech Signal Processing: Principles and Practice, Thomas F. Quateri, Ed., PE, 2004
3. Speech Enhancement, Philipos C. Loizou, 2nd Edition, CRC Press, Taylor & Francis Group, 2013

REFERENCES:

1. Digital Processing of Speech Signals, L. R. Rabiner and R.W. Schafer, Prentice-Hall Inc. USA, 1978
2. Speech Communications Human and Machine, Douglas O. Shaughnessy, 2nd Edition, IEEE Press, 2000
3. Statistical Methods of Speech Recognition, Frederick Jelinek, MIT Press, 1997
4. Speech Recognition, Claudio Becchetti and Lucio Prina Ricotti, John Wiley and Sons, 1999
5. Speech and Audio Signal Processing, Processing and Perception of Speech and Music- Ben Gold and Nelson Morgan, Wiley- India Edition, 2006

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

(19PE1EI10) TELE MEDICINE

COURSE OBJECTIVES:
- To know scope, benefits and limitations of telemedicine
- To know security and standards and their use in telemedicine applications
- To explain basic parts of teleradiology systems like image acquisition system, display system, communication network, interpretation
- To describe the need of various communication networks, antennas in designing the telemedicine system

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify fundamental requirements and need for telemedicine
CO-2: Identify and analyse types of information, security and Standards and their use in Telemedicine Applications
CO-3: Recognize Communication Networks for information exchange
CO-4: Outline the Design requirements of tele pathology and tele radiology

UNIT – I:
Introduction: History of Telemedicine, Block diagram of telemedicine system, Definition of telemedicine, Tele health, Tele care, origins and Development of Telemedicine, Scope, Benefits and limitations of Telemedicine.

UNIT – II:
Types of information: Audio, Video, still Images, text and data, Fax. Types of Communication and Network: PSTN, POTS, ATN, ISDN, Internet, Wireless Communications: GSM, satellite and Micro Wave. Different modulation techniques, Integration and Operational issues: system integration, Store-and-forward operation, realtime Telemedicine.

UNIT – III:
Data Exchanges: Network Configuration, Circuit and packet switching, H.320 series (Video phone based ISBN) T.120, h.324 (Video phone based PSTN), Video Conferencing.

UNIT – IV:
Data Security and Standards: Encryption, Cryptography, Mechanisms of encryption, Phases of Encryption. Photocols: TCP/IP, ISO-OSI, Standards to followed DICOM, HL7. Ethical and legal aspects of Telemedicine: Confidentiality and Law, patient rights and consent, access to medical Records, Consent treatment, jurisdictional Issues, Intellectual property rights.

UNIT – V:
Tele Pathology: Multimedia databases, color images of sufficient resolution: Dynamic range, spatial resolution, compression methods, Interactive control of colour, Controlled sampling, security and confidentiality tools.

UNIT – VI:

Tele Radiology: Basic parts of Teleradiology system: Image Acquisition system, Display system, Communication network, Interpretation.

TEXT BOOKS:

1. Handbook of Telemedicine, Olga Ferrer-Roca, M. Sosa Ludicissa, IOS Press 2002
2. Essentials of Telemedicine and Telecare, A. C. Norris, John Wiley & Sons, 2002

REFERENCES:

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2747412/

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

(19PC2EI07) ANALYTICAL INSTRUMENTATION LABORATORY

COURSE OBJECTIVES:

- To introduce the whole array of modern analytical instruments to implement statical analysis tools
- To emphasize hands-on approach with sample preparation, application, method development, data analysis and interpretation being key elements
- To introduce methods to Interpret data derived from any analytical instrument
- To familiarize with the basic concepts, principles and terms of chromatography, Spectroscopy and gas analyzers

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify modern analytical instruments to analyze liquids, solids and gases
CO-2: Perform hands-on approach with sample preparation, application, method development, measurement, data analysis and interpretation
CO-3: Apply the basic concepts and principles of chromatography, spectroscopy and gas analyzers for the measurement of concentration of different constituents
CO-4: Measure and analyze nuclear radiation intensity of radioactive materials

LIST OF EXPERIMENTS:

1. Analysis of CO2, O2, HC and CO concentration in the ambient air & automobile emissions using gas analyzers.
2. Separation of different constituents in a mixture of chemical using chromatography
3. Identification of atoms and its concentration through absorption spectra with UV-VIS spectrophotometer.
4. Identification of chemical compounds and its concentration using FTIR spectrometer.
5. Identification of atoms and its concentration through emission spectra using flame photometer.
6. Measurement of calorific value using digital bomb calorimeter
7. Determination of acid/alkaline nature of water using pH meter.
8. Qualitative and quantitative analysis of milk and protein using Milk Analyzer.
9. Blood glucose analysis using blood glucometer.
10. Radiation intensity measurement with varying distance and measurement of absorber thickness using nuclear radiation detector-G.M. counter.
11. Analysis of water quality using water purity meter.
12. Measurement of total dissolved salts and conductivity of water using digital conductivity meter
13. Measurement of turbidity of water using digital turbidity meter.
14. Measurement of colour concentration of a sample using photo calorimeter.

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

(19PC2EI08) IoT LABORATORY - INTERFACING AND APPLICATIONS

COURSE OBJECTIVES:

- To understand embedded system programming, design and develop embedded solutions
- To impart system level thinking
- To acquaints innovative design applications
- To acquire command over design automation

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Acquire knowledge with programming environment to develop Embedded and IoT Applications
CO-2: Implement Interfacing input output modules to various processors
CO-3: Design & Implement Small Embedded applications using controllers, Sensors and Actuators
CO-4: Design & Implement Small IoT applications using controllers, Sensors and Actuators

LIST OF EXPERIMENTS:

Interfacing:

1. Interfacing of Keypad and LCD with ARM Processors
2. Interfacing of GPS & GSM with ARM Processors

Embedded Applications (with ARM Processors /Arduino):

3. Implementation of Multichannel Data Acquisition systems.
4. Automatic Wiper control in Automobile System.
5. Implementation of Smart Traffic management System.
6. Implementation of Multilevel Vehicle Parking System.
7. Implementation of Line Follower Robot.
8. Implementation of Obstacle avoidance Robot.

IoT Applications (with Arduino / Raspberry Pi):

9. Design and development of Home Automation System.
10. Design and Control of Smart Irrigation System.
11. Design and development of Weather reporting system.
12. Implementation of health monitoring System.

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	0	**4**	**2**

(19PW4EI04) MINI-PROJECT

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand the formulated industry / technical problem
CO-2: Analyze and / or devlop models for providing solution to Industry / Technical problems
CO-3: Interpret and arrive at conclusions from the project carried out
CO-4: Demonstrate effective communication skills through oral presentation
CO-5: Engage in effective written communication through project report

COURSE OUTLINE:

- A student shall undergo an industry oriented mini-project, in collaboration with an industry of their specialization, during the summer vacation after sixth semester (III year II semester) of the B.Tech. programme.
- Mini-project shall be carried out for a minimum period of 04 weeks and maximum of 06 weeks.
- Evaluation of the mini-project shall be done by a Project Review Committee (PRC) consisting of the Head of the Department, faculty supervisor and a senior faculty member of the department.
- The industry oriented mini-project shall be submitted in a report form and presented before the Project Review Committee (PRC) for evaluation.

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	3	**0**	**3**

(19PE1EI11) DIGITAL CONTROL SYSTEM

COURSE PRE-REQUISITES: Control Systems

COURSE OBJECTIVES:
- To understand the importance and necessity of development and/or analysis of systems in discrete/digital time domain
- To realize and implement the traditional PID controller and other digital controllers using Computer through Programming techniques
- To examine the stability regions in the discrete time domain
- To realize the digital controllers in digital state space domain and to introduce some advanced control strategies

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Elicit the need of digital control systems in era of computers
CO-2: Familiarize in representing discrete systems in both pulse transfer function and state variable approach
CO-3: Analyze the stability of discrete time systems and design of Digital Control Systems
CO-4: Design State Feedback control and optimal control strategies

UNIT – I:
Sampling and Reconstruction: Introduction, sample and hold operations, sampling theorem, Reconstruction of original signal from sampled signal
The Z-Transforms: Introduction, Linear difference equations, pulse response, Z-Transforms, Theorems of Z-Transforms, The inverse Z-Transforms, Modified Z-Transforms. Z plane analysis of discrete time control systems, Z-Transforms method for solving difference equations, block diagram analysis of sampled data systems, mapping between s and z-planes: primary strips and complementary strips.

UNIT – II:
State Space Analysis: State Space Representation of discrete time systems - Solving discrete time state space equations, State transition matrix and its properties, method for computation of state transition matrix, discretization of continuous time state-space equations. Controllability and Observability- concepts of controllability and observability, tests for controllability and observability. Duality between controllability and observability, controllability and observability conditions.

UNIT – III:
Stability Analysis: Stability analysis of closed loop systems in Z plane, Jury stability test- Stability analysis using Bilinear transformation and Routh stability criterion. Stability analysis using Lyapunov theorem.

UNIT – IV:
Design of Discrete Time Control System by Conventional Methods: Design based on the frequency response method – Bilinear Transformation and Design, procedure in

the W-plane, Lead, Lag, Lead-Lag compensators and digital PID controllers, design of digital control through deadbeat response method.

UNIT – V:

State Feedback Controllers and Observers: Design of state feedback controller through pole placement- Necessary and sufficient conditions, Ackerman's formula. State Observers-Full order and Reduced order observers.

UNIT – VI:

Quadratic Optimal Control: Introduction, Quadratic Optimal Control, Steady state Quadratic Optimal Control, Quadratic Optimal Control for servo systems, Linear Quadratic Regulators (LQRs).

TEXT BOOKS:

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

REFERENCES:

1. Digital Control Systems, Kuo, 2nd Edition, Oxford University Press, 2003
2. Digital Control Engineering, M. Gopal, New Age International publishers

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

(19PE1EI12) INSTRUMENTATION AND CONTROL FOR PETROCHEMICAL INDUSTRIES

COURSE OBJECTIVES:

- To expose to various petroleum production processes
- To impart knowledge on various processes involved in petroleum refinery
- To provide knowledge on specific measurement techniques practiced, control systems and automation involved in petrochemical industry

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Perform investigations to extract crude oil sources by using various instruments
CO-2: Implement safety and automation systems for smooth running of complex units in petrochemical plants
CO-3: Operate and maintain petrochemical processing equipment for refining of crude oil using distillation, reflux and reboiler systems
CO-4: Commission and test instrumentation equipment for oil refineries at different stages

UNIT – I:
Introduction to Petroleum Products: Brief survey of petroleum formation, petroleum exploration, Petroleum production, Petroleum refining and its methods, refining capacity and consumption in India, constituents of Crude Oil, Recovery techniques – Oil – Gas separation, Processing wet gases.

UNIT – II:
P & I Diagrams for Petroleum Plants: P & I diagram of petroleum refinery, Atmospheric distillation process, Vacuum distillation process, Thermal cracking, Catalytic cracking, Catalytic reforming, and Utility plants – Air, N2, and cooling water.

UNIT – III:
Instruments for Petroleum Industries: Basics of field instruments, Parameters to be measured in Petrochemical industry, Distillation Column control, Selection of instruments, Basics of intrinsic safety of instruments, Area classification.

UNIT – IV:
Petroleum and its Chemicals: Chemicals from petroleum, Chemicals from methane, acetylene, ethylene and propylene - production routes of important petrochemicals such as polyethylene, polypropylene, ethylene dioxide, methanol, xylene, benzene, toluene, styrene, VCM and PVC.

UNIT – V:
Control of Petroleum Industries and its units: Control of furnace, Reboiler Control, Reflux Control, Control of catalytic crackers, Control of heat exchanger, Control of cooling tower.

UNIT – VI:
Safety Systems for Petroleum Industries: Basics of PLC, and Safety interlocks in furnace, separator, pump, and compressor. Basics of SIL, Introduction to Standards.

TEXT BOOKS:

1. Chemical from Petroleum, Waddams A. L., Butter and Janner Ltd., 1968
2. Process Control Structures and Applications, Balchan J. G. and Mumme K. I., Van Nostrand Reinhold Company, New York, 1988
3. Chemical Process Industries, Austin G. T. Shreves, McGraw Hill International Student Edition Singapore, 1985

REFERENCES:

1. Instrumentation in Process Industries, Béla G. Lipták, Chilton Book Company, 2005
2. Oil and Gas Production Handbook-An Introduction to Oil and Gas Production, Havard Devold, ABB ATPA Oil and Gas, 2006

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

(19PE1EI22) PRINCIPLES AND APPLICATIONS OF NANO TECHNOLOGY

COURSE OBJECTIVES:
- To introduce the multidisciplinary nature of nanotechnology and its applications
- To outline various nanomaterials and methods manipulating these materials for wide variety of applications
- To introduce Instrumentation for nanoscale measurements
- To enumerate specific applications of nanotechnology to electronics

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Infer the approaches and materials useful for nanotechnology and nano-system development
CO-2: Evaluate various existing and emerging fabrication techniques used in nanotechnology and nanoelectronics
CO-3: Defend the need for specialized metrology for nanoscale measurements and familiarize with various commonly used equipment
CO-4: Summarize the advances and applications of nanotechnology to electronics with focus on the use of III-V compounds and carbon nano-tubes

UNIT – I:
Introduction to Nanotechnology
Introduction & History: Overview of atomic physics; Chemistry of atoms and molecules; Overview of quantum mechanics; Feynman's perspective of nanoscience; Social impact of nanotechnology; Motivation, Top-down vs. Bottom-up approaches
Applications: Electronics, instrumentation, medicine, aerospace, and material science.

UNIT – II:
Nanomaterials: Metal Nanomaterials, Semiconductor nanomaterials, Quantum Dots, Quantum Wells, 2-terminal Quantum Wires, Buckyballs, Carbon Nanotubes, Nano Peapods, Nano Rods, Polymer-based Nanostructures, Gold Nanostructures: Nano-rods, Nano-cages, Nano-shells.

UNIT – III:
Fabrication Techniques: Top-down approach–Nanolithography, CVD; Bottom-up approach – sol-gel process, chemical synthesis, wet deposition techniques, Self-assembly and Layer-by-layer assembly (LbL).

UNIT – IV:
Nanoscale Measurements: Principle of working, Operational aspects, Limitations, and Applications for: SEM, TEM, STM, SPM, AFM, Fluorescence microscopy.

UNIT – V:
Nanoelectronics: Materials: Graphene, Boron Nitride Nano-mesh, III-V compounds: GaAs, GaN, AlGaN,InGaAs, High-K/Metal-Gate applications for non-Si nanoelectronics.

Devices: Silicon nanowires, CNTFET, Ballistic deflection transistors (BDT)

UNIT – VI:

Advances in Nanoelectronics: Printed electronics, Molecular electronics, Spintronics, Nano electronic displays, Memory devices, Electronics modelled after living systems.

TEXTBOOKS:

1. Introduction to Nanotechnology, Poole C., Owens F., Wiley
2. Nano Science and Nanotechnology: Fundamentals to Frontiers, Wiley Ramachandra M. S., Singh S, India Pvt. Ltd., 2013 (ISBN: 978-8126542017)
3. Nano: The Essentials: Understanding Nanoscience and Nanotechnology, Pradeep T., McGraw Hill India, 2007 (ISBN:978-0070617889)

REFERENCES:

1. Springer Handbook of Nanotechnology, Bhushan B., (Ed.), Springer, 2006 (ISBN: 978-3540298557)
2. Nanotechnology: Basic Calculations for Engineers and Scientists, Theodore L., Wiley India Pvt. Ltd., 2011 (ISBN: 978-8126529667)
3. Nanotechnology: An Introduction to Synthesis, Properties and Applications of Nanomaterials, Varghese T.; Balakrishna K. M., Atlantic, 2012 (ISBN: 978-8126916382)

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

(19PE1EC06) CPLD AND FPGA ARCHITECTURE

COURSE PRE-REQUISITES: Digital System Design

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

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

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

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

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

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

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

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

TEXT BOOKS:

1. Fundamentals of Logic Design, Charles H. Roth Jr., 5th 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, 3rd Edition, Springer International Edition, 2005
2. Field-Programmable Gate Arrays, Stephen D. Brown, Springer, 1992

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

(19PE1EI13) BIOMEDICAL NANO TECHNOLOGY

COURSE PRE-REQUISITES: Engineering Physics, Engineering Chemistry, Electronic Devices & Circuits

COURSE OBJECTIVES:
- To grasp the multidisciplinary and diverse nature of nanotechnology and its applications
- To outline various nanomaterials and methods to manipulate these materials for wide variety of biomedical applications
- To understand methods of fabrication and measurements used in the nanoscale regime and select the appropriate ones for various applications
- To describe specific applications of nanotechnology in therapy, biomedicine, and healthcare

COURSE OUTCOMES: After the completion of the course, students should be able to
CO-1: Infer the approaches and materials useful for nanotechnology and nano-system development
CO-2: Evaluate various existing and emerging fabrication techniques used in nanotechnology
CO-3: Defend the need for specialized metrology for nanoscale measurements and familiarize with commonly used scanning microscopes
CO-4: Summarise the advancements in the field of therapy, biomedicine, and healthcare due to the advent of nanotechnology

UNIT – I:
Introduction to Nanotechnology: Introduction & History: Overview of atomic physics; Chemistry of atoms and molecules; Overview of quantum mechanics; Feynman's perspective of nanoscience; Social impact of nanotechnology with focus on healthcare: Risks and Remedies; Motivation, Top-down vs. Bottom-up approaches.
Applications: Electronics, instrumentation, medicine, and material science

UNIT – II:
Nanomaterials and Applications
Introduction to Nanomaterials: Overview of Metal and Semiconductor Nanomaterials; Quantum Structures: Dots, Wells, and 2-terminal Wires; Buckyballs, Carbon Nanotubes; Polymer-based Nanostructures; Gold Nanostructures: Nano-rods, Nano-cages, Nano-shells; Other nanostructures: Nano-buds, Torus, Nano Peapods, Nano Rods
Applications: Medical use of nanomaterials; Biomaterials in nanotechnology applications, Growth of neurons on nanomaterials, Nanomaterials for brain protection and repair

UNIT – III:

Nano Fabrication

Fabrication Techniques: Top-down approach – Nanolithography, CVD; Bottom-up approach – sol-gel process, chemical synthesis, wet deposition techniques, Self-assembly and Layer-by-layer assembly (LbL)

UNIT – IV:

Nanoscale Measurements

Instrumentation: Principle of working, Operational aspects, Limitations, and Applications for: SEM, TEM, STM, SPM, AFM, Fluorescence microscopy.

UNIT – V:

Nanotechnology in Therapy

Cytotoxicity: Targeted Drug Delivery using Nanowires, Nanotubes, Nanoshells, Nanoparticles; Nanotechnology in Cancer treatment; Nanoparticle-mediated Gene Therapy; Regenerative Therapy using Nanotechnology

UNIT – VI:

Other Medical Applications of Nanotechnology: Electronics modelled after living systems and Biomimetics; NEMS sensors and Biosensors; Lab on a Chip (LoC); Quantum Dots for Drug Discovery and Imaging; Nanoprinting of DNA, RNA, and proteins; Nanorobotics for Surgery; Neuroelectronic Interfaces; Implants and Prostheses

TEXT BOOKS:

1. Biomedical Nanotechnology, Malsch N. H., CRC Press, 2019 (ISBN: 978-0367392994)
2. Nanotechnology: Science, Innovations and Opportunity, Foster L. E., Pearson Education India, 2007 (ISBN: 978-8131711187)
3. Introduction to Nanotechnology, Poole C., Owens F., Wiley, 2007 (ISBN: 978-8126510993)

REFERENCES:

1. Nano Science and Nanotechnology: Fundamentals to Frontiers, Ramachandra, M. S., Singh S., Wiley India Pvt. Ltd., 2013 (ISBN: 978-8126542017)
2. Nano: The Essentials: Understanding Nanoscience and Nanotechnology, Pradeep T., McGraw Hill India, 2007 (ISBN:978-0070617889)
3. Springer Handbook of Nanotechnology, Bhushan B. (Ed.), Springer, 2006 (ISBN: 978-3540298557)
4. Nanomedicine, Volume I: Basic Capabilities: 1, Freitas R. A., CRC Press, 1999 (ISBN: 978-1570596803)
5. Nanomedicine, Volume IIA: Biocompatibility: 2A, Freitas R. A., CRC Press, 2003 (ISBN: 978-1570597008)

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

(19PE1EI14) AUTOMOTIVE INSTRUMENTATION

COURSE OBJECTIVES:
- To impart basic knowledge about the electronics and Instrumentation systems in the classic and contemporary automobiles
- To impart the basic knowledge of the different subsystem of automotive
- To expose the control system applications to various modular operations of the automobiles

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify the components of the automotive system and its associated electronics
CO-2: Appreciate the sensors, actuators, electronic engine control and measurement schemes used in the automotive subsystem
CO-3: Interpret the digital power train Vs conventional power train control systems.
CO-4: Combine scientific principles and engineering concepts to the formulate control system required for different submodules of automotive system

UNIT – I:
The Systems Approach to Control and Instrumentation: Concept of a System, Linear System Theory, Control Theory: Introduction to open to closed loop system, Stability of Control System, Example of limit cycle control system, Basic of measurement system, Introduction to Random Error, Signal Processing and Filters

UNIT – II:
Microcomputer Instrumentation and Control: Microcomputer Fundamentals, Microcomputer Tasks & Operation, CPU Registers, Reading Instructions, Microcomputer Hardware, Microcomputer Applications in Automotive Systems, Instrumentation Applications of Microcomputers, Microcomputers in Control Systems

UNIT – III:
The Basics of Electronic Engine Control: Concept of an Electronic Engine Control System, Definition of Engine Performance Terms, Exhaust Catalytic Converters, Electronic Fuel-Control System, Analysis of Intake Manifold Pressure, Idle Speed Control, Electronic Ignition

UNIT – IV:
Automotive Sensors and Actuators: Automotive Control System Applications of Sensors and Actuators, Throttle Angle Sensor, Temperature Sensors, Sensors for Feedback Control, Typical Coolant Sensor, Electric Motor Actuators, Ignition System

UNIT – V:
Digital Powertrain Control Systems: Digital Engine Control, Digital Engine Control Features, Control Modes for Fuel Control, Electronic Ignition Control, Integrated Engine Control System, Hard Acceleration, Deceleration and Idle, Automatic Transmission Control, Torque Converter Lock-Up Control, Differential and Traction Control, Hybrid Electric Vehicle Powertrain Control.

UNIT – VI:

Vehicle-Motion Controls: Representative Cruise Control System, Cruise Control Electronics, Antilock Braking System, Electronic Suspension System, Electronic Steering Control, Four-Wheel Steering

TEXT BOOKS:

1. Understanding Automotive Electronics, William B. Ribbens, 7th Edition, Butterworth Heinemann 2012

REFERENCES:

1. Automotive Electrical Equipment, Young A. P., Griffiths L., ELBS & New Press, 2010
2. Automotive Computers and Control System, Tom Weather Jr., Cland C. Hunter, Prentice Hall Inc., New Jersey, 2009
3. Automobile Electrical Equipment, Crouse W. H., McGraw Hill Co. Inc., New York, 2005
4. Understanding Automotive Electronic, Bechtold, SAE, 2010 5
5. Automotive Handbook, 9th Edition, Bentely Publishers, BOSCH, Germany, 2014

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

(19PE1EI15) INDUSTRIAL ELECTRONICS

COURSE OBJECTIVES:
- To understand the application of Amplifiers in industries
- To understand the need and working of SCR
- To understand the need of different operation of SCR and their industrial applications

COURSE OUTCOME: After completion of the course, students should be able to
CO-1: Identify the need of DC amplifiers, RPS and SMPS
CO-2: Elicit the need for SCR and different firing angle
CO-3: Identify the use of industrial and power electronic devices and modules for various industrial applications
CO-4: Employ electronic devices for the high frequency heating applications

UNIT – I:
DC Amplifiers: Need for DC amplifiers, DC amplifiers—Drift, Causes, Darlington Emitter Follower, Cascode amplifier, Stabilization, Differential amplifiers—Chopper stabilization, Operational Amplifiers, Ideal specifications of Operational Amplifiers, Instrumentation Amplifiers.

UNIT – II:
Regulated Power Supplies: Block diagram, Principle of voltage regulation, Series and Shunt type Linear Voltage Regulators, Protection Techniques— Short Circuit, Over voltage and Thermal Protection.

UNIT – III:
Switched Mode & IC Regulators: Switched Mode voltage regulator, Comparison of Linear and Switched Mode Voltage Regulators, Servo Voltage Stabilizer, monolithic voltage regulators Fixed and Adjustable IC Voltage regulators, 3-terminal Voltage regulators—Current boosting.

UNIT – IV:
SCR, Thyristor, and its applications: Principles of operation and characteristics of SCR, Triggering of Thyristors, Commutation Techniques of Thyristors—Classes A, B, C, D, E and F, Ratings of SCR.
Static circuit breaker, Protection of SCR, Inverters—Classification, Single Phase inverters, Converters – single phase Half wave and Full wave.
Chopper circuits – Principle, methods and Configurations, Diac and Triac, Triacs – Triggering modes, Firing Circuits, Commutation.
Design of power supplies and regulators.

UNIT – V:
Industrial Applications: Industrial timers -Classification, types, Electronic Timers – Classification, RC and Digital timers, Time base Generators. Electric Welding – Classification, types and methods of Resistance and ARC wielding, Electronic DC Motor Control.

UNIT – VI:

High Frequency heating – principle, merits, applications, High frequency Source for Induction heating. Dielectric Heating – principle, material properties, Electrodes and their Coupling to RF generator, Thermal losses and Applications. Ultrasonics – Generation and Applications.

TEXT BOOKS:

1. Industrial and Power Electronics, G. K. Mithal and Maneesha Gupta, 19th Edition, Khanna Publishers, 2003
2. Integrated Electronics, J. Millman and C. C. Halkias, McGraw Hill, 1972

REFERENCES:

1. Electronic Devices and Circuits, Theodore H. Bogart, 6th Edition, Pearson Education, 2003
2. Thyristors and applications, M. Rammurthy, East-West Press, 1977
3. Integrated Circuits and Semiconductor Devices, Deboo and Burroughs, ISE

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

(19PE1EC18) WIRELESS SENSOR NETWORKS AND PROTOCOLS

COURSE PRE-REQUISITES: Computer Networks and Systems Approach (19PC1EC12)

COURSE OBJECTIVES:
- To understand basics of Wireless Sensor Networks
- To study of medium access control protocols
- To distinguish key routing protocols used in sensor networks
- To learn transport layer protocols used in for sensor networks

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify engineering components, systems and protocols necessary for establishing the WSN to any application
CO-2: Appreciate the merits and security requirements of the different WSN protocols
CO-3: Demonstrate proficiency in using different WSN Protocols with sufficient security
CO-4: Identify the design goals and issues in Routing and Transport Layer Protocols for Ad Hoc Wireless Networks

UNIT – I:
Overview of Wireless Sensor Networks: Key definitions of sensor networks, Advantages of sensor Networks, Unique constraints and challenges, Driving Applications, Enabling Technologies for Wireless Sensor Networks.

UNIT – II:
Networking Technologies: Physical Layer and Transceiver Design Considerations, Personal area networks (PANs), hidden node and exposed node problem, Topologies of PANs, MANETs, WANETs.

UNIT – III:
MAC Protocols for Wireless Sensor Networks: Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals, Classifications of MAC Protocols, MAC Protocols that use Directional Antennas,

UNIT – IV:
Routing Protocols: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms.

UNIT – V:
Transport Layer Protocols: Introduction, Issues in Designing a Transport Layer Protocol for Adhoc Wireless Networks, Design Goals of a Transport Layer Protocol for Adhoc Wireless Networks, Classification of Transport Layer Solutions.

UNIT – VI:

Security in WSN: Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.

TEXTBOOKS:

1. Adhoc Wireless Networks: Architectures and Protocols, C. Siva Ram Murthy and B. S. Manoj, PHI, 2004
2. Wireless Adhoc and Sensor Networks: Protocols, Performance and Control – Jagannathan Sarangapani, CRC Press, 2007
3. Protocols and Architectures for Wireless Sensor Networks, Holger Karl & Andreas Willig, John Wiley, 2005

REFERENCES:

1. Wireless Sensor Networks - Technology, Protocols, and Applications, Kazem Sohraby, Daniel Minoli, & Taieb Znati, John Wiley, 2007
2. Wireless Sensor Networks - An Information Processing Approach, Feng Zhao & Leonidas J. Guibas, Elsevier, 2007
3. Adhoc Mobile Wireless Networks: Protocols & Systems, C. K. Toh, 1st Edition, Pearson Education
4. Wireless Sensor Networks, C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer
5. Wireless Sensor Networks, S. Anandamurugan, Lakshmi Publications

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

(19PE1EC04) DIGITAL IMAGE PROCESSING

COURSE PRE-REQUISITES: Digital Signal Processing

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

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

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

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

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

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

UNIT – V:

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

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19PE1EI16) MEDICAL IMAGING AND PROCESSING

COURSE OBJECTIVES:

- To provide the concepts of PET, MRI, CT, DICOM and Ultrasound images
- To familiarize the Image processing concepts for medical Images
- To introduce the image enchantment methods
- To demonstrate image morphology, segmentation, compression and restoration techniques

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify medical Images of numerous modalities such as PET, MRI, CT and Ultrasound systems and their formats
CO-2: Apply fundamental Image Processing Concepts for Medical Images
CO-3: Analyze Image enhancement and segmentation concepts for medical images
CO-4: Interpret image compression and restoration and morphological techniques

UNIT – I:
Basics of Medical Image Sources: Radiology- The electromagnetic spectrum-Computed Tomography-Magnetic Resonance Tomography–ultrasound-nuclear medicine and molecular imaging-other imaging techniques- image file formats-DICOM- other formats.

UNIT – II:
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 – III:
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 – IV:
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 – V:
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 – VI:

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.

TEXT BOOKS:

1. Applied Medical Image Processing – A Basic Course, Wolfgang Birkfellner, CRC Press, 2011
2. Medical Image Analysis, Atam P. Dhawan, Wiley Interscience Publication, NJ, USA 2003
3. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, 4th Edition, Pearson, 2018

REFERENCES:

1. Fundamentals of Digital Image Processing, Anil K. Jain, Indian Reprint, Pearson Education, 2003
2. Digital Image Processing, S. Jayaraman, S. Esakkirajan, T. Veerakumar, 5th Edition, TMH, 2015

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

(19PW4EI05) MAJOR PROJECT PHASE-I

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

(19PW4EI06) 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.