R18

TAMASOMA JYOTHIRGAMAYA

B.Tech. (MECHANICAL ENGINEERING)

B.Tech. R18 CBCS Curriculum

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous, ISO 9001:2015 & QS I-Gauge Diamond Rated Institute, Accredited by NAAC with 'A++' Grade
NBA Accreditation for B.Tech. CE, EEE, ME, ECE, CSE, EIE, IT Programmes
Approved by AICTE, New Delhi, Affiliated to JNTUH, NIRF 135 Rank in Engineering Category
Recognized as "College with Potential for Excellence" by UGC
Vignana Jyothi Nagar, Pragathi Nagar, Nizampet (S.O), Hyderabad – 500 090, TS, India.
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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

MECHANICAL ENGINEERING

VISION OF THE DEPARTMENT

To develop into a Centre of Excellence in Education and interdisciplinary research withcutting edge technologies in the field of Mechanical Engineering, consistent with thecontemporary and future societal needs of the country

MISSION OF THE DEPARTMENT

- To impart high quality education by using modern pedagogical tools so as to make the students technically competent in their chosen fields.
- To inculcate quality research by developing linkages with Industry and R & D organizations in India & abroad for developing technically competent and socially responsible engineers, managers and entrepreneurs.

B.TECH.
(MECHANICAL ENGINEERING)

B.TECH. (ME)

PROGRAM EDUCATIONAL OBJECTIVES

PEO-I: To prepare students for successful careers as mechanical engineers in organizations that meet the needs of Indian and global/multinational industrial/research establishments.

PEO-II: To provide a strong foundation in mathematical, scientific and engineering fundamentals in both domain and cross domain spheres, that enables students to visualize, analyze and solve mechanical engineering problems and be innovative and research oriented.

PEO-III: To train students with a wide spectrum of scientific and engineering courses so that students could comprehend, analyze, design and create products and services, which promotes entrepreneurship culture in the campus that address real life problems, which are efficient and cost effective.

PEO-IV: To inculcate in students a professional and ethical attitude, impart effective communication skills and ability to work in teams with multidisciplinary approach, be part of and interact with professional bodies so as to resolve engineering issues of social relevance.

PEO-V: To provide students with an academic environment that fosters excellence, leadership, yearning to pursue higher studies and passion for lifelong learning so as to have a successful professional career.

B.TECH. (ME)

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 analyse 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 modelling 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 in the broadest context of technological change.

B.TECH. (ME)

PROGRAM SPECIFIC OUTCOMES

PSO-1: Analyse, design, evaluate and provide solutions to the real-life mechanical engineering problems.

PSO-2: Design and evaluate thermal systems including IC engines, refrigeration, air conditioning, and power generating systems.

PSO-3: Engage in Planning, including methods design, process plan, process automation and quality assurance systems to ensure optimization in manufacturing.

PSO-4: Innovate on product design and development using modern management methods in manufacturing.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY HYDERABAD

B.TECH. I YEAR

(Common to ME and AE)

I SEMESTER **R18**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
18BS1MT01	Advanced Calculus	3	1	0	4	4
18BS1PH01	AppliedPhysics	3	1	0	4	4
18ES1CS01	Programming through C	3	0	0	3	3
18ES2CS01	Programming through C Laboratory	0	0	4	4	2
18BS2PH01	Applied Physics Laboratory	0	0	3	3	1.5
18ES3ME01	Engineering Graphics	1	0	5	6	3.5
18PW4ME01	Design Sensitization	0	0	2	2	1
Total		**10**	**2**	**14**	**26**	**19**
18MN6HS01	Induction Programme	-	-	-	-	-

II SEMESTER **R18**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
18BS1MT02	Linear Algebra and Ordinary Differential Equations	3	1	0	4	4
18BS1CH01	Engineering Chemistry	3	1	0	4	4
18ES1ME01	Engineering Mechanics	3	1	0	4	4
18HS1EN01	English	2	0	0	2	2
18HS2EN01	English Language Communication Skills Laboratory	0	0	2	2	1
18BS2CH01	Engineering Chemistry Laboratory	0	0	3	3	1.5
18ES2ME01	Workshop Practices	1	0	3	4	2.5
Total		**12**	**3**	**8**	**23**	**19**

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

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

III SEMESTER **R18**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
18BS1MT06	Partial Differential Equations and Numerical Methods	3	1	0	4	4
18PC1CS06	Data Structures Through C	3	0	0	3	3
18PC1ME01	Thermodynamics	3	1	0	4	4
18PC1ME02	Fluid Mechanics and Machinery	3	1	0	4	4
18ES1EE02	Basic Electrical and Electronics Engineering	3	0	0	3	3
18PC2ME01	Fluid Mechanics and Machinery Laboratory	0	0	2	2	1
18ES2EE02	Basic Electrical and Electronics Engineering Laboratory	0	0	2	2	1
18PC2CS03	Data Structures Through C Laboratory	0	0	2	2	1
Total		**15**	**3**	**6**	**24**	**21**

IV SEMESTER **R18**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
18PC1ME03	Thermal Engineering	3	1	0	4	4
18PC1ME04	Kinematics of Machinery	3	1	0	4	4
18PC1ME05	Mechanics of Solids	3	1	0	4	4
18PC1ME06	Metallurgy and Materials Engineering	3	0	0	3	3
18PC1ME07	Instrumentation and Control Systems	3	0	0	3	3
18PC2ME02	Thermal Engineering Laboratory	0	0	2	2	1
18PC2ME03	Mechanics of Solids Laboratory	0	0	2	2	1
18PC2ME04	Metallurgy and Instrumentation and Control Systems Laboratory	0	0	2	2	1
Total		**15**	**3**	**6**	**24**	**21**
18MN6HS02	Environmental Science	2	0	0	2	0

L – Lecture T – Tutorial P – Practical

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

V SEMESTER **R18**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
18PC1ME08	Heat Transfer	3	0	0	3	3
18PC1ME09	Manufacturing Processes	3	0	0	3	3
18PC1ME10	Dynamics of Machinery	3	0	0	3	3
	Professional Elective -I					
18PE1ME01	Non-Conventional Energy Source	3	0	0	3	3
18HS1MG02	Principles of Management and Organizational Behaviour					
18PE1ME03	Advanced Strength of Materials					
18PC1EE06	Control Systems					
18PE1ME05	Enterprise Resource Planning					
	Open Elective -I	3	0	0	3	3
18HS1MG01	Engineering Economics and Accountancy	3	0	0	3	3
18PC2ME05	Heat Transfer Laboratory	0	0	2	2	1
18PC2ME06	Manufacturing Processes Laboratory	0	0	2	2	1
18PC2ME07	Dynamics of Machinery Laboratory	0	0	2	2	1
18PW4ME02	Internship*	0	0	2	2	1
Total		**18**	**0**	**8**	**26**	**22**
18MN6HS03	Gender Sensitization	2	0	0	2	0

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY HYDERABAD

B.TECH. III YEAR

(MECHANICAL ENGINEERING)

VI SEMESTER **R18**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
18PC1ME11	Turbo Machinery	3	0	0	3	3
18PC1ME12	Machine Tools and Metrology	3	0	0	3	3
18PC1ME13	Design of Machine Elements	3	0	0	3	3
18PC1ME14	CAD/CAM and Robotics	3	0	0	3	3
	Professional Elective -II					
18PE1ME06	Refrigeration and Air Conditioning	3	0	0	3	3
18PE1ME07	Operations Research					
18PE1ME08	Finite Element Method					
18PE1ME09	Mechatronic Systems					
18PE1ME10	Unconventional Machining Processes					
	Open Elective -II	3	0	0	3	3
18PC2ME08	Machine Tools and Metrology Laboratory	0	0	2	2	1
18PC2ME09	CAD/CAM and Robotics Laboratory	0	0	2	2	1
18HS2EN02	Advanced English Communication Skills Laboratory	0	0	2	2	1
18PW4ME03	Design Thinking	0	0	4	4	2
Total		**18**	**0**	**10**	**28**	**23**

L – Lecture T – Tutorial P – Practical

OE TRACKS BASED ON MEZZANINE TECHNOLOGIES:

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

GENERAL POOL OF OE COURSES:

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

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

VII SEMESTER **R18**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
18PC1ME15	Digital Manufacturing	3	0	0	3	3
	Professional Elective - III					
18PE1ME11	Fluid Power Systems	3	0	0	3	3
18PE1ME12	Total Quality Management					
18PE1ME13	Mechanical Vibrations					
18PE1ME14	Mechanics of Composite Materials					
18PE1ME15	Tool Design					
	Professional Elective - IV					
18PE1ME16	Computational Fluid Dynamics	3	0	0	3	3
18PE1ME17	Optimization Techniques					
18PE1ME18	Mechanical Behavior of Engineering Materials					
18PE1ME19	Microprocessors in Automation					
18PE1ME20	Theory of Metal Cutting					
	Open Elective - III	3	0	0	3	3
18PC2ME10	Mechanical Drawing Practice Laboratory	0	0	2	2	1
18PC2ME11	Digital Manufacturing Laboratory	0	0	2	2	1
18PW4ME04	Mini-Project	0	0	4	4	2
18PW4ME05	Major Project Phase - I	0	0	8	8	4
Total		**12**	**0**	**16**	**28**	**20**

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

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

VIII SEMESTER **R18**

Course Category	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
	Professional Elective - V					
18PE1ME21	Gas Dynamics and Jet Propulsion	3	0	0	3	3
18PE1ME22	Design for Manufacturing and Assembly					
18PE1ME23	Advances in CAD/CAM					
18PE1ME24	Product Design and Process Planning					
18PE1ME25	Metal Casting Technology					
	Professional Elective - VI					
18PE1ME26	Power Plant Engineering	3	0	0	3	3
18PE1ME27	Plant Layout and Material Handling Systems					
18PE1ME28	Advanced Machine Design					
18PE1ME29	Flexible Manufacturing Systems					
18PE1ME30	Computer Integrated Manufacturing					
	Open Elective - IV	3	0	0	3	3
18PW4ME06	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 – Common to all branches	**L**	**T/P/D**	**C**
	3	**1**	**4**

(18BS1MT01) ADVANCED CALCULUS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To learn geometrical approach to the mean value theorems and their application to the mathematical problem
- To learn concept of Sequence and Series
- To learn evaluation of improper integrals using Beta and Gamma functions
- To learn evaluation of multiple integrals and their applications
- To learn basic properties of vector point function and their applications to line, surface and volume integrals

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Solve problems involving mean value theorems
CO-2: Analyze the nature of convergence of sequence and series
CO-3: Evaluate integrals using special functions and change of variables
CO-4: Evaluate double and triple integrals
CO-5: Transform line integral to surface and surface to volume integrals

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

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

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

UNIT-IV:
Multiple Integrals: Evaluation of Double Integrals (Cartesian and polar coordinates); change of order of integration (only Cartesian form); Evaluation of Triple Integrals: Change of variables (Cartesian to polar) for double and (Cartesian to Spherical and

Cylindrical polar coordinates) for triple integrals. Applications: Areas (by double integrals) and volumes (by double integrals and triple integrals).

UNIT-V:

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

UNIT-VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Semester – Common to CE, ME & AE	L	T/P/D	C
	3	1	4

(18BS1PH01) APPLIED PHYSICS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To comprehend various phenomena of light- Interference and Diffraction
- To understand the basic principles, working of lasers and optical fibers
- To learn basic structures and X-ray diffraction
- To study polarization mechanisms in dielectrics
- To understand the magnetic and superconducting properties of materials

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Realize the importance of Interference in thin films and Fraunhofer diffraction
CO-2: Analyze the lasing action of various laser sources and describe propagation of light through optical fiber
CO-3: Identify different types of crystals and importance of X-ray studies in crystals
CO-4: Understand the frequency dependence of different polarizabilities
CO-5: Recognize applications of magnetic materials and superconductors

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, Fraunhofer diffraction from a single slit, Double slit diffraction, Diffraction grating (Qualitative), and a circular aperture.

UNIT-II:
Lasers: Introduction, Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Meta Stable State, Population Inversion, Lasing Action, Einstein's Coefficients And Relation Between Them, Ruby Laser, Helium-Neon Laser, Semiconductor Laser, Application of Lasers in Science, Engineering and Medicine.

UNIT-III:
Optical Fibers: Principle of optical fiber (Total Internal Reflection) – Acceptance angle and acceptance cone – Numerical aperture –Types of fibers and refractive index profiles – Qualitative analysis of attenuation in optical fibers –Application of optical fibers: Optical fiber communication system.

UNIT-IV:
Crystal Structures and XRD: Space lattice, UNIT- cell, Lattice parameters, Crystal systems, Bravais lattice, Atomic radius,Co-ordination number, Structures and Packing fractions of Simple Cubic, Body Centered Cubic, Face Centered Cubic, Hexagonal closed packed, Miller Indices for Crystal planes and directions, Inter planar spacing of orthogonal crystal systems, Diffraction of X-rays by crystal planes and Bragg's law, Powder method, Applications of XRD.

UNIT-V:

Dielectric Properties: Electric dipole, Dipole moment, Dielectric constant, Electronic, Ionic polarizations and calculation of their polarizabilities, Orientation Polarization (qualitative), Frequency dependence of Polarization- Internal fields, Claussius – Mossotti equation, Piezo and Ferro electricity.

UNIT-VI:

Magnetic Materials and Superconductors: Permeability, Field intensity, magnetic field induction, Magnetization and Magnetic susceptibility – Origin of magnetic moment, Bohr magneton – Classification of magnetic materials (Dia, Para and Ferro)- Domain theory of ferromagnetism, Hysteresis curve – Soft and Hard magnetic materials – Ferrites and their applications, Superconductivity phenomenon, Meissner effect, Critical fields and Persistent currents, Type I and Type II superconductors, Applications of Superconductors.

TEXT BOOKS:

1. Physics Vol.2, Halliday, Resnick and Krane, John Wiley &Sons
2. Engineering Physics, R.K.Gaur and S.L.Gupta, Dhanpat Rai and Sons
3. Engineering Physics, B.K.Pandey and S. Chaturvedi, Cengage Learning

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18ES1CS01) PROGRAMMING THROUGH C

COURSE PRE-REQUISITES: None

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the computer fundamentals and basics of C programming for problem solving and represent the same by algorithm, flowchart, and pseudocode
CO2: Apply and write C programs using C language construct basic and derived data types
CO3: Classify different searching and sorting techniques, and able to use preprocessor directives
CO4: Develop a solution for a given problem using modular approach, file I/O

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

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

UNIT-III:
Basic Algorithms: Searching, basic sorting algorithms (bubble, insertion and selection), finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT-IV:
Functions: (Including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference.
Recursion: Recursion, as a different way of solving programs. Example programs, such as finding factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

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

UNIT-VI:
File Handling: Basic concepts, text files and binary files, file input/output operations, random access of files, command line arguments.

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Semester– Common to all branches	**L**	**T/P/D**	**C**
	0	**4**	**2**

(18ES2CS01) PROGRAMMING THROUGH C LABORATORY

COURSE PRE-REQUISITES: None

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

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

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

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

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

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

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

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

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

Tutorial 7: Functions, call by value:

Lab 7: Simple functions.

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

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

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

Tutorial 12: File handling
Lab 12: File operations.

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B.Tech. I Semester– Common to CE, ME & AE	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

(18BS2PH01) APPLIED PHYSICS LABORATORY

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To practically learn interaction of light with matter through physical phenomena like interference, diffraction and dispersion
- To understand the periodic motion and formation of standing waves and know the characteristics of the capacitors and resistors
- To experience the mechanical oscillations and resonance phenomena
- To verify Biot –Savart law
- To compare the experimental results with the class room learning

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1:demonstrate the optical phenomena with formation of Newton Rings, pure spectrum through prism and to evaluate grating parameters
CO-2:illustrate periodic motion by measuring rigidity modulus of a material and also discharging of a capacitor
CO-3:differentiate resonance phenomenon in Melde's experiment and Sonometer experiment
CO-4:realize tangent law of magnetism
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. **Optical fiber:** Numerical aperture and acceptance angle of an optical fiber.
6. **Torsional pendulum:** To determine the rigidity modulus of a given wire
7. **Melde's experiment:** To determine the frequency of electrical vibrator using resonance phenomenon
8. **AC frequency by Sonometer**: To measure frequency of A.C mains
9. **RC Circuit:** To determine the time constant of RC circuit
10. **Stewart Gee's experiment:** To verify Biot - Savart's law
11. **Solar Cell:** To study the V-I characteristics of Solar cell
12. **Light Emitting Diode:** To study the V-I characteristics of LED

REFERENCES:

1. Engineering Physics laboratory Manual/Observation, Physics Faculty of VNRVJIET
2. Laboratory Manual of Engineering Physics, Dr. Y.Aparna & Dr. K. Venkateswara Rao, VGS Publications

3. Engineering Physics Practicals, Dr. B. Srinivasa Rao, Keshava Vamsi Krishna and K. S. Rudramamba, 2nd Edition, Laxmi Publications Pvt. Ltd. (University Science Press)

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B.Tech. I Semester– Common to ME & AE	**L**	**T/P/D**	**C**
	1	**5**	**3.5**

(18ES3ME01) ENGINEERING GRAPHICS

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 scales and 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: Obtain the development and sections of regular solids using AutoCAD
CO-4: Demonstrate construction of simple solid models of domain applications 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.

Customisation & CAD Drawing:
Setting of drawing page and the printer, including scale settings, Setting of units and drawing limits; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles

Annotations, Layering &Other Functions:
Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, Layers to create drawings; Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print commands

Introduction to Computer Graphics:
Introduction to Computer Graphics; Modeling – Wireframe, Surface and Solid Modelling; Spatial Transformations - Move, Rotate, Zoom; Co-ordinate Systems; Model Viewing

UNIT-I:
Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance, Drawing instruments
Engineering Curves:
Conic Sections: Ellipse, Parabola and Hyperbola including the Rectangular Hyperbola (General method only)
Cycloidal Curves & Involutes: Cycloid, Epicycloid, Hypocycloid and Involutes
Scales: Plain, Diagonal and Vernier Scales

UNIT-II:
Orthographic Projections: Principles of Orthographic Projections - Conventions
Projections of Points in all positions
Projections of lines and planes inclined to both the planes - Auxiliary Views

UNIT-III:
Projections of Regular Solids: Projections of Solids inclined to both the Planes - Auxiliary Views

UNIT-IV:
Sections and Development of Surfaces of Right Angular Solids: Section and sectional views of right angular solids of Prism, Cylinder, Pyramid, Cone – Auxiliary Views
Development of surfaces of Right Regular Solids of Prism, Pyramid, 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; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions

UNIT-VI:
Solid Modeling: Introduction to solid modeling; Creation of simple solid models; Part editing and two-dimensional documentation of models.
Demonstration of a Simple Team Design Project: Creation of engineering models of practical applications relevant to the domain and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids using Solid Modeling software Applications could include but are not limited to: Table, Chair, Sink, Hinge, Remote Casing, CPU, Electrical Pole, Windows, Door Frames etc.

TEXTBOOKS:

1. Engineering Drawing, Bhatt N.D., Panchal V.M. & Ingle P.R., Charotar Publishing House, 2014
2. Engineering Drawing and Computer Graphics, ShahM.B. & Rana B.C., Pearson Education, 2008
3. Textbook on Engineering Drawing, Narayana K.L. & P. Kannaiah, Scitech Publishers, 2008

REFERENCES:

1. AutoCAD Software Theory and User Manuals

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Semester– Common to ME & AE	**L**	**T/P/D**	**C**
	0	**2**	**1**

(18PW4ME01) DESIGN SENSITISATION

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

Students' Responsibilities:

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

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

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

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

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

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

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

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

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

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B.Tech. II Semester – Common to CE, ME, CSE, IT & AE	L	T/P/D	C
	3	1	4

(18BS1MT02) LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS

COURSE PRE-REQUISITES: Matrices, Differentiation and Integration

COURSE OBJECTIVES:

- To learn concept of Rank of the matrix and its application to consistency of system of linear equations
- To learn concept of Eigen Values and Eigen Vectors
- To learn nature of Quadratic forms
- To learn the methods of solving first order differential equations and learn about its applications to basic engineering problems
- To learn the methods of solving higher order differential equations and learn about its applications to basic engineering problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Find the rank of a matrix and to analyze the solution of system of linear equations
CO-2: Calculate Eigen values and Eigen vectors
CO-3: Reduce the quadratic form to canonical form
CO-4: Formulate and solve the problems of first and higher order differential equations
CO-5: Apply knowledge of differential equations to real world problems

UNIT-I:
Linear Algebra-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, Gauss Jacobi and Seidel Iteration Method.

UNIT-II:
Linear Algebra-Eigen Values and Eigen Vectors: Eigen values and eigenvectors 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 forms using Linear Transformation and Orthogonal Transformations.

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

UNIT-V:

Higher Order ODE with Constants Coefficients: Second order linear differential equations with constant coefficients: Solution of Homogenous nonhomogeneous differential equations, Non-Homogeneous terms of the type e , sin (ax), cos (ax), polynomials in x, e V(x), x V(x).

UNIT-VI:

Ordinary Differential Equations with Variable Coefficients: Method of variation of parameters; Equations reducible to linear ODE with constant Coefficients: Legendre's equation, Cauchy-Euler equation. Series solutions of second order Ordinary Differential Equations, Singular point, Regular singular point, Frobineous Method.

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18BS1CH01) ENGINEERING CHEMISTRY

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To list out the importance of polymers, surfactants and lubricants in real world scenario
- To outline the features of conventional and non-conventional sources of energy
- To discuss the problems of corrosion on structures to interpret the need of alloys and describe the thermodynamic equilibrium of a system using phase rule
- To emphasize the importance of nanomaterials, analytical techniques, environmental and green chemistry

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

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

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

UNIT-III: Energy Science
Fuels: Definition, classification, characteristics of a good fuel. Coal-proximate & ultimate analysis-significance. Petroleum- refining, knocking, octane number, cetane number.

Cracking-definition, types of cracking, fluid-bed cracking. Limitations of fossil fuels. Alternative and non-conventional sources of energy – solar, wind, geothermal, nuclear and biomass (advantages and disadvantages).
Battery Technology: Features of batteries, Rechargeable batteries- lithium ion and Zn-air batteries. Fuel cells-methanol-oxygen fuel cell, Solar cells- principle and applications.

UNIT-IV:
Alloys: Purpose of making alloys, classification of alloys, ferrous alloys ex: Steel, non-ferrous alloys ex: Cu, Al, Pb (features and applications).
Phase rule, definition of terms in phase rule, advantages and limitations of phase rule, simple phase diagram -water system.
Corrosion: Introduction, causes and effects of corrosion, chemical and electrochemical corrosion and mechanism of corrosion. Types-differential aeration corrosion (Pitting and waterline corrosion), differential metal corrosion (Galvanic corrosion). Factors affecting corrosion-nature of metal (position, passivity, purity, areas of anode and cathode) & nature of environment (temperature, pH, humidity). Corrosion control methods-proper designing, cathodic protection, differences between galvanizing and tinning, paints-constituents and functions.

UNIT-V:
Nanomaterials: Definition, synthesis-top down and bottom up approaches. Properties and application of fullerenes, fullerols and carbon nanotubes. Applications of nanomaterials in electronics, catalysis, telecommunication and medicine.
Analytical Techniques: Working principle and applications of pH-metry, conductometry, colorimetry, chromatography (TLC), Scanning tunneling microscope and atomic force microscope. Sensors: Lab-on-a-chip- features and applications.

UNIT-VI:
Environmental: Air, water and noise pollution: sources and effects, optimum levels of pollution. Solid waste management and e-waste: effects and management.
Green Chemistry- Definition, principles and applications of green chemistry. Self-healing materials-principle and applications.

TEXT BOOKS:

1. Engineering Chemistry, P. C. Jain and M. Jain, 16th Edition, Dhanpat Rai Publications, New Delhi
2. Engineering Chemistry, Prasanta Rath, B.Rama Devi, Ch.Venkata Ramana Reddy, Subhendu Chakroborty, Cengage Publications,Delhi, 2018
3. A Textbook of Engineering Chemistry, Shashi Chawla, Dhanpat Rai Publications, New Delhi

REFERENCES:

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

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B.Tech. II Semester – Common to CE, ME & AE	**L**	**T/P/D**	**C**
	3	**1**	**4**

(18ES1ME01) ENGINEERING MECHANICS

COURSE PRE-REQUISITES: Mathematics, Physics

COURSE OBJECTIVES:
- To understand, analyze the forces and moment systems for equilibrium
- To know the concept of centroid and area moment of inertia about any axes
- To distinguish between statics and dynamics & kinematics and kinetics
- To understand the work-energy principle and impulse-momentum principles

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the systems using equilibrium conditions and apply the concepts of mechanics to engineering applications
CO-2: Determine the centroid of composite areas and moment of inertia of areas
CO-3: Solve the kinematics and kinetics problems.
CO-4: Apply work-energy principle, impulse-momentum principle to solve engineering problems

UNIT-I:
Forces: Introduction to Engineering Mechanics – Basic concepts - Classification of a force system - Parallelogram law of forces - Triangle law of forces - Polygon law of forces – Law of transmissibility of forces – Principle of superposition - Lami's theorem - Free Body Diagram – Resultant – Equilibrant - Resultant of coplanar concurrent forces.
Moments: Moment of a force - Varignon's principle - Parallel forces - Resultant of parallel forces – Couple - Moment of a couple about any point lying in the plane - Resolution of a force into a force-couple and vice-versa - Resultant of coplanar non-concurrent forces.

UNIT-II:
Friction: Types of Friction - Limiting friction - Laws of friction - Equilibrium of bodies on rough horizontal and inclined planes - Equilibrium of connected bodies on rough horizontal and inclined planes.

UNIT-III:
Centroid & Centre of Gravity: Introduction - Centroid - Centroids of lines, Standard areas and volumes – Centroids of composite sections - Centre of gravity of bodies - Pappu's theorems.

UNIT-IV:
Area Moment of Inertia: Introduction - Inertia - Inertia of areas - Rotation of areas - Radius of gyration - Polar moment of inertia - Parallel axis theorem - Perpendicular axis theorem - Moments of inertia of standard sections and composite sections.

UNIT-V:
Kinematics of Particles: Kinematics of particles – Rectilinear motion – Curvilinear motion – Projectiles.

Kineticsof Particles: Kinetics of particles – Newton's Second Law – Differential equations of rectilinear and curvilinear motion – Dynamic equilibrium – Inertia force – D Alembert's Principle applied for rectilinear and curvilinear motion.

UNIT-VI:

Work–Energy, Impulse–Momentum: Work of a force - Principle of Work and Energy - Application of principle of Work-Energy - Impulse-Momentum Principle, Application of Impulse-Momentum principle.

TEXT BOOKS:

1. Engineering Mechanics, S. Timoshenko, D. H. Young & J. V. Rao, TMH Publishers
2. Singer's Engineering Mechanics, K. Vijaya Kumar Reddy & J. Suresh Kumar, B.S. Publishers

REFERENCES:

1. Engineering Mechanics, J. L. Meriam & L.G. Kraige, Wiley Publishers
2. Engineering Mechanics, R. C. Hibbeler, Pearson Education
3. Engineering Mechanics, A.K. Tayal, Umesh Publications
4. Engineering Mechanics, R. K. Rajput, Laxmi Publications
5. A Text Book of Engineering Mechanics, R. K. Bansal, Laxmi Publications

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester – Common to all branches	**L**	**T/P/D**	**C**
	2	**0**	**2**

(18HS1EN01) ENGLISH

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

UNIT-I:

1. Reading: On the Conduct of Life by William Hazlitt
2. Speaking & Listening: Pronunciation, Stress, Intonation and Rhythm
3. Grammar: Prepositions
4. Vocabulary: Word Formation- I
5. Writing: Punctuation, Clauses and Sentences
6. Life Skills: Values and Ethics; 'If' by Rudyard Kipling

UNIT-II:

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

UNIT-III:

1. Reading: The Death Trap by Saki
2. Speaking & Listening: Gaining attention, Interrupting Conversations

3. Grammar: Noun-Pronoun Agreement; Subject-Verb Agreement
4. Vocabulary: Word Formation- III
5. Writing: Transitional Devices & Paragraph Writing; Writing Process
6. Life Skills: Time Management; On Saving Time by Seneca

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

UNIT-V:
1. Reading: Politics and the English Language by George Orwell
2. Speaking & Listening: Interview Skills; Making a Presentation
3. Grammar: Cliches; Redundancies
4. Vocabulary: Common Abbreviations
5. Writing: Cause and Effect Paragraphs
6. Life Skills: Motivation; The Dancer with a White Parasol by Ranjana Dave

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

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

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

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester – Common to all branches	**L**	**T/P/D**	**C**
	0	**2**	**1**

(18HS2EN01) ENGLISH LANGUAGE COMMUNICATION SKILLS LABORATORY

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

UNIT-I:

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

UNIT-II:

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

UNIT-III:

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

UNIT-IV:

1. Speaking Activity: Oral Presentation
2. Accuracy in listening- listening to discussion on specific issues
3. Reading Comprehension

UNIT-V:

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

UNIT-VI:

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

SUGGESTED READINGS:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18BS2CH01) ENGINEERING CHEMISTRY LABORATORY

COURSE PRE-REQUISITES: None

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

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

LIST OF EXPERIMENTS:

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

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

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

REFERENCES:

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

VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18ES2ME01) WORKSHOP PRACTICES

COURSE PRE-REQUISITES: None

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Exposure to Various types of manufacturing Process
CO-2: Fabricate/make components from wood, MS flat, GI Sheet etc. – hands on experience
CO-3: Exposure to manufacturing of machine components like fasteners, holes & threaded holes etc.
CO-4: Produce small devices / products /appliances by assembling different components

LECTURES & VIDEOS:

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

TRADES:
I. Carpentry
  i. Cross lap joint
  ii. Mortise & tenon joint

II. Fitting
  i. Square fitting
  ii. L-Fitting

III. Welding

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

IV. Smithy

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

V. Electrical & Electronics

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

VI. Machine Shop

i. Step turning on lathe
ii. Drilling & threading

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18BS1MT06) PARTIAL DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS
(Common to ME and AE)

COURSE PRE-REQUISITES: Differentiation, Integration

COURSE OBJECTIVES:
- To know evaluation of Fourier coefficients
- To know method of Separation of Variables to solve second order Partial Differential Equations
- To know numerical methods to solve non-linear systems
- To know various methods of interpolation and its application
- To know concepts of numerical differentiation and integration

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Determine the Fourier series for periodic functions
CO-2: Solve the second order linear partial differential equations
CO-3: Apply numerical methods to find a root of algebraic and transcendental equations
CO-4: Find the interpolate value from the given set of data points
CO-5: Evaluate problems based on numerical differentiation, integration and numerical solutions of ordinary differential equations

UNIT-I:
Fourier Series: Introduction of Fourier Series, determination of Fourier coefficients, Fourier series in an arbitrary interval, Fourier series for even and odd functions, Half range sine and cosine series

UNIT-II:
Partial Differential Equations of Second Order: Classifications of Second Order Partial differential Equations, Method of separation of variables, Applications: Problems of vibrating string- wave equation, Problems of one-dimensional heat equation, Problems of steady state two dimensional heat flow-Laplace equation.

UNIT-III:
Solutions of Non-linear Systems: Introduction; Mathematical preliminaries; Solution of algebraic and transcendental equations–bisection method, the method of false position, Fixed point iterative method, Newton - Raphson method, and their order of convergence.

UNIT-IV:
Interpolation: Introduction; Errors in polynomial interpolation; Finite differences; Forward differences; Backward differences; Central differences; Symbolic relations and separation of symbols; Differences of a polynomial; Newton's formulae for interpolation; Central difference interpolation formulae; Gauss's central difference formulae and Lagrange's interpolation formulae.

UNIT-V:

Numerical Differentiation and Integration: Numerical differentiation based on interpolation, Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, and Simpson's 3/8 rule, Gaussian quadrature 2 & 3-point formulae.

UNIT-VI:

Numerical Solutions of Ordinary Differential Equations: Solution of initial value problems by Taylor's series - Picard's method of successive approximations, Euler's method, Modified Euler's method and Runge - Kutta methods.

TEXT BOOKS:

1. Higher Engineering Mathematics, B. V. Ramana, McGraw-Hill
2. Advanced Engineering Mathematics, Erwin Kreyszig, 8thEdition, John Wiley
3. Introductory Methods of Numerical Analysis, S. S. Sastry, PHI Learning Pvt. Ltd.

REFERENCES:

1. Advanced Engineering Mathematics, Peter 'O' Neil, Cengage Learning
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar,Narosa Publication
3. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 36th Edition, 2010

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

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

COURSE OBJECTIVES:

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

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

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

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

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

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

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

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

TEXT BOOKS:

1. C Programming& Data Structures, B.A.Forouzan and R.F. Gilberg, 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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1ME01) THERMODYNAMICS
(Common to ME and AE)

COURSEPRE-REQUISITES: Physics, Mathematics

COURSE OBJECTIVES:
- To apply the basic concepts of thermodynamics, heat and work done on the system
- To apply the basic concepts of Thermodynamic Laws for various thermodynamic systems
- To evaluate the properties of pure substance and to analyse the concept of irreversibility and availability
- To apply the basic concept of power cycles for External combustion engines and internal combustion engines
- To evaluate the behaviour of ideal gas mixtures and thermodynamic properties

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: To apply the basic concepts of thermodynamics, heat and work done on the system
CO-2: To apply the basic concepts of thermodynamic laws for various thermodynamic systems
CO-3: To evaluate the properties of pure substance and to analyse the concept of irreversibility and availability
CO-4: To apply the basic concept of power cycles for external combustion engines and internal combustion engines
CO-5: To evaluate the behaviour of ideal gas mixtures and thermodynamic properties

UNIT-I:
Concepts and Definitions: Thermodynamic system and control volume; Macroscopic versus microscopic point of view; Properties and state of a substance; Processes and cycles, Energy, Specific volume and density, Equality of temperature; The Zeroth law of thermodynamics; Temperature scales.
Work and Heat: Definition of work; Units for work; Work done at the moving boundary of a simple compressible system; Other systems that involve work; Definition of heat; Heat transfer modes; Comparison of heat and work.

UNIT-II:
The First Law of Thermodynamics: The first law of thermodynamics for a control mass undergoing a cycle; The first law of thermodynamics for a change in state of a control mass; Internal energy-a thermodynamic property; Problem analysis and solution technique; Enthalpy; The constant-volume and constant-pressure specific heats; The internal energy, enthalpy, and specific heat of ideal gases; The first law as a rate equation.
First Law Analysis for a Control Volume: Conversion of mass and the control volume, the first law of thermodynamics for a control volume, The steady-state process; Examples of steady-state processes.

UNIT-III:

The Second Law of Thermodynamics: Heat engines and refrigerators; The second law of thermodynamics; The reversible process; Factors that render processes irreversible; The Carnot cycle; Two propositions regarding the efficiency of a Carnot cycle; The thermodynamic temperature scale; The ideal-gas temperature scale; Ideal versus real machines.

Entropy for a Control Mass: The inequality of Clausius; Entropy — a property of a system; The entropy of a pure substance; Entropy change in reversible processes; The thermodynamic property relation; Entropy change of an ideal gas; The reversible polytropic process for an ideal gas; Entropy change of a control mass during an irreversible process; Entropy generation; Principle of increase of entropy; Entropy as a rate equation.

UNIT-IV:

Irreversibility and Availability: Available energy; Available energy Referred to a cycle; Quality of energy; Maximum work in a reversible process; reversible work by an open system; Exchanging heat only with the surroundings; Useful work; Dead state; Availability; Availability in chemical reaction; Irreversibility and Gouy-stodola Theorem; Availability or Exergy Balance; second law efficiency;

Properties of a Pure Substance: The pure substance; Vapor- liquid- solid- phase equilibrium in a pure substance; Independent properties of a pure substance; Steam Tables; Thermodynamic surfaces; The compressibility factor; Equations of state.

UNIT-V:

Power Cycles: Introduction to power systems; The Rankine cycle; Effect of pressure and temperature on the Rankine cycle; Air-standard power cycles; Basic Brayton cycle; The air-standard cycle for jet propulsion; Reciprocating engine power cycles; The Otto cycle; The Diesel cycle; The Dual cycle, The Sterling cycle; The Atkinson and Miller cycles.

UNIT-VI:

Properties of Gases and Gas Mixtures: Avogadro's Law; Ideal Gas; Equation of State; Law of Corresponding; Properties of Mixture of Gases-Dalton's Law of Partial Pressures; Internal Energy, Enthalpy, and Specific Heats of Gas Mixtures; Entropy of Gas Mixtures; Gibbs Function of a Mixture of Inert ideal Gas;

Thermodynamic Property Relations: Mathematical relations for a homogeneous phase; The Maxwell relations; Thermodynamic relations involving enthalpy, internal energy, and entropy; The Clapeyron equation; Joule-Thompson coefficient.

TEXT BOOKS:

1. Engineering Thermodynamics, P. K. Nag, McGraw-Hill
2. Fundamentals of Thermodynamics, C. Borgnakke, R. E. Sonntag, and G. J. Van Wylen,John Wiley

REFERENCES:

1. Engineering Thermodynamics, Burgadt, Harper & Row Publication
2. Thermodynamics - An Engineering Approach, YunusCengel and Boles, TMH
3. Engineering Thermodynamics, P. Chattopadhyay, Oxford University Press

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1ME02) FLUID MECHANICS AND MACHINERY
(Common to ME and AE)

COURSE OBJECTIVES:

- To understand the properties of fluids, principles of buoyancy, flow, force and head calculations
- To evaluate types of fluid flow, laminar and dynamic
- To know boundary layer principles applied to airfoils
- To know principles of operation of different types of hydraulic machinery
- To understand Hydraulic systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyzing the fluid properties to solve flow, force and velocity problems
CO-2: Evaluating the flow characterizing in static and dynamic nature of flow
CO-3: Applying fluid flow and dynamics in solving problems in hydraulic machines
CO-4: Understanding the model analysis of hydraulic machinery and select appropriate machines for hydro power plant
CO-5: Analyzing the hydraulic systems

UNIT-I:
Fluid Statics: Properties of fluid – specific gravity, viscosity, surface tension, vapor pressure and their influence on fluid motion, Pressure at a point, measurement of pressure, Forces on immersed surfaces, Center of pressure, Buoyancy, Elements of stability of floating and submerged bodies.

UNIT-II:
Fluid Kinematics: Introduction, methods of describing the fluid motion, Classification of flows, acceleration equations, Stream line, path line and streak lines and stream tube, continuity equation, Stream function, velocity potential function, introduction to free and forced vortex flows.

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

UNIT-IV:
Boundary Layer Theory: Development of boundary layer along a thin flat plate, laminar boundary layer and turbulent boundary layer, Laminar sub layer, boundary layer separation, Drag and lift forces - Aero foils, pressure and form drags.
Impact of Jets: Hydrodynamic force of jets on flat, inclined and curved vanes - jet striking centrally and at tip, flow over radial vanes.

UNIT-V:

Hydraulic Turbines: Classification of turbines, design of Pelton wheel, Francis turbine and Kaplan turbine – working proportion, work done, efficiency, draft tube- theory, functions and efficiency. Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank and water hammer, elements of hydropower plant.

UNIT-VI:

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

TEXT BOOKS:

1. Hydraulics and Fluid Mechanics Including Hydraulics Machines, P. N. Modi, S.M. Seth
2. Introduction to Fluid Mechanics, R. W. Fox, A. T. McDonald and P.J. Pritchard

REFERENCES:

1. Fluid Mechanics, V. L. Streeter & E. B. Wylie
2. Fluid Mechanics, Fundamentals & Applications,Yunus A. Çengel, John M. Cimbala
3. Fluid Mechanics, F. M. White
4. Fundamentals of Fluid Mechanics, Bruce Roy Munson, Donald F. Young, Theodore H. Okiishi, Wade W. Huebsch, Wiley

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18ES1EE02) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
(Common to ME and AE)

COURSE PRE-REQUISITES: Physics, Electrical Engineering & Electronics Engineering

COURSE OBJECTIVES:
- To get awareness of using mechanical energy for electrical energy generation
- To understand the basic operation of circuits used for automobile control
- To know about working of different electrical machines used for propulsion of vehicles
- To know the basic operation of diode and transistor

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the electro-mechanical energy conversion using electrical machines
CO-2: Analyze the different electrical machines used for propulsion of vehicles
CO-3: Analyze different control circuits which involve different circuits‘ parameters
CO-4: Analyze the operation of transistor and CRT

UNIT-I:
Electrical Circuits: Circuit Concept R-L-C Parameters-Ohm’s Law - Kirchhoff’s Laws - Series - Parallel resistive networks - Star/delta transformations.
AC Circuits: Average value, rms value, form factor of sinusoidal function,R-L, R-C and R-L-C circuits- Concept of Power factor, Real and reactive powers simple problems.

UNIT-II:
DC Machines: Principle of operation of DC Generator – emf equation - types – Principle of operation of DC Motor - DC motor types –torque equation – Three point starter -Swinburne‘s test, applications.

UNIT-III:
AC Machines I:
Transformers: Principle of operation of single phase transformer–emf equation–losses– OC and SC tests - efficiency and regulation (simple Problems)

UNIT-IV:
AC Machines-II & Instruments: Principle of operation of alternator – regulation by synchronous impedance method –Principle of operation of induction motor – slip – torque characteristics – applications
Instruments: Principle and construction of permanent magnet moving coil and moving iron instruments.

UNIT-V:
Diode and It’s Characteristics: P-N junction diode, symbol, V-I Characteristics, Diode Applications: Rectifiers – Half wave Full wave and Bridge rectifiers (simple Problems)

UNIT-VI:

Transistors: PNP and NPN Junction transistor, Transistor as an amplifier, SCR characteristics and applications.

Cathode Ray Oscilloscope: Principles of CRT (Cathode Ray Tube), Deflection, Sensitivity, Electrostatic and Magnetic deflection, Applications of CRO - Voltage, Current and frequency measurements

TEXT BOOKS:

1. Electronic Devices and Circuits, David A. Bell, Oxford University Press
2. Introduction to Electrical Engineering, M. S. Naidu and S. Kamakshaiah, TMH Publications

REFERENCES:

1. Principles of Electrical and Electronics Engineering, V. K. Mehta, S. Chand & Co.
2. Basic Electrical Engineering, Kothari and Nagarath, TMH Publications, 2nd Edition

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC2ME01) FLUID MECHANICS AND MACHINERY LABORATORY
(Common to ME and AE)

COURSE PRE-REQUISITES: Fluid Mechanics and Hydraulic Machines

COURSE OBJECTIVES:
- To analyze the experiments to understand the concept, find the values and obtain the result of experiments
- To apply fundamental principles of fluid mechanics for the solution of practical mechanical engineering problems of water conveyance in pipes, orifices, mouth pieces, notches & weirs
- To analyze various pumps, water turbines, pipes and pressure measurement devices
- To evaluate efficiency for pumps and turbines

COURSEOUTCOMES: After completion of the course, the student should be able to
CO-1: Apply fundamental equations of fluid mechanics for turbines and pumps
CO-2: Model and analyse fluid flow problems in mechanical engineering
CO-3: Create a model of fluid flow equipments
CO-4: Evaluate the experimental results with theoretical concepts

LIST OF EXPERIMENTS:

ANY 10 EXPERIMENTS to be conducted from the following**:**
1. Verification of Bernoulli's theorem
2. Calibration of Venturimeter/ Orifice meter
3. Calibration of notches
4. Determination of friction factor for a given pipe
5. Determination of Minor losses for the given equipment
6. Impact of jet on vanes
7. Performance test on Pelton wheel
8. Performance test on Francis turbine
9. Performance test on Kaplan turbine
10. Performance test on single stage centrifugal pump
11. Performance test on multi stage centrifugal pump
12. Performance test on reciprocating pump

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18ES2EE02) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY
(Common to ME and AE)

COURSE OBJECTIVES:
- To understand the performance of DC Shunt Machine
- To understand the performance of AC machines
- To understand the performance and efficiency / regulation of electrical machines are determined experimentally
- To understand the operation of solid-state devices like diode, transistor and SCR

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Find the application of electrical machines with the experimental determination of the performance of the machines
CO-2: Find the application of Induction motor with the experimental determination of the performance of the machines
CO-3: Find the application of single phase transformer
CO-4: Identify the characteristics of all solid state devices

Section A: Electrical Engineering:

The following experiments are required to be conducted as compulsory experiments:
1. Swinburne's test on D.C. Shunt machine. (Predetermination of efficiency of a given D.C. Shunt machine working as motor and generator)
2. Brake test on D.C. Shunt Motor
3. OC and SC tests on single phase transformer(Predetermination of efficiency and regulation at given power factors)
4. Brake test on 3-phase Induction motor (Determination of performance characteristics)
5. Regulation of alternator by Synchronous impedance method

Section B: Electronics Engineering:

The following experiments are required to be conducted as compulsory experiments:
1. P-N Diode Characteristics
2. Transistor CE Characteristics (Input and Output)
3. Full wave Rectifier with and without filters
4. CE Amplifiers
5. SCR Characteristics

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

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

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

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

WEEK 1
1. Write a C program for Merge Sort

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

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

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

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

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

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

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

WEEK 9
11. Write a C program to implement QUEUE operations using arrays and LL.

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

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

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

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1ME03) THERMAL ENGINEERING

COURSE PRE-REQUISITE: Mathematics, Thermodynamics

COURSEOBJECTIVES:

- T o analyse the actual cycles and systems of Internal Combustion Engine
- To analyse the combustion phenomena in Spark Ignition and Compression Ignition Engines
- To evaluate the performance parameters of internal combustion engines
- To analyse working and the performance of reciprocating compressor
- To evaluate the COP of different refrigeration cycles and to measure the psychrometric properties of air-conditioning system

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

CO-1: T o analyse the actual cycles and compare it with the air standard cycle of the given engine

CO-2: To analyse the combustion phenomena in Spark Ignition and Compression ignition engines

CO-3: To evaluate the performance parameters (Brake power, Friction power, Torque, Efficiencies) of internal combustion engines

CO-4: To analyse working and the performance of (Isothermal efficiency, volumetric efficiency) reciprocating compressor

CO-5: To evaluate the COP of different refrigeration cycles and to measure the psychrometric properties of air

UNIT-I:

Actual Cycles and Their Analysis: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust blow down, Loss due to Gas exchange process, Volumetric Efficiency, Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of I.C. Engines.

UNIT-II:

I. C. Engines: Classification, Working principles, Valve and Port Timing Diagrams, Air Standard, air-fuel and actual cycles, Engine systems; Fuel Systems, Simple Carburetor, Solex Carburetor, Fuel Injection Systems; Ignition systems, Battery ignition, Magneto ignition, Cooling and Lubrication systems.

UNIT-III:

Combustion in S. I. Engines: Homogeneous mixture, Heterogeneous mixture, Stages of combustion, Flame front propagation, Factors influencing the flame speed, Rate of pressure rise, Abnormal combustion, Phenomenon of Knock, Types of Combustion chambers, Fuel requirements and fuel rating

Combustion in C. I. Engines: Combustion process, stages of combustion, Delay period and its importance, Factors affecting Delay period, Diesel Knock, Comparison of Knock in C.I and S.I engine, Combustion chambers in C.I. Engine, Fuel requirements and fuel rating.

UNIT-IV:

Testing and Performance: Measurement and Testing; Friction power, Indicated power, Brake power, Fuel consumption, Air consumption, Emissions Performance parameters; Engine power, Engine efficiencies, Engine performance characteristics, Heat Balance.

UNIT-V:

Reciprocating Air Compressors: Classification; Reciprocating Compressor: Principle of operation, Work required, Isothermal efficiency, Volumetric efficiency and effect of clearance, Multi stage compression with inter cooling, Saving of work, Minimum work condition for stage compression.

UNIT-VI:

Introduction to Refrigeration Cycle and Psychrometric Properties: Ideal Refrigeration cycles - Vapor compression refrigeration cycle, Bell Colman refrigeration cycle, Vapour Absorption Refrigeration System

Psychrometric properties - Dry bulb temperature, Wet bulb temperature, Dew point temperature, Specific humidity, Relative humidity, Degree of saturation, Specific enthalpy, Psychrometric chart,(**Indicating only Psychrometric processes on Chart)**

TEXT BOOKS:

1. I. C. Engines, V. Ganesan, Tata McGraw-Hill
2. Thermal Engineering, Mahesh M. Rathore, Tata McGraw-Hill

REFERENCES:

1. Refrigeration & Air Conditioning, C. P. Arora, Tata McGraw-Hill
2. I.C. Engines, Heywood, Tata McGraw-Hill
3. Thermal Engineering, Rajput, Lakshmi Publication

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1ME04) KINEMATICS OF MACHINERY

COURSE PRE-REQUISITES: Geometrical Construction, Engineering Mechanics

COURSEOBJECTIVES:

- To understand mechanisms for motion transmission
- To understand the construction methods for drawing velocity and acceleration diagrams
- To design engineering applications involving in selection, sizing of mechanism to accomplish motion objectives
- To understand the mechanism involving cams, gears and gear trains

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Draw velocity and acceleration diagrams of various parts of a machine along with the transmission Mechanisms
CO-2: Design components of machine parts, structures, gears, cams, belts, pulleys, etc. for kinematic analysis
CO-3: Understand the straight line motion mechanisms, Hooke's joint and steering mechanisms
CO-4: Design the mechanisms after analysis for safety and efficient working

UNIT-I:
Mechanisms and Machines: Elements or links-classification-rigid link, flexible and fluid link-types of kinematic pairs-sliding pairs, turning, rolling, screw and spherical pairs-lower and higher pairs-closed and open pairs-constrained motion-completely, partially or successfully constrained and incompletely constrained.
Mechanisms, Machines -classification of machines- kinematic chain-inversion of mechanism-inversions of quadric cycle chain, single and double slider crank chains, Intermittent motion mechanisms.

UNIT-II:
Kinematics: Velocity and acceleration-motion of link in machine-Construction of velocity and acceleration diagrams-graphical method- Application of relative velocity method- four bar chain.
Analysis of Mechanisms: Analysis of slider crank chain for displacement, velocity and acceleration of slider- acceleration diagram for a given mechanism, Klein's construction, Coriolis acceleration, determination of Coriolis component of acceleration.
Plane Motion of Body: Instantaneous center of rotation, centroids and axodes - relative motion between two bodies-Three centers in line theorem-Graphical determination of instantaneous centre,analysis of simple mechanisms and determination of linear velocity and angular velocity of links.

UNIT-III:

Mechanisms and Hooke's Joint: Condition for correct steering –Davis steering gear, Ackerman's steering gear-velocity -ratio - Single and double Hooke's Joint- Universal coupling-applications- problems.

Straight Line Motion Mechanisms: Exact and approximate-copied and generated types - Peaucellier, Hart and Scott Russell- Grasshopper- Watt-Tchebicheff and Robert mechanism and straight line motion, Pantograph.

UNIT-IV:

Cams: Definition of cam and followers-their uses-types of followers and cams-terminology-types of follower motion-uniform velocity-simple harmonic motion and uniform acceleration, maximum velocity and acceleration during outward and return strokes in the above three cases. Overview of polynomial motions, Analysis of motion of followers: roller follower- circular cam with straight, concave and convex flanks.

UNIT-V:

Higher Pairs: Friction wheels and toothed gears-types-law of gearing, condition for constant velocity ratio for transmission of motion, forms of teeth- Cycloidal and Involute profiles. Velocity of sliding-phenomena of interference-methods of interference, condition for minimum number of teeth to avoid interference, expression for arc of contact and path of contact- introduction to helical, bevel and worm gearing, Central distance for a pair of spiral gears. Efficiency of spiral gears.

UNIT-VI:

Gear Trains: Introduction-train value-types-simple, compound and reverted wheel trains – epicyclic gear train, methods of finding train value or velocity ratio-selection and determination of torque, differential gear box for an automobile.

TEXT BOOKS:

1. Theory of Machines, Thomas Bevan
2. Theory of Machines, Rattan

REFERENCES:

1. Theory of Machines, P. L. Ballaney
2. Theory of Machines, R. S. Khurmi& J. K. Gupta
3. Theory of Machines, Sadhu Singh
4. Theory of Machines, Shigley
5. Mechanism and Machine Theory, J. S. Rao and R. V. Dukkipati

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Semester

L	T/P/D	C
3	1	4

(18PC1ME05) MECHANICS OF SOLIDS
(Common to ME and AE)

COURSEPRE-REQUISITES: Mathematics, Physics and Engineering Mechanics

COURSEOBJECTIVES:
- To list and define the Material properties and show the relationships between them.
- To describe principles of Mechanics, Stress and Strain
- To demonstrate throughly the concepts of principal stresses applied to solid structural members and Mohr's circle diagram
- To analyse various types of mechanical engineering problems concern to bending of beams, torsion of shafts etc.

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Show basic stress strain equations with appropriate assumptions
CO-2: Interpret model and analyze solid mechanics problems on bars, beams and shafts
CO-3: Apply the concepts of principal stresses in real life design issues
CO-4: Analyse and develop beams, shafts for various applications

UNIT-I:
Tension, Compression, and Shear: Introduction; Normal Stress and Strain; Stress-strain diagrams; Elasticity and plasticity; Linear elasticity and Hooke's law; Allowable stress and allowable loads.
Axially Loaded Members: Introduction; Deflections of axially loaded members; Strain energy; Dynamic loading.
Thermal Stresses

UNIT-II:
Shear Force and Bending Moment Diagrams: Types of beams; Types of loading; Shear force and bending moment; Relationship between load, shear force and bending moment; Shear force and bending moment diagrams.

UNIT-III:
Area Moment of Inertia of Composite Sections:
Stresses in Beams: Introduction; Normal strains in beams; Normal stresses in beams; Cross-sectional shapes of beams-C, angular and semicircle structures; Shear stresses in rectangular beams; Shear stress in webs of beams with flanges; Shear stress in circular beams (solid and hollow sections); Concept of shear center and shear flow.

UNIT-IV:
Analysis of Stress and Strain: Introduction; Plane stress; Principal stresses and maximum shear stresses; Mohr's circle for plane stress; Hooke's law for plane stress; Spherical and cylindrical pressure vessels (biaxial stress; Hoop and longitudinal stresses); Combined loadings (plane stress); Principal stresses in beams.

UNIT-V:

Deflections of Beams: Introduction; Differential equations of the deflection curve; Deflections by integration of the bending moment equation; Deflections by integration of the shear-force and load equations; Macaulay's method; Moment area method; Method of superposition.

UNIT-VI:

Columns: Short columns, Euler's theory for axially loaded elastic long columns, Effective length, Limitations of Euler's Theory, Rankine's formula

Torsion: Introduction; Torsion of circular bars; Non uniform torsion; Pure shear; Relationship between modulus of elasticity E and G; Transmission of power by circular shafts.

TEXT BOOKS:

1. Mechanics of Materials (SI units), J. M. Gere and S. P. Timoshenko, CBS Publishers
2. Strength of Materials, S. S. Rattan, Tata McGraw-Hill Education

REFERENCES:

1. Engineering Mechanics of Solids, Popov, Pearson Education
2. Strength of Materials, Schaum's Series

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1ME06) METALLURGY AND MATERIALS ENGINEERING
(Common to ME and AE)

COURSEPRE-REQUISITES: Physics and Chemistry

COURSEOBJECTIVES:
- To understand the microstructures of different types of metal and alloys –cast iron, steels, non-ferrous metal and alloys
- To understand the heat treatment principles-annealing, normalizing and hardening
- To understand the different types of tools
- To understand the importance of titanium & its alloys

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Distinguish different types of metals, solid solutions, alloys compounds and phases
CO-2: Design a heat treatment process to change the properties-hardness, ductility, etc.
CO-3: Analyze the characters and failure of metals and alloys
CO-4: Explain & justify the usage of composites in engineering field

UNIT-I:
Metal Structure and Crystallization: Introduction - atom binding, ionic bond, covalent bond, metallic bond, and Vander Waals forces; Crystal imperfections.
Overview of Metal Structure and Crystallization
Constitution of Alloys: Introduction; Classification of alloys or compounds; Pure metal; Intermediate alloy phase or compound - intermetallic compounds or valency compounds, interstitial compounds, and electron compounds; Solid solutions; Substitution solid solution - factors that control the range of solubility in alloy system; Interstitial solid solutions.

UNIT-II:
Phase Diagrams: Introduction; Coordinates of phase diagrams; Experimental methods - construction of equilibrium diagrams by thermal analysis, metallographic methods, and X-ray diffraction; Type-I-Two metals completely soluble in the liquid and solid states; Chemical composition of phases; relative amounts of each phase; Equilibrium cooling of a solid solution alloy; Diffusion; Nonequilibrium cooling; Homogenization; Properties of solid-solution alloys; Variation of Type I; Type II-Two metals completely soluble in the liquid state and completely insoluble in the solid state; Type III-Two metals completely soluble in the liquid state but only partly soluble in the solid state; Properties of eutectic alloy systems; Age hardening – solution treatment, and aging process; Type IV-The congruent-melting intermediate phase; Type V-The peritectic reaction; Type VI-Two liquids partly soluble in the liquid state: the monotectic reaction; Type VII-two metals insoluble in the liquid and solid states; Interrelation of basic types;

UNIT-III:

The Heat Treatment of Steel: Introduction; Full Annealing; Spheroidizing; Stress-relief annealing; Process annealing; Normalizing; Hardening; The isothermal transformation diagram; Cooling curves and I-T Diagram; Transformation on continuous cooling; Position of the I-T curves,Hardening or austenitizing temperature, Mechanism of heat removal during quenching - vapor-blanket cooling state (stage A), vapor transport cooling stage (stage B), Liquid cooling stage (stage C); Quenching medium; Temperature of quenching medium, Surface condition - methods to minimize the formation of scale - copper plating, protective atmosphere, liquid-salt pots, and cast-iron chips; Size and Mass,Hardenability; Use of Hardenability data; Tempering; Austempering; Surface heat treatment or case hardening; Carburizing; Heat treatment after carburizing; Cyaniding and Carbonitriding; Nitriding; Flame hardening; Induction Hardening.

UNIT-IV:

Alloy Steels: Introduction; Purpose of alloying; Effect of alloying elements upon Ferrite; Effect of alloying elements upon carbide; Influence of alloying elements on the iron-iron carbide diagram; Effect of alloying elements in tampering; Classification of steels - nickel steel, chromium steel, nickel-chromium steels, manganese steels, molybdenum steels, tungsten steels, vanadium steels, silicon steels, stainless steels, martensitic stainless steels, ferritic stainless steels, austenitic stainless steels, precipitation-hardening stainless steels, maraging steels, and ausforming.

Tool Steels: Classification of tool steels; Selection of tool steels; Comparative properties; Non-deforming properties; Depth of hardening; Toughness; Wear resistance; Red-hardness; Machinability; Resistance to decarburization; Brand names; Water-hardening tool steels (Group W); Shock resisting tool steels (Group S); Cold-work tool steels; Hot-work tool steels (Group H); High speed tool steels; Mold Steels (Group P); Special purpose tool steels; Heat treatment of tool steels; Overview of tool failures; Special cutting materials – satellites, cemented carbides, and ceramic tools.

UNIT-V:

Cast Iron: Introduction; Types of cast iron; White cast iron; Malleable cast iron; Pearlitic malleable iron; Gray cast iron; Silicon in cast iron; Sulfur in cast iron; Manganese in cast iron; Phosphorus in cast iron; Heat treatment of grey iron, Size and distribution of graphite flakes; Mechanical properties and applications of grey cast iron; Chilled cast iron; Nodular cast iron; Alloy cast irons.

Non-Ferrous Metals and Alloys: Introduction; Copper and its alloys - Copper, temper designation of copper and copper alloys, and copper alloys; Aluminum and its alloys - Aluminum, Alloy designation system, and temper designation; Titanium and Titanium alloys.

UNIT-VI:

Composites: Introduction, classification of composites-Fibre reinforced composites, Pertial reinforced composites, Dispersion strengthened metals ,laminates; Advanced Fibre reinforced composites –Metal matrix composites, Ceramic –matrix composites ,Carbon - Carbon composites, Hybrid composites; Fabrication of Fibre- reinforced composites-Hand lay –up process ,Filament winding process, Sheet- moulding compound process, continuous pultrusion process, resin transfer moulding, vacuum-bag moulding.

TEXT BOOKS:

1. Introduction to Physical Metallurgy, Sidney H. Avner, McGraw-Hill
2. Materials Science and Metallurgy, Kodgire, Everest

REFERENCES:

1. Essentials of Materials Science and Engineering, Donald R. Askeland and Thomson
2. Materials Science and Engineering, William and Collister
3. Elements of Materials Science, V. Raghavan
4. Metallurgy and Material Science, Pakirappa

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1ME07) INSTRUMENTATION AND CONTROL SYSTEMS

COURSE PRE-REQUISITES: Metrology

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 automation in industries
- To provide familiarity with different sensors and their application in real time applications
- To provide the knowledge of various measurement methods of industrial parameters like velocity, acceleration, torque, pressure, flow, temperature etc. and control of the same

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Know instrumentation system used in the industry
CO-2: Appreciate the automation with the help of instrumentation
CO-3: Understand the experimental applications and selecting appropriate engineering modules
CO-4: Develop aptitude for self-learning and modern technical skills beyond the curriculum

UNIT - I:
Definition: Basic principles of measurement - Measurement systems, generalized configuration and functional descriptions of measuring instruments - examples. Dynamic performance characteristics - sources of error, Classification and elimination of error,

UNIT - II:
Measurement of Displacement: Theory and construction of various transducers to measure displacement - Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.
Measurement of Temperature: Classification - Ranges - Various Principles of measurement - Expansion, Electrical Resistance - Thermistor - Thermocouple - Pyrometers - Temperature Indicators.

UNIT - III:
Measurement of Pressure: Units - classification - different principles used. Manometers, Piston, Bourdon pressure gauges, Bellow - Diaphragm gauges. Low pressure measurement - Thermal conductivity gauges - ionization pressure gauges, Mcleod pressure gauge.
Measurement of Level: Direct method - Indirect methods capacitive, ultrasonic, magnetic, cryogenic fuel level indicators - Bubble level indicators.
Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow mete Hot - wire anemometer, Laser Doppler Anemometer (LDA) .

UNIT - IV:

Measurement of Speed: Mechanical Tachometers Electric tachometers - Stroboscope, Non- contact type of tachometer. Measurement of Acceleration and Vibration: Different simple instruments - Principles of Seismic instruments - Vibrometer an accelerometer using this principle.

Stress Strain Measurements: Various types of stress an strain measurements - electrical strain gauge - gauge factor - method of usage of resistance strain gauge for bending compressive and tens) strains - usage for measuring torque, Strain gauge Rosettes.

UNIT - V:

Measurement of Humidity: Moisture content of gases, all psychrometer, Absorption psychrometer, Dew point meter Measurement of Force, Torque And Power: Elastic force meters, lo cells, Torsion meters, Dynamometers.

UNIT - VI:

Elements of Control Systems: Introduction, Importance -Classification - Open and closed systems Servomechanisms Examples with block diagrams - Temperature, speed and position control systems.

TEXT BOOKS:

1. Measurement Systems: Applications & Design, D.S. Kumar, Anuradha Agencies
2. Instrumentation, Measurement &Analysis, B.C.Nakra & K.K.Choudhary, TMH

REFERENCES:

1. Instrumentation and Control Systems, S.Bhaskar, Anuradha Agencies
2. Experimental Methods for Engineers, Holman, McGraw-Hill Education
3. Mechanical and Industrial Measurements, R.K. Jain, Khanna Publishers
4. Mechanical Measurements, Sirohi and Radhakrishna, New Age
5. Instrumentation & Mechanical Measurements, A.K. Tayal,Galgotia Publications

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC2ME02) THERMAL ENGINEERING LABORATORY

COURSEPRE-REQUISITES: Thermodynamics, Thermal Engineering

COURSEOBJECTIVES:

- To measure the performance parameters and draw its characteristic curve for a diesel engine
- To measure the performance parameters and draw its characteristic curve for a petrol engine
- To measure the performance parameters of reciprocating compressor
- To evaluate the COP of refrigeration and Air conditioning system

COURSEOUTCOMES: After completion of the course, the student should be able to
CO-1: Measure the Performance parameters like Brake Power, Indicated Power, friction power, specific fuel consumption, volume flow rate of air into the engine cylinder and specific heat of the exhaust gases and to calculate the various heat losses in the engine
CO-2: Measure the Performance parameters like Brake Power, Indicated Power, friction power, specific fuel consumption, volume flow rate of air into the cylinder and specific heat of the exhaust gases and draw its characteristic curve for a petrol engine
CO-3: Measure the Performance parameters of reciprocating compressor like mass flow rate of air in the compressor, power consumed by the compressor, volumetric efficiency and Isothermal efficiency
CO-4: Evaluate the COP of refrigeration system based on the experimental value as well as the P-H chart and to evaluate COP Air conditioning system based on the experimental value and by using the Psychrometric chart for air

LIST OF EXPERIMENTS:

Any 10 experiments to be conducted from the following**:**

1. Valve Timing Diagram on Single Cylinder Four Stroke Diesel Engine
2. Port Timing Diagrams on Single Cylinder Two Stroke Petrol Engine
3. Performance Test on Single Cylinder Four Stroke Diesel Engine
4. Heat Balance Test on Single Cylinder Four Stroke Diesel Engine
5. Measurement of Optimum Cooling Water Temperature on Single Cylinder Four Stroke Diesel Engine
6. Performance Test on Four Stroke Multi Cylinder Petrol Engine
7. Heat Balance Test on Four Stroke Multi Cylinder Petrol Engine
8. Measurement of Air/Fuel Ratio and Volumetric Efficiency on Multi Cylinder Four Stroke Petrol Engine
9. Evaluation of Engine Friction by Conducting Morse Test on Four Stroke Multi Cylinder Petrol Engine
10. Performance Test on Single Cylinder Two Stroke Petrol Engine
11. Performance Test on Reciprocating Air – Compressor Test Rig
12. Performance Test on Air Conditioning Test Rig
13. Performance Test on Refrigeration Test Rig
14. Dis-assembly / Assembly of I.C. Engines
15. Performance Test on Computerized Diesel Engine.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC2ME03) MECHANICS OF SOLIDS LABORATORY

COURSEPRE-REQUISITES: Engineering Mechanics, Mechanics of Solids

COURSEOBJECTIVES:

- To analyze the various tests to be conducted on engineering materials
- To know the significance of tests in evaluating the corresponding mechanical properties
- To analyze the importance of technical parameters used during tests
- To apply the concepts learned in the real time

COURSEOUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the theoretical concepts by conducting the tests on different materials
CO-2: Evaluate the result of test and comment on the mechanical properties of materials
CO-3: Decide a material and an appropriate test suitable for given application
CO-4: Analyze the significance of the tests in different fields of engineering

LIST OF EXPERIMENTS:

1. Direct tension test
2. Bending test on simply supported beam
3. Bending test on cantilever beam
4. Torsion test
5. Brinell hardness test
6. Rockwell hardness test
7. Test on close coiled helical spring
8. Compression test on a cube
9. Charpy Impact test
10. Izod Impact test
11. Direct shear test
12. Mechanical advantage of simple screw jack
13. Moment of Inertia of a fly wheel

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC2ME04) METALLURGY AND INSTRUMENTATION AND CONTROL SYSTEMS LABORATORY

COURSE PRE-REQUISITES: Metallurgy and Material Science

COURSE OBJECTIVES:
- To understand the significance of microstructure of different materials under microscopic testing
- To understand the changes in microstructures after different treatments
- To get hands on experience to use different transducers
- To study about calibration procedure of different transducers

COURSE OUTCOMES: After completion of the course, the student should be able to**CO-1:** Test and Identify different microstructures of various materials
CO-2: Prepare appropriate heat treatment for a given material by checking its microstructure
CO-3: Setup given sensor on equipment for measurement of different parameters like temperature, pressure speed and flow
CO-4: Design and Develop a control unit on boiler/ Turbine

METALLURGYLABORATORY

1. Preparation and study of the microstructure of metals like Iron, Cu and Al
2. Preparation and study of the microstructure of mild steels, low carbon steels, and high carbon steels
3. Study of the microstructures of cast irons
4. Study of the microstructures of non-ferrous alloys
5. Study of the microstructures of heat treated steels
6. Hardenability of steels by Jominy end quench test
7. Study the microstructure of cutting tools
8. Study the micro structures of stainless steel

INSTRUMENTATION AND CONTROL SYSTEMS LABORATORY

1. Study and Calibration of Thermistor for temperature measurement
2. Study and calibration of LVDT transducer for displacement measurement
3. Study and Calibration of strain gauge for load measurement
4. Study and Calibration of thermocouple for temperature measurement
5. Study and calibration of Bourdon Tube Pressure gauge for pressure measurement
6. Study and Calibration of resistance temperature detector for temperature measurement
7. Study and calibration of Radiation and Optical Pyrometers for temperature measurement
8. Study and calibration of Optical and magnetic transducers for speed measurements

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18MN6HS02) ENVIRONMENTAL SCIENCE

COURSE PRE-REQUISITES: Basic knowledge of environmental issues

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

COURSE OBJECTIVES:
- 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

TEXTBOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1ME08) HEAT TRANSFER
(Common to ME & AE)

COURSE PRE-REQUISITES: Engineering Mathematics and Thermodynamics

COURSE OBJECTIVES:
- To understand the conduction and convective modes of heat transfer in physical environment and to derive general mathematical equation
- To know the heat transfer through Homogeneous slabs, hollow cylinders, sphere, extended surfaces and fins
- To learn heat transfer during radiation, boiling and condensation
- To appreciate heat transfer through different types of heat exchangers

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Derive the general conduction equation in Cartesian, cylindrical and spherical coordinates
CO-2: Solve the problems related to heat transfer through homogeneous slabs, hollow cylinders, sphere, extended surfaces and fins
CO-3: Apply and calculate convective heat transfer equations to natural and forced convection
CO-4: Design the devices that transfer heat and measure their effectiveness

UNIT – I:
Introduction: Modes and mechanisms of heat transfer - Basic laws of heat transfer - Simple general discussion about applications of heat transfer. Conduction Heat Transfer: Fourier heat conduction equation - General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates - simplification and forms of the field equation steady, unsteady and periodic heat transfer - Initial and boundary conditions.

UNIT – II:
One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and sphere - overall heat transfer coefficient - electrical analogy - Critical radius of insulation - variable Thermal conductivity - systems with heat sources or Heat generation - extended surfaces and fins. One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance - chart solutions of transient conduction systems.

UNIT – III:
Convective Heat Transfer: Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow - Dimensional analysis as a tool for experimental investigation - Concepts about hydrodynamic and thermal boundary layers - Buckingham Pi- Theorem and method, application for developing Semi - empirical non-dimensional correlation for convection heat transfer - Significance of non -dimensional numbers - use of empirical correlations for

convective heat transfer- Forced Convection: Flat plates and horizontal pipes. Free Convection: Vertical plates and pipes.

UNIT – IV:

Heat Transfer with Phase Change: Heat transfer with boiling - pool boiling and film boiling - boiling curve for pool boiling - simple correlations for pool boiling - Condensation plates heat transfer: film wise and drop wise condensation - film condensation on vertical and horizontal cylinders using empirical correlations.

UNIT – V:

Radiation Heat Transfer: Emission characteristics and laws of black-body radiation - incident radiation - total and monochromatic quantities -laws of Planck, Wien, Kirchhoff, Lambert, Stefan and Boltzmann - heat exchange between two black bodies -concepts of shape factor - emissivity - heat exchange between grey bodies - radiation shields - electrical analogy for radiation networks.

UNIT – VI:

Heat Exchangers: Classification of heat exchangers - overall and fouling resistance - problems using LMTD – multiple passes and cross flow heat exchangers - effectiveness - NTU method of heat exchanger analysis.

TEXT BOOKS:

1. Fundamentals of Engineering Heat and Mass Transfer, Sachdeva R.C., 5thEdition,New Age International, 2017
2. Heat and Mass Transfer Data Book, Kothandaraman C.P., 9th Edition, New AgeInternational, 2018
3. Fundamentals of Heat and Mass Transfer, Thirumaleshwar M., Pearson Publisher,2006

REFERENCES:

1. Heat Transfer: A Basic Approach, Ozsik, McGraw-Hill International Edition, 1985
2. Heat Transfer, Holman J.P., Mcgraw-Hill College, 1990
3. A Textbook on Heat Transfer, Sukhatme S.P., 3rd Edition, Sangam Books Ltd.
4. Heat and Mass Transfer, Kumar D. S., Katson Books, 2013
5. Fundamentals of Heat & Mass Transfer, Incopera, Dewitt, Wiley, 2006

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1ME09) MANUFACTURING PROCESSES

COURSE PRE-REQUISITES: Material Science, Manufacturing Science

COURSE OBJECTIVES:
- To understand about sand casting and metal casting techniques
- To impart the knowledge of various welding processes
- To evaluate the importance of rolling, forging and sheet metal operations
- To analyze the processing of plastics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze and select the suitable casting technique for making the components
CO-2: Analyze the different types of welding processes are needed for various materials and importance of welding
CO-3: Apply the methods involved in sheet metal operations, rolling, forging etc.
CO-4: Apply the various manufacturing methods in processing of plastics

UNIT– I:
Casting: Steps involved in making a casting; Advantage of casting and its applications; Types of Foundry sands, Types of patterns – Materials used for patterns; Pattern allowances and their construction; Principles of Gating, Gating ratio and design of gating systems. Risers; Types; Casting design considerations
Special Casting Processes: Centrifugal, Die, Investment casting only, Cupola furnace and Electric arc furnace only.

UNIT– II:
Welding: Classification of welding processes, types of welds and welded joints, Gas welding, ARC welding, Resistance welding, Thermit welding and Plasma welding. TIG & MIG welding, Friction stir welding, Explosive welding, Soldering & Brazing. Heat affected zones in welding; welding defects.

UNIT– III:
Mechanical Working-I: Hot working; Cold working; Strain hardening; Recovery; Recrystallisation and grain growth; Comparison of properties of cold and hot worked parts.
Rolling: Rolling fundamentals; Theory of rolling; Types of Rolling mills and products.

UNIT– IV:
Extrusion: Basic extrusion process and its characteristics; Hot extrusion and Cold extrusion; Forward extrusion and backward extrusion – Impact extrusion; Hydrostatic extrusion; Extrusion defects.
Forging Processes: Principles of Forging; Tools and dies; Types of Forging; Smith forging; Drop Forging; Roll Forging; Rotary Forging; Forging defects.

UNIT– V:
Mechanical Working-II: Stamping, forming and other cold working processes: Blanking and piercing; Bending and forming; Drawing and its types; Wire drawing and Tube drawing; Coining; Hot and cold spinning

UNIT– VI:
Plastic Materials and Processes: Types of plastics; advantages of plastics, Injection moulding; Blow moulding; Thermoforming. Compression moulding.

TEXT BOOKS:

1. Manufacturing Technology, P.N. Rao
2. Production Technology, R.K. Jain

REFERENCES:

1. Manufacturing Engineering and Technology, Kalpak Jian S.
2. Process and Materials of Manufacturing, Lindberg, PE
3. Principles of Metal Castings, Rosenthal
4. Welding Process, Parmar
5. Production Technology, Sharma P. C.

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

(18PC1ME10) DYNAMICS OF MACHINERY

COURSE PRE-REQUISITES: Engineering Mechanics, Kinematics of Machinery

COURSE OBJECTIVES:
- To study the construction methods like Klien's, velocity polygons, acceleration diagrams etc. for drawing various mechanisms
- To identify the significance of the principles of equilibrium, super position, virtual work& D'Alembert's principle
- To familiarize with the methods of static &dynamic stability
- To study the Mechanical vibrations on various systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Show the engineering applications involving the selection and design of machine components with respect to the forces developed
CO-2: Check whether the proposed design is satisfactory
CO-3: Analyze and design flywheels, governors and gyroscopes to withstand forces
CO-4: Analyze the different vibration system using equilibrium, energy, Rayleigh's dunker's,etc. method

UNIT– I:
Static and Dynamic Force Analysis of Planar Mechanisms: (NEGLECTING FRICTION) Introduction-free body diagrams-conditions of equilibrium-two and three force members-Inertia forces and D'Alembert's principle.
Synthesis of Linkages: Three position synthesis-four position synthesis- precision positions-structural error-Chebyshev's spacing, Freudenstein's Equation, problems.

UNIT– II:
Clutches: Friction clutches, Single disc or plate clutch, multiple disc clutch, cone clutch& centrifugal clutch.
Brakes and Dynamometers: Simple block brakes, band brake of vehicle and working of internal expanding brake. Dynamometers - absorption and transmission types-general description and method of operation.

UNIT– III:
Precession: Gyroscopes, effect of precessional motion on the stability of moving vehicles such as motor car, motorcycle and aero planes, Gyroscopic effect on ships like steering, pitching and rolling conditions.

UNIT– IV:
Turning Moment Diagrams and Flywheels:
Turning Moment: Inertia torque-angular velocity and acceleration of connecting rod, crank effort and torque diagrams- Fluctuation of energy-design of flywheels.
Governors: Types of Governors – Watt governor, Porter and Proell governors, Spring loaded governors- Hartnell and Hartung with auxiliary springs, Sensitiveness, isochronism and hunting of governor.

UNIT– V:

Balancing: Balancing of rotating masses – single and multiple-single and different planes-balancing of reciprocating masses-primary and secondary balancing-analytical and graphical methods.

Unbalanced Forces and Couples: Balancing of multi cylinder inline and radial engines for primary, secondary balancing and locomotive balancing.

UNIT– VI:

Vibrations: Free vibration of mass attached to a vertical spring - simple problems on forced damped vibration, Vibration isolation and transmissibility - Whirling of shafts, critical speeds, torsional vibrations, two and three rotor systems.

TEXT BOOKS:

1. Kinematics and Dynamics of Machinery, R. L. Norton,McGraw-Hill
2. Theory of Machines, S. S. Ratan, Tata McGraw-Hill
3. Theory of Machines, R.S. Kurmi, J.K.Gupta

REFERENCES:

1. Theory of Machines and Mechanisms, P. L. Ballaney, Khanna
2. Theory of Machines, Thomas Bevan, Pearson Education
3. Theory of Machines and Mechanisms, J.E.Shigley, Tata McGraw-Hill

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

(18PE1ME01) NON-CONVENTIONAL ENERGY SOURCE

COURSE PRE-REQUISITES: Thermodynamics, Fluid Mechanics and Heat Transfer

COURSE OBJECTIVES:

- To understand about different types of Non-Conventional Energy Sources
- To understand about different equipments used in generation of energy
- To understand about design and fabrication of equipments for collection and conversion of energy

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Select any Non-Conventional Energy Source equipment and apply concept of heat transfer and obtain the results
CO-2: Able to design a windmill
CO-3: Able to design a solar collector for different applications
CO-4: Evaluate the performance of solar refrigerator

UNIT – I:
Introduction:
Principles of Renewable Energy: Introduction; Energy and sustainable development; Fundamentals; Scientific principles of renewable energy; Technical implications; Social implications.
Principles of Solar Radiation: the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT – II:
Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.
Solar Energy Storage and Applications: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT – III:
Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria.
Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

UNIT – IV:
Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters – design calculations, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.

UNIT – V:

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:

Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joul Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHDEngine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS:

1. Renewable Energy Resources, Tiwari and Ghosal,Narosa
2. Non-Conventional Energy Sources, G.D. Rai

REFERENCES:

1. Renewable Energy Sources, Twidell& Weir
2. Solar Energy, Sukhatme
3. Solar Power Engineering, B.S.Magal, Frank Kreith& J.F.Kreith
4. Principles of Solar Energy, Frank Krieth& John F. Kreider
5. Non-Conventional Energy, Ashok V. Desai, Wiley Eastern

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

(18HS1MG02) PRINCIPLES OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR

COURSE OBJECTIVES:

- To understand the principles, functions, theories and practices of different management areas and to provide them with practical exposure to cases of success/failure in business
- To expose with a systematic and critical understanding of organizational theory, structures and design
- To comprehend conceptual models of strategic management and to familiarize with the tools of operations and project management
- To understand the role of human relations in the management of operations and to provide basic insights into contemporary management practices

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Function effectively in multidisciplinary teams to accomplish a common goal of organizations
CO-2: Apply theories to improve the practice of management
CO-3: Appreciate the management challenges associated with high levels of change in the organizations
CO-4: Develop global vision and management skills at both a strategic level and interpersonal level

UNIT – I:
Introduction to Management: Concepts of management - nature, importance, and functions of management; Taylor's scientific management theory; Fayol's principles of management; Mayo's Hawthorne experiments; Maslow's theory of human needs; Douglas McGregor's theory X and theory Y; Herzberg's two-factor theory of motivation; System and contingency approach to management; Planning – meaning, significance, and types of plans; Decision making and steps in decision making process; Leadership styles; Social responsibilities of management.
Organizing - Meaning, and features; Process of organization; Principles of organization; Elements of organization; Organization chart; Span of control - Graicunas formulae; Centralisation and decentralization; Types of mechanistic and organic structures of organisation - line organization, line and staff organization, functional organization, committee organization, matrix organization, virtual organisation, cellular organisation, team structure, boundaryless organization, inverted pyramid structure, and lean and flat organization structure; Their merits, demerits and suitability.

UNIT – II:
Human Resources Management: Concepts of HRM; Basic functions of HR manager - human resource planning (definition; objectives; process), recruitment (definition; sources; techniques), selection (definition; process), induction and orientation, training and development (definition; need;

methods), employee exit process, employee relations management, employee compensation and benefits administration, job evaluation (objectives; process; methods), and performance appraisals (objectives; process; methods).

UNIT – III:
Strategic Management: Mission; Goals; Objectives; Policy; Strategy; Programmes; Elements of corporate planning process - environmental scanning; value chain analysis, BCG matrix, generic strategy alternatives, SWOT analysis, and steps in strategy formulation and implementation; Balance score card; Capability maturity model (CMM)/ People capability maturity model(PCMM).

UNIT – IV:
Operations Management: Plant location; Types of plant layout; Methods of production – job, batch, and mass production; Work study-basic procedure involved in method study and work measurement.

UNIT – V:
Materials Management: Objectives; Need for inventory control; EOQ, ABC Analysis; Purchase procedure; Value analysis; JIT, Six sigma; TQM; Supply chain management; Stores management and stores records.
Marketing: Functions of marketing; Marketing mix, and marketing strategies based on product life cycle; Channels of distribution.

UNIT – VI:
Project Management – Network Analysis: Network analysis; Programme evaluation review technique - PERT (probability of completing the project within given time); Critical path method - CPM (Identifying critical path); Project cost analysis; Project crashing; Simple problems.

TEXT BOOKS:
1. Management Science, Aryasri, Tata McGraw-Hill, 2009
2. Management, James Arthur, Finch Stoner, R. Edward Freeman, and Daniel R. Gilbert, 6thEdition, Pearson Education/Prentice Hall
3. Principles and Practice of Management, L.M. Prasad, Sultan Chand Publications, New Delhi

REFERENCES:
1. Principles of Marketing: A South Asian Perspective, Kotler Philip, Gary Armstrong, Prafulla Y. Agnihotri, and Eshanul Haque, 13thEdition, Pearson Education/ Prentice Hall of India, 2010
2. A Handbook of Human Resource Management Practice, Michael Armstrong, Kogan Page Publishers, 2010
3. Quantitative Techniques in Management, N.D. Vohra, 4th Edition, Tata McGraw-Hill, 2010
4. Operations Management: Theory and Practice, B. Mahadevan, Pearson Education, 2010
5. Strategic Management, V.S.P. Rao and V. Hari Krishna, Excel Books, 2010

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

(18PE1ME03) ADVANCED STRENGTH OF MATERIALS

COURSE PRE-REQUISITES: Mechanics of Solids, Engineering Mechanics and Mathematics

COURSE OBJECTIVES:

- To understand the concept of stress and strain in 3-D, cauchy's formula, Mohr's circle,Drucker-pager yield criteria, shear effect on inelastic bending etc.
- To understand the concept of torsion, buckling and stability, columns with eccentric axis loads
- To understand method of superposition, principal of work, power and energy and its importance

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Solve solid mechanics problems effectively using softwares
CO-2: Understand the concept of torsion, buckling and stability, columns with eccentric axis loads
CO-3: Analyze stresses build in various members in a given applications
CO-4: Apply the concepts of torsion, buckling and stability, columns with eccentric axis loads for real life situations

UNIT – I:
Three Dimensional Stresses: Introduction, Stress and Strains in 3-D – Cauchy's formula, Principal Stress, hydrostatic stress, deviatoric stress, stress transformations, Mohr circle, octahedral shear stress, strain energy densities, etc.
Theories of Failure: Yield criteria: general concepts – maximum principal stress criterion, maximum principal strain criterion, and strain-energy density criterion; Yielding of ductile metals – maximum shear stress (Tresca) criterion, distortional energy density (von mises) criterion, and effect of hydrostatic stress and the π - plane; alternative yield criteria – mohr-coulomb yield criterion, Drucker-Prager yield criterion, and Hill's criterion for orthotropic materials; General yielding – elastic-plastic bending, fully plastic moment, shear effect on inelastic bending, modulus of rupture, comparison of failure criteria and interpretation of failure criteria for general yielding.

UNIT – II:
Unsymmetrical Bending: Introduction; Doubly symmetric beams with skew loads; Pure bending of unsymmetric beams; Generalized theory of pure bending; Bending of beams by lateral loads; Shear centre; Shear stresses in beams of thin-walled open cross sections; Shear centers of thin-walled open sections; General theory for shear stresses.
Bending of Curved Beams: Introduction; Circumferential stresses in a curved beam – location of neutral axis of cross section; Radial stresses in curved beams – curved beams made from anisotropic materials; Correction of circumferential stresses in curved beams having I, T, or similarcross sections – Bleich's correction factors; Deflections of curved beams – cross sections in the form of an I, T, etc.; Statically

indeterminate curved beams – fully plastic versus maximum elastic loads for curved beams.

UNIT – III:
Torsion: Torsion of a cylindrical bar of Circular cross Section; Saint-Venant's semi-inverse methods; Linear elastic solution; Prandtl elastic membrane (Soap-Film) Analogy; Narrow rectangular cross Section; Hallow thin wall torsion members, Multiply connected Cross section, Thin wall torsion members with restrained ends Axi-Symmetric Problems: Rotating Discs – Flat discs, Discs of uniform thickness, Discs of Uniform Strength, Rotating Cylinders.

UNIT – IV:
Columns: Buckling and stability; Columns with pinned ends; Columns with other support conditions; Columns with eccentric axis loads; Secant formula; Imperfections in columns; Elastic and inelastic column behavior; Inelastic buckling; Column design formulas.

UNIT – V:
Beam on Elastic Foundations: General theory; Infinite beam subjected to concentrated load: boundary conditions – method of superposition, and beam supported on equally spaced discrete elastic supports; Infinite beam subjected to a distributed load segment – uniformly distributed load; semi-infinite beam subjected to loads at its end; semi-infinite beam with concentrated load near its end; Short beams.

UNIT – VI:
Energy Methods: Introduction; Principal of virtual work; unit load method for calculating displacements; Reciprocal theorems; Strain-energy and complementary energy; Strain-energy methods; Complementary energy methods; Castigliano's second theorem; Shear deflections of beams. Introduction to Photoelasticity.

TEXT BOOKS:
1. Advanced Mechanics of Materials, Arthur P. Boresi and Richard J. Schmidt,6th Edition, JohnWiley
2. Mechanics of Materials, J. M. Gere and S. Timoshenko, CBS

REFERENCES:
1. Strength of Materials (Part 2): Advanced Theory and Problems, Stephen Timoshenko, CBS
2. Engineering Mechanics of Solids, E.P.Popov, Pearson Education
3. Strength of Materials,Schaum's Series

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

(18PC1EE06) CONTROL SYSTEMS

COURSE PRE-REQUISITES: Ordinary Differential Equations and Laplace Transform

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

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

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

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

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

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

UNIT – V:
Introduction to Controller Design: Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design- Application of Proportional, Integral and Derivative

Controllers. Design specifications in frequency-domain. Frequency domain methods of design- Lead and Lag compensators.

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(18PE1ME05) ENTERPRISE RESOURCE PLANNING

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the evolution and the modules of ERP
- To get the knowledge of ERP technologies and system
- To understand the market and its software in ERP and life cycle of ERP
- To know the ERP technologies and its related technologies like SCM

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understands and explain the definitions and the evolution of ERP
CO-2: Applies the BPR, DSS, EPR related technologies
CO-3: Analyzes, applies and suggests for the development of ERP software
CO-4: Evaluates the SCM in ERP

UNIT – I:
Introduction to ERP: Evolution of ERP; what is ERP? Reasons for the Growth of ERP; Scenario and Justification of ERP in India; Evaluation of ERP; Various Modules of ERP; Advantage of ERP.
An Overview of Enterprise: An Overview of Enterprise; Integrated Management Information; Business Modeling; ERP for Small Business; ERP for Make to Order Companies; Business Process Mapping for ERP Module Design; Hardware Environment and its Selection for ERP Implementation.

UNIT – II:
ERP and Related Technologies: ERP and Related Technologies; Business Process Reengineering (BPR); Management Information System (MIS); Executive Information System (EIS); Decision support System (DSS); Supply Chain Management (SCM).
ERP System: ERP system Introduction; Finance, Plant Maintenance, Quality Management, Materials Management.

UNIT – III:
ERP Market: Introduction, SAP AG, Baan Company, Oracle Corporation, People Soft, JD Edwards World Solutions Company, System Software Associates, Inc. (SSA); QAD; A Comparative Assessment and Selection of ERP Packages and Modules.

UNIT – IV:
ERP Implementation Lifecycle: ERP Implementation Lifecycle: Issues in Implementing ERP Packages; Pre-evaluation Screening; Package Evaluation; Project Planning Phase; Gap Analysis; Reengineering; Configuration; Implementation; Team Training; Testing; Going Live; End-User Training; Post Implementation (Maintenance Mode).

UNIT – V:
Selection of ERP Vendors: Vendors; Consultants and Users; In-House Implementation - Pros and Cons; Vendors; Consultants; End User.

Future Directions In ERP: Future Directions in ERP; New Markets; New Channels; Faster Implementation Methodologies; Business Modules and BAPIs; Convergence on Windows NT; Application Platform; New Business Segments; More Features; Web Enabling; Market Snapshot.

UNIT – VI:

Other Related Technologies of SCM: Relation to ERP; E-Procurement; E-Logistics; Internet Auctions; E-markets; Electronic Business Process Optimization; Business Objects in SCM; E commerce.

TEXT BOOKS:

1. Manufacturing Resource Planning (MRP II) with Introduction to ERP, SCM an CRM, Khalid Sheikh, McGraw-Hill
2. The Impact of Enterprise Systems on Corporate Performance: A Study of ERP, SCM, and CRM System Implementations [An article from: Journal of Operations Management], K.B.Hendricks, V.R. Singhaland J.K.Stratman, Elsevier

REFERENCES:

1. ERP and Supply Chain Management, Christian N. Madu, CHI
2. Implementing SAP ERP Sales & Distribution, Glynn C. Williams, McGraw-Hill

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

(18HS1MG01) ENGINEERING ECONOMICS AND ACCOUNTANCY
(Common to all branches)

COURSE OBJECTIVES:

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

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

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

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

merits, limitations, suitability. (iii) Joint-Stock Company - Definition, Companies Act, features, types, merits, limitations, suitability.
Public Sector Business Enterprises: Definition, features, objectives, merits, problems.

UNIT – III:
Market Structures: Definition & common features of market and classifications of markets. Evaluation of market structures-Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly.
Product Life-Cycle and Pricing: Definition, various stages of PLC, and Life-Cycle Costs; objectives and methods of pricing.
Introduction to Financial Accounting: Definition, basic principles and double-entry book-keeping, practice of accounting process-Journal, ledger, trial balance and final accounts (simple problems)

UNIT – IV:
Financial Analysis through Ratios: Meaning, Computation of Ratios
(i) Liquidity Ratios: Current Ratio and Quick Ratio,
(ii) Solvency Ratios: Interest Coverage Ratio and Debt- Equity Ratio,
(iii) Activity Ratios: Stock/Inventory Turnover Ratio and Debt Turnover Ratio,
(iv) Profitability Ratios: Gross Profit Ratio, Net Profit Ratio & Earning Per Share(EPS) Ratio.

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

(18PC2ME05) HEAT TRANSFER LABORATORY
(Common to ME & AE)

COURSE PRE-REQUISITES: Thermodynamics and Heat and Mass Transfer

COURSE OBJECTIVES:
- To analyze various modes of heat transfer experimentally
- To measure heat transfer through conduction
- To measure heat transfer through natural and forced convection
- To measure heat transfer through radiation

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify and analyse the mode of heat transfer
CO-2: Evaluate thermal conductivity of lagged pipe, metal bar and insulating powder
CO-3: Find heat transfer coefficient for natural and forced convection
CO-4: Estimate emissivity of the given metal

LIST OF EXPERIMENTS:

Any 10 experiments to be conducted from the following

1. Determination of thermal conductivity of given metal rod
2. Determination of Stefan Boltzmann constant
3. To find out critical heat flux
4. Determination of overall heat transfer coefficient of composite wall
5. Determination of thermal conductivity of lagged Pipe
6. Determination of heat transfer coefficient in forced convection apparatus
7. Determination of heat transfer coefficient in natural convection apparatus
8. Determination of thermal conductivity of insulating powder
9. Determination of effectiveness of heat exchanger
10. Measurement of emissivity of given test plate
11. Heat transfer in dropwise and film wise condensation
12. Determination of heat transfer coefficient and instantaneous heat transfer rate for transient heat conduction

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC2ME06) MANUFACTURING PROCESSES LABORATORY

COURSE PRE-REQUISITES: Production Technology

COURSE OBJECTIVES:
- To understand and evaluate casting techniques and sand properties
- To understand different welding processes and their use
- To understand different press working operations
- To understand about the processing of plastics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the knowledge involved in casting techniques
CO-2: Decide the selection of various welding techniques applicable for different materials
CO-3: Integrate the knowledge involved in press working operations
CO-4: Analyze the techniques involved in processing of plastics

LIST OF EXERCISES:

10 Exercises to be performed from the following:

METAL CASTING:
1. Pattern Design and making - for one casting drawing
2. Sand properties testing - Exercise -for strengths, and permeability – 2Exercises
3. Moulding, Melting and Casting - 1 Exercise

WELDING:
1. Arc Welding Lap and Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise
4. MIG Welding - 1 Exercise
5. Brazing - 1 Exercise

MECHANICAL PRESS WORKING:
1. Blanking and Piercing operations
2. Bending operation

PROCESSING OF PLASTICS:
1. Injection Molding
2. Blow Molding

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

(18PC2ME07) DYNAMICS OF MACHINERYLABORATORY

COURSE PRE-REQUISITES: Kinematics of Machinery

COURSE OBJECTIVES:
- To understand the static and dynamic balancing and the gyroscopic effects
- To find the whirling speed of shaft and the natural frequency of undamped and damped free vibration system
- To determine the kinematics of gear trains and Coriolis component of acceleration
- To analyze the follower movement and Mass Moment of Inertia
- To evaluate the working of various governors

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Balance the static and dynamic forces and identify the effect of gyroscopic couple
CO-2: Estimate the natural frequency of Undamped and damped free vibration system
CO-3: Evaluate Calculate the Coriolis component of acceleration
CO-4: Draw cam profile based on the follower movement and calculate the Mass moment of inertia
CO-5: Analyse the various governors

LIST OF EXPERIMENTS: (Any ten experiments)

1. Experimental analyses of the motion of a motorized gyroscope
2. To balance the masses statically and dynamically of a rotating mass system
3. To study the effect of varying initial spring compression for Hartnell governor
4. Determine the effect of varying mass on the center of sleeve in Porter governor
5. Determine the effect of varying mass on the center of sleeve in Proell governor
6. To determine whirling speed of shaft and study the modes of vibration
7. To determine the frequency ofundamped free vibration of spring mass system
8. To determine the frequency of the forced damped vibration of spring mass system
9. To determine the natural frequency of undamped torsional vibration of a single and double rotor shaft system
10. To determine the frequency ofthe forced vibration of simply supported beam for different damping
11. Verification of Dunkerley'srule
12. Determine the pressure distribution of lubricating oil at various load and speed of a Journal bearing

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

(18PW4ME02) INTERNSHIP

COURSE OUTCOMES: After completion of the course, the student 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**

(18MN6HS03) GENDER SENSITIZATION

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

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

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand important issues related to gender in contemporary India
CO-2: Attain a finer grasp of how gender discrimination works in our society and 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, DuggiralaVasanta, 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, 1990
2. ‘We Were Making History’ Life Stories of Women in the Telangana People’s Struggle. New Delhi: Kali for Women, 1989
3. TriptiLahiri, 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/>
4. 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/
5. The Violence of Development: The Politics of Identity, Gender and Social Inequalities in India, K. Kapadia, London: Zed Books, 2002

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

(18PC1ME11) TURBO MACHINERY

COURSE PRE-REQUISITES: Mathematics, Basics of Thermodynamics, Basic Concepts of Thermal Engineering

COURSE OBJECTIVES:
- To analyze and understand various energy conversations that take place in a turbo machines
- To apply the principles of turbo machines
- To evaluate governing mathematical equations to perform theoretical calculations
- To create a model for condensers, compressors and turbines

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Model and analysis of boiler and its accessories
CO-2: To understand the performance of steam condenser and nozzle
CO-3: To understand the behaviour& performance of steam turbine
CO-4: Evaluate the performance of gas turbines and jet propulsions

UNIT – I:
Basic Concepts, Steam Generators: Rankine Cycle: Schematic layout, operation, Thermodynamic Analysis.
Introduction, Classification of Boilers, Working Principles of Fire Tube and Water Tube Boilers, Low Pressure boilers, High Pressure Boilers – Babcock and Wilcox , Lamont Boiler, Boiler draught and performance of boilers, Equivalent evaporation.

UNIT – II:
Steam Condensers: Requirements of steam condensing plant – Classification of condensers – working principle of different types of condensers, vacuum efficiency and condenser efficiency– air leakage, sources and its affects, air pump- cooling water requirement.

UNIT – III:
Steam Nozzles: Functions of nozzle, applications, types, flow through nozzles, Thermodynamic analysis, assumptions, velocity at nozzle exit, Ideal and actual expansion in nozzle, velocity coefficient, condition for maximum discharge, nozzle efficiency, Critical pressure ratio, Supersaturated flow and its effects, degree of super saturation, degree of under cooling, Wilson line.

UNIT – IV:
Steam Turbines:
Impulse Turbine: Mechanical details, velocity diagram, effect of friction, power developed, axial thrust, diagram efficiency, Condition for maximum efficiency, Methodsto reduce rotor speed - velocity compounding, pressure compounding, combined velocity and pressure compounding, velocity and pressure variation along the flow.

Reaction Turbine: Mechanical details, principle of operation, Thermodynamic analysis of a stage, Degree of reaction, velocity diagram, parson's reaction turbine, condition for maximum efficiency.

UNIT – V:

Rotary Compressors: Working Principles of - Root's blower, Vvane blower and Screw compressor.

Centrifugal Compressors: Mechanical details and principle of operation, velocity and pressure variation, Energy transfer. Impeller blade shape-losses, slip factor, power input factor, pressure co-efficient and adiabatic co-efficient, velocity diagrams.

Axial Flow Compressors: Mechanical details and principle of operation, velocity triangles and energy transfer per stage, degree of reaction, work done factor, isentropic efficiency, pressure rise calculations, Polytrophic efficiency.

UNIT – VI:

Gas Turbines: Classification of Gas Turbines, Ideal cycle, essential components, parameters of performance, actual cycle, regeneration, inter cooling and reheating, closed and semi closed cycles, merits and demerits, Combustion chambers and turbines for Gas Turbine plants.

Jet Propulsion: Principle of operation, Classification of Jet propulsion engines, working principles with schematic diagram and representation on T-s diagram, Thrust, Thrust power and propulsion efficiency. Needs and demands met by Turbo Jet Engines, Schematic diagram, Thermodynamic cycle, performance evaluation thrust augmentation methods.

Rockets: Application - working principle, Classification, Propellant type, Thrust, Propulsive efficiency – Specific impulse, solid and liquid propellant Rocket Engines.

TEXT BOOKS:

1. Thermal Engineering, Mahesh M. Rathore, 15th Edition, Tata McGraw-Hill, 2016
2. Thermal Engineering, R.K. Rajput, 10th Edition, Lakshmi Publications, 2017

REFERENCES:

1. Gas Turbines, V. Ganesan, 3rd Edition,Tata McGraw-Hill, 2010
2. Thermal Engineering, P. L. Ballaney, 5th Edition, Khanna, 2010
3. Fundamentals of Turbo Machinery, B. K. Venkanna, Prentice Hall International, 2019
4. Thermal Engineering, P.L.Bellaney, 5th Edition, Khanna Publishers, 2010
5. Thermal Engineering,M.L.Marthur& Mehta, 3rd Edition, Jain Bros. Publishers, 2014

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

(18PC1ME12) MACHINE TOOLS AND METROLOGY

COURSE PRE-REQUISITES: Production Technology and Engineering Materials

COURSE OBJECTIVES:
- To understand about the importance of metal cutting and cutting tools
- To understand different types of machine tools and the operations
- To learn about broaching, gear cutting, metal finishing processes
- To learn the measurement standards and methods of measurement

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire basic knowledge on metal cutting, tools and the type of cutting tool materials in machining
CO-2: Understand various types of machine tools, principles and the operations performed
CO-3: Knowledge of broaching, gear cutting and finishing operations- grinding and super finishing operations
CO-4: Understand the measurement principles and methods

MACHINE TOOLS
UNIT – I:
Introduction: Material removal processes, Types of Machine Tools; Types of cutting tools (Single and multi-point) and Nomenclature of Single point cutting tools.
Metal Cutting: Chip Formation, Shear Zone, Orthogonal & oblique Cutting, Merchant circle diagram (construction only), Tool Wear and Tool Life; Surface Finish; types of Cutting Tool Materials.

UNIT – II:
Centre Lathe: Constructional Features of a Centre Lathe, Cutting Tools, Operations Performed in a Centre Lathe.
Special Purpose Lathes: Limitations of a Centre Lathe, Capstan and Turret Lathes-construction and differences.

UNIT – III:
Milling: Types of Milling Machines, Milling Cutters and Milling Operations.
Hole Making Operations: Types of hole making operations (basic),
Drilling: Twist drill geometry; Types of drills; Drilling machine types BORING- principle and types of boring machines- horizontal boring and Jig boring machines
Reciprocating Machine Tools: Introduction of Shaper, Slotter and Planer

UNIT – IV:
Broaching: Principle and types of broaching, Gear Cutting Methods (Basics), Gear Hobbing (Principle &Operation)
Grinding & Super Finishing Processes:
Grinding: Principle of grinding; Types of Grinding Machines- Cylindrical grinding, Centerless Grinding & Surface Grinding processes

Super Finishing: Basics of Honing, Lapping and Superfinishing.

METROLOGY

UNIT – V:

Systems of Limits and Fits: Introduction, normal size, tolerance limits, deviations, allowance, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly.

Linear Measurement: Limit Gauges; Go and No-go gauges- plug, ring, snap, gap, taper, profile position gauges and slip gauges;

Angular Measurement: sine bar, spirit level, angle slip gages and sine plate.

UNIT – VI:

Screw Thread Measurement: Elements of measurement; Measurement of- effective diameter, angle of thread and thread pitch.

Gear Measurement: Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch pressure angle and tooth thickness

Optical Measuring Instruments: Tool maker's microscope and its uses; optical projector

Surface Roughness Measurement: Differences between surface roughness and surface waviness; Numerical assessment of surface finish – CLA, R.M.S Values, Rz values; Measurement of surface finish.

TEXT BOOKS:

1. Manufacturing Technology, Vol. 2, Metal Cutting and Machine Tools, P. N. Rao, Tata McGraw-Hill
2. Engineering Metrology, R.K. Jain, Khanna
3. Engineering Metrology, I. C. Gupta,Dhanpat Rai

REFERENCES:

1. Manufacturing Engineering and Technology, Serope Kalpak Jian, Pearson Learning
2. A Textbook of Manufacturing Technology (Manufacturing Processes), R. K. Rajput, Laxmi Publications
3. Fundamentals of Modern Manufacturing, Mikell P. Groover
4. Production Technology, R. K. Jain & S. C. Gupta
5. BIS standards on Limits and Fits, Surface Finish, Machine Tool Alignment etc.

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	3	**0**	**3**

(18PC1ME13) DESIGN OF MACHINE ELEMENTS

COURSE PRE-REQUISITES: Mathematics, Engineering Mechanics, Mechanics of Solids, Kinematics of Machinery, Dynamics of Machinery

COURSE OBJECTIVES:
- To understand different properties of materials and relationship between them
- To understand the principles of stress and strain as applied to solid bodies, and structural and machine elements under the action of loads including fatigue and supports
- To understand to form mathematical equation and analyze problems by making appropriate assumptions and learn systematic and analytical engineering method to solve the practical design engineering problems
- To understand different types of elements like fasteners, joints, bearings etc.
- To understand the overview of different types of machine elements like different bearings, gears, shafts, power screws, clutches, couplings, flywheels, and flexible mechanical elements to gain a comprehensive view of the use of various elements in machinery

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Model and analyze design problems in mechanical/ structural engineering
CO-2: Apply knowledge of standard elements and their use in designing the machine elements
CO-3: Predict modes of failure in materials/ machine elements caused by different types of loads under operation
CO-4: Apply knowledge of design procedures to design the basic machine elements

FUNDAMENTALS OF MECHANICAL DESIGN
UNIT – I:
Introduction: The meaning of design; Mechanical engineering design; The phases of design; Recognition and identification; Evaluation and presentation; Design considerations; Factor of safety; Codes and standards; Economics; Reliability; Safety and product liability; UNITs.
Stress Analysis: Stress; Mohr's circle; Triaxial stress states; Uniformly distributed stresses; Elastic strain; Stress strain relations; Shear and moment; Singularity functions.
Normal stresses in bending; Vector programming; Beams with unsymmetrical sections; Shear stresses in beams; Shear stresses in rectangular-section beams; Flexural shear for other shapes; Shear center; Torsion; Stresses in cylinders; Press and shrink fits
Strain Energy: Concepts, The theorem of Castigliano; Overview of columns

UNIT – II:
Design for Static Strength: Static strength; Static loads and factor of safety; Failure theories; The maximum-normal- stress theory; The maximum-shear-stress theory; The distortion–energy theory; Failure of ductile materials; Failure of brittle materials; Stress concentration; Determination of stress concentration factors; Stress-concentration charts; Stress concentration and static loads.

UNIT – III:

Design for Fatigue Strength: Introduction; The S-N diagram, Low-cycle fatigue; High-cycle fatigue; Endurance-limit modifying factors; Surface finish; Size effects; Reliability; Temperature effects; Stress concentration effects; Fluctuating stresses; Fatigue strength under fluctuating stresses.

UNIT – IV:

Design of Mechanical Elements:

The Design of Screws, Fasteners, and Connections: Thread standard and definitions; The mechanics of power screws; Thread stresses; Threaded fasteners; Bolted joints in tension; Compression of bolted members; Torque requirements; Strength specifications; Bolt preload; Selecting the nut; Fatigue loading; Gasketed joints; Bolted and riveted joints loaded in shear; Centroids of bolt groups; Shear of bolts and rivets due to eccentric loading; Keys, pins, and retainers.

UNIT – V:

Welding, Bonding and The Design of Permanent Joints: Welding; Butt and fillet welds; Torsion in welded joints; Bending in welded joints; The strength of welded joints.

Mechanical Springs: Stresses in helical springs; Deflection of helical springs; Extension springs; Compression springs; Spring materials; Design of helical springs; Critical frequency of helical springs; Overview of Fatigue loading.

UNIT – VI:

Rolling Contact Bearings: Bearing types; Bearing life; Bearing load; Selection of ball and straight roller bearings; Selection of tapered roller bearings; Lubrication; Mounting and enclosure.

Introduction to Other Machine Elements: Introduction to lubrication and journal bearings, Gears-spur, helical, worm and bevel types, shafts, power screws, clutches, couplings, flywheels, and flexible mechanical elements.

TEXT BOOKS:

1. Mechanical Engineering Design (SI Edition), J.E. Shigley, McGraw-Hill
2. Mechanical Engineering Design (SI Edition), J.E.Shigley and Mischke

REFERENCES:

1. Machine Design, R.L.Norton, McGraw-Hill
2. Schaum's Outline of Machine Design, TMH
3. Mechanical Engineering Design, J.E.Shigley, Mischke and Budynas, International Edition, McGraw-Hill
4. Mechanical Engineering Design, J.E.Shigley, Mischke R.G.Budynas, and K.J.Nisbett, International Edition, TMH

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	3	0	3

(18PC1ME14) CAD/CAM AND ROBOTICS

COURSE PRE-REQUISITES: Engineering Graphics, Engineering Design, Production Technology, Control Power Systems, Mathematics, Kinematics of Machinery

COURSE OBJECTIVES:
- To understand the mathematics behind the transformations and projections in design of products on CAD devices
- To know the various types of modeling and drafting
- To learn the fundamentals of part programming required for manufacturing a product
- To appreciate the integration of design and manufacturing functions through CAD and CAM
- To evaluate the motion analysis, kinematics, dynamics and types of robot motions

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Select the types of computer devices and solve the problems on transformations and use them in CAD software
CO-2: Compare the different types of models and perform drafting
CO-3: Prepare part programs involving various operations for the manufacturing of simple and complex products
CO-4: Integrate the knowledge learnt in CAD and CAM
CO-5: Evaluate the positions, angles of the manipulators given the required motion analysis, kinematics, dynamics and trajectory planning concepts

CAD/CAM
UNIT – I:
Introduction: Computers in Industrial Manufacturing, Product cycle, CAD and CAM, Computer graphics: Raster scan graphics, Coordinate systems, Database structure for graphics modeling, Transformation of geometry, 3D Transformations,

UNIT – II:
Geometric Modeling: Geometric models, Geometric construction methods, Curve representation, Surface representation methods, Modeling facilities desired, Solid modeling.

UNIT – III:
Computer Numerical Control: Introduction to NC machines and CNC machines, Structure of CNC machine tools, Features of Machining center, Concept of ATC & APC, Feedback control.
CNC Part Programming: Fundamentals, Introduction to G & M codes, Manual part programming methods, Computer Aided Part Programming.

UNIT – IV:
Group Technology: Philosophy of Group Technology, Part families, Methods of Parts Classification and Coding, Advantages and Limitations.

Computer Aided Process Planning: Introduction, Retrieval type and Generative type, Benefits.
Computer Aided Quality Control: Introduction, Terminology in quality control, The computer in QC, Contact inspection methods, Noncontact inspection methods-optical and non-optical.

ROBOTICS
UNIT – V:
Introduction: Classification by Coordinate Systems and control systems Components of the Industrial Robotics: Degrees of freedom, End effectors Motion Analysis.
Kinematics and Dynamics: Manipulator Kinematics: D-H notations, Joint coordinates and world coordinates, Forward and Inverse kinematics, Problems.

UNIT – VI:
Trajectory Planning: Joint space scheme, Cubic polynomial fit, Avoidance of obstacles, Types of motions: Slew motion, Joint interpolated motion, Straight line motion, Problems.
Robot Actuators and Feedback Components: Actuators – Pneumatic, Hydraulic and Electric actuators, DC Servo motors, Stepper motors. Feedback components – Position sensors, Potentiometers, Resolvers and Encoders, Velocity sensors, tactile sensors.

TEXT BOOKS:
1. CAD/CAM, A.Zimmers and P. Groover, Prentice Hall International/Pearson Education
2. CAD/CAM Principles and Applications, P. N. Rao, Tata McGraw-Hill
3. Industrial Robotics, M. P. Groover, Pearson Education

REFERENCES:
1. CAD / CAM Theory and Practice, Ibrahim Zeid, Tata McGraw-Hill
2. Automation, Production Systems and Computer Integrated Manufacturing, Groover, Pearson Education
3. CAD / CAM / CIM, Radhakrishnan and Subramanian, Pearson Education
4. Principles of Computer Aided Design and Manufacturing, Farid Amirouche, Pearson Education
5. CAD/CAM: Concepts and Applications, Alavala, Prentice Hall International

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	3	**0**	**3**

(18PE1ME06) REFRIGERATION AND AIR CONDITIONING

COURSE PRE-REQUISITES: Thermodynamics, Heat & Mass Transfer

COURSE OBJECTIVES:
- To apply the fundamentals of Thermodynamics and its relative laws and effect on the system
- To analyze the concept of Heat and Mass Transfer on the system
- To evaluate performance of various thermodynamic cycles used in RAC
- To evaluate the performance of vapour compression and vapour absorption system

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Develop and analyze a system which totally based on the refrigeration concept
CO-2: Apply the basic principles on the Thermodynamics to solve an engineering problem related to Refrigeration and Air conditioning
CO-3: Select suitable Refrigeration cycle and apply the concept of Heat and Mass Transfer and obtain the result
CO-4: Develop and Evaluate the performance of air conditioning system

UNIT – I:
Introduction to Refrigeration: Necessity and applications – unit of refrigeration andC.O.P. – Mechanical Refrigeration – Types of Ideal cycles of refrigeration. Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems – Actual air refrigeration system problems – Refrigeration needs of Air crafts. Refrigerants – Desirable properties – classification refrigerants used – Nomenclature – Ozone Depletion– Global Warming.

UNIT – II:
Vapour Compression Refrigeration: Working principle and essential components of the plant – simple Vapour compression refrigeration cycle – COP – Representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – Actual cycle Influence of various parameters on system performance – Use of p-h charts – numerical Problems.

UNIT – III:
System Components: Compressors – General classification – Multistage or Compound Compression – comparison – Advantages and Disadvantages. Condensers – classification – Working Principles Evaporators – Multi Operator System, Cascade System– classification – Working Principles Expansion devices – Types – Working Principles.

UNIT – IV:

Vapor Absorption System: Calculation of max COP – description and working of NH3 – water system and Li Br –water (Two shell &Four shell) System. Principle of operation Three Fluid absorption system, salient features.

Steam Jet Refrigeration System – Working Principle and Basic Components. Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube.

UNIT – V:

Introduction to Air Conditioning: Psychometric Properties & Processes – Characterization of Sensible and latent heat loads — Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF, GSHF- Problems, Concept of ESHF and ADP.

Requirements of human comfort and concept of effective temperature - Comfort chart–Comfort Air conditioning – Requirements of Industrial air conditioning, Air conditioning Load Calculations.

UNIT – VI:

Air Conditioning Systems: Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, fans and blowers. Heat Pump – Heat sources – different heat pump circuits. Introduction to refrigeration and air-conditioning controls – basic elements of controls

TEXT BOOKS:

1. Refrigeration and Air Conditioning, C. P. Arora, Tata McGraw-Hill India
2. A Course in Refrigeration and Air Conditioning, S.C. Arora &Domkundwar, Dhanpat Rai, 1973

REFERENCES:

1. Refrigeration and Air Conditioning, Manohar Prasad, New Age
2. Principles of Refrigeration, Dossat, Pearson Education
3. Refrigeration and Air Conditioning, P.L.Ballaney
4. Basic Refrigeration and Air-Conditioning, Ananthanarayanan, TMH
5. Refrigeration and Air Conditioning, R.S. Khurmi& J.K. Gupta, S.Chand, Eurasia Publishing

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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	3	0	3

(18PE1ME07) OPERATIONS RESEARCH

COURSE PRE-REQUISITES: Mathematics, Industrial Engineering

COURSE OBJECTIVES:
- To analyze linear programming models in practical and their practical use
- To apply the Transportation, Assignment and sequencing models and their solution methodology for solving problems
- To apply the Theory of games, Replacement, Inventory and Queuing models and their solution methodology for solving problems
- To evaluate the Dynamic programming and simulation models

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze Assignment, Transportation, Sequencing, Replacement, Inventory and Queuing problems
CO-2: Apply Theory of games in various applications
CO-3: Evaluate the Problems using Linear Programming
CO-4: Apply dynamic programming problem solving and simulation models

UNIT – I:
Introduction: Origin, Development-Definition-Characteristics and Phases-Types of OR models- applications, limitations.
Allocation: Linear Programming Problem Formulation- Graphical solution-Simplex method-Artificial variables technique-Two phase method, Big-M Method-Duality Principle.

UNIT – II:
Transportation Problem: Formulation-Optimal solution-unbalanced transportation problem-Degeneracy. Assignment problem-Formulation-Optimal solution-Variations of Assignment Problem- Travelling Salesman Problem.

UNIT – III:
Sequencing: Introduction-Flow Shop sequencing-n jobs through two machines-n jobs through three machines-Job shop sequencing-two jobs through m machines.
Replacement: Introduction-Replacement of items that deteriorate with time-when money value is not counted and counted-Replacement of items that fail completely, group replacement.

UNIT – IV:
Theory of Games: Introduction-Minimax (maximin) - criterion and optimal strategy-Solution of games with saddle points-Rectangular games without saddle points-principles of dominance-M X 2and 2 X n games-graphical method.
Waiting Lines: Introduction-Single channel-Poisson arrivals-exponential service times-with infinite population and finite population models-Multichannel-Poisson arrivals-exponential service times with infinite population single channel Poisson arrivals.

UNIT – V:

Inventory: Introduction-Single item-Deterministic models-Purchase inventory models with one price break and multiple price breaks-shortages not allowed-Stochastic models-demand may be discrete variable or continuous variable-Instantaneous production, Instantaneous demand and continuous demand and no set up cost-single period model.

UNIT – VI:

Dynamic Programming: Introduction-Terminology-Bellman's Principle of optimality-Applications of dynamic programming- shortest path problem-linear programming problem.

Simulation: Definition-Types of simulation models-phases of simulation-applications of simulation- Inventory and Queuing Problems-Advantages and Disadvantages-Brief Introduction of Simulation Languages.

TEXT BOOKS:

1. Operations Research, J.K.Sharma, MacMilan
2. Operations Research, R. Pannerselvam, Prentice Hall International

REFERENCES:

1. Operations Research, A. M. Natarajan, P.Balasubramani, A.Tamilarasi, Pearson Education
2. Operations Research: Methods and Problems, Maurice Saseini, Arthur Yaspan and Lawrence Friedman
3. Introduction to OR, Taha, Prentice Hall International

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PE1ME08) FINITE ELEMENT METHOD

COURSE PRE-REQUISITES: Mathematics, Strength of Materials, Mechanical Vibrations

COURSE OBJECTIVES:
- To quote different concepts of traditional methods to evaluate FEM
- To summarize the boundary conditions, formulations and other functional approaches of FEM
- To demonstrate simulation process using FEM software
- To explain real life applications in dynamic analysis

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Name and tabulate various approaches leads to FEM to solve a given problem
CO-2: Describe the given problem for finding solution using finite element technique
CO-3: Apply the concept of FEM to solve different field problems
CO-4: Assess real life problems using dynamic analysis

UNIT – I:
Fundamental Concepts: Introduction; Historical background; Stresses and equilibrium; Boundary conditions; Strain displacement relations; Stress-strain relations; Temperature effects. ONE-DIMENSIONAL PROBLEMS: Introduction; Finite element modeling; Co-ordinates and shape functions; The potential energy approach; Rayleigh-Ritz method; Galerkin's method, The Galerkin approach; Assembly of the global stiffness matrix (K) and load vector; Properties of K; The finite element equations; Treatment of boundary conditions; Quadratic shape functions; Temperature effects.

UNIT – II:
Trusses: Introduction; Plane trusses; Three-dimensional trusses; Assembly of global stiffness matrix for the banded and skyline solutions.
Two-Dimensional Problems Using Constant Strain Triangles: Introduction; Finite element modeling; Constant strain triangle (CST); Problem modeling and boundary conditions.

UNIT - III:
Two-Dimensional Isoperimetric Elements and Numerical Integration: Introduction; The four-node quadrilateral; Numerical integration; Higher-order-elements. DYNAMIC ANALYSIS USING FINITE ELEMENT METHOD: Introduction; Vibration problems; Equations of motion based on weak form; Longitudinal vibrations of bars; consistent mass matrices; element equations; solution of Eigen value problems.

UNIT – IV:
Axisymmetric Solids Subjected to Axisymmetric Loading: Introduction; Axisymmetric formulation; Finite element modeling - triangular element; Problem modeling and boundary conditions.
Steady State Heat Transfer Analysis: One dimensional analysis of Slab, fin and two-dimensional analysis of thin plate.

UNIT – V:

Beams: Introduction; Finite element formulation; Hermite shape function, Load vector; Boundary considerations; Shear force and bending moment; Beams on elastic supports.

UNIT – VI:

Non-Linearity: Introduction, Non-linear problems, Geometric non-linearity, Non-linear dynamic problems, Analytical problems.

TEXT BOOKS:

1. Introduction to Finite Elements in Engineering, Tirupathi R. Chandrupatla, Ashok D. Belegundu, 2E, Prentice Hall of India
2. Textbook of Finite Element Analysis, Seshu

REFERENCES:

1. Finite Element Analysis using ANSYS 11.0, Srinivas et al.
2. Finite Element Method, Zienkiewicz
3. An Introduction to Finite Element Methods, J. N. Reddy
4. Finite Element Method, S. S. Rao

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

(18PE1ME09) MECHATRONIC SYSTEMS

COURSE PRE-REQUISITES: Analog and Digital Electronics, Control Power Systems, Instrumentation and Control system

COURSE OBJECTIVES:
- To design Mechatronics system and simulation for ergonomics and safety
- Theoretical and practical aspects of computer interfacing, real time data acquisition and control
- To design of motion control, motion converter and temperature control
- To realize the concepts of real time interfacing and data acquisition

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the basics and key elements of Mechatronics design process
CO-2: Familiar with basic system modeling
CO-3: Understand the concepts of engineering system and dynamic response of the system
CO-4: Understanding the concepts of design of Mechatronics system through case studies

UNIT – I:
Introduction to Design of Mechatronics System: Key elements – Mechatronics design process – design parameters – mechatronics and traditional design – Advanced approaches in mechatronics design – Introduction to industrial design, modelling, simulation and analysis – Ergonomics and safety.

UNIT – II:
Basic System Modelling: Introduction – model catagories – model development – Simulation using softwares – verification and validation – Mathematical modelling : Basic system modelling – mechanical electrical, fluid and thermal.

UNIT – III:
Mechatronic System Modelling: Engineering systems: Rotational – translational, electro-mechanical, pneumatic- mechanical, hydraulic-mechanical, micro electro mechanical system – Dynamic responses of system: first order, second order system – Performance measures

UNIT – IV:
Real Time Interfacing: Introduction – Selection of interfacing standards- elements of data acquisition and control systems – Overview of I/O process – general purpose I/O cards and its installation – Data conversion process – Application softwares – Man machine interface

UNIT – V:
Case Studies on Design of Mechatronics System: Motion control using DC Motor, AC Motor and Servomotor - Temperature control of hot/cold reservoir – Pick and place

robot – Car parking barriers – Motion and temperature control of washing machine – Auto focus camera, exposure control

UNIT -VI:

Robotic Vision System - Image Acquisition: Vidicon, charge coupled device (CCD) and charge injection device (CID) cameras. Image processing techniques: histogram processing: sliding, stretching, equalization and thresholding. Case studies of Mechatronics systems: Automatic camera, bar code reader, pick and place robot, automatic car park barrier system, automobile engine management system.

TEXT BOOKS:

1. Mechatronics System Design, DevdasShetty, Richard A. Kolk
2. Mechatronic Systems: Modelingand Simulation with HDL's, GeorgPelz, 2nd Edition, John Wiley and Sons Ltd., 2003

REFERENCES:

1. Mechatronics Handbook, Bishop, Robert H., CRC Press, 2002
2. Mechatronics: Electronics in Products and Processes, Bradley D.Dawson, N.C. Burd and A.J. Loader, CRC Press 1991, First Indian Print 2010
3. Mechatronics: A Foundation Course, De-Silva, Indian Reprint, Taylor & Francis, 2013

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

(18PE1ME10) UNCONVENTIONAL MACHINING PROCESSES

COURSE PRE-REQUISITES: Manufacturing Technology, Engineering Materials

COURSE OBJECTIVES:

- To know the importance of classification of various Non-Traditional machining processes and their applicability to various metals, non - metals & alloys
- To understand the working principles of mechanical energy based and spark energy-based material removal processes
- To remember the working principles of chemical and electro-chemical based material removal processes
- To remember the working principles of thermal energy-based material removal processes

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize various Non-Traditional machining methods which are applicable for difficult-to-cut materials, defense and aerospace sectors
CO-2: Analyze and decide the process parameters to be adopted and applicability of various materials that are suitable for mechanical energy and spark energy-based machining processes
CO-3: Analyze and decide the process parameters to be adopted and applicability of various materials that are suitable for chemical and electro-chemical energy-based machining processes
CO-4: Analyze and decide the process parameters to be adopted and applicability of various materials that are suitable for thermal based machining processes

UNIT – I:
Introduction: Unconventional Machining Process, Need, Classification, Brief overview of all techniques, Study of material removal phenomena.

UNIT – II:
Mechanical Energy Based Processes: Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining- Ultrasonic Machining (AJM, WJM, AWJM, USM). Working Principles – equipment used – Process parameters – MRR – Applications.

UNIT – III:
Electrical Energy Based Processes: Electric Discharge Machining (EDM) - working Principles-equipments-Process Parameters- MRR- electrodes Used – Power Circuits – Dielectric – Flushing – Applications, Wire Cut EDM- Applications

UNIT – IV:
Chemical and Electro-Chemical Energy Based Processes: Chemical Machining and Electro-Chemical machining (CHM and ECM)-Etchants- maskants -techniques of applying maskants-Process Parameters – MRR-Applications- Principles of ECM-equipments-MRR-Processes Parameters.

UNIT – V:

Thermal Energy Based Processes: Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining (EBM), Principles-Equipment-Process Parameters - Applications.

UNIT – VI:

Advanced Machining Processes: Magnetic abrasive finishing, Abrasive flow finishing, Electro stream drilling, shaped tube electrolyte machining.

TEXT BOOKS:

1. Advanced Machining Processes, Vijay K. Jain, Allied Publishers
2. Modern Machining Processes, P. C. Pandey, H. S. Shan, Tata McGraw-Hill Education

REFERENCES:

1. Nontraditional Manufacturing Processes, Benedict. G. F., Marcel Dekker
2. Advanced Methods of Machining, McGeough, Chapman and Hall, London
3. Unconventional Machining Processes, P. K. Mishra, Narosa

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC2ME08) MACHINE TOOLS AND METROLOGY LABORATORY

COURSE PRE-REQUISITE: Machine Tools, Metrology and Engineering Materials

COURSE OBJECTIVES:
- To learn the principles of various machine tools and their accessories
- To learn to grind the cutting tools on tool and cutter grinder
- To know various methods of measurements
- To know the thread profile and surface roughness profile measurement

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Perform operations on different Machine tools
CO-2: Knowledge of tool grinding using tool and cutter grinder
CO-3: Knowledge of different methods of Measurements in different machining operations
CO-4: Analyze the thread profile and surface roughness profile

LIST OF EXPERIMENTS:

MACHINE TOOLS:

Any FIVE experiments from the following
1. Exercise on Facing, turning, step turning and taper turning on lathe machine
2. Exercise on Grooving, Thread cutting and knurling on lathe machine
3. Exercise on Drilling, Counter sinking and Tapping operations on drilling machine
4. Exercise on Shaping to prepare plain surfaces
5. Exercise on Slotting to prepare keyway slot (internal/ external)
6. Exercise on Milling to perform plain /gear cutting
7. Exercise on Grinding of Tool angles
8. Exercise on Cylindrical Surface Grinding

METROLOGY:

Any FIVE experiments from the following
1. Measurement of lengths, heights, diameters by Vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators
3. Use of gear teeth, Vernier calipers and checking the chordal addendum and chordal height of spur gear
4. Use of spirit level in finding the flatness of surface plate
5. Thread measurement by two wire/ three wire method or tool makers' microscope
6. Tool makers microscope and its application
7. Angle and taper measurements by bevel protractor, sine bars, etc.
8. Surface roughness measurement
9. Machine tool alignment test on a lathe
10. Machine tool alignment test on a milling machine
11. Surface wear resistances test using electro spark coating device

REFERENCES:

1. Workshop Technology, W.A.J. Chapman (Parts I, II, and III), Viva Books
2. The Principles of Metallographic Laboratory Practice, George L. Kehl, McGraw-Hill

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC2ME09) CAD/CAM AND ROBOTICS LABORATORY

COURSE PRE-REQUISITES: CAD, CAM and SOM

COURSE OBJECTIVES:
- To understand the ways in which 2D sketches and 3D models – solid and surface are made using appropriate CAD packages
- To know the procedure of building assembly drawings and obtain drafted views from it
- To learn the part programming techniques in turning, milling and drilling operations.
- To understand the determination of stresses and strains in systems like trusses and beams
- To analyze the experiments for understanding the working of hydraulic, pneumatic, electric and electronic controls used in automation

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize the skills learnt in sketching and modeling using CAD packages
CO-2: Design product assemblies and obtain drafted views from it
CO-3: Produce components with different features using CNC machines and machining centers
CO-4: Analyze the stress and strain in various structures
CO-5: Create and analyze the hydraulic/pneumatic circuits

LIST OF EXPERIMENTS:

10 exercises from the following syllabus:

1. 2D Sketcher & 3D modeling using CATIA workbench – 1 exercise containing at least 3 drawings
2. Assembly and drafting – 1 exercise containing 2 assembly
3. Part programming for Turning, Facing, Grooving, Step turning, Taper turning operations
4. Part programming for Point-to-point motions, linear motions, Circular interpolation, Contour motion, Pocket milling, using Fixed or Canned Cycles
5. Determination of deflection and stresses in 2D objects
6. Determination of deflection and stresses in 3D objects
7. To develop circuit for single and double acting pneumatic cylinder using push button and lever type DCV's
8. To develop double acting hydraulic cylinder controlled by manually operated DCV using Automation studio and experiences it on trainer kit
9. To determine the torque vs. speed characteristics using VVVF Electrical drive system
10. Demonstration on PLC ladder logic with gates (AND, OR...etc.)
11. Simulation of Direct and inverse kinematics robot simulator
12. Experiment on open loop and closed loop control system

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

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

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize and synthesize information and produce technical writing that is required in academics as well as in the engineering profession
CO-2: Write covering letters, resume, SOP, Project Proposals and Technical Reports
CO-3: Speak fluently and address a large group of audience and participate in debates and discussions
CO-4: Negotiate terms, manage situations through interpersonal skills, persuade people and make quick decisions

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

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

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

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

UNIT – V:

Presentation Skills:

1. Oral Presentations
2. Powerpoint Presentations

UNIT – VI:

Report Writing:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PW4ME03) DESIGN THINKING

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

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

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

OPEN ELECTIVE COURSES

SMART CITIES

SMART CITIES

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

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

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

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

What is the concept of a smart city?

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

Growth in Global population continues to drive citizens from rural areas to cities. With rapid expansion of urban areas, cities need to become intelligent to handle this large scale urbanization. This is driving city operators to look at smarter ways to manage complexities, increase efficiencies and improve quality of life. Today we need cities that monitor& integrate infrastructure to better optimize resources while maximizing

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

Smart solutions

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

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

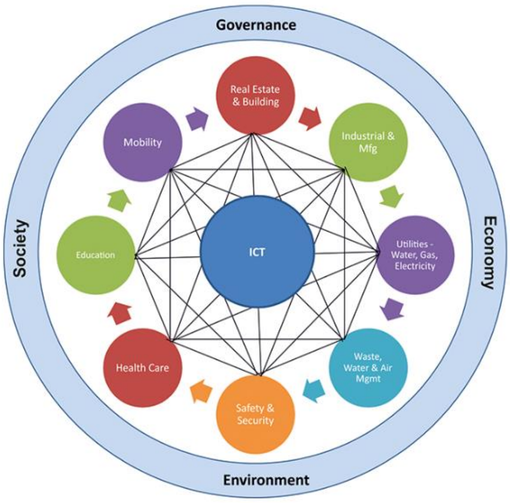
Advantages of a smart cities,

1. Promotion of mixed land usage resulting in higher efficiency and reduced wastage of land.
2. Expanded housing opportunities.
3. Reduced congestion, air pollution and resource depletion.
4. Helps to boost local economies by promoting localized trade and interactions.
5. Efficient use of public transport to reduce fuel wastage.

6. Safe and secure localities.
7. Preservation of open spaces.
8. Reduction in urban heating.
9. Promotion of transit-oriented development.
10. Making governance more people-friendly and cost-effective.

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

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



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

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

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

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

Conclusion

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1CE01) SMART CITIES PLANNING AND DEVELOPMENT

COURSE PRE-REQUISITES: None

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

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

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

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

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

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

- Advantage & limitation - Definition, Structure of Smart Grid- Indian Perspective- Advantage & limitation.

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

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1CE02) GREEN BUILDING TECHNOLOGY

COURSE PRE-REQUISITES: Smart Cities Planning and Development

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

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

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

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

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

UNIT – IV:

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

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1CE03) SMART MATERIALS AND STRUCTURES

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

COURSE OBJECTIVES:
- To introduce the students to various smart materials and their working principles
- To learn about various smart sensors, actuators and their application in structural health monitoring
- To acquire knowledge on different smart composite materials and their modelling concepts
- To learn about the advancements in the field of smart structures, materials and their application in engineering domain

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the different smart materials and their principles
CO-2: Identify suitable smart sensors and actuators for a specific engineering application
CO-3: Explainthe mechanics of smart composite materials
CO-4: Gain the knowledge on smart materials and smart structures

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

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

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

UNIT –IV:

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

UNIT-V:

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

UNIT –VI:

Applications to Engineering Domains – Case studies

TEXT BOOKS:

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

REFERENCES:

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

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

(18OE1CE04) INTELLIGENT TRANSPORTATION SYSTEM

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

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Differentiate different ITS user Services
CO-2: Apply ITS for road user safety
CO-3: Interpret importance of AHS in ITS
CO-4: Extend future research and special project

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

WASTE MANAGEMENT

WASTE MANAGEMENT

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

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

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

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

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

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1CE05) SOLID WASTE MANAGEMENT

COURSE PRE-REQUISITES: None

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the fundamental concepts of solid waste management
CO-2: Apply the acquired knowledge to resolve the practical problems on source reduction
CO-3: Apply the knowledge on collection, storage, transport and waste processing of solid waste in real time situation
CO-4: Impart the gained knowledge and skills and various laws & regulations on treatment of SW in real time societal problems

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

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

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

UNIT – IV:
Waste Processing Technologies: Objectives of waste processing – material separation and processing technologies – biological and chemical conversion technologies – methods and controls of Composting - thermal conversion technologies and energy recovery – incineration – solidification and stabilization of hazardous wastes-

treatment of biomedical wastes - Health considerations in the context of operation of facilities.

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(18OE1CE06) HAZARDOUS WASTE MANAGEMENT

COURSE PRE-REQUISITES: Solid Waste Management

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

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

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

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

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

UNIT – IV:

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

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1CE07) WASTE TO ENERGY

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

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

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

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

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

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

UNIT – IV:
Biological Conversion Technologies: Nutritional requirement for microbial growth – types of microbial metabolism – types of microorganisms – environmental requirements – aerobic biological transformation – anaerobic biological transformation – aerobic composting – low solid anaerobic digestion – high solid anaerobic digestion – development of anaerobic digestion processes and technologies for treatment of the organic fraction of MSW – Biodegradation and biodegradability of substrate; biochemistry and process parameters of biomethanation - other biological transformation processes.

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1CE08) INTELLIGENT WASTE MANAGEMENT SYSTEM AND RECYCLING SYSTEM

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

COURSE OBJECTIVES:
- To understand the concepts of Solid waste
- To understand the principle and process of IWMS Tools
- To understand the applications of IoT, ML, DL, BC and LCA & Carbon Footprint (CFP) based SWM
- To understand the principles of Process Systems Engineering (PSE) and various laws and regulation of SWM

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the fundamental concepts of Solid waste
CO-2: Apply the knowledge to resolve the practical problems with the help of IWMS Tools
CO-3: Apply the knowledge of IoT, ML, DL, BC and LCA & CFP to resolve the practical problems in SWM
CO-4: Impart the PSE knowledge and various laws and regulation to resolve the practical problems in SWM

UNIT – I:
Introduction to Solid Waste: Sources, Generation, Classification and Types of Solid Waste – Biomedical Waste – E-Waste – Construction and Demolition Waste – Plastic Waste – Batteries Waste – Hazardous Waste - Waste Management Through Waste Hierarchy: Reduce, Reuse, Recycle, Recover, and Disposal - Waste Operational Units: Equipment and Facilities: Collection and Transportation - Mechanical Treatment - Biological Treatment - Thermal Treatment – Disposal.

UNIT – II:
Introduction to IWMS Tools: Introduction – Need of the IWMS – functional elements of IWMS – Ultrasonic Sensor, Arduino Board, GSM Module, Bread Board, Power Supply (Battery) – Jump Wires - Navigation system – Cloud Services - Zero Waste Principle.

UNIT – III:
Applications in Intelligent Waste Management System: Introductory Applications of IoT, Machine Learning, Deep Learning and Block Chain Technology in Waste Characterization and Source Reduction, Storage, Collection and Transport of Wastes, Waste Processing Technologies and Waste Disposal.

UNIT – IV:
Life Cycle Assessment and Carbon-Footprint-Based IWMS: Phases of Life Cycle Assessment: Goal and Scope Definition - Life Cycle Inventory - Life Cycle Impact Assessment – Interpretation - LCA Waste Management Software - Umberto Software - SimaPro Software - LCA Assessment Methodology: Life Cycle Inventory Analysis - Life

Cycle Impact Assessment – Interpretation - Sensitivity Analysis - Carbon-Footprint-Based SWM - The Global-Warming Potential Impact - GHG Accounting - GWP Assessment for Solid Waste Management.

UNIT – V:

Principles of Systems Engineering: Systems Engineering Principles and Tools for SWM - Planning Regional Material Recovery Facilities - Optimal Planning for Solid Waste Collection, Recycling, and Vehicle Routing - Multiattribute Decision Making with Sustainability Considerations - Decision Analysis for Optimal Balance between Solid Waste Incineration and Recycling Programs - Environmental Informatics for Integrated Solid Waste Management - Future Perspectives.

UNIT – VI:

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

TEXT BOOKS:

1. Sustainable Solid Waste Management - A Systems Engineering Approach, Ni-Bin Chang and Ana Pires, IEEE & John Wiley & Sons, Inc., Hoboken, New Jersey, 2015
2. Integrated Solid Waste Management, George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, McGraw-Hill International Edition, New York, 1993

REFERENCES:

1. Manual on Municipal Solid Waste Management, CPHEEO, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2014
2. Smart Waste Management-Nutshell, Vishal Gupta, Amazon.com Services LLC, September 11, 2017
3. Recyclable Household Waste Management System for Smart Home in IOT, Manpreet Kaur & Dr. Kamaljit Singh Saini, Independently Published, June 12, 2018
4. GoI, Ministry of Environment and Forest and Climate Change, Various Recent Laws and Rules of Solid Waste Management

GREEN ENERGY

1. RENEWABLE ENERGY SOURCES

What we are studying?
The climate landscape is changing rapidly, and new technologies and solutions keep arising to respond to global and local challenges.
Renewable energy sources course makes you discover how Solar Thermal Energy conversion system works. It makes you understand how a Solar Photo voltaic generation system generates electricity. Scope of the course also includes wind energy generation. It also navigates you through Biomass and geo thermal energy generation systems.
Job opportunities:
When it comes to the hottest and most buzzing careers in the 21st century, the majority of people think of hardcore technical domains such as data science, machine learning & artificial intelligence. Few people might also come up with biotechnology (or biosciences). But, quite often people forget about one of the dark horses – the Renewable Energy sector. Even Bill Gates lobbied for the Energy sector as one of the top three career choices for making an impactful career.

Reference:
https://www.stoodnt.com/blog/careers-in-renewable-energy-job-opportunities-fields-of-study-and-top-universities/

2. RENEWABLE ENERGY TECHNOLOGIES

Within Crisis, there are seeds of opportunity..! We are at the wedge of fossil fuel end. After few years you can witness fuel crisis all over the world, as an engineer one must aware of the solution. To design sustainable systems those last for decades, one must use renewable energy as main or auxiliary source of energy. The application may be electrical or mechanical or chemical, one must convert energy from renewable source into electricity for ease of use.
Renewable Energy Technologies course will introduce you to Different types of Solar PV systems and their characteristics. Students will know the functionality of Power Converters such as Inverters etc., through block diagram approach. Fuel cell technology, which is one of the solutions for energy crisis will be discussed in detail. Course will conclude by discussing impact of PV panel production on environment and disposal of it.
Job Opportunities:
Green jobs in the renewable energy sector are expected to touch new figures with 6 digit monthly income. Following link may describe the interesting interdisciplinary careers for budding engineers.

Reference:
https://www.businessinsider.in/slideshows/miscellaneous/21-high-paying-careers-for-people-who-want-to-save-the-planet-and-also-have-job-security/slidelist/70677782.cms#slideid=70677804

3. ENERGY STORAGE TECHNOLOGIES

Battery technology is an essential skill for every engineer in present scenario. Course on energy storage technologies will enable student to, Design storage system Residential loads integrated to Renewable and storage systems for Electric Vehicles. It will make student to understand various electrochemical storages such as Lead acid, Li Ion cell etc. and their characteristics. The course enables student to compare non-electric, electric storage systems and analyze application of them to various domains.

Job opportunities:

Upon successful completion of course student will enhance the chances of getting into EV industry , which almost open fact. Job Profiles include

i. Battery algorithms engineer
ii. Battery management engineer
iii. Battery modeling expert
iv. Design engineer – EV

4. ENERGY MANAGEMENT AND CONSERVATION

Energy Management And Conservation course is mainly intended to monitor Energy consumption of industries and to manage energy systems. This course also deals with methods of improving efficiency of electric machinery and to design a good illumination system. It also teaches student calculate pay back periods for energy saving equipment.

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

(18OE1EE01) RENEWABLE ENERGY SOURCES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the role of solar power
- To know components of PV system conversion
- To learn Operation of windmills
- To understand the principle operation of biomass and geo thermal energy systems

COURSE OUT COMES: After completion of the course, the student should be able to
CO-1: Understand Solar Thermal Energy conversion systems
CO-2: Understand Solar Photo voltaic systems
CO-3: Analyze wind energy conversion system
CO-4: Understand the principle operation of Biomass and geo thermal energy systems

UNIT – I:
Principles of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sunshine, solar radiation data.

UNIT – II:
Solar Thermal Energy Conversion:
Solar Heating: Some basic calculations, The performance of solar heating devices, Available energy from the sun, The apparent motion of the sun, Evaluation of sunlight received by a collector, Flat solar panels - Different technologies of thermal solar collectors-Evaluation of the performance of solar collectors- Selective coatings for collectors and glazing, Solar heating systems -Individual and collective solar water heaters- Combined solar systems for the heating of buildings
Power Stations: Concentric Solar Power Plants- Concentrating systems- Components for production of heat and conversion into electricity

UNIT – III:
Solar PV Conversion: The PV Cell-Crystalline Solar cells-Thin film solar cell, Module, Array, Equivalent Electrical circuit, Open circuit voltage and Short circuit current, I-V, P-V Corves, Array design- Sun angle- effect of Temperature-Sun tracking, PV system components

UNIT – IV:
Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria, Maximum power Tracking of wind mills, Site selection of Wind mills, working Induction generator (Principle only)

UNIT – V:

Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.

UNIT – VI:

Geothermal & Ocean Energy: Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

TEXT BOOKS:

1. Non-Conventional Energy Sources, G. D. Rai, Khanna Publishers
2. Renewable Energies, John Claude Sabbonedere, ISTE & John Wiley Publishers, 2007
3. Renewable Energy Resources, Twidell& Wier, CRC Press (Taylor & Francis), 2016

REFERENCE:

1. Wind & Solar Power Systems, Mukund R. Patel, CRC Press, 2003

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

(18OE1EE02) RENEWABLE ENERGY TECHNOLOGIES

COURSE PRE-REQUISITES: Renewable Energy Sources

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Model, analyze and design various photovoltaic systems
CO-2: Know the feasibility of PV systems as an alternative to the fossil fuels
CO-3: Design efficient stand alone and grid connected PV and WEC power systems

UNIT – I:
Behavior of Solar Cells-Basic Structure and Characteristics: Types - equivalent circuit-modeling of solar cells including the effects of temperature, irradiation and series/shunt resistances on the open-circuit voltage and short-circuit current-Solar cell arrays- PV modules-PV generators- shadow effects and bypass diodes- hot spot problem in a PV module and safe operating area.

UNIT – II:
Types of PV Systems: Grid connected PV systems- Net-metering- Estimation of actual a.c. output power from PV systems
Stand-alone system- Approach to designing an off-grid PV system with battery- with battery and diesel generator- Stand-alone solar water pumping system- Sizing/designing PV water pumping system- Problems

UNIT – III:
Power Converters for PV and Wind: Basic switching devices, AC-DC Rectifier, DC-AC inverter (Basic operation), DC DC converter - Buck, Boost converters Basic operation, Battery charger (Basic operation), grid interface requirements in Renewable energy integration

UNIT – IV:
Maximum Power Point Tracking: Various Sources of Losses is PV system, Charge Control in Battery Backed PV Systems, Maximum Power Point Tracking (MPPT)- Role of DC-DC converter in MPP tracking- Perturb and Observe Method-pseudo program for P&O method, Advanced Issues & Algorithms- search steps-variable step size algorithm. Peak Power operation of Wind Energy conversion system.

UNIT – V:

Fuel Cell Technology: History of Fuel cells, Fuel Cell Vehicle Emissions, Hydrogen safety factors, Principle of Operation- Fuel cell Model- cell voltage, Power and efficiency of fuel cell, Various types of fuel cells, Various storage systems for Hydrogen, Applications

UNIT – VI:

Solar Thermal Electricity Generation: Sterling Engine, Solar Pond, Solar Chimney

Solar PV System Environment Impact: Potential Hazards in production of PV cell, Energy payback and CO2 emission calculations of PV systems, Procedure for decommissioning of PV plant, Future Trends of Wind Energy system

TEXT BOOKS:

1. Handbook of Renewable Energy Technology, Ahmed F. Zobaa, World Scientific Publishing Company, 2011
2. Wind and Solar Power Systems Design, Analysis, and Operation, Patel M. R., 2nd Edition, CRC Press, New York, 2005
3. Practical Handbook of Photovoltaics - Fundamentals and Applications, Augustin McEvoy, Tom Markvart, T. Markvart, L. Castaner, Elsevier Science, 2003

REFERENCE:

1. Electric Powertrain - Energy Systems, Power Electronics & Drives for Hybrid, Electric & Fuel Cell Vehicles, Goodarzi, Gordon A., Hayes, John G, John Wiley & Sons, 2018

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

(18OE1EE03) ENERGY STORAGE TECHNOLOGIES

COURSE PRE-REQUISITES: Renewable Energy Sources, Renewable Energy Technologies

COURSE OBJECTIVES:
- To understand Techno economic analysis of various storage systems
- To know Feasibility of different storage technologies
- To learn Operation of several electrochemical storage systems
- To understand Functionality of non-electric storage systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Design storage system Residential loads integrated to Renewable and storage systems for Electric Vehicles
CO-2: Understand various electrochemical storage system
CO-3: Understand terminology and characteristics of Electro chemical systems
CO-4: Compare non-electric and electric storage system
CO-5: Analyze application of storage systems to various domains

UNIT – I:
Techno-economic Analysis of Various Energy Storage Technologies: Electrical Energy Storage (EES)-Definition-Role, Energy storage components, Applications and Technical support, Financial Benefits of EES, Techno economic analysis, Classification of Energy Storage systems, Comparison

UNIT – II:
Estimation of Energy Storage and Feasibility Analysis: Background-Solar Power-Wind Power (Brief discussion), Estimation-daily residential load-daily available solar energy-daily available wind energy-Importance, Estimation of Storage sizing- Steps for Storage sizing- Grid connected residential PV-grid connected residential Wind-hybrid system, Feasibility analysis of Storage systems- Various Terms involved- Case study of comparison between Off grid and grid connected systems

UNIT – III:
Electro Chemical Storage: Standard Batteries- Lead Acid- VRLA - Ni-cd, Modern Batteries- Ni MH- Li Ion, Flow Batteries – Br2 Zn-Vanadium Redox, Battery composition, construction, Principle of operation, Types, Advantages and disadvantages to above batteries.

UNIT – IV:
Terminology & Characteristics: Battery Terminology, Capacities, Definitions of various characteristics, Different States of charge-DOD-SOC-SOE-SOH-SOF, Resistance, Battery Design, Battery Charging, Charge Regulators, Battery Management, General Equivalent Electrical Circuit, Performance Characteristics

UNIT – V:

Non-Electric Storage Technologies: Flywheel, Energy Relations, Flywheel System Components, Benefits of Flywheel over Battery, Superconducting Magnet Energy Storage, Compressed Air Energy storage, Overview Thermal Energy Storage. Capacitor bank storage, Comparison of storage Technologies

UNIT –VI:

Applications: Domains of applications of Energy storage- Starter-Traction-stationary-mobile or nomadic, Review of storage requirements, Storage for Electric Vehicle application, Storage for hybrid vehicle-Regenerative Braking-Super capacitor-hybrid capacitor

TEXT BOOKS:

1. Energy Storage Technologies and Applications, Ahmed Faheem Zobaa, InTech Publishers, 2013
2. Lithium Batteries and Other Electrochemical Storage Systems, Christian Glaize, Sylvie Geniès, ISTE & John Wiley, 2013
3. Wind and Solar Power Systems, Mukund R. Patel, 2nd Edition, CRC Press, 2006

REFERENCES:

1. Rechargeable Batteries Applications Handbook, EDN Series for Design Engineers, Elsevier

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

(18OE1EE04) ENERGY MANAGEMENT AND CONSERVATION

COURSE PRE-REQUISITES: Renewable Energy sources, Renewable Energy Technologies, Energy Storage Technologies

COURSE OBJECTIVES:
- To understand the necessity of conservation of Energy
- To Know the methods of Energy management
- To identity the factors to increase the efficiency of electrical equipment
- To know the benefits of carrying out energy Audits

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: To conduct Energy Audit of industries
CO-2: To manage energy Systems
CO-3: To specify the methods of improving efficiency of electric motor
CO-4: To improve power factor and to design a good illumination system
CO-5: To calculate pay back periods for energy saving equipment

UNIT – I:
Basic Principles of Energy Audit: Energy audit- definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit

UNIT – II:
Energy Management: Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting- Energy manager, Qualities and functions, language, Questionnaire - check list for top management

UNIT – III:
Energy Efficient Motors: Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed, variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit

UNIT – IV:
Power Factor Improvement, Lighting and Energy Instruments: Power factor – methods of improvement, location of capacitors, p.f with non-linear loads, effect of harmonics on p.f., p.f motor controllers – simple problems
Lighting Energy Audit and Energy Instruments: Good lighting system design and practice, lighting control, lighting energy audit - Energy Instruments- watt meter, data loggers, thermocouples, pyrometers, flux meters, tongue testers, application of PLC's

UNIT – IV:

Economic Aspects and Analysis: Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis.

UNIT – VI:

Analysis of Energy Efficient Motor: Energy efficient motors- calculation of simple payback method, net present worth method- Power factor correction, lighting - Applications of life cycle costing analysis, return on investment.

TEXT BOOKS:

1. Energy Management, W. R. Murphy & G. Mckay, Butterworth-Heinemann Publications
2. Energy Management, Paul o' Callaghan, 1st Edition, McGraw-Hill Book Company, 1998

REFERENCES:

1. Energy Efficient Electric Motors, John C. Andreas, 2nd Edition, Marcel Dekker Inc. Ltd., 1995
2. Energy Management Handbook, W. C. Turner, John Wiley and Sons
3. Energy Management and Good Lighting Practice: Fuel Efficiency Booklet12-EEO

3D PRINTING AND DESIGN

3D PRINTING AND DESIGN

3D Printing is a process for making a physical object from a three-dimensional digital model by laying down many successive thin layers of a material. It brings a digital CAD model into its physical form by adding layer by layer of materials. Thus called 'Additive Manufacturing'. It is the opposite of subtractive manufacturing i.e., removing material from an object using a mechanical machine. It enables to produce complex shapes using less material than traditional manufacturing methods. There are several different techniques to 3D print an object. It saves time through prototyping and is also responsible for manufacturing impossible shapes. Due to these, it has many applications in different fields like consumer products (eyewear, footwear, design, furniture, industrial products (manufacturing tools, prototypes, functional end-use parts, dental products, prosthetics, architectural scale models, reconstructing fossils, replicating ancient artefacts, reconstructing evidence in forensic pathology etc.

3D printing has good prospects from career perspective. Various positions that could be available are CAD designers, engineers, technical developers, software developers, electronics engineers, etc.

This OE track consists of 04 courses and is designed with an objective to provide an overview of all the constituents of 3D Printing starting from elements of CAD that are needed to create CAD models, followed by basics of 3D Printing required for setting the parameters, then the machines and tools used in 3D Printing for thorough understanding of systems and processes and finally the reverse engineering of 3D printing models from actual objects.

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

(18OE1ME01) ELEMENTS OF CAD

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand the basics of CAD and devices used
- To know the various types of modeling used in CAD
- To appreciate the concept of feature-based modeling and geometric transformations
- To comprehend the assembly modeling procedure and data exchange formats

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Know the fundamentals of CAD and devices used
CO-2: Identify the types of CAD modeling techniques and utilize them
CO-3: Evaluate the objects or models using geometric transformations and manipulations
CO-4: Perform the assembly modeling and asses the various data exchange formats

UNIT – I:
Fundamentals of CAD: Introduction to Computer Aided Design (CAD), Design process, Application of computers for Design and Manufacturing, Benefits of CAD, Brief overview of computer peripherals for CAD.

UNIT – II:
Geometric Modeling: Introduction to Geometric Model, Types of modeling, Curve representation
Wireframe Modeling: Introduction, advantages, limitations and applications, Wire frame entities-analytic and synthetic, Basic definitions of Cubic, Bezier and B-spline curves

UNIT – III:
Surface Modeling: Introduction, advantages, limitations and applications, surface entities, Basic definitions of analytic surfaces - planar surface, ruled surface, tabulated cylinder, surface of revolution; Basic definitions of synthetic surfaces - Bezier surface, B-spline surface

UNIT – IV:
Solid Modeling: Introduction, advantages, limitations and applications, Solid Entities, Solid Representation schemes – Boundary Representation (B-Rep) scheme, Constructive Solid Geometry (CSG) scheme.
Feature-based Modeling: Introduction, Feature entities, Feature representation, 3D Sketching, Parameter, Relations and Constraints

UNIT – V:

Geometric Transformations: Introduction to 2D & 3D transformations, Brief treatment on Translation, Scaling, Reflection and Rotation using Homogeneous and concatenated transformations

Manipulations: Displaying, Segmentation, Trimming, Intersection, Projection

UNIT – VI:

Assembly Modeling: Introduction, Assembly modeling, Assembly Tree, Mating Conditions, Bottom-up and Top-down approach

Product Data Exchange: Introduction, Graphics Standards, Types of translators, Importance of formats in 3D Printing, Data exchange formats - IGES, STEP and STL

TEXT BOOKS:

1. CAD/CAM Theory and Practice, Ibrahim Zeid, Tata McGraw-Hill
2. Mastering CAD/CAM, Ibrahim Zeid, Tata McGraw-Hill
3. CAD/CAM-Computer Aided Design and Manufacturing, Mikell P. Groover, E.W. Zimmers, Pearson Education/Prentice Hall

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

(18OE1ME02) INTRODUCTION TO 3D PRINTING

COURSE PRE-REQUISITES: Elements of CAD

COURSE OBJECTIVES:
- To understand the need of 3D Printing
- To understand about the process chain involved in 3D Printing
- To know about the two-dimensional layer by layer techniques, solid based systems & 3D Printing data exchange formats
- To know the post processing methods involved in 3D Printing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize the importance of 3D Printing
CO-2: Explain the process chain involved in 3D Printing
CO-3: Explain about two-dimensional layer-by-layer techniques, solid based systems and 3D printing data exchange formats
CO-4: Apply the knowledge gained in the post-processing methods

UNIT – I:
Introduction to 3D Printing: Introduction to 3D Printing, 3D Printing evolution, Classification of 3D Printing, Distinction between 3D Printing & CNC Machining, Advantages of 3D Printing

UNIT – II:
Generalized 3D Printing Process Chain: Process chain, Materials for 3D Printing, Design for 3D Printing and Overview of Medical Modeling& Reverse Engineering.

UNIT – III:
Two-Dimensional Layer-By-Layer Techniques: Stereolithography (SL), Selective Laser Sintering (SLS), Selective Powder Building (SPB), Advantages and Applications.

UNIT – IV:
Solid Based Systems: Introduction, basic principles, Fused Deposition Modeling, Multi-Jet Modeling, Laminated Object Manufacturing (LOM), Advantages and Applications.

UNIT – V:
3D Printing Data Exchange Formats: STL Format, STL File Problems, Brief Overview of other translations like IGES File, HP/GL File and CT data only.

UNIT – VI:
Post-Processing: Introduction, Support Material Removal, Surface Texture Improvements, Accuracy Improvements, Aesthetic Improvements.

TEXT BOOKS:

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W. Rosen, Brent Stucker, Springer, 2010
2. Rapid Prototyping: Principles & Applications, Chuaa Chee Kai, Leong Kah Fai, World Scientific, 2010

REFERENCES:

1. Rapid Prototyping: Theory and Practice, Ali K. Karmani, EmandAbouel Nasr, Springer, 2006
2. Understanding Additive Manufacture: Rapid Prototyping, Rapid Tooling and Rapid Manufacture, Andreas Gebhardt, Hanser Publishers, 2013
3. Rapid Manufacturing: Advanced Research in Virtual and Rapid Prototyping, Hopkinson, N. Haque, and Dickens, Taylor and Francis, 2007

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

(18OE1ME03) 3D PRINTING-MACHINES, TOOLING AND SYSTEMS

COURSE PRE-REQUISITES: Elements of CAD, Introduction to 3D Printing

COURSE OBJECTIVES:
- To understand the need of prototyping
- To understand about the liquid and solid based 3D printing systems
- To know about the liquid-based 3D printing systems & rapid tooling
- To know the applications of 3D Printing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize the importance of 3D Printing
CO-2: Explain the process involved in liquid and solid based 3D printing systems
CO-3: Explain about the liquid-based 3D printing systems and rapid tooling
CO-4: Adapt the knowledge gained in applications of 3D Printing

UNIT – I:
Introduction: Prototype Fundamentals, Types of Prototypes, Roles of Prototypes, Phases of Development Leading to Rapid Prototyping, Fundamentals of Rapid Prototyping.

UNIT – II:
Liquid Based 3D Printing Systems: Introduction, Principles, Processes and Applications of Solid Ground Curing, Material Jetting & Binder Jetting

UNIT – III:
Solid Based 3D Printing Systems: Introduction, Principles, Processes and Applications of Fused Deposition Modelling (FDM), Paper Lamination Technology (PLT) and Laminated Object Manufacturing (LOM)

UNIT – IV:
Laser Based 3D Printing Systems: Selective Laser Sintering (SLS)-Principle, Process and Applications, Three-Dimensional Printing- Principle, Process and Applications, Laser Engineered Net Shaping (LENS)- Principle, Process and Applications

UNIT – V:
Rapid Tooling: Introduction and need for Rapid Tooling, Overview of Indirect and Direct Processes, Applications

UNIT – VI:
3D Printing Applications: Brief overview of Applications in Design, Engineering, Aerospace Industry, Automotive Industry and Biomedical Industry

TEXT BOOKS:
1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W. Rosen, Brent Stucker, Springer, 2010

2. Rapid Prototyping: Principles & Applications, Chuaa Chee Kai, Leong Kah Fai, World Scientific, 2010

REFERENCES:

1. Rapid Prototyping: Theory and Practice, Ali K. Karmani, EmandAbouel Nasr, Springer, 2006
2. Understanding Additive Manufacture: Rapid Prototyping, Rapid Tooling and Rapid Manufacture, Andreas Gebhardt, Hanser Publishers, 2013
3. Rapid Manufacturing: Advanced Research in Virtual and Rapid Prototyping, Hopkinson, N. Haque, and Dickens, Taylor and Francis, 2007

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

(18OE1ME04) REVERSE ENGINEERING

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

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

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

UNIT-I:
Introduction to Reverse Engineering: Need, Definition, The Generic Process, History of Reverse Engineering, Scopeand tasks of RE, Domain analysis, Overview of Applications

UNIT-II:
Methodologies and Techniques: Potential for Automation with 3-D Laser Scanners, Computer-aided (Forward) Engineering, Computer-aided Reverse Engineering, Computer Vision and Reverse Engineering

UNIT-III:
Data Acquisition Techniques: Contact Methods- Coordinate Measurement Machine and Robotic Arms; Noncontact Methods- Triangulation, and Structured Light, Destructive Method; Issues involved in data acquisition techniques

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

UNIT-V:
Segmentation: Definition and need, Methods for segmentation -Edge based and face based.
Integration Between Reverse Engineering and Additive manufacturing: Modeling Cloud Data, Integration of RE and AM for Layer-based Model Generation, Adaptive Slicing Approach for Cloud Data Modeling, Planar Polygon Curve Construction for a Layer, Determination of Adaptive Layer Thickness

UNIT-VI:
Applications: Automotive, Aerospace, Medical sectors
Legal Aspects: Copyright Law, Reverse Engineering, Recent Case Law Barriers in adopting RE

TEXT BOOKS:

1. Reverse Engineering: An Industrial Perspective, V. Raja and K. Fernandes, Springer-Verlag
2. Reverse Engineering, K. A. Ingle, McGraw-Hill
3. Reverse Engineering, L. Wills and P. Newcomb, 1st Edition, Springer-Verlag

REFERENCES

1. Smart Product Engineering, Michael Abramovici, Rainer Stark, Springer Berlin Heidelberg
2. Product Design: Techniques in Reverse Engineering and New Product Development, K. Otto and K. Wood, Prentice Hall, 2001

INTERNET OF THINGS

INTERNET OF THINGS

Internet of Things: The IoT creates opportunities for more direct integration of the physical world into computer-based systems, resulting in efficiency improvements, economic benefits, and reduced human exertions. *IoT* **is changing how we live, work, travel, and do business. It is even the basis of a new industrial transformation, known as** Industry 4.0**, and key in the** digital transformation **of organizations, cities, and society overall.** The IoT track helps students to learn about how to

- Learn different protocols and connectivity technologies used in IOT.
- Expose the various sensors and transducers for measuring mechanical quantities.
- Develop simple applications using 8051 microcontrollers.
- Understand the key routing protocols for sensor networks and their design issues.

Some of the more common career paths in the Internet of Things path are

- IoT Developer. ...
- IoT Architect…
- IoT Embedded Systems Designer…
- IoT Solutions Engineer…
- Professional in Sensors and Actuators…
- Embedded Programs Engineer…
- Safety Engineer…

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

(18OE1EC01) SENSORS TRANSDUCERS AND ACTUATORS

COURSE PRE-REQUISITES: Engineering Physics, Electronic Measuring Instruments

COURSE OBJECTIVES:

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Familiar with classification and characteristics of various sensors and transducers
CO-2: Familiar with the principle and working of various sensors and transducers
CO-3: Familiar with the principle and working of various actuators
CO-4: Able to select proper Transducer / Sensor for a specific measurement application
CO-5: Able to select proper Actuator for a specific measurement application

UNIT – I:
Primary Sensing Elements and Transducers: Mechanical devices as primary detectors, mechanical spring devices, pressure sensitive primary devices, flow rate sensing elements, Transducers-electrical Transducers, classification of Transducers, characteristics and choice of Transducers, factors influencing the choice of Transducers.

UNIT – II:
Electric Transducers: Resistive transducers, Potentiometers, Strain gauges, Types of Strain gauges, Resistance thermometers, Thermistors, Thermocouples, variable Inductance Transducers, Linear Variable Differential Transformer, Synchros, Resolvers, Capacitive Transducers, Piezo electric Transducers.

UNIT – III:
Magnetic and Optical Transducers: Hall Effect Transducers, Magneto resistors, Magneto-Elastic and Magneto-Strictive Transducers, Opto electronic Transducers, Digital Encoding Transducers, Photo Optic Transducers.

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

UNIT – V:

Mechanical and Electrical Actuators: Mechanical Actuation Systems-Types of motion, Kinematic chains, Cams, Gears, Ratchet and pawl, Belt and chain drives, Bearings, Mechanical aspects of motor selection, Electrical Actuation Systems, Electrical systems, Mechanical switches, Solid-state switches, Solenoids, D.C. Motors, A.C. Motors, Stepper motors.

UNIT – VI:

Pneumatic and Hydraulic Actuators: Pneumatic and Hydraulic Actuation Systems-Actuation systems, Pneumatic and hydraulic systems, Directional Control valves, Pressure control valves, Cylinders, Servo and proportional control valves, Process control valves, Rotary actuators.

TEXT BOOKS:

1. A Course in Electrical and Electronic Measurements and Instrumentation, A. K. Sawhney, Puneet Sawhney,19th Edition, 2011
2. Sensors and Transducers, D. Patranabis, 2nd Edition, PHI Learning Private Limited, 2013
3. Mechatronics, W. Bolton, 7th Edition, Pearson Education Limited, 2018

REFERENCES:

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

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

(18OE1EC02) INTRODUCTION TO MICROCONTROLLER AND INTERFACING

COURSE PRE-REQUISITES: Sensors Transducers and Actuators

COURSE OBJECTIVES:
- To differentiate various number systems
- To understanding programming concepts
- To develop simple applications using 8051 microcontrollers

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand basic computing concepts
CO-2: Know architecture of 8051 microcontrollers
CO-3: Program internal resources of 8051 microcontroller
CO-4: Interface peripherals to 8051 microcontroller

UNIT – I:
Introduction to Computing: Numbering and Coding Systems: Binary, Decimal, Hexadecimal and conversions, Binary and Hexadecimal Arithmetic, Complements, Alphanumeric codes. Digital Premier, Inside the Computer

UNIT – II:
Embedded System Design: Embedded system - Definition, Characteristics of embedded computing applications, Design challenges, Requirements, Specification, Architecture design, Designing hardware and software components, system integration, Design example: Model train controller.

UNIT – III:
8051 Microcontroller: Microcontrollers and Embedded Processors, Architecture and Programming Model of 8051, Special Function Register formats, Memory Organization, Timers and Counters- Operating modes, Serial port, Interrupts

UNIT – IV:
8051 Programming in C: Data types, software delay generation, Logical operations, Accessing code and data space in 8051, I/O port programming, Timer/counter programming.

UNIT – V:
8051 Programming: Serial IO modes and their programming in C, interrupts programming in C: serial, timer and external interrupts.

UNIT – VI:
Introduction to Arduino: Features of Arduino, Arduino components and IDE, Interfacing: Seven Segment Display, Pulse Width Modulation, Analog Digital Converter, Wireless connectivity to Arduino. Case study: From BT To WiFi: Creating WiFi Controlled Arduino Robot Car.

TEXT BOOKS:

1. The 8051 Microcontroller: Programming, Architecture, Ayala &Gadre, Cengage Publications 3rd Edition, 2008
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. McKinlay, 2nd Edition, 2005

REFERENCES:

1. Digital Design, Morris Mano, PHI, 3rd Edition, 2006
2. Embedded Systems: Architecture, Programming and Design, 2nd Edition, TMH

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

(18OE1EC03) IOT PROTOCOLS AND ITS APPLICATIONS

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

COURSE OBJECTIVES:
- To understand the basics of Internet of Things and Cloud of things
- To learn different protocols and connectivity technologies used in IOT
- To understand various IoT platforms
- To learn different applications with IoT

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the concepts of Internet of Things and Cloud of things
CO-2: Analyze various protocols for IoT
CO-3: Apply IOT to different applications in the real world

UNIT – I:
Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Deployment Templates, M2M, IoT vs M2M.

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

UNIT – III:
Connectivity Technologies: IEEE802.15.4, ZIGBEE, 6LOWPAN, Wireless HART, Z-Wave, Bluetooth, NFC, RFID.
Prototyping Embedded Device: Sensors, Actuators, Embedded computing Basics, System on chips.

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

UNIT – V:
Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

UNIT – VI:

Domain Specific Applications of IoT: IoT Design Methodology, Applications of IoT– Home, Health, Environment, Energy, Agriculture, Industry and Smart City.

TEXT BOOKS:

1. Internet of Things: A Hands-On Approach, Vijay Madisetti, ArshdeepBahga, 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, WimerHazenberg, Menno Huisman, BIS Publishers, 2011
3. Designing the Internet of Things, Adrian Mcewen, HakinCassimally, John Wiley and Sons, 2015

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

(18OE1EC08) WIRELESS SENSOR NETWORKS

COURSE PRE-REQUISITES: Sensors Transducers and Actuators, Introduction to Microcontrollers and Interfacing, IoT Protocols and its applications

COURSE OBJECTIVES:
- To expose basic concepts of wireless sensor network technology
- To study medium access control protocols and various issues in a physical layer
- To understand the key routing protocols for sensor networks and their design issues
- To understand sensor management in networks and design requirements

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Appreciate various design issues of wireless sensor networks
CO-2: Understand the hardware details of different types of sensors and select the application specific sensor
CO-3: Understand radio standards and communication protocols to be used for wireless sensor networks

UNIT – I:
Introduction: Overview of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.

UNIT – II:
Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (Operating Systems): TinyOS, MANTIS, Contiki, and RetOS.

UNIT – III:
Programming Tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet, NetSim)

UNIT – IV:
Overview of Sensor Network Protocols (Details of at least 2 important protocol per layer): Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi- hop and cluster-based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

UNIT – V:
Data Dissemination and Processing: Differences compared with other database management systems, Query models, In-network data aggregation, data storage; query processing.

UNIT – VI:

Specialized Features: Energy preservation and efficiency; security challenges; Fault tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

TEXT BOOKS:

1. Wireless Sensor Networks Technology, Protocols, and Applications, Kazem Sohraby, Daniel Minoli, TaiebZnati, 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**

(18OE1EC04) INTRODUCTION TO C-SHARP

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand the foundations of CLR execution
- To learn the technologies of the .NET framework and object-oriented aspects of C#
- To be aware of application development in .NET
- To learn web-based applications on .NET (ASP.NET)

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain how C# fits into the .NET platform
CO-2: Analyze the basic structure of a C# application
CO-3: Develop programs using C# on .NET
CO-4: Design and develop Web based applications on .NET

UNIT – I:
Introduction to C#: Introducing C#, Understanding .NET, overview of C#, Literals, Variables, Data Types, Operators, checked and unchecked operators, Expressions, Branching, Looping, Methods, implicit and explicit casting, Constant, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing.

UNIT – II:
Object Oriented Aspects of C#: Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism, sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, events, errors and exception, Threading.

UNIT – III:
Application Development on .NET: Building windows application, Creating our own window forms with events and controls, menu creation, inheriting window forms, SDI and MDI application, Dialog Box (Modal and Modeless), accessing data with ADO.NET, DataSet, typed dataset, Data Adapter, updating database using stored procedures

UNIT – IV:
SQL Server with ADO.NET, handling exceptions, validating controls, windows application configuration.

UNIT – V:
Web Based Application Development on .NET: Programming web application with web forms, ASP.NET introduction, working with XML and .NET, Creating Virtual Directory and Web Application, session management techniques, web.config, web services, passing datasets, returning datasets from web services, handling transaction, handling exceptions, returning exceptions from SQL Server.

UNIT – VI:

CLR and .NET Framework: Assemblies, Versoning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, remoting, security in .NET

TEXT BOOKS:

1. The Complete Reference: C# 4.0, Herbert Schildt, Tata McGraw-Hill, 2012
2. Professional C# 2012 with .NET 4.5, Christian Nagel et al. Wiley India, 2012

REFERENCES:

1. Pro C# 2010 and the .NET 4 Platform, Andrew Troelsen, 5th Edition, A Press, 2010
2. Programming C# 4.0, Ian Griffiths, Matthew Adams, Jesse Liberty, 6th Edition, O"Reilly, 2010

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

(18OE1EC05) INTRODUCTION TO SIGNAL PROCESSING

COURSE PRE-REQUISITES: Introduction to C Sharp

COURSE OBJECTIVES:
- To understand various fundamental characteristics of signals and systems
- To analyze signals in frequency domain
- To know principles of signal transmission through systems
- To understand fundamentals of digital signal

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Classify signals and implement various operations on signals
CO-2: Analyze the characteristics of signals and systems
CO-3: Understand the basics of filter design
CO-4: Appreciate the processes of Multirate systems

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

UNIT – II:
Representation of Systems: Classification of discrete time Systems, impulse response, Concept of convolution in time domain and frequency domain, response of a linear system, System function, Signal bandwidth, system bandwidth. Ideal filter characteristics.

UNIT – III:
Sampling Theorem: Representation of continuous time signals by its samples - Sampling theorem – Reconstruction of a Signal from its samples, aliasing
Z –Transform: Basic principles of z-transform, region of convergence, properties of ROC, Inverse z-transform using Partial fraction.

UNIT – IV:
Introduction to Digital Signal Processing: Applications of Z-Transforms- Solution of Linear Constant Coefficient Difference equations (LCCD), System function, Frequency Response of the system.

UNIT – V:
Discrete Fourier Transforms: Circular convolution, Comparison between linear and circular convolution, Computation of DFT.
IIR Digital Filters: Design of IIR Digital filters (H(s) to be given) - Impulse invariance transformation techniques, Bilinear transformation method.

UNIT – VI:

FIR Digital Filters: Characteristics of linear phase FIR filters and its frequency response, Comparison of IIR and FIR filters. Design of FIR filters using Fourier Method and Windowing Technique (only Hanning).

Realization of IIR and FIR Filters: Direct and Cascade forms.

TEXT BOOKS:

1. Signals, Systems and Communications, B. P. Lathi, BS Publications, 2009
2. Signals and Systems, Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, 2nd Edition, PHI
3. Digital Signal Processing: Principles, Algorithms and Applications, John G. Proakis, D.G. Manolakis, 4th Edition, Pearson/PHI, 2009

REFERENCES:

1. Signals and Systems, Simon Haykin and Barry Van Veen, 2nd Edition, John Wiley
2. Signals, Systems and Transforms, C. L. Philips, J. M. Parr and Eve A. Riskin, 3rd Edition, Pearson, 2004
3. Signals and Systems, Schaum's Outlines, Hwei P. Hsu, Tata McGraw-Hill, 2004
4. Digital Signal Processing – A Practical Approach, Emmanuel C. Ifeacher, Barrie W. Jervis, 2nd Edition, Pearson Education

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

(18OE1EC06) INTRODUCTION TO IMAGE AND VIDEO PROCESSING

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

COURSE OBJECTIVES:

- To introduce fundamentals of digital image and video processing
- To demonstrate digital signal processing techniques in spatial and frequency domains
- To study and compare various image and video compression algorithms
- To study applications of motion estimation in video processing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire, represent the digital image and transforms
CO-2: Apply various pixel position and intensity-based image processing techniques
CO-3: Understand and analyze the performance of block matching algorithms in MPEG video coding standards

UNIT – I:
Fundamentals of Image Processing and Image Transforms: Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels, 2 – D Discrete Fourier Transform, Discrete Cosine Transform, Introduction to Wavelet transforms.

UNIT – II:
Image Enhancement-Spatial Domain Methods: Point Processing, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters.

UNIT – III:
Image Enhancement-Frequency Domain Methods: Basics of filtering in frequency domain, Image Smoothing, Image Sharpening, Selective Filtering.
Image Segmentation: Segmentation Concepts, Point, Line and Edge Detection, Thresholding, Region Based Segmentation.

UNIT – IV:
Image Compression: Image compression fundamentals – coding Redundancy, spatial and temporal redundancy.
Compression Models: Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding.

UNIT – V:
Basic Steps of Video Processing: Analog video, Digital Video, Time varying Image Formation models: 3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals.

UNIT – VI:

2-D Motion Estimation: Optical flow, pixel-based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Application of motion estimation in video coding.

TEXT BOOKS:

1. Digital Image Processing, Gonzaleze and Woods, 3rd Edition, Pearson
2. Video Processing and Communication, Yao Wang, JoemOstarmann 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**

(18OE1EC07) APPLICATIONS OF AR AND VR

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

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

- A review of current Virtual Reality (VR) and Augmented Reality (AR) technologies
- The fundamentals of VR/AR modeling and programming
- Provides a detailed analysis of engineering scientific and functional aspects of VR/AR

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire knowledge in main applications VR / AR technologies
CO-2: Analyze different tools for VR/AR applications
CO-3: Developing VR/AR applications

UNIT – I:
Augmented Reality and Virtual Reality:
Augmented Reality: Introduction to Augmented Reality (AR), Fundamentals, Chronicle order of AR, features
Virtual Reality: Introduction to Virtual Reality (VR), Features of VR and Chronicle order of VR; Difference between AR and VR.

UNIT – II:
Types of Augmented Reality: Marker based AR, Marker less AR, Projection based AR, Super Imposition based AR, Applications of AR.

UNIT – III:
Types of Virtual Reality: Non- immersive simulation, Semi-immersive simulations, Fully immersive simulations; Applications VR.

UNIT – IV:
Making an AR App with Simple CUBE: Introduction to Unity, Installation steps, Fundamentals while implementing Project, importing a cube, Create an account in Vuforia, license manager, target manager, downloading database and uploading target database in unity.

UNIT – V:
AR App with Interaction: Introduction to C#, Scripting interactive objects, implementation C# Script using unity, uploading target object, deploying application into ANDROID Device.

UNIT – VI:

Creating an Virtual Reality: Creating an Virtual Reality Scene in unity, adding colliders, Settings of Unity to make the application compatible with Google cardboard.

TEXT BOOKS:

1. Virtual Reality & Augmented Reality in Industry, Ma D., Gausemeier J., Fan X., Grafe M. (Eds.) Springer, 2011

REFERENCES:

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

ADDITIONAL RESOURCES:

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

ARTIFICIAL INTELLIGENCE

ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) is a cognitive science with highly research activities in the major areas like Machine Learning, Robotics, Natural Language Processing and image processing. This track will cover basic foundations of artificial intelligence it will make the students industry-ready for artificial intelligence and data science job roles. Artificial intelligence is used in wide range of industrial applications such as healthcare, transportation, entertainment, insurance, transport and logistics, and customer service.

Future applications of AI would be utilized in automated transportation, cyborg technology, solving problems associated with climate change, deep-sea and space exploration.

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

(18OE1MT02) MATHEMATICS FOR ARTIFICIAL INTELLIGENCE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce the basic concepts of probability and matrices in the field of Artificial Intelligence
- To identify, explore the complex problem-solving strategies
- To develop problem solving skills related to algorithmic analysis required for AI
- To apply and build mathematical model to solve real-world problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explore and demonstrate practical approaches related to implementation of the AI algorithms using probability concepts
CO-2: Formulate and solve the Artificial intelligence related problems by using the knowledge of matrices and vectors
CO-3: Demonstrate the understanding of mathematical ideas from artificial intelligence perspective and machine learning
CO-4: Analyze and solve the complexity of a given problem with suitable optimization techniques

UNIT – I:
Probability: Basic rules and axioms, events, sample space, frequentist approach, dependent and independent events, conditional probability, Random variables, continuous and discrete, expectation, variance, distributions - joint and conditional, Bayes' theorem, Popular distributions - Bernoulli, Binomial, Poisson, Normal.

UNIT – II:
Descriptive Statistics & Linear Regression: Classification and tabulation of univariate data, graphical representation, Frequency curves. Descriptive measures - Central tendency and Dispersion. Simple Linear Regression Models.

UNIT – III:
Vector Space: Vectors, definition, scalars, addition, scalar multiplication, inner product (dot product), vector projection, cosine similarity, orthogonal vectors, normal and orthonormal vectors, vector norm, vector space, linear combination, linear span, linear independence, basis vectors.

UNIT – IV:
Matrices: Matrices definition, rank, System of equations: Direct methods - LU decomposition method, Tri-diagonal system; Applications of linear systems - Network flows and Mechanical systems.

UNIT – V:

Eigen Values & Eigen Vectors: Eigen values & eigen vectors, concept, intuition, significance, how to find principle component analysis, concept, properties, applications, Singular value decomposition, concept, properties, applications.

UNIT – VI:

Multivariate Calculus: Functions, Scalar derivative, partial derivatives, Gradient, chain rule, properties, method for derivative of vector-valued function with respect to scalar, vector four combinations - Jacobian, Hessian, Gradient of vector valued function, Gradient of matrices. Local/global maxima and minima, saddle point, convex functions, gradient descent algorithms - Learning rate, momentum, stochastic, Constrained optimization (Lagrange Multiplier method), convex optimization.

TEXT BOOKS:

1. Mathematics for Machine Learning, Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Cambridge University Press, 2020
2. Linear Algebra and it's Applications, David C. Lay, 3rd Edition, Pearson Publications
3. Probability and Statistics for Engineers, Richard A. Johanson, 5th Edition, Prentice-Hall, 1995

REFERENCES:

1. Math for Machine Learning: Open Doors to Data Science and Artificial Intelligence, Richard Han, Paperback, 2018
2. Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning, James V Stone
3. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006

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

(18OE1CS01) FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence

COURSE OBJECTIVES:
- To understand and analyze the importance and basic concepts of artificial intelligence and the use of agents
- To identify, explore the complex problem-solving strategies and approaches
- To analyze the concepts of basic concepts of neural networks and learning process
- To explore and analyze the methodology used in machine learning

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply 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: Correlate the algorithmic approach of machine learning algorithms for a given case study
CO-4: Analyse the phenomenon of neural networks and apply basic learning laws

UNIT – I:
Introduction to AI: Foundations of AI – History of AI - Applications of AI, Intelligent Agents – Agents and Environments – Nature of Environments – Structure of Agents – Problem solving Agents – Problem formulation – Example Problems.

UNIT – II:
Searching Techniques: Uninformed Search Strategies – Breadth first search – Depth first search – Depth limited search - Bidirectional search – comparison – Search with partial information - Heuristic search – Greedy best first search – A* search – Memory bounded heuristic search - Heuristic functions - Local search- Hill climbing – Simulated annealing search - Local beam search, Genetic algorithms.

UNIT – III:
Constraint Satisfaction Problems: Backtracking search for CSP's - local search for constraint satisfaction problem. *Adversarial search* – Games - Minimax algorithm, Alpha beta pruning, cutting-off search.

UNIT – IV:
Knowledge Representation and Reasoning: Propositional Logic, Rules of Inference, First Order Logic (FOL) Syntax, Semantics, Entailment.

UNIT – V:
Classical Planning: Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches.

UNIT – VI:

Planning and Acting in the Real World: Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent Planning.

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall, 2010
2. Machine Learning, Tom M. Mitchell, McGraw-Hill
3. Neural Networks A Comprehensive Foundation, Simon Haykin, Pearson Education, 2nd Edition, 2004

REFERENCES:

1. Artificial Intelligence, Elaine Rich & Kevin Knight, 2nd Edition, TMH
2. Artificial Intelligence-A New Synthesis, Nils J. Nilsson, Elsevier
3. Artificial Neural Networks, Yegna Narayana B., PHI

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

(18OE1CS02) MACHINE LEARNING TECHNIQUES

COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence, Fundamentals of Artificial Intelligence

COURSE OBJECTIVES:

- To understand applications in computational learning theory
- To analyse the pattern comparison techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and Familiarize the basics concept, notations used in machine learning and mathematics behind machine learning algorithms
CO-2: Demonstrate different types of machine learning algorithms
CO-3: Apply the suitable machine learning techniques and construct a machine learning model to solve real world applications
CO-4: Evaluate model accuracy and familiarize with advanced learning algorithms

UNIT – I:
Introduction to Machine Learning: Perspectives and issues in machine learning, Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation.

UNIT – II:
Supervised Learning: Classification, decision boundaries; nearest neighbor methods, Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, Linear classifiers Bayes' Rule and Naive Baye's classification
Regression: Regression types, gradient descent; features of Over fitting and complexity; training, validation, test data, Logistic regression and applications.

UNIT -III:
Unsupervised Learning: Clustering, k-means, hierarchical, partition-based clustering, overlapping clustering, Support vector machines, Support vector regression.

UNIT -IV:
Reinforcement Learning: Introduction to Reinforcement learning, the learning task, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

UNIT- V:
Instance-Based Learning: Introduction, k-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT – VI:

Neural Networks: Introduction to neural networks, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and Convolution neural networks.

TEXT BOOKS:

1. Machine Learning, Tom M. Mitchell, McGraw-Hill
2. Neural Networks and Learning Machines, S. Haykin, Pearson, 2008

REFERENCES:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis
2. Machine Learning: The Art and Science of Algorithms that make Sense of Data, Peter Flash, Cambridge, University Press
3. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, MIT Press, 2012

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

(18OE1CS03) DEEP LEARNING

COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence, Fundamentals of Artificial Intelligence, Machine Learning Techniques

COURSE OBJECTIVES:
- To introduce the foundations of deep learning
- To acquire the knowledge on Deep Learning Concepts

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify and select appropriate learning network models required for real world problems
CO-2: Design an efficient model with various deep learning techniques
CO-3: Implement deep learning algorithms and solve real-world problems
CO-4: Apply optimization strategies necessary for problem solving required for large scale applications

UNIT – I:
Introduction to Deep Learning: History of Deep Learning, Deep Learning Success Stories, Biological Neuron, Idea of computational units, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm and Convergence.

UNIT – II:
Feedforward Networks: Multilayer Perceptron, Gradient Descent, Back-propagation, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks.

UNIT – III:
Regularization for Deep Learning: Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, Multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier.

UNIT – IV:
Optimization for Training Deep Models: Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithm.

UNIT – V:
Convolutional Neural Networks: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Markov Networks, Object Detection, RCNN, Fast RCNN, Faster RCNN, YOLO

UNIT – VI:

Auto-Encoders: Regularization in auto-encoders, De-noising auto-encoders, Sparse auto-encoders, Contractive auto-encoders, Structured probabilistic models of deep learning.

TEXT BOOKS:

1. Deep Learning: An MIT Press Book, Ian Goodfellow and YoshuaBengio and Aaron Courville
2. Neural Networks and Learning Machines, Simon Haykin, 3rd Edition, Pearson Prentice Hall

REFERENCES:

1. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
2. Pattern Recognition and Machine Learning, Christopher Bishop, 2007

BLOCKCHAIN TECHNOLOGIES

BLOCKCHAIN TECHNOLOGIES

The blockchain is one of the fastest growing skills in the IT sector today. This track will help the students to gain knowledge in blockchain technology, it has taken quite a turn in the industry given its popularity in providing safe and secured online transactions. Most individuals and organizations have started adopting blockchain because of the many benefits it offers to the industry today. It is used in many industry applications such as banking sector, voting, health care, real estate, the legal industry and government.

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

(18OE1CS04) FUNDAMENTALS OF COMPUTER NETWORKS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce the fundamental various types of computer networks
- To demonstrate the TCP/IP and OSI models with merits and demerits
- To explore the various layers of OSI model
- To introduce UDP and TCP models
- To have the concept of different routing techniques for data communications

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

CO-1: Understand and explore the basics of Computer Networks reference models and the functionalities of physical layer

CO-2: Learn major concepts, principles involved in Data Link Layer and Network Layer

CO-3: Analyze how to maintain QoS in Network and maintaining of Congestion Control

CO-4: Demonstrate the Application Layer functionalities and importance of Security in the Network

UNIT – I:
Introduction to Networks: Internet, Protocols and Standards, The OSI Model, Layers in OSI Model, TCP/IP Suite, Addressing.
Physical Layer: Multiplexing, Transmission Media, Circuit Switched Networks, Datagram Networks, and Virtual Circuit Networks.

UNIT – II:
Data Link Layer: Introduction, Checksum, Framing, Flow and Error Control, Noiseless Channels, Noisy Channels, Random Access Controlled Access, Channelization, IEEE Standards, Ethernet, Giga-Bit Ethernet, Wireless LANs, SONET-SDH, Frame Relay and ATM.

UNIT – III:
Network Layer: Logical Addressing, Internetworking, Tunneling, Address Mapping, ICMP, IGMP, Forwarding, Routing-Flooding, Bellman& Ford, Disjkstra's routing protocols, RIP, OSPF, BGP and Multicast Routing Protocols. Connecting Devices-Passive Hubs, Repeaters, Active Hubs, Bridges, Routers.

UNIT – IV:
Transport Layer: Process to Process Delivery, UDP, TCP and SCTP Protocols, Congestion, Congestion Control, Quality of Service.

UNIT – V:
Application Layer: Domain Name Space, DNS in Internet, Electronic Mail, File Transfer Protocol, WWW, HTTP, SNMP, Multi-Media.

UNIT – VI:

Network Security: Security services, mechanisms and attacks, IPSec, SSL, VPN, Firewall. Bluetooth, Zigbee, IPv4, IPv6.

TEXT BOOKS:

1. Data Communications and Networking, Behrouz A. Forouzan, 4th Edition, McGraw-Hill Education, 2006
2. Computer Networks, Andrew S. Tanenbaum, 4th Edition, Pearson Education
3. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education

REFERENCES:

1. Data Communications and Networks, William Stallings
2. Data Communication and Networks, Bhusan Trivedi, Oxford University Press, 2016
3. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education
4. Understanding Communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning

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

(18OE1CS08) RELATIONAL DATABASE MANAGEMENT SYSTEMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the basic elements of a relational database management system
CO-2: Identify the data models for relevant problems
CO-3: Design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data
CO-4: Apply normalization for the development of application software

UNIT – I:
Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.
Introduction to Database Design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.
Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT – II:
Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.
SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

UNIT – III:
Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of

Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

UNIT – IV:

Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

UNIT – V:

Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.

Recovery System-Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

UNIT – VI:

Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.

Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.

Hash- Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw-Hill Education (India) Private Limited
2. Database System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, 6th Edition, McGraw-Hill Education (India) Private Limited,
3. Database Systems, R. Elmasri, Shamkant B. Navathe, 6th Edition, Pearson Education

REFERENCES:

1. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning
2. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Introduction to Database Systems, C. J. Date, Pearson Education

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

(18OE1CS05) DISTRIBUTED DATA BASES

COURSE PRE-REQUISITES: Fundamentals of Computer Networks

COURSE OBJECTIVES:
- To introduce distributed databases and exploring several algorithms for processing queries and be able to use them
- To describe the methods to translate complex conceptual data models into logical and Physical database designs
- To demonstrate query optimization and its algorithms
- To enumerate the concepts behind distributed transaction processing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze issues related to distributed database design
CO-2: Apply Partitioning techniques to databases
CO-3: Design and develop query processing strategies
CO-4: Describe transaction processing and concurrency control in distributed databases

UNIT – I:
Introduction: Features of Distributed versus Centralized Databases,
Levels of Distribution Transparency: Reference Architecture for Distributed Databases, Types of Data Fragmentation, Distribution transparency for Read – only Applications, Distribution transparency for update Applications, Distributed database Access primitives, Integrity Constraints in Distributed Databases.

UNIT – II:
Distributed Database Design: A framework, the design of database fragmentation, the allocation of fragments.
Translation of Global Queries to Fragment Queries: Equivalence Transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries.

UNIT – III:
Optimization of Access Strategies: A Framework for Query Optimization, Join Queries, General Queries.

UNIT – IV:
The Management of Distributed Transactions: A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural aspects of Distributed Transactions.

UNIT – V:
Concurrency Control: Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.

UNIT – VI:

Reliability: Basic Concepts, Nonblocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart.

TEXT BOOKS:

1. Principles of Distributed Database Systems, M. Tamer OZSU and PatuckValduriez, Pearson Education Asia, 2001
2. Distributed Databases, Stefano Ceri and WillipsePelagatti, McGraw-Hill

REFERENCES:

1. Database System Concepts, Henry F. Korth, A. Silberchatz and Sudershan, MGH
2. Database Management Systems, Raghuramakrishnan and JohhanesGehrke, MGH

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

(18OE1CS06) CRYPTOGRAPHY AND NETWORK SECURITY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases

COURSE OBJECTIVES:
- To outline security concepts, threats, attacks, services and mechanisms
- To describe various cryptosystems- symmetric key cryptography, public key cryptography
- To apply authentication services and Secure hash functions
- To discuss the concepts of IP Security, web security, viruses and firewalls

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the basics of security attacks, services, goals and mechanism of security
CO-2: Apply variety of cryptographic algorithms, Hash Functions and protocols underlying network security applications and authentication applications
CO-3: Examine and analyze various email security and web security mechanisms
CO-4: Understand the system level security issues

UNIT – I:
Security Attacks: Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

UNIT – II:
Conventional Encryption: Classical Encryption techniques, Fiestel Cipher Structure, Data Encryption Standard, Block Cipher Design Principles and Modes of Operation, Triple DES, RC-4, Evaluation criteria for AES, AES Cipher, Placement of Encryption Function, Traffic Confidentiality.

UNIT – III:
Public Key Cryptography and Authentication: Confidentiality using Symmetric Encryption – Principles of Public key Cryptosystems, RSA algorithm, Key Management, Diffie-Hellman key Exchange, Elliptic Curve Cryptography.
Authentication requirements, Authentication functions, Message Authentication Codes

UNIT – IV:
Hash Functions: Hash Functions, Security of Hash Functions and MACs, MD5 message Digest algorithm, Secure Hash Algorithm, HMAC, Digital Signatures, Authentication Protocols, Digital Signature Standard, Authentication Applications: Kerberos, X.509 Authentication Service

UNIT – V:

Network Security: Email Security and Web Security

Electronic Mail Security – PGP/ SMIME, IP security- Architecture, Authentication Header, Encapsulating Security Payload, Key Management, Web Security- Secure Socket Layer, Transport Layer Security and Secure Electronic Transaction

UNIT – VI:

System Level Security: Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

TEXT BOOKS:

1. Cryptography and Network Security – Principles and Practices, William Stallings, 4th Edition, Prentice Hall of India, 2005
2. Hack Proofing Your Network, Ryan Russell, Dan Kaminsky, Rain Forest, Puppy, Joe Grand, David Ahmad, Hal Flynn IdoDubrawsky, Steve W. Manzuik and Ryan Permeh, Wiley Dreamtech

REFERENCES:

1. Network Security Essentials: Applications and Standards, William Stallings Prentice Hall,1999, ISBN 0130160938
2. Security in Computing, Charles B. Pfleeger, Shari Lawrence Pfleeger, 3rd Edition, Pearson Education, 2003

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

(18OE1CS07) BLOCKCHAIN TECHNOLOGY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases, Cryptography and Network Security

COURSE OBJECTIVES:
- To get the terminologies and overview of blockchain technologies
- To study the concepts and foundation of blockchain technology
- To understand security mechanism and consensus in blockchain
- To design use cases and architecture blockchain technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the basic concepts and characteristics of Blockchain technology
CO-2: Demonstrate key mechanisms like Decentralization, Transparency and trust, Immutability, High availability, highly secure and different types of Blockchain
CO-3: Apply the concept of Hash Function and Related Hash Algorithm to provide the security and analyze the various types of blockchains
CO-4: Understand the Crypto Currency and implement, the applications using Blockchain Technology

UNIT – I:
Introduction to Blockchain Part I: Introduction to Centralized, Decentralized and Distributed system, History of Blockchain, Various technical definitions of Blockchain.
Introduction to Blockchain Technology Part II: Generic elements of a blockchain: Block, Transaction, Peer-to-peer network, Node, Smart contract, Why It's Called "Blockchain", Characteristics of Blockchain Technology, Advantages of blockchain technology.

UNIT – II:
Concept of Blockchain Technology Part I: Cryptography, Hashing, Nonce, Distributed database, Consensus, Smart Contract, Component of block, Structure of Block chain, Technical Characteristics of the Blockchain.
Concept of Blockchain Technology Part II: Applications of blockchain technology, Tiers of blockchain technology Bolckchain 0, Bolckchain 1, Blockchain 2, Blockchain 3, Generation of Blockchain X.

UNIT – III:
Technical Foundations Part I: Cryptography, Confidentiality, Integrity, Authentication, Cryptographic primitives, Public and private keys, RSA, Discrete logarithm problem, Hash Function: Message Digest (MD), Secure Hash Algorithms (SHAs), Design of Secure Hash Algorithms (SHA), SHA-256, Design of SHA3, Elliptic Curve Digital signature algorithm.
Technical Foundations Part II: Consensus algorithm: Proof of work (PoW), Proof-of-Stake (PoS), Byzantine Fault Tolerance (BFT)
UNIT – IV:

Types of Blockchain: Public blockchains, Private blockchains, Semi-private blockchains, Side chains, Permissioned ledger, Distributed ledger, Shared ledger, Fully private and proprietary blockchains, Tokenized blockchains, Tokenless blockchains, CAP theorem and blockchain

UNIT – V:
Financial markets and trading, Trading, Exchanges, Trade life cycle, Order anticipators, Market manipulation.
Crypto Currency: Bitcoin, Bitcoin definition, Keys and addresses, Public keys in Bitcoin, Private keys in Bitcoin, Bitcoin currency units

UNIT – VI:
Implementation Platforms: Hyperledger as a protocol, Reference architecture, Hyperledger Fabric, Transaction Flow, Hyperledger Fabric Details, Fabric Membership, Fabric Membership

TEXT BOOKS:

1. Mastering Blockchain, Imaran Bashir, Second Edition, Packt
2. Blockchain Basic, Daniel Drescher, A Press

REFERENCES:

1. Blockchain For Dummies®, IBM Limited Edition, John Wiley & Sons Inc.

ROBOTICS

ROBOTICS

Robotics is a field of study that involves the design, construction and operation of robots. This field overlaps with electronics, computer science, mechatronics and artificial intelligence. Robotic companies are booming all over the world and are seeking engineers with skills for implementing **Next -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**

(18OE1EI01) FUNDAMENTALS OF ROBOTICS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the basic components of a Robot
- To learn different types of Robot sensors and actuators used in Robotics
- To identify different types of Robot grippers and their applications
- To acquire basic Knowledge on Robot kinematics
- To expose to various application fields of Robotics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain knowledge about basic concepts of robots
CO-2: Appreciate the usage of different sensors and actuators in Robotics
CO-3: Select appropriate Gripping mechanism for a particular application
CO-4: Analyze the direct and the inverse kinematic problems
CO-5: Appreciate robot design deference's for various applications

UNIT – I:
Basic Concepts: An overview of Robotics, classification of Robots, Robot Components, Robot degrees of freedom, Robot Joints, Robot Coordinates, Robot reference frames, Programming modes, Robot Characteristics.

UNIT – II:
Sensors: Sensor characteristics, Position sensors, Velocity sensors, Acceleration sensors, Force and Pressure sensors, Torque sensors, Microswitches, Light and infrared sensors, Touch and tactile sensors, Proximity sensors, Range finders.

UNIT – III:
Actuators: Characteristics of actuating system, Comparison of actuating systems, Hydraulic actuators, Pneumatic devices, Electric motors, Magneto-strictive actuators, Shape-Memory Metals, Electro-active Polymer Actuators.

UNIT – IV:
Grippers: Classification of Grippers, Drive system for Grippers, Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Adhesive Grippers, Hooks and Scoops, Gripper Force analysis and design, Active and Passive Grippers.

UNIT – V:
Kinematics: Robots as Mechanisms, Matrix Representation, Homogeneous Transformation Matrices, Representation of Transformations, Inverse of Transformation Matrices, Forward and Inverse Kinematics with Equations.

UNIT – VI:

Applications: Industrial applications, material handling, processing, assembly application, inspection application, application planning, justification of robots, non-industrial applications, Robot safety.

TEXT BOOKS:

1. Introduction to Robotics: Analysis, Control, Applications, Saeed B. Niku, Wiley, 2nd Edition
2. Robotics Technology and Flexible Automation, Deb S. R., John Wiley
3. Robotics and Control, R. K. Mittal, I. J. Nagrath, McGraw-Hill Education

REFERENCES:

1. Industrial Robotics, Technology programming and Applications, Mikell P. Groover, Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, McGraw-Hill, 2012
2. Robotics-Control, Sensing, Vision and Intelligence, K. S. Fu, R. C. Gonzalez, C. S. G Lee, McGraw-Hill International Edition
3. Robotic Engineering–An Integrated Approach, Klafter R. D., Chimielewski T. A., Negin M., Prentice Hall of India, New Delhi, 2009

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

(18OE1EI02) KINEMATICS AND DYNAMICS OF ROBOTS

COURSE PRE-REQUISITES: Fundamentals of Robotics

COURSE OBJECTIVES:
- To understand the basics of robot coordinate frames and their representation
- To obtain knowledge about direct kinematics and inverse kinematics for a robot manipulator
- To examine techniques for planning robot motion in a workspace
- To understand various methods for developing dynamic models for manipulator
- To learn control techniques applied to robot manipulators

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Mathematically represent a Robot system
CO-2: Calculate robot hand position and orientation for specific joint angles
CO-3: Calculate joint angles to achieve a particular hand position
CO-4: Plan trajectories for robot tool to do meaningful tasks
CO-5: Analyze different controlling techniques used for robot manipulators

UNIT – I:
Introduction: Introduction, position and orientation of objects, objects coordinate frame Rotation matrix, Euler angles Roll, pitch and yaw angles coordinate Transformations, Joint variables and position of end effector, Dot and cross products.

UNIT – II:
Direct Kinematics: Coordinate frames, Rotations, Homogeneous coordinates, Link coordinates D-H Representation, The ARM equation. Direct kinematic analysis for Four axis SCARA Robot and three, five and six axis Articulated Robots.

UNIT – III:
Inverse Kinematics: The inverse kinematics problem, General properties of solutions. Tool configuration, Inverse kinematics of four axis SCARA robot and three and five axis Articulated robot.

UNIT – IV:
Workspace Analysis and Trajectory Planning: Workspace Analysis, work envelope of a Four axis SCARA robot and five axis articulated robot workspace fixtures, the pick and place operations, Joint space technique - continuous path motion, Interpolated motion, straight line motion and Cartesian space technique in trajectory planning.

UNIT – V:
Manipulator Dynamics: Introduction, Lagrange's equation kinetic and potential energy. Link inertia Tensor, link Jacobian Manipulator inertia tensor. Gravity, Generalized forces, Lagrange-Euler Dynamic model, Dynamic model of a Two-axis planar robot, Newton Euler formulation, Lagrange - Euler formulation, problems.

UNIT – VI:

Robot Control: The Control Problem, State Equations: one axis robot; three axis SCARA robot, Constant solutions, Linear Feedback Systems, Single Axis PID Control, PD-Gravity Control.

TEXT BOOKS:

1. Fundamentals of Robotics: Analysis & Control, Robert J. Schilling, Prentice Hall of India
2. Robotics and Control, R. K. Mittal, I. J. Nagrath, McGraw-Hill Education

REFERENCES:

1. Robotic Engineering–An Integrated Approach, Klafter R. D., Chimielewski T. A., Negin M, Prentice Hall of India, New Delhi, 2009
2. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover & Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, Tata McGraw-Hill Education, 2012
3. Robotics-Control, Sensing, Vision and Intelligence, K.S. Fu, R.C. Gonzalez, C.S.G Lee, McGraw-Hill International Edition

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

(18OE1EI03) DRIVES AND CONTROL SYSTEM FOR ROBOTICS

COURSE PRE-REQUISITES: Fundamentals of Robotics, Kinematics and Dynamics of Robotics

COURSE OBJECTIVES:
- To get acquainted with different robot drive mechanisms
- To understand in detail, working of hydraulic and pneumatic drives used in robotics
- To learn working principles of various electric drive systems for robotics
- To acquire basic Knowledge on servo systems for robot control

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Categorize various drive systems for robot movement
CO-2: Select appropriate drive system for a particular application
CO-3: Inspect different electric drives and their applications in robotics
CO-4: Analyze accurate positioning of robot end effector by servo control

UNIT – I:
Introduction: Objectives, motivation, open loop control, closed loop control with velocity and position feedback, Types of drive systems. Functions of drive system.

UNIT – II:
Robot Drive Mechanism: Lead Screws, Ball Screws, Chain & linkage drives, Belt drives, Gear drives, Precision gear boxes, Harmonic drives, Cyclo speed reducers.

UNIT – III:
Hydraulic Drives: Introduction, Requirements, Hydraulic piston and transfer valve, hydraulic circuit incorporating control amplifier, hydraulic fluid considerations, hydraulic actuators Rotary and linear actuators. Hydraulic components in robots.

UNIT – IV:
Pneumatic Drives: Introduction, Advantages, pistons-Linear Pistons, Rotary pistons, Motors-Flapper motor, Geared motor, Components used in pneumatic control. Pneumatic proportional controller, pneumatically controlled prismatic joint.

UNIT – V:
Electric Drives: Introduction, Types, DC electric motor, AC electric motor, stepper motors, half step mode operation, micro step mode. Types of stepper motors, Direct drive actuator.

UNIT – VI:
Servo Mechanism for Robot: Mathematical modeling of robot servos, error responses and steady state errors in robot servos, feedback and feed forward compensations, hydraulic position servo, computer-controlled servo system for robot applications, selection of robot drive systems.

TEXT BOOKS:

1. Engineering Foundation of Robotics, Francis N-Nagy Andras Siegler, Prentice Hall Inc.
2. Robotics Engineering - An Integrated Approach, Richard D. Klafter, Thomas. A, ChriElewski, Michael Negin, PHI Learning, 2009

REFERENCES:

1. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover & Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, Tata McGraw-Hill Education, 2012
2. Industrial Robotics, Bernard Hodges, 2nd Edition, Jaico Publishing House, 1993
3. Fundamentals of Robotics Analysis and Control, Robert J. Schilling, PHI Learning, 2009
4. Foundations of Robotics Analysis and Control, Tsuneo Yohikwa, MIT Press, 2003
5. Introduction to Robotics Mechanics and Control, John J. Craig, 3rd Edition, Pearson, 2008

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

(18OE1EI04) ROBOT PROGRAMMING AND INTELLIGENT CONTROL SYSTEM

COURSE PRE-REQUISITES: Fundamentals of Robotics, Kinematics and Dynamics of Robotics, Drives and Control Systems for Robotics

COURSE OBJECTIVES:
- To understand the fundamentals of robot programming
- To learn robot textual languages that are in common use
- To expose to artificial intelligence in robotics
- To acquire basic knowledge on neural networks in robotics
- To acquire basic knowledge on fuzzy logic in robotics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain knowledge about different methods of robot programming
CO-2: Examine various robot language elements and their functions
CO-3: Analyze different AI techniques employed in robotics
CO-4: Design basic neuro-controller for robot motion control
CO-5: Apply fuzzy logic to robot control systems

UNIT – I:
Robot Programming: Methods of robot programming, leadthrough programming methods, robot program as a path in space - defining position in space, speed control, motion interpolation, WAIT, SIGNAL, DELAY commands, Branching.

UNIT – II:
Robot Languages: Textual robot language, generations of robot languages, robot language structure, operating systems, Robot language Elements and functions, constraints and variables, aggregates and location variables.

UNIT – III:
Basic Commands and Operations: Motion commands- move and related statements, speed control, points in workspace, paths and frames. End effector and sensor commands- end effector operation, sensor operation, REACT statement. Computations and operation. Program control and subroutines. Communications and data processing. Monitor mode commands.

UNIT – IV:
AI for Robotics: Introduction to Artificial Intelligence, goals of AI research, AI techniques- knowledge representation, problem representation, search techniques. LISP programming. AI and Robotics. LISP in the factory. Robotic Paradigms.

UNIT – V:
Neural Network Approach in Robotics: Introduction, Connectionist Models, Learning Principles and Learning Rules: Supervised, unsupervised, reinforcement learning. Sensor based robot learning, Neural Network in Robotics: Control of robot hands by

neural network, neural set approach to robot motion coordination, robotic motor control using reinforcement learning optimization.

UNIT – VI:

Fuzzy Logic Approach in Robotics: Introduction, Fuzzy sets, Operation of Fuzzy sets, Fuzzy relations, Fuzzy rule formation, Control rules, Fuzzy algorithm in robotics, Robot obstacle avoidance using fuzzy logic, Fuzzy logic for robot path tracking and behavior coordination, fuzzy control system in mobile robots, fuzzy controller design for robot systems, Case study of fuzzy logic in robotics.

TEXT BOOKS:

1. Industrial Robotics Technology, Programming and Applications, Mikell. P. Groover, McGraw-Hill, 2012
2. Robotics Technology and Flexible Automation, Deb S. R., Tata McGraw-Hill Publishing Company Limited

REFERENCES:

1. Design and Control of Intelligent Robotic Systems, (Studies in Computational Intelligence 177) M. Begum, F. Karray (auth.), Dikai Liu, Lingfeng Wang, Kay Chen Tan (eds.), Springer
2. Neural Networks in Robotics, Edited by George Bekey, Kenneth Y. Goldberg, Springer US, 2012
3. Neural Networks, Fuzzy Logic, Genetic Algorithm - Synthesis and Applications, Rajasekharan and Rai, PHI Publications
4. Introduction to Neural Networks using MATLAB 6.0, S. N. Sivanandam, S. Sumathi, S. N. Deepa, TMH, 2006

CYBER SECURITY

CYBER SECURITY

Cybersecurity is **important** because it incorporates everything that relates to protecting our sensitive data, personally identifiable information (PII), protected health information (PHI), personal information, intellectual property, data, and governmental and **industry** information systems from stealing and destruction endeavoured. The cyber security track helps students to learn about how to
Defend networks and data from unapproved access.
Enhanced information security and business endurance supervision.
Upgraded stakeholder confidence in your information security preparations.
Developed company authorizations with the correct security controls in place.

Some of the more common career paths in the cyber security path are

- Chief Information Security Officer. ...
- Forensic Computer Analyst. ...
- Information Security Analyst. ...
- Penetration Tester. ...
- Security Architect. ...
- IT Security Engineer. ...
- Security Systems Administrator. ...
- IT Security Consultant.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1CS04) FUNDAMENTALS OF COMPUTER NETWORKS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To introduce the fundamental various types of computer networks
- To demonstrate the TCP/IP and OSI models with merits and demerits
- To explore the various layers of OSI model
- To introduce UDP and TCP models
- To have the concept of different routing techniques for data communications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and explore the basics of Computer Networks and Various Protocols and in a position to understand the World Wide Web concepts
CO-2: Administrate a network and flow of information
CO-3: Understand easily the concepts of network security, Mobile and ad-hoc networks

UNIT – I:
Introduction to Networks: Internet, Protocols and Standards, The OSI Model, Layers in OSI Model, TCP/IP Suite, Addressing.
Physical Layer: Multiplexing, Transmission Media, Circuit Switched Networks, Datagram Networks, and Virtual Circuit Networks.

UNIT – II:
Data Link Layer: Introduction, Checksum, Framing, Flow and Error Control, Noiseless Channels, Noisy Channels, Random Access Controlled Access, Channelization, IEEE Standards, Ethernet, Giga-Bit Ethernet, Wireless LANs, SONET-SDH, Frame Relay and ATM.

UNIT – III:
Network Layer: Logical Addressing, Internetworking, Tunneling, Address Mapping, ICMP, IGMP, Forwarding, Routing-Flooding, Bellman& Ford, Disjkstra's routing protocols, RIP, OSPF, BGP,- and Multicast Routing Protocols. Connecting Devices-Passive Hubs, Repeaters, Active Hubs, Bridges, Routers.

UNIT – IV:
Transport Layer: Process to Process Delivery, UDP, TCP and SCTP Protocols, Congestion, Congestion Control, Quality of Service.

UNIT – V:
Application Layer: Domain Name Space, DNS in Internet, Electronic Mail, File Transfer Protocol, WWW, HTTP, SNMP, Multi-Media.

UNIT – VI:

Network Security: Security services, mechanisms and attacks, IPSec, SSL, VPN, Firewall, Bluetooth, Zigbee, IPv4, IPv6.

TEXT BOOKS:

1. Data Communications and Networking, Behrouz A. Forouzan, 4th Edition, McGraw-Hill Education, 2006
2. Computer Networks, Andrew S. Tanenbaum, 4th Edition, Pearson Education
3. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education

REFERENCES:

1. Data Communications and Networks, William Stallings
2. Data Communication and Networks, Bhusan Trivedi, Oxford University Press, 2016
3. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education
4. Understanding Communications and Networks, 3rd Edition, W.A. Shay, Cengage Learning

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

(18OE1CS08) RELATIONAL DATABASE MANAGEMENT SYSTEMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the basic elements of a relational database management system
CO-2: Identify the data models for relevant problems
CO-3: Design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data
CO-4: Apply normalization for the development of application software

UNIT – I:
Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.
Introduction to Database Design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.
Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT – II:
Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.
SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

UNIT – III:
Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of

Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

UNIT – IV:

Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

UNIT – V:

Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.
Recovery System-Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

UNIT – VI:

Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.
Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.
Hash- Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw-Hill Education (India) Private Limited
2. Database System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, 6thEditio,n McGraw-Hill Education (India) Private Limited
3. Database Systems, R. Elmasri, Shamkant B. Navathe, 6th Edition, Pearson Education

REFERENCES:

1. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning
2. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Introduction to Database Systems, C. J. Date, Pearson Education

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

(18OE1CS06) CRYPTOGRAPHY AND NETWORK SECURITY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases

COURSE OBJECTIVES:
- To outline security concepts, threats, attacks, services and mechanisms
- To describe various cryptosystems- symmetric key cryptography, public key cryptography
- To apply authentication services and Secure hash functions
- To discuss the concepts of IP Security, web security, viruses and firewalls

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the security attacks, services, goals and mechanism of security
CO-2: Develop a security model using conventional approach to prevent the attacks
CO-3: Apply public key cryptography principles, examine authenticity and integrity of the messages in the communication
CO-4: Build a model for IP security, firewall and test the security issues

UNIT – I:
Security Attacks: Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

UNIT – II:
Conventional Encryption: Classical Encryption techniques, Fiestel Cipher Structure, Data Encryption Standard, Block Cipher Design Principles and Modes of Operation, Triple DES, RC-4, Evaluation criteria for AES, AES Cipher, Placement of Encryption Function, Traffic Confidentiality.

UNIT – III:
Public Key Cryptography and Authentication: Confidentiality using Symmetric Encryption – Principles of Public key Cryptosystems, RSA algorithm, Key Management, Diffie-Hellman key Exchange, Elliptic Curve Cryptography.
Authentication requirements, Authentication functions, Message Authentication Codes

UNIT – IV:
Hash Functions: Hash Functions, Security of Hash Functions and MACs, MD5 message Digest algorithm, Secure Hash Algorithm, HMAC, Digital Signatures, Authentication Protocols, Digital Signature Standard, Authentication Applications: Kerberos, X.509 Authentication Service

UNIT – V:

Network Security: Email Security and Web Security

Electronic Mail Security – PGP/ SMIME, IP security- Architecture, Authentication Header, Encapsulating Security Payload, Key Management, Web Security- Secure Socket Layer, Transport Layer Security and Secure Electronic Transaction

UNIT – VI:

System Level Security: Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

TEXT BOOKS:

1. Cryptography and Network Security – Principles and Practices, William Stallings, 4th Edition, Prentice Hall of India, 2005
2. Hack Proofing your Network, Ryan Russell, Dan Kaminsky, Rain Forest, Puppy, Joe Grand, David Ahmad, Hal Flynn IdoDubrawsky, Steve W. Manzuik and Ryan Permeh, Wiley Dreamtech

REFERENCES:

1. Network Security Essentials: Applications and Standards, William Stallings, Prentice Hall,1999, ISBN 0130160938
2. Security in Computing, Charles B. Pfleeger, Shari Lawrence Pfleeger, 3rd Edition, Pearson Education, 2003

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1IT01) ESSENTIALS OF CYBER SECURITY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Cryptography and Network Security

COURSE OBJECTIVES:
- To identify the key components of cyber security in network
- To describe various security levels and categories, operating system security
- To define authentication issues and network security
- To describe memory management and protection measures

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Categorize cyber-crime and an understand social, political, ethical and psychological dimensions cyber security
CO-2: Demonstrate security levels and models with objects and access control
CO-3: Analyse tools and methods used in cybercrime
CO-4: Understand Organizational Implications and security risks

UNIT – I:
Introduction to Cybercrime: Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT – II:
Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT – III:
Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies an Measures in Mobile Computing Era, Laptops.

UNIT – IV:
Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT – V:
Cyber Security: Organizational Implications

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications.

UNIT – VI:

Social Media Marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

TEXT BOOKS:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley India

REFERENCES:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press
2. Introduction to Cyber Security, Chwan-Hwa (John) Wu, J. David Irwin, CRC Press T&F Group

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

(18OE1IT02) COMPUTER FORENSICS

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Cryptography and Network Security, Essentials of Cyber Security

COURSE OBJECTIVES:
- To provide an understanding of computer forensics fundamentals
- To analyze various computer forensics technologies and to provide computer forensics systems
- To identify methods for data recovery
- To apply the methods for preservation of digital evidence

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Define and discuss the concepts of computer forensics
CO-2: Explain and apply the concepts of computer investigations
CO-3: Select and apply current computer forensics tools
CO-4: Identify and apply current practices for processing crime and incident scenes

UNIT – I:
Computer Forensics Fundamentals: What is Computer Forensics? Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists.

UNIT – II:
Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement — Computer Forensic Technology — Types of Business Computer Forensic Technology Computer Forensics Evidence and Capture: Data Recovery Defined — Data Back-up and Recovery — The Role of Back-up in Data Recovery — The Data-Recovery Solution.

UNIT – III:
Evidence Collection and Data Seizure: Why Collect Evidence? Collection Options — Obstacles — Types of Evidence — The Rules of Evidence — Volatile Evidence — General Procedure — Collection and Archiving — Methods of Collection — Artifacts — Collection Steps — Controlling Contamination: The Chain of Custody Duplication and Preservation of Digital Evidence: Preserving the Digital Crime Scene — Computer Evidence Processing Steps — Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer Image Verification and Authentication: Special Needs of Evidential Authentication — Practical Consideration —Practical Implementation.

UNIT – IV:
Computer Forensics Analysis and Validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network

tools, examining the honeynet project. Processing Crime and Incident Scenes: Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case.

UNIT – V:

Current Computer Forensic Tools: Evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.

Cell Phone and Mobile Device Forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

UNIT – VI:

Working with Windows and DOS Systems: understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

TEXT BOOKS:

1. Computer Forensics, Computer Crime Investigation, John R. Vacca, Firewall Media, New Delhi
2. Computer Forensics and Investigations, Nelson, Phillips Enfinger, Steuart, Cengage Learning
3. Real Digital Forensics, Keith J. Jones, Richard Bejtiich, Curtis W. Rose, Addison Wesley, Pearson Education

REFERENCES:

1. Forensic Compiling, A Practitioners Guide, Tony Sammes and Brian Jenkinson, Springer International Edition
2. Computer Evidence Collection & Presentation, Christopher L.T. Brown, Firewall Media
3. Homeland Security, Techniques & Technologies, Jesus Mena, Firewall Media
4. Software Forensics Collecting Evidence from the Scene of a Digital Crime, Robert M. Slade, TMH 2005
5. Windows Forensics, Chad Steel, Wiley India Edition

DATA SCIENCES / BIG DATA AND ANALYTICS

DATA SCIENCES / BIG DATA AND ANALYTICS

Data science helps in risk evaluation and observing, possible deceitful comportment, payments, customer analysis, and experience, among much other exploitation. The capability to make **data**-driven choices generates a steadier financial situation and **data scientists** make the strength of the **industry.**
As such, **data science** track helps students to apply business concepts in banking, finance, manufacturing, transport, e-commerce, education, etc. that use **data science**. As a consequence, there are numerous **Data Science** Applications associated to it

Job Roles in Data Science Track

- Data Analyst
- Data Engineers
- Database Administrator
- Machine Learning Engineer
- Data Scientist
- Data Architect
- Statistician
- Business Analyst
- Data and Analytics Manager

Big Data analytics track helps the students to learn the process of gathering, establishing and examining large sets of **data** (called **Big Data**) to determine patterns and other beneficial information. Analysts occupied with **Big Data** characteristically want the acquaintance that comes from investigating the **data**.
Big data analytics is the practice of mining useful information by examining different **types** of big data sets. Big data analytics is utilized to determine concealed patterns, market developments and consumer favorites, for the advantage of organizational decision making.

Job responsibilities in a Big Data Analytics Track are

- To gather and accumulate data from disparate sources, clean it, organize it, process it, and analyse it to extract valuable insights and information.
- To identify new sources of data and develop methods to improve data mining, analysis, and reporting.
- To create data definitions for new database files or alterations made to the already existing ones for analysis purposes.
- To present the findings in reports (in table, chart, or graph format) to help the management team in the decision-making process.
- To apply statistical analysis methods for consumer data research and analysis purposes.
- To keep track of the trends and correlational patterns among complex data sets.
- To perform routine analysis tasks to support day-to-day business functioning and decision making.
- To collaborate with Data Scientists to develop innovative analytical tools.
- To work in close collaboration with both the IT team and the business management team to accomplish company goals.

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

(18OE1MT03) STATISTICAL METHODS FOR DATA SCIENCE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To provide insights about the basic roles of various statistical methods in building computer applications
- To develop a greater understanding of the importance of Data Visualization techniques
- To develop problem-solving skills
- To make inferences about the population parameters using sample data
- To provide an understanding on the importance and techniques of predicting a relationship between the two sets of data and determine the goodness of fitted model

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze an extremely large data set and perform exploratory data analysis to extract meaningful insights
CO-2: Develop various visualizations of the data in hand and communicate results of analysis effectively (visually and verbally)
CO-3: Examine a real-world problem and solve the same with the knowledge gained from various distributions study
CO-4: Use and fit a linear regression model to data and use it for prediction
CO-5: Fit a polynomial regression model to data and use it for prediction

UNIT – I:
Introduction to Statistics: Definition of statistics, basic objectives, applications in various branches of science with examples, collection of data: internal and external data, primary and secondary data, population and sample, representative sample.

UNIT – II:
Descriptive Statistics: Classification and tabulation of univariate data, graphical representation, frequency curves, descriptive measures - central tendency and dispersion, bivariate data, summarization, marginal and conditional frequency distribution.

UNIT – III:
Introduction to R: Introduction, Installing R and data types in R, programming using R: operators, conditional statements, looping, scripts, function creation, creating list, list operations, recursive list, creating a data frame, operations on data frames.

UNIT – IV:
Data Visualization using R: Import - export of data, measures of central tendency and measures of dispersion, data visualization – scatter plot, pie chart, histogram, bar chart, box plot, absolute and relative frequencies, frequency distribution.

UNIT – V:

Correlation & Linear Regression:

Correlation: Correlation, types of correlation, coefficient of correlation, rank correlation coefficient.

Linear Regression: Introduction, regression model, interval estimation, estimation of parameters of β_0 and β_1, Estimation of σ^2.

UNIT – VI:

Non-Linear Regression: Regression of second-degree polynomial (non-linear least square method for polynomial function), power function, exponential, estimation of coefficients, linear and polynomial regressions in R.

TEXT BOOKS:

1. Introductory Statistics, Thomas H. Wonnacott& Ronald J. Wonnacot, John Wiley & Sons Inc., 1969
2. Applied Statistics and Probability for Engineers, Douglas C. Montgomery, George C. Runger, 3rd Edition, John Wiley & Sons, Inc., 2003
3. R for Beginners, Sandip Rakshit, 1st Edition, McGraw-Hill Education, 2017

REFERENCES:

1. R-The Statistical Programming Language, Dr. Mark Gardner, Wiley India Pvt. Ltd, 2013
2. Introduction to the Theory of Statistics, A. M. Mood, F. A. Graybill and D. C. Boes, 3rd Edition, McGraw-Hill Education, 2017
3. Introduction of Probability Models, S. M. Ross, 11th Edition, Academic Press, N.Y., 2014
4. Statistical Methods, S. P. Gupta, 42nd Revised Edition, Sultan Chand & Sons, 2012

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1IT03) COMPUTATIONAL THINKING USING PYTHON

COURSE PRE-REQUISITES: Statistical Methods for Data Science

COURSE OBJECTIVES:
- To understand why Python is a useful scripting language for developers
- To create and execute Python programs and to Learn how to use lists, tuples, and dictionaries in Python programs
- To learn how to build and package Python modules for reusability
- To learn how to design object-oriented programs with Python classes
- To learn how to use exception handling in Python applications for error handling

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms)
CO-2: Adequately use standard programming constructs: repetition, selection, functions, composition, modules, aggregated data (arrays, lists, etc.)
CO-3: Explain what a given program (in Python) does identify and repair coding errors in a program
CO-4: Understand and use object-based software concepts (constructing OO software will be dealt with in the course Software Engineering)
CO-5: Use library software for (e.g.) building a graphical user interface, web application, or mathematical software

UNIT – I:
Introduction: History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator, Conditional Statements-If
If- else Nested if-else Looping for While Nested loops Control Statements Break
Continue Pass String Manipulation Accessing Strings Basic Operations String slices Function.

UNIT – II:
Methods, Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods, Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods
Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties.

UNIT – III:
Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.
Modules: Creation, Importing module, Math module, Random module, Packages.

UNIT – IV:
Composition: Input-Output-Printing on screen, Reading data from keyboard, Opening and closing file Reading and writing files, Functions.

Exception Handling: Exception, Exception Handling, Except clause, Try? Finally clause, User Defined Exceptions

UNIT – V:

OOPs Concept: Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding, Regular expressions- Match function, Search function, Matching VS Searching, Modifiers, Patterns.

Multithreading: Thread, Starting a thread, Threading module, Synchronizing threads.

CGI: Introduction, Architecture, CGI environment variable, GET and POST methods, Cookies, File upload.

UNIT – VI:

Database: Introduction, Connections, Executing queries, Transactions Handling error,

Networking: Socket, Socket Module, Methods, Client and server, Internet modules, Sending email.

TEXT BOOKS:

1. Learning Python, David Ascher and Mark Lutz, O'Reilly

REFERENCES:

1. Python Programming: An Introduction to Computer Science, John M. Zelle, 2^{nd} Edition, Kindle Edition
2. Python Essential Reference, David M. Beazley, 4^{th} Edition, Developer's Library

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

(18OE1IT04) FUNDAMENTALS OF DATA MINING

COURSE PRE-REQUISITES: Statistical Methods for Data Science, Computational Thinking using Python

COURSE OBJECTIVES:
- To introduce the basic concepts and techniques in building a Data Warehouse
- To apply preprocessing methods for any given raw data
- To develop skills of using recent data mining software for solving practical problems
- To implement and apply basic algorithms for supervised and unsupervised learning

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Assess raw input data and process it to provide suitable input for a range of data mining algorithms.
CO-2: Discover and measure interesting patterns from different kinds of databases
CO-3: Evaluate and select appropriate data-mining algorithms and apply, interpret and report the output appropriately
CO-4: Design and implement data-mining applications using sample, realistic data sets and modern tools

UNIT – I:
Data Warehousing & Modeling: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading.

UNIT – II:
Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.

UNIT – III:
Data Warehouse Implementation & Data Mining: Data Warehouse Architecture, What is data mining, Challenges, From Data Warehousing and Data Mining, Data Mining Tasks, Data Mining Functionalities, Major Issues in Data Mining. Data: Types of Data, Data Quality, Data Pre-processing, Measures of Similarity and Dissimilarity.

UNIT – IV:
Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.

UNIT – V:
Classification: Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.

UNIT – VI:

Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph- Based Clustering, Scalable Clustering Algorithms.

TEXT BOOKS:

1. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, First Impression, Pearson, 2014
2. Data Mining-Concepts and Techniques, Jiawei Han, Micheline Kamber, Jian Pei, 3rd Edition, Morgan Kaufmann, 2012

REFERENCES:

1. Data Warehousing in the Real World, Sam Anahory, Dennis Murray, Tenth Impression, Pearson, 2012
2. Mastering Data Mining, Michael J. Berry, Gordon S. Linoff, 2ndEdtion, Wiley, 2012

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

(18OE1IT05) DATA ANALYSIS AND VISUALIZATION

COURSE PRE-REQUISITES: Statistical Methods for Data Science, Computational Thinking using Python, Fundamentals of Data Mining

COURSE OBJECTIVES:
- To introduce concept and characteristics of probability distribution
- To introduce underlying design principles, properties and assumptions of linear and non-linear regression modelling
- To introduce design principles involved in identifying interesting classification and prediction of data patterns
- To introduce properties of time series data and perform time series analysis

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply probability distribution concepts to identify univariate data patterns
CO-2: Apply regression modelling to build efficient mathematical models for prediction and classification
CO-3: Apply decision and regression trees for supervised learning
CO-4: Visualize time series data by applying time series techniques

UNIT – I:
Data Definitions and Analysis Techniques: Elements, Variables, and Data categorization, Introduction to statistical learning, Descriptive Statistics: Measures of central tendency, Measures of location of dispersions.

UNIT – II:
Basic Analysis Techniques: Basic analysis techniques, Statistical hypothesis generation and testing, Chi-Square test, t-Test Analysis of variance, Correlation analysis, Maximum likelihood test.

UNIT – III:
Data Analysis Techniques: Regression analysis and visualization, Classification techniques and visualization, Clustering and visualization, Association rules analysis and visualization

UNIT – IV:
Time-Series Analysis and Forecasting: Time-series components, Variation in Time Series, Cyclic Variation, Seasonal Variation, Irregular Variation.

UNIT – V:
Smoothing Techniques: A problem involving all four components of time series, Introduction to forecasting, forecasting models, Trend and Seasonal effects, Trend Analysis

UNIT – VI:

Case-studies and Projects: Understanding business scenarios, Feature engineering and visualization, Sensitivity Analysis.

TEXT BOOKS:

1. Data Mining and Analysis, Mohammed J. Zaki, Wagner Meira, Cambridge, 2012
2. Data Mining: Theories, Algorithms, and Examples, Nong Ye, CRC Press Taylor & Francis Group, 2014
3. Statistics for Management, David S. Rubin, Sanjay Rastogi, Masood Husain Siddiqui Richard I. Levin, 7^{th} Edition, Pearson Learning

REFERENCES:

1. Probability & Statistics for Engineers & Scientists, Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, 9^{th} Edition, Prentice Hall Inc.
2. The Elements of Statistical Learning, Data Mining, Inference and Prediction, Trevor Hastie, Robert Tibshirani, Jerome Friedman, 2^{nd} 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 17th and 18th centuries were mostly about steam-powered vehicles transporting people and goods. While electric cars enjoyed popularity in the 19th and early 20th 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 21st 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**

(18OE1AE01) PRINCIPLES OF AUTOMOBILE ENGINEERING

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the layout of an automobile and functionalities subsystems
- To provide overview on concepts of engine, cooling, lubrication and fuel systems
- To present constructional features and working of automotive driveline and running systems
- To study the fundamentals and principles of automotive electrical systems

COURSE OUTCOMES After completion of the course, the student should be able to
CO-1: Explain the functionalities of automotive systems and subsystems
CO-2: Give an overview on engine and engine subsystems.
CO-3: Describe working of automotive driveline and running systems
CO-4: Discuss the concepts of automotive starting, ignition and charging systems

UNIT – I:
Introduction: Classification of automobiles, layout of an automobile, automobile sub systems and their role. Types of chassis, role and requirement of a chassis frame, types of frames, materials, loading points and types of bodies.

UNIT – II:
Engine: Classification and components of an engine, principle and working of four stoke and two stroke SI and CI engines, petrol fuel system - carburetor, diesel fuel system - diesel fuel pump, injectors, introduction to electronic fuel injection system – MPFI and CRDI.

UNIT – III:
Cooling and Lubrication: Necessity of cooling, air-cooling, water cooling - thermosyphon and pump cooling, radiator, pump, thermostat, antifreeze solution and radiator fan. Mist, splash and forced lubrication, oil filters and oil pumps.

UNIT – IV:
Drive Line: Clutches, principle, single plate clutch, multi plate clutch and centrifugal clutch. Gear box - Need, sliding mesh, constant mesh and synchromesh gear box. Propeller shaft, universal joint, differential, wheels and tyres.

UNIT – V:
Running Systems: Suspension systems – Objective, rigid axle and independent suspension system and torsion bar. Steering system – Layout, steering mechanism, steering geometry and steering gear boxes. Brake system –Principle, stopping distance, types of brakes and actuation.

UNIT – VI:

Electrical Systems: Starting system - Principle, working of different starter drive units and solenoid switches. Ignition system **-** Conventional ignition system types, ignition advance and retarding mechanisms. Charging system – Alternator principle, construction and working, cut-outs and regulators.

TEXT BOOKS:

1. Advanced Vehicle Technology, Heinz Heisler, Butterworth Heinemann Publishers, 2002
2. Automobile Electrical Equipment, Crouse W. H., 3rdEdition, McGraw-Hill Book Co., Inc., New York,1986

REFERENCES:

1. Motor Vehicle, Garrett T. K., Newton K. and Steeds W. ButterWorths& Co. Publishers Ltd., New Delhi, 2001
2. Automotive Electrical Equipment, Kohli P. L., Tata McGraw-Hill Co., Ltd., New Delhi, 1975
3. Automotive Chassis and Body, Crouse W. H., McGraw-Hill Book Co., 5thEdition, 1976
4. Automotive Mechanics, Giri N. K., Khanna Publications, 2006

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1AE02) MODERN AUTOMOTIVE TECHNOLOGIES

COURSE PRE-REQUISITES: Principles of Automobile Engineering

COURSE OBJECTIVES:
- To provide an overview on advanced engine control system concepts
- To know the interdisciplinary concepts and intelligent automotive systems
- To understand the interdisciplinary concepts and GPS-enabled applications in automobile
- To present intelligent vehicle technologies like comfort, safety and security systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply advanced engine control system concepts in engineering
CO-2: Discuss the need for implementation intelligent vehicle technologies
CO-3: Address the key technologies in automotive navigation
CO-4: Appreciate the technological advancements driver assistance systems

UNIT – I:
Advanced Engine Controls: Concept of an electronic engine control system, engine control module, powertrain control module, electronic fuel injection - throttle body fuel injection, multi-point fuel injection, gasoline direct injection, common rail direct injection, electronic ignition control, engine mapping, on-board diagnostics.

UNIT – II:
Introduction to Intelligent Vehicles: Driver information, driver perception, driver convenience, driver monitoring, general vehicle control, longitudinal and lateral control, collision avoidance, vehicle monitoring.

UNIT – III:
Telematics: Global positioning system, geographical information systems, navigation system, architecture, automotive vision system, road recognition.

UNIT – IV:
Comfort Systems: Adaptive cruise control system, active suspension system, power steering, collapsible and tiltable steering column, power windows.

UNIT – V:
Safety Systems: Active and passive safety, airbags, seat belt tightening system, forward collision warning systems, child lock, anti-lock braking systems, traction control system, lane departure warning system.

UNIT – VI:
Security Systems: Anti-theft technologies – mechanical, electromechanical and electronic immobilizers, alarm system, stolen vehicle tracking system, remote keyless entry, smart card system, number plate coding.

TEXT BOOKS:

1. Understanding Automotive Electronics, William B. Ribbens, 5th Edition, Butterworth Heinemann Woburn,1998
2. Intelligent Vehicle Technologies: Theory and Applications, LjuboVlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann Publications, Oxford, 2001

REFERENCES:

1. Automotive Handbook, Robert Bosch, 5th Edition, SAE, 2000
2. Navigation and Intelligent Transportation Systems – Progress in Technology, Ronald K. Jurgen, Automotive Electronics Series, SAE, USA, 1998
3. Understanding Automotive Electronics, Bechhold, SAE, 1998

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1AE03) ELECTRIC, HYBRID AND FUEL CELL VEHICLES

COURSE PRE-REQUISITES: Principles of Automobile Engineering, Modern Automotive Technologies

COURSE OBJECTIVES:
- To study the concepts and drivetrain configurations of electric and hybrid vehicles
- To understand about electric propulsion system
- To provide various energy storage devices
- To present principle, working and automotive applications of fuel cell and solar technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the concepts and drivetrain configurations of electric and hybrid vehicles
CO-2: Discuss various electric motors and controls
CO-3: Present various energy storage devices
CO-4: Describe automotive applications of fuel cell and solar technology

UNIT – I:
Electric Vehicles: Layout of an electric vehicle, system components, traction motor characteristics, transmission, electronic control system, advantage and limitations, performance and energy consumption of electric vehicles.

UNIT – II:
Hybrid Vehicles: Concepts of hybrid electric drivetrain based on hybridization and powertrain configuration, architecture of series, parallel and series-parallel hybrid electric drivetrains, modes of operation, merits and demerits, plug-in hybrid architecture, speed and torque coupling of hybrid electric drivetrains.

UNIT – III:
Electric Motors: Review of technology suited to automotive propulsion, requirements, DC motors, Induction motors, permanent magnet brushless DC motors and switched reluctance motors.

UNIT – IV:
Motor Drives: Speed and torque control, DC motor - Chopper based four quadrant operations, induction motor, permanent magnet motor and switched reluctance motor.

UNIT – V:
Energy Storages: Electromechanical batteries - Types, parameters, lead acid batteries, nickel-based batteries, lithium-based batteries, battery management system and ultracapacitors.

UNIT – VI:

Fuel Cell and Solar Vehicles: Fuel cell vehicle – Operating principle, types of fuel cells, fuel cell options for fuel cell vehicle and fuel cell hybrid vehicle. Solar vehicle - Solar photovoltaic cell, solar array, solar car electrical system and drive train.

TEXT BOOKS:

1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, CRC Press, 2004
2. Electric Vehicle Technology-Explained, James Larminie and John Loury, John Wiley & Sons Ltd., 2003

REFERENCES:

1. Electric and Hybrid Vehicles – Design Fundamentals, Iqbal Husain, CRC Press, 2010
2. Electric Vehicle Battery Systems, Sandeep Dhameja, Butterworth–Heinemann, 2002
3. Electric and Hybrid – Electric Vehicles, Ronald K. Jurgen, SAE, 2002
4. Light Weight Electric/Hybrid Vehicle Design, Ron Hodkinson and John Fenton, Butterworth–Heinemann

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1AE04) CONNECTED AND AUTONOMOUS VEHICLES

COURSE PRE-REQUISITES: Principles of Automobile Engineering, Modern Automotive Technologies, Electric, Hybrid and Fuel Cell Vehicles

COURSE OBJECTIVES:
- To understand the fundamentals of vehicle communication and networking
- To provide state-of-the-art in wireless communication technology within and between vehicles
- To know various levels of vehicle autonomy and intelligent automotive systems
- To provide an overview on driver-assist and self-driving processes

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Present the fundamentals of vehicle communication and networking
CO-2: Appreciate intra-vehicle and inter-vehicle communication technologies
CO-3: Describe various levels of vehicle autonomy
CO-4: Discuss the driver-assist and self-driving processes

UNIT – I:
Introduction to Vehicle Communications: Intra-vehicle communications - communications protocols, systems and sensors (Braking, steering, power train, chassis systems, body electronics, instrument clusters, infotainment systems), inter-vehicle communications - cooperative driving (accident warning, frontal/rear collision prevention, lane change, assistance). Consumer assistance – traffic information, multimedia support and smart parking

UNIT – II:
Communication Fundamentals and Controller Area Network: Communication fundamentals – Frequency, bandwidth, power measurement, signal to noise ratio, transmission rate constraints, radio frequency spectrum allocation, RADAR operation and types of RADAR. CAN evolution, versions, types of controllers, layered architecture. CAN bus, message frames and error handling.

UNIT – III:
Intra-Vehicle Communications: Wired communication – Network comparison, two tier approach, LIN applications - Localized vehicle area support, general support areas, CAN applications - In vehicle operation, infotainment, wireless communication – Bluetooth vehicle applications, satellite services – satellite radio, vehicle care and traffic status.

UNIT – IV:
Inter-Vehicle Communication: Adhoc Communications –Applications in Vehicle traffic Monitoring, Collision and congestion avoidance, Highway lane reservation, Emission Control, Vehicle Frequency Utilization – AM Radio, Bluetooth, FM Radio, GPS, Short range RADAR, Wireless LAN, Intelligent Roadway-Infrastructure to vehicle and

vehicle to vehicle communications. Evolving smart vehicle – ECU, wireless networking, forward RADAR, side RADAR, GPS, cellular transmission and event Recorder.

UNIT – V:
Autonomous Vehicles: Importance, levels of automation, policy making, social costs, safety and crashes, congestion, land use, energy and emissions, costs and disadvantages

UNIT – VI:
Current State of Autonomous Vehicles: Research, challenges, commercial development, sensor systems, sensor suits, environmental challenges, graceful degradation, V2V and V2I communication, sharing the drive, integrity, security, verification and policy implications.

TEXT BOOKS:

1. Inter and Intra Vehicle Communications, Gilbert Held Auerbach Publications, 2008
2. Autonomous Vehicle Technology-A Guide for Policymakers, James M. Anderson, Nidhi Kalra, Karlyn D. Stanley, Paul Sorensen, Constantine Samaras, Oluwatobi A. Oluwatola, RAND Corporation, Santa Monica, Calif., 2016
3. Autonomous Driving - Technical, Legal and Social Aspects, Markus Maurer, J. Christian Gerdes, Barbara Lenz, Hermann Winner, Editors, Springer, 2016

REFERENCES:

1. Intelligent Vehicle Technologies: Theory and Applications, LjuboVlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann Publications, Oxford, 2001
2. Navigation and Intelligent Transportation Systems – Progress in Technology, Ronald K. Jurgen, Automotive Electronics Series, SAE, USA, 1998
3. Automotive In–vehicle Networks, J. Gabrielleen, Wiley-Blackwell, 2008
4. In-Vehicle Network Architecture for the Next-Generation Vehicles, Syed Masud Mahmud, IGI
5. Communication Technologies for Vehicles, Mohamed Kassab Springer, 2015

GENERAL - COMPUTING

1. PROGRAMMING THROUGH JAVA

Java is an extensively **used** programming language specifically intended for use in the distributed environment of the internet. **Java** help students to create wide-ranging applications that possibly will run on a single workstation or be distributed among servers and clients in a network.

Java is an extremely fruitful language and an upper option for many developers for many years. The motive that it has remained so prevalent is since it still happens the needs of functioning across networks.

Students will have different roles and responsibilities by learning Java Programming

- Designing, implementing, and maintaining Java applications that are often high-volume and low-latency, required for mission-critical systems.
- Delivering high availability and performance.
- Contributing in all phases of the development lifecycle.
- Writing well-designed, efficient, and testable code.

2. RELATIONAL DATABASE MANAGEMENT SYSTEMS

A relational database permits you to effortlessly find precise information. It also consents you to sort based on any field and produce reports that comprise only definite fields from each record. With features like, Data Accuracy, Easy Access to Data, Data Integrity, Flexibility, Normalization, High Security, Feasible for Future Modifications

By learning RDBMS Students will have different roles in Database environment

- Data Administrator,
- Database Administrator
- Database Designer
- Application Programmer

3. COMPUTATIONAL THINKING USING PYTHON

The **python** language is one of the utmost accessible programming languages available because it has streamlined syntax and not complex, which gives more importance on natural language. Due to its comfort of learning and practice, **python** codes can be readily written and executed much quicker than former programming languages.

Data Science: The libraries and frameworks Python offers, e.g.PyBrain, PyMySQL, and NumPy are one of the big reasons. Another reason is diversity. Python experience allows you to do a lot more than any other language, e.g. you can create scripts to automate stuff, go into web development, and so much more.

Students will have various Job Profiles by learning Python

- Software Engineer.
- Python Developer.
- Research Analyst.
- Data Analyst.
- Data Scientist.
- Software Developer.

4. INTRODUCTION TO DATA ANALYTICS

Data Scientists and Analysts **use data analytics** techniques in their research, and businessesalso **use** it to inform their conclusions. **Data analysis** can assistance corporations healthier comprehend theircustomers, assess their ad-campaigns, personalize gratified, create content approaches and progress products.

By learning Data Analytics students will get Jobs with different designations

- IT Systems Analyst. Systems analysts use and design systems to solve problems in information technology. ...
- Healthcare Data Analyst. ...
- Operations Analyst. ...
- Data Scientist. ...
- Data Engineer. ...
- Quantitative Analyst. ...
- Data Analytics Consultant. ...
- Digital Marketing Manager.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1IT06) PROGRAMMING THROUGH JAVA

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce object-oriented programming concepts using the Java language
- To introduce the principles of inheritance and polymorphism; and demonstrates how they relate to the design of abstract classes
- To introduce the implementation of packages and interfaces
- To introduce exception handling, event handling and multithreading

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Develop applications for range of problems using object-oriented programming techniques
CO-2: Design simple graphical user interface applications
CO-3: Explore the design of graphical user interface using applets and swings

UNIT – I:
Object Oriented Thinking and Java Basics: Need for OOP Paradigm, Summary of OOP Concepts, Coping with Complexity, Abstraction Mechanisms, A Way of Viewing World – Agents, Responsibility, Messages, Methods, History of Java, Java Buzzwords, Data Types, Variables, Scope and Life Time of Variables, Arrays, Operators, Expressions, Control Statements, Type Conversion and Casting, Simple Java Program, Concepts of Classes, Objects, Constructors, Methods, Access Control, This Keyword, Garbage Collection, Overloading Methods and Constructors, Method Binding, Inheritance, Overriding and Exceptions, Parameter Passing, Recursion, Nested and Inner Classes, Exploring String Class.

UNIT – II:
Inheritance, Packages and Interfaces: Hierarchical Abstractions, Base Class Object, Subclass, Subtype, Substitutability, Forms of Inheritance- Specialization, Specification, Construction, Extension, Limitation, Combination, Benefits of Inheritance, Costs of Inheritance. Member Access Rules, Super Uses, Using Final with Inheritance, Polymorphism- Method Overriding, Abstract Classes, The Object Class.
Defining, Creating and Accessing a Package, Understanding Classpath, Importing Packages, Differences between Classes and Interfaces, Defining an Interface, Implementing Interface, Applying Interfaces, Variables in Interface and Extending Interfaces, Exploring Java.IO.

UNIT – III:
Exception Handling and Multi-threading: Concepts of Exception Handling, Benefits of Exception Handling, Termination or Resumptive Models, Exception Hierarchy, Usage of Try, Catch, Throw, Throws and Finally, Built in Exceptions, Creating Own Exception Sub Classes.
String Handling, Exploring Java. Util, Differences between Multi-Threading and Multitasking, Thread Life Cycle, Creating Threads, Thread Priorities, Synchronizing

Threads, Interthread Communication, Thread Groups, Daemon Threads. Enumerations, Autoboxing, Annotations, Generics.

UNIT – IV:

Event Handling: Events, Event Sources, Event Classes, Event Listeners, Delegation Event Model, Handling Mouse and Keyboard Events, Adapter Classes.

The AWT Class Hierarchy, User Interface Components- Labels, Button, Canvas, Scrollbars, Text Components, Check Box, Check Box Groups, Choices, Lists Panels – Scrollpane, Dialogs, Menubar, Graphics, Layout Manager – Layout Manager Types – Border, Grid, Flow, Card and Grid Bag.

UNIT – V:

Applets: Concepts f Applets, Differences between Applets and Applications, Life Cycle of an Applet, Types of Applets, Creating Applets, Passing Parameters to Applets.

UNIT – VI:

Swing: Introduction, Limitations of AWT, MVC Architecture, Components, Containers, Exploring Swing- Japplet, Jframe and Jcomponent, Icons and Labels, Text Fields, Buttons – The Jbutton Class, Check Boxes, Radio Buttons, Combo Boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

TEXT BOOKS:

1. Java The Complete Reference, Herbert Schildt, 7th Edition, TMH
2. Understanding OOP with Java Updated Edition, T. Budd, Pearson Education
3. An Introduction to Programming and OO Design using Java, J. Nino and F. A. Hosch, John Wiley & Sons

REFERENCES:

1. Introduction to Java Programming, Y. Daniel Liang, Pearson Education
2. An Introduction to Java Programming and Object-Oriented Application Development, R. A. Johnson, Thomson
3. Core Java 2, Vol. 1 - Fundamentals, Cay. S. Horstmann and Gary Cornell, 8th Edition, Pearson Education
4. Core Java 2, Vol. 2 - Advanced Features, Cay. S. Horstmann and Gary Cornell, 8th Edition, Pearson Education

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

(18OE1CS08) RELATIONAL DATABASE MANAGEMENT SYSTEMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the basic elements of a relational database management system
CO-2: Ability to identify the data models for relevant problems
CO-3: Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data
CO-4: Apply normalization for the development of application software

UNIT – I:
Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.
Introduction to Database Design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.
Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT – II:
Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.
SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

UNIT – III:
Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

UNIT – IV:

Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

UNIT – V:

Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.

Recovery System-Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

UNIT – VI:

Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.

Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.

Hash- Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw-Hill Education (India) Private Limited
2. Database System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, 6th Edition, McGraw-Hill Education (India) Private Limited
3. Database Systems, R. Elmasri, Shamkant B. Navathe, 6th Edition, Pearson Education

REFERENCES:

1. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning
2. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Introduction to Database Systems, C. J. Date, Pearson Education

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

(18OE1IT03) COMPUTATIONAL THINKING USING PYTHON

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand why Python is a useful scripting language for developers
- To create and execute Python programs and to Learn how to use lists, tuples, and dictionaries in Python programs
- To learn how to build and package Python modules for reusability
- To learn how to design object-oriented programs with Python classes
- To learn how to use exception handling in Python applications for error handling

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms)
CO-2: Adequately use standard programming constructs: repetition, selection, functions, composition, modules, aggregated data (arrays, lists, etc.)
CO-3: Explain what a given program (in Python) does identify and repair coding errors in a program
CO-4: Understand and use object-based software concepts (constructing OO software will be dealt with in the course Software Engineering)
CO-5: Use library software for (e.g.) building a graphical user interface, web application, or mathematical software

UNIT – I:
Introduction: History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator, Conditional Statements-If
If- else Nested if-else Looping for While Nested loops Control Statements Break
Continue Pass String Manipulation Accessing Strings Basic Operations String slices Function.

UNIT – II:
Methods, Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods, Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods
Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties.

UNIT – III:
Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.
Modules: Creation, Importing module, Math module, Random module, Packages.

UNIT – IV:
Composition: Input-Output-Printing on screen, Reading data from keyboard, Opening and closing file Reading and writing files, Functions.

Exception Handling: Exception, Exception Handling, Except clause, Try? Finally clause, User Defined Exceptions

UNIT – V:

OOPs Concept: Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding, Regular expressions- Match function, Search function, Matching VS Searching, Modifiers, Patterns.

Multithreading: Thread, Starting a thread, Threading module, Synchronizing threads.

CGI: Introduction, Architecture, CGI environment variable, GET and POST methods, Cookies, File upload.

UNIT – VI:

Database: Introduction, Connections, Executing queries, Transactions Handling error,

Networking: Socket, Socket Module, Methods, Client and server, Internet modules, Sending email.

TEXT BOOKS:

1. Learning Python, David Ascher and Mark Lutz, 2nd Edition, O'Reilly, 2003

REFERENCES:

1. Python Programming: An Introduction to Computer Science, John M. Zelle, 2nd Edition, Kindle Edition
2. Python Essential Reference, David M. Beazley, 4th Edition, Developer's Library

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1IT07) INTRODUCTION TO DATA ANALYTICS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To be exposed to conceptual framework of big data
- To understand different techniques of data analysis
- To be familiar with concepts of data streams
- To be exposed to item sets, clustering, frame works and Visualization

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand big data fundamentals
CO-2: Learn various data analysis techniques
CO-3: Implement various data streams
CO-4: Understand item sets, clustering, frame works & Visualizations

UNIT – I:
Introduction to Big Data: Introduction to Big Data Platform – Challenges of Conventional systems – Web data – Evolution of Analytic scalability, analytic process and tools, Analysis vs Reporting – Modern data analytic tools,
Statistical Concepts: Sampling distributions, resampling, statistical inference, prediction error.

UNIT – II:
Data Analysis: Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and Kernel methods
Analysis of Time Series: Linear systems analysis, nonlinear dynamics – Rule induction –
Neural Networks: Learning and and Generalisation, competitive learning, Principal component analysis and neural networks
Fuzzy Logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.

UNIT – III:
Mining Data Streams: Introduction to Streams Concepts – Stream data model and architecture – Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a Window – Decaying window – Real time Analytics Platform (RTAP) applications – case studies – real time sentiment analysis, stock market predictions.

UNIT – IV:
Frequent Itemsets and Clustering: Mining Frequent itemsets – Market based Modeling – Apriori Algorithm – Handling large data sets in Main Memory – Limited Pass Algorithm – Counting frequent itemsets in a Stream – Clustering Techniques – Hierarchical – K-Means.

UNIT – V:
Clustering high dimensional data – CLIQUE and ProCLUS – Frequent pattern-based clustering methods – Clustering in non-Euclidean space – Clustering for streams and Parallelism.

UNIT – VI:
Frameworks and Visualization: MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – S3 – Hadoop Distributed file systems – Visualizations – Visual data analysis techniques,
Interaction Techniques: Systems and Applications

TEXT BOOKS:

1. Intelligent Data Analysis, Michael Berthold, David J. Hand, Springer, 2007
2. Mining of Massive Datasets, Anand Rajaraman and Jeffrey David Ullman, Cambridge University Press, 2012

REFERENCES:

1. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks, John Wiley & Sons, 2012
2. Big Data Glossary, Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, Pete Warden, O'Reilly, 2011
3. Data Mining Concepts and Techniques, Jiawei Han, Micheline Kamber, 2nd Edition, Elsevier, 2008

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

(18OE1CS11) FUNDAMENTALS OF COMPUTER ALGORITHMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To reinforce algorithms analysis methods
- To analyse running time of an algorithm
- To understand different algorithm design strategies
- To familiarize with an assortment of important algorithms

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply algorithm design techniques and concepts to solve given engineering problem
CO-2: Analyze running times of algorithms using asymptotic analysis
CO-3: Develop efficient algorithms for computational tasks
CO-4: Computing complexity measures of algorithms

UNIT – I:
Introduction: Characteristics of algorithm. Analysis of algorithms: Asymptotic analysis of complexity bounds – best, average and worst-case behaviour; Performance measurements of Algorithm, Time and space trade-offs.

UNIT – II:
Divide and Conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication. Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

UNIT – III:
Greedy Method: General method, applications-Job sequencing with deadlines, 0/1 knapsack problem, Minimum cost spanning trees, Single source shortest path problem, Huffman Codes.

UNIT – IV:
Dynamic Programming-I: General method, Principle of optimality, applications-Multistage graphs, Matrix chain multiplication, Optimal binary search trees.

UNIT – V:
Dynamic Programming-II: 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem, Reliability design.

UNIT – VI:
Backtracking: General method, applications- N-Queen problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles.

TEXT BOOKS:

1. Fundamentals of Computer Algorithms, E. Horowitz et al., Galgotia Publications
2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Lieserson, Ronald L. Rivest and Clifford Stein, 4^{th} Edition, MIT Press/McGraw-Hill

REFERENCES:

1. Algorithm Design, Jon Kleinberg and EvaTardos, 1^{st} Edition, Pearson
2. Algorithm Design: Foundations, Analysis and Internet Examples, Michael T. Goodrich and Roberto Tamassia, Second Edition, Wiley
3. Algorithms – A Creative Approach, Udi Manber, 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**

(18OE1HS01) PROFESSIONAL ETHICS AND HUMAN VALUES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To emphasize on the importance of ethics for engineers and computer scientists
- To provide a toolkit for ethical behaviour in personal and professional settings
- To relate the profession of engineering to sociocultural as well as ethical and moral contexts in India and globally
- To develop more socially conscious engineers who create and conceive a better society and a better world without sacrificing or ignoring public good

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Distinguish morals, values, and ethics in Indian and global contexts
CO-2: Resolve moral and ethical dilemmas through ethical inquiries and appropriate ethical theories
CO-3: Realize the professional role of engineers in society and the support available in creating safe solutions for the society focusing on public welfare
CO-4: Conduct themselves ethically in various roles that present themselves in professional and business environments

UNIT – I:
Motivation and Introduction to Human Values: Motivation to study ethics in engineering with justifying case studies, historical events, and current affairs; Morals, Values, and Ethics – Definitions; Moral Judgement vs. Value Judgement; Moral Character and Moral Autonomy – Conscientiousness, Integrity, Empathy as basic building blocks; The Golden Rule; Maslow's Theory of Needs; Universal Human Values and Theories; Conventional and Constitutional Values in Indian Ethos; Anomie vs. Civic Virtue as a foundation for an ideal society; Ethics as a basis of legal framework; Privacy and Confidentiality – Increasing emphasis in personal and professional lives, technological considerations and examples; Profession, Professionalism – Definitions, Engineering as a Profession

UNIT – II:
Ethics, Ethical Theories, and Professionalism: Ethics through Spirituality, Religion, and beyond; Indian Philosophy and Ethos, ancient to modern – Family System, Ethical Pluralism, Unity in Diversity; Ethics as application of values and as moral philosophy – Kohlberg's theory vs. Gilligan's theory of moral development leading to ethics, examples; Moral and Ethical Dilemmas – Definition, Causes, Case Studies and Examples; Resolution of Ethical Dilemmas through Ethical Inquiries – Normative, Conceptual, and Factual Inquiries, Classification of Ethics by Character and Conduct – Consequentialism/ Utilitarianism, Deontological Ethics, Virtue Ethics and Theories, Rights Theories; Ethical Frameworks and examples; Practical application of ethical theories for decision-making in personal life

UNIT – III:

Professionalism, Engineering in the Societal Context: Professionalism – Professional Traits, Rights, Responsibilities, Roles, Virtues; Business Ethics; Engineering as Social Experimentation – Context with examples, Comparison with standard experiments, Application of Ethical Inquiries to gain knowledge and to gather relevant information, Responsibility of Experimenters, Accountability and Answerability, Consensus and Need for Informed Consent – how to address exceptions; Responsible Innovation – Social Context of Innovation, Responsible Research and Innovation, Data Privacy and Protection of Individual Rights, being Ethical by Design; Trust in the context of professionalism – confidentiality, non-disclosure agreements (NDA); Intellectual Property (IP) – IP Rights (IPR) as Professional Rights, Law, Moral Rights and Economic Rights, Patenting; Diverse roles of Engineers as Professionals – Manager, Leader, Consultant, and Expert Witness

UNIT – IV:

Professional Ethics, Ethics at Workplace and Roles of Engineers: Overview 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, JidduKrishnamurti, 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, JidduKrishnamurti, Shambhala, 2000 (ISBN: 978-1570625961)
5. On Ethics and Economics, Amartya Sen, Oxford India, 1999 (ISBN: 978-0195627619)

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

(18OE1HS02) ENTREPRENEURSHIP

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To motivate the engineers to inculcate the skills thereof in any professional role and to consider intrapreneurship or entrepreneurship as career choices for personal and societal growth
- To impart lean management principles and practices to plan, execute, and convert one's own idea into a sustainable business model
- To gain practical knowledge to design one's own lean startup
- To identify and avoid the potential pitfalls in validation, design, production, and marketing phases of an innovative product or service

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

CO-1: Discover societal problems as entrepreneurial opportunities and ideate to develop solutions through systematic and creative approaches to innovation and business strategy

CO-2: Apply lean methodology to startup ideas using Business Model Canvas and Lean Canvas and be able to create Business Plan

CO-3: Validate ideas, design, production, and marketing systematically using techniques such as 5 Whys, Innovation Accounting, Value and Growth Propositions

CO-4: To strategize during ideation, production, market research, marketing and facing competition

UNIT – I:

Entrepreneurial Skills and Opportunities : Role of Entrepreneurs in Indian and World Economy; Entrepreneurship as a career for engineers, scientists, and technologists; Personality and Skill Set of an Entrepreneur; Need for Ethics and Empathy for Entrepreneurs; Stories of Successful and Failed Enterprises; Current Business Trends; Entrepreneurial Management vs. Corporate Management – Roles and Scope; Concepts of Intrapreneurship, Social Entrepreneurship, Technopreneurship, Studentpreneurship; Opportunities in Telangana State and India – incubators, schemes, accelerators

UNIT – II:

Introduction to Lean Startup Methodology: Overview, Principles of Lean Startup, Lean vs. Traditional Startup; Vision-to-Steering, Start-Define-Learn-Experiment, Leap-Test-Measure-Pivot, Build-Measure-Learn

UNIT – III:

Business Model Concepts: Components of Business Plan; Business Model Canvas (BMC); Lean Canvas (LC); Pitch Deck; Elevator Pitch; Financial Aspects – Financing, Funding Stages, Inflows, Outflows; Market Research and Marketing

UNIT – IV:
Building Your Business Model: Desirability, Feasibility, and Viability; Minimum Viable Product (MVP), Proof of Concept (PoC), Prototype; Early Adopters; Value Proposition; Overview of opportunities in India – Financing and Support Schemes, Online and Offline Resources, Entrepreneurial Networks

UNIT – V:
Evaluating Your Business Model: Three Learning Milestones of Innovation; Root Cause Analysis (RCA) through 5 Whys; Pivot or Persevere; The Engines of Growth: Sticky, Viral, and Paid; Kan-ban Diagram for Project Planning and Resource Allocation

UNIT – VI:
Strengthen Your Business Model: Why startups fail? Value and Waste; Design Thinking for Business; Analogs and Antilogs; Paralysis by Analysis and Extinct by Instinct; The three A's: Actionable, Accessible, and Auditable Metrics and Vanity Metrics

TEXT BOOKS:

1. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Eric Ries, Penguin Portfolio, 2015 (ISBN: 978-0670921607)
2. Entrepreneurship, Robert D. Hisrich, Michael P. Peters and Dean A. Shepherd, Tata McGraw-Hill, 11th Ed., 2020 (ISBN: 978-9390113316)
3. Entrepreneurship Simplified: From Idea to IPO, Ashok Soota, S R Gopalan, Penguin Random House India, 2016 (ISBN: 978-0670088959)
4. Startup Easy - Part 1: The Essentials, Shishir Gupta, StartupLanes.Com, 2017 (ISBN: 978-9386503886)

REFERENCES:

1. Measure What Matters: OKRs: The Simple Idea that Drives 10x Growth, John Doerr, Penguin Portfolio, 2018 (ISBN: 978-0241348482)
2. Entrepreneurship Development and Business Ethics, Abhik Kumar Mukherjee, Shaunae Roy, Oxford University Press, 2019 (ISBN: 978-0199494460)
3. The Manual for Indian Start-Ups, Vijay Kumar Ivaturi et al., Penguin Random House India, 2017 (ISBN: 978-0143428527)
4. Social Entrepreneurship in India: Quarter Idealism and a Pound of Pragmatism, Madhukar Shukla, SAGE Publications India Pvt Ltd, 2020 (ISBN: 978-9353882372)
5. Entrepreneurship: A South Asian perspective. Donald F Kuratko, T.V Rao. Cengage Learning, 2012

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1HS03) PERSONALITY DEVELOPMENT AND PUBLIC SPEAKING

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To develop skills and techniques for Effective Communication and Public Speaking
- To develop Leadership qualities and increase Self – confidence
- To get along with people and Team-Building
- To enhance career opportunities by Goal setting
- To develop an acceptable personality

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Communicate better and speak with confidence
CO-2: Exhibit Leadership qualities and increased Self – confidence
CO-3: Work towards Team-Building
CO-4: Use career opportunities by Goal setting
CO-5: Acquire a forceful personality to maintain a pleasant relationship between the seniors and subordinates and other stakeholders

UNIT – I:
EFECTIVE COMMUNICATION
i. Fundamentals of Effective Communication
ii. How to sell your ideas
iii. Communication within Industry (awareness of motivation, ego states, games, etc.)
iv. Guidelines on: Listening, Reading and Writing
v. Non-verbal Communication (Body Language)
vi. Barriers of Communication

UNIT – II:
PUBLIC SPEAKING (SPEECH COMMUNICATION)
i. How to develop courage and self-confidence
ii. Speech purposes, preparation patterns and outlining of speech
iii. Fundamentals and secrets of good delivery
iv. How to make your meaning clear and convince an audience / client
v. How to close effectively and get action?
vi. How to participate in conferences, group discussions and office meetings

UNIT – III:
PERSONALITY DEVELOPMENT -1
i. Leadership - qualities of a successful leader ; Leadership Styles; Leadership in Administration; Problem-solving & Decision-making
ii. Group Dynamics and Team Building
iii. Importance of groups in organization; Interactions in group, Group Decision Taking, Team Building, Interaction with the Team, Building a good team

UNIT – IV:

PERSONALITY DEVELOPMENT -2

i. Interpersonal Relations- Introduction; Transactional Analysis in communication Awareness of Ego states and their application in communication
ii. Conflict Management- Introduction & Causes of Conflict; Managing Conflict

UNIT – V:

PERSONALITY DEVELOPMENT -3

i. Positive Attitude &Ways to develop positive attitude
   Self Esteem & Confidence Building
ii. Motivation- Importance of self-motivation;
iii. Stress -Causes of Stress & Impact of Stress; Managing Stress

UNIT – VI:

PERSONALITY DEVELOPMENT -4

i. Goal Setting-Meaning; Short, medium and Long Term Goals;
   Importance of Goal setting & Steps for Goal Setting
ii. Creativity-Meaning; Barriers to Creativity & Steps to stimulate Creativity
   Understanding and Importance of Human Values; Ideals in Life; Becoming a Role Model
iii. Time Management - Time as a Resource; Techniques for better Time Management.

TEXT BOOKS:

1. Advance Speaking Skills, Jeremy Harmar& John Arnold, Essex, Longman Group Limited, 1978
2. Developing Soft Skills, Sherfield, R. M., Montgomery, R. J., Moody, P. G. 4th Edition, Pearson, 2010
3. Personality Development and Soft Skills, Barun K. Mitra, Oxford University Press, 2016

REFERENCES:

1. Body Language: A Guide for Professionals, Hedwig Lewis, Response Books (A division of Sage Publications India, Pvt. Ltd.,) New Delhi, 1998
2. Emotional Intelligence, Daniel Goldman, Bantam Books, 1995
3. Personality Development, Rajiv Mishra, Rupa & Co., 2004

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. VIII Semester

L	T/P/D	C
3	0	3

(18OE1HS04) FOREIGN LANGUAGE – FRENCH

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To communicate verbally in a simple way by asking and responding to simple questions related to everyday language needs
- To read and comprehend different kinds of texts (notices, informal letters, catalogues, menus etc.)
- To write clear, concise, and correct sentences and paragraphs on familiar topics.
- To recognize and use basic syntax and structures in French including articles, prepositions and connecting words as well as master basic vocabulary

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Use vocabulary contextually and effectively
CO-2: Use reading skills to comprehend different kinds of texts
CO-3: Understand everyday expressions dealing with simple and concrete everyday needs, in clear, slow and well-articulated speech and manage very short mini dialogues /conversations
CO-4: Demonstrate basic competence in Written French including grammar, sentence and paragraph structure, coherence

UNIT – I: Introduce oneself and introduce someone:
Reading: Read and understand an introduction about someone
Grammar: Question words, Subject verb agreement, Mas/fem and prepositions with cities and countries
Vocabulary: professions, nationalities, countries numbers, days of the week and verbs
Writing: Build basic sentences and Write about oneself
Life Skills: Greetings, Formal and Informal way of asking questions

UNIT – II: Express likes and dislikes and Talk about your locality:
Reading: Read and understand description of a place
Grammar: Articles, prepositions, possessive adjectives, basic connecting words such as **"like, and, but"**, and Negation
Vocabulary: Adjectives, verbs of preference, different places, and basic vocabulary on leisure and sports activities.
Writing: Write about hobbies and pastimes
Life Skills: Conversation fillers

UNIT – III: Take / Fix an appointment with someone:
Reading: Understand propositions and counters
Grammar: How to say time, Interrogative adjectives
Vocabulary: Irregular verbs, days of the week, Fixed expressions with Etre and Avoir and expressions to ask for appointment or refuse/accept a proposed time
Life Skills: Telephone etiquette and colloquial expressions in French

UNIT – IV: Talk about your routine / Invite someone and Accept or refuse an invitation
Reading: Read and understand an invitation on basic info: date and time, venue, occasion, type of invitation etc.
Grammar: Question word Why, Connecting word "because", partitive and contracted articles, reflexive verbs
Vocabulary: Expressions to propose, thank / apologize and accept or refuse an invitation,
Writing: Respond to an invitation (Accept or refuse)
Life Skills: At the table

UNIT – V: Ask for information (timings, price, etc) and Ask for/ Give Directions
Reading: Understand signboards and instructions
Grammar: Imperative mode and prepositions.
Vocabulary: Directions, Expressions to ask information or seek precision
Writing: Give instructions and fill a form

UNIT – VI: Vacation (plan vacation, choose destination, visit, and appreciate)
Reading: Read and understand travel brochures for basic info on offers, locations, touristic attractions hotels and so on
Grammar: demonstrative adjectives and near future tense
Vocabulary: Weather forecast, modes of transport, and vacation activities
Writing: Write a post card
Life Skills: Types of vacation in France

TEXT BOOKS:

1. Painless French, Carol Chitin, M.S., Lynn Gore, Barrons Educational Series, 2016 (ISBN: 978-1438007700)
2. Language Learning University, French: Learn French for Beginners Including French Grammar, French Short Stories and 1000+ French Phrases, Createspace Independent Publications, 2018 (ISBN: 978-1726415002)
3. Language School, French Language for Beginners, 2019 (ISBN: 978-1700175700)

REFERENCES:

1. Practice Makes Perfect: Complete French All-in-One, Annie Heminway, McGraw-Hill Education, 2018 (ISBN: 978-1260121032)
2. Easy French Step-by-Step, Myrna Bell Rochester, McGraw-Hill Education, 2008 (ISBN: 978-0071453875)
3. Contacts: Langue et culture françaises, Jean-Paul Valette, Rebecca Valette, Wadsworth Publishing Co. Inc., 2012 (ISBN: 978-1133309581)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1CE09) SMART CITIES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain and elaborate smart city concepts and their international and national standards
CO-2: Conceptualize smart community, transportation and building concepts
CO-3: 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

(18OE1EE05) TRENDS IN ENERGY SOURCES FOR SUSTAINABLE DEVLOPMENT

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand the role of sustainable energy
- To know components of solar PV and wind energy conversion systems
- To understand the principles of Biomass, geo-thermal and wave energy systems
- To learn various energy storage methods

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand various sources for sustainable energy
CO-2: Understand Solar Photo voltaic and wind energy systems
CO-3: Learnt the harnessing techniques of Biomass, geothermal and ocean energy
CO-4: Familiarize with energy storage methods

UNIT – I:
Introduction: Trends in energy consumption - Conventional and renewable sources, Energy sources and their availability, Energy Conservation status in India -need of new energies for sustainable development.

UNIT – II:
Fundamentals of Solar Radiation: Introduction-The Sun as Source of Energy, Extraterrestrial and Terrestrial Radiations, Spectral Power Distribution of Solar Radiation, instruments for measuring solar radiation and sunshine recorder.
Solar PV Conversion: The PV Cell-Crystalline Solar cells -Thin film and amorphous solar cells, Module, Array, Equivalent Electrical circuit- Open circuit voltage and Short circuit current, I-V, P-V Curves. Developments in efficient non silicon solar cells

UNIT – III:
Wind Energy: origin of winds-Global (or Planetary) Winds- Local Winds-Factors Affecting the Distribution of Wind Energy on the Surface of Earth, Wind Turbine – Types, construction of HAWT, VAWT, performance characteristics, Betz criteria.

UNIT – IV:
Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Biogas digesters, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.

UNIT – V:
Geothermal Energy: Resources, types of wells, methods of harnessing the energy
Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles.
Tidal and Wave Energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT – VI:

Energy Storage:

Electro Chemical Storage: lead-acid- nickel cadmium-nickel-metal-hydride and lithium type batteries-Principle of operation, Types, Advantages and disadvantages.

Non-Electric Storage: Methods of Energy storage –Pumped Energy Storage – Compressed air Energy Storage, Superconducting Magnet Energy Storage.

TEXT BOOKS:

1. Non-Conventional Energy Sources, G. D. Rai, 6th Edition, Khanna Publishers, 2004
2. Non-Convention Energy Resources, B.H. Khan, 3rd Edition, McGraw-Hill, 2017

REFERENCES:

1. Renewable Energy Sources, Twidell& Weir, 3rd Edition, CRC Press, 2015
2. Solar Energy, Sukhatme, 3rd Edition, McGraw-Hill, 2008
3. Non-Conventional Energy, Ashok V. Desai, Wiley Eastern, 1990

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

(18OE1ME05) 3D PRINTING AND DESIGN

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the need and know about the applications of 3D Printing
- To understand the need of liquid and solid based 3D Printing systems
- To know about the laser-based 3D Printing systems and importance of CAD for 3D Printing
- To understand post-processing, inspection and testing involved in 3D Printing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize the importance of 3D Printing
CO-2: Explain the process involved in liquid and solid based 3D Printing Systems
CO-3: Explain about the laser-based 3D Printing systems and CAD for 3D Printing
CO-4: Plan post-processing techniques and perform inspection and testing in 3D Printing

UNIT – I:
Introduction: Introduction to 3D Printing, Classification, 3D Printing Process Chain, Materials for 3D Printing, Distinction between 3D Printing & Conventional Manufacturing.
Applications: Brief overview of applications in Aerospace, Automotive, Biomedical, Defense, Construction, Jewelry, Coin and Tableware Industry.

UNIT – II:
Liquid Based 3D Printing Systems: Introduction, Principle, Processes and Applications of Material Jetting and Binder Jetting.

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

UNIT – IV:
Laser Based 3D Printing Systems: Introduction, Principle, Processes and Applications of Selective Laser Sintering (SLS), Three-Dimensional Printing (3DP).

UNIT – V:
CAD for 3D Printing: CAD data formats, CAD model preparation, Part orientation and support generation, Overview of 3D Printing softwares like MAGICS and MIMICS only.

UNIT – VI:
Post Processing: Introduction, Post Processing Techniques like Support material removal, Cleaning, Sanding and Polishing.
Inspection: Introduction, Significance, Inspection techniques like Dimensional measurement along X, Y and Z axes, visual inspection of the surface finish (overall

aesthetics and intact features), flatness or warp check, and FOD (foreign objects or debris) check.

TEXT BOOKS:

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W. Rosen, Brent Stucker., Springer, 2010
2. Rapid Prototyping: Principles and Applications, Chua C. K., Leong K. F., and Lim C. S., 3rd Edition, World Scientific, 2010

REFERENCES:

1. Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development, Liou L. W. and Liou F. W., CRC Press, 2007
2. Rapid Prototyping: Theory and Practice, Kamrani A. K. and Nasr E. A., Springer, 2006
3. Rapid Tooling: Technologies and Industrial Applications, Hilton P. D. and Jacobs P. F., CRC Press, 2000
4. Rapid Prototyping, Gebhardt A., Hanser Gardener Publications, 2003

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

(18OE1EC09) EMBEDDED SYSTEMS FOR IOT

COURSE PRE-REQUISITES: Programming through C

COURSE OBJECTIVES:

- To understand the basics of computing with Embedded Systems
- To expose the students to various smart sensors
- To make the students familiar with the programming concepts of Embedded development board
- To understand the basics of Internet of Things and Cloud of things

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Familiar with architectural and programming issues of Embedded Systems
CO-2: Able to select proper smart Sensor for a specific measurement application
CO-3: Analyze various protocols for Internet of Things
CO-4: Apply Internet of Things to different applications in the real world

UNIT – I:
Embedded System Design: Numbering and Coding Systems, Digital Premier, Inside the Computer
Embedded System - Definition, Characteristics of embedded computing applications, Design challenges, Requirements, Specification, Architecture design, Designing hardware and software components, system integration.

UNIT – II:
Smart Sensors & Applications: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation.

UNIT – III:
Sensors Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring.

UNIT – IV:
Micro Controller Board: Features of Arduino, Arduino components and IDE, **Interfacing:** Seven Segment Display, Pulse Width Modulation, Analog Digital Converter, Wireless connectivity to Arduino. Case study: From BT To WiFi: Creating WiFi Controlled Arduino Robot Car.

UNIT – V:
Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Deployment Templates, M2M, IoT vs M2M.

UNIT – VI:

Domain Specific Applications of IoT: IoT Design Methodology, Applications of IoT–Home, Health, Environment, Energy, Agriculture, Industry and Smart City.

TEXT BOOKS:

1. The 8051 Microcontroller: Programming, Architecture, Ayala &Gadre, 3rd Edition, Cengage Publications, 2008
2. Sensors and Transducers, D. Patranabis, 2nd Edition, PHI Learning Private Limited, 2013
3. Internet of Things: A Hands-On Approach, Vijay Madisetti, ArshdeepBahga, 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 GillispieMazidi, Rolin D. McKinlay, 2nd Edition, 2005
3. Internet of Things with Raspberry Pi and Arduino, Singh R., Gehlot A., Gupta L., Singh B., Swain M., Boca Raton, CRC Press, 2020

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

(18OE1CS09) ARTIFICIAL INTELLIGENCE – A BEGINNER'S GUIDE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand and analyze the basic concepts of artificial intelligence
- To identify, explore the complex problem-solving strategies and approaches
- To analyze the concepts of basic concepts of neural networks and learning process
- To explore and analyze the methodology used in machine learning and computer vision

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and apply the basic concepts of artificial intelligence and its use cases. lives
CO-2: Explore the various search strategies and approaches for problem solving
CO-3: Correlate the fields related to AI, and articulate various learning paradigms
CO-4: Describe several issues and ethical concerns surrounding AI

UNIT – I:
Introduction to AI: What is AI-On Overview, History of AI, Applications and Examples of AI, AI Concepts, Terminology, Key fields of AI. AI Issues, Concerns, and Ethical Considerations.

UNIT – II:
AI as Search Process: On overview of Search Strategy. Types of Searches- Uninformed, Informed, Bidirectional search, Heuristic search. Local search, Local beam search, Adversarial Search.

UNIT – III:
AI as Knowledge Exploration: Introduction to Propositional Logic, Rules of Inference, First Order Logic (FOL) Syntax, Semantics, Entailment, Tools to represent knowledge.

UNIT – IV:
AI as a Learning Task: Introduction to Learning, Learning types -Supervised, Unsupervised, Reinforcement Learning, Machine learning, Deep Learning, The link between AI, ML, DL.

UNIT – V:
AI as Neural Networks: Introduction to biological neural networks. Link between biological neuron and artificial neuron. Architecture of artificial neural network, Types of Neural networks-single layer, multilayer, Back propagation networks.

UNIT – VI:
The Future of AI: Computer Vision - Seeing the World Through AI, Bots - Conversation as a Platform, AI and the society, AI in action-the Use Cases, Building AI Projects.

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall, 2010
2. Machine Learning, Tom M. Mitchell, McGraw-Hill Publications
3. Neural Networks-A Comprehensive Foundation, Simon Haykin, 2nd Edition, Pearson Education, 2004

REFERENCES:

1. Artificial Intelligence, Elaine Rich & Kevin Knight, 2nd Edition, TMH
2. Artificial Intelligence, A New Synthesis, Nils J. Nilsson, Elsevier
3. Artificial Neural Networks, Yegna Narayana B., PHI

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	3	**0**	**3**

(18OE1CS10) BLOCKCHAIN TECHNOLOGY ESSENTIALS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce and get the technological overview of blockchain technologies
- To Study the foundation of Blockchain Technology and demonstrate the various types of Blockchain
- To explore the application area of Blockchain Technology
- To introduce smart contract, consensus algorithm and Security Mechanism
- Introduction to available platforms to implement Blockchain Technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and explore the Blockchain Technology
CO-2: Describe smart contract concepts
CO-3: Explore different types of Blockchain
CO-4: Develop the platforms to implement Blockchain Technology

UNIT – I:
Fundamental of Blockchain Part I: Introduction to Centralized, Decentralized and Distributed system, computer network peer to peer connection
Fundamental of Blockchain Part II: History of Blockchain, Various technical definitions of Blockchain. Generic elements of a blockchain: Block, Transaction, Node, Why It's Called "Blockchain", Characteristics of Blockchain Technology, Advantages of blockchain technology, Limitations of blockchain as a technology

UNIT – II:
Concept of Blockchain Technology Part I: Applications of blockchain technology, Tiers of blockchain technology Blockchain 0, Blockchain 1, Blockchain 2, Blockchain 3, Generation of Blockchain X, smart contract
Concept of Blockchain Technology Part II: Types of blockchain: Public blockchain, private blockchain, hybrid blockchain, examples of Public, private, hybrid blockchain and it merit and demerit.

UNIT – III:
Technical Foundations Part I: Component of block, Structure of Block chain, Technical Characteristics of the Blockchain, genesis block, Nonce
Technical Foundations Part II: Cryptography, Hashing, Distributed database, Consensus mechanisms, and basic of Cryptographic primitives, Technical Characteristics of Secure Hash Algorithms (SHA), Digital signature.

UNIT – IV:
Consensus Algorithm: Proof of work (PoW), Proof-of-Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of authority (PoA), Confidentiality, Integrity, Authentication, Permissioned ledger, Distributed ledger, Shared ledger, Fully private and proprietary

blockchains, Tokenized blockchains, Tokenless blockchains, CAP theorem and blockchain

UNIT – V:

E-Governance and other contract enforcement mechanisms, Financial markets and trading, Trading, Exchanges, Trade life cycle, Order anticipators, Market manipulation. **Crypto Currency:** Bitcoin, Bitcoin definition, Keys and addresses, Public keys in Bitcoin, Private keys in Bitcoin, Bitcoin currency units

UNIT – VI:

Implementation Platforms: Hyperledger as a protocol, Reference architecture, Hyperledger Fabric, Transaction Flow, Hyperledger Fabric Details, Fabric Membership, Fabric Membership

TEXT BOOKS:

1. Mastering Blockchain, Imaran Bashir, 2nd Edition, Packt
2. Blockchain Basic, Daniel Drescher, A Press

REFERENCES:

1. Blockchain For Dummies®, IBM Limited Edition, John Wiley & Sons, Inc.

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(18OE1EI05) FUNDAMENTALS OF ROBOTICS AND DRONES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To classify by coordinate system and control system
- To acquire Knowledge on different types Power Sources and Sensors
- To classify different types of Manipulators, Actuators and Grippers
- To acquire Knowledge on kinematics and Vision systems used for different Robots
- To acquire Knowledge on the basics of Drones

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire knowledge on different types of Power Sources (actuators) and Sensors, Manipulators, Actuators and Grippers
CO-2: Acquire knowledge on different applications of various types of robots
CO-3: Analyze the direct and the inverse kinematic problems and calculate the manipulator dynamics
CO-4: Acquire knowledge on the applications of Machine Vision in Robotics
CO-5: Acquire Knowledge on the basics of Drones

UNIT – I:
Basic Concepts & Fundamentals: An overview of Robotics, classification of Robots, Robot Components, Robot degrees of freedom, Robot Joints, Robot Coordinates, Robot reference frames, Programming modes, Robot Characteristics.

UNIT – II:
Sensors and Actuators:
Sensors: Sensors characteristics, Position sensors, velocity sensors, acceleration sensors, torque sensors, micro switches, lighten infrared sensors, touch and tactile sensors, proximity sensors, range finders.
Actuators: Characteristics of activating system, comparison of activating system Hydraulic devices, Pneumatic devices, electric motors, magneto-strictive actuators.

UNIT – III:
Manipulators and Grippers:
Grippers: Robot end effectors, Classification, drive system for Gripper, Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Adhesive Grippers, Hooks, Scoops and other Miscellaneous Devices, Gripper force Analysis and Gripper Design, Active and passive Grippers.

UNIT – IV:
Kinematics: Matrix representation of translational and Rotational motion – Homogeneous Transformation-DH representation of standard configuration Robots-Inverse Kinematics. Joint space vs. Cartesian space-Basics of Trajectory planning in joint and Cartesian space.

UNIT – V:

Robot Vision: Low level and High-level vision

Image acquisition, Illumination Techniques, Imaging Geometry, Some Basic Relationships between Pixels, Segmentation, Description, Segmentation and Description of 3-D Structures, Recognition, Interpretation.

UNIT – VI:

Basics of Drones: Theory behind how drones work, individual components that makeup a drone, basic concepts involved radio-controlled model flying, building a complete quad copter drone from scratch

TEXT BOOKS:

1. Introduction To Robotics: Analysis, Control, Applications, Wiley, Saeed B. Niku, 2nd Edition
2. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover, Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, McGraw-Hill, 2012

REFERENCES:

1. Robotics Technology and Flexible Automation, Deb S. R., John Wiley
2. Robots and Manufacturing Automation, Asfahl C. R., John Wiley
3. Robotic Engineering–An Integrated Approach, Klafter R. D., Chimielewski T. A., Negin. M, Prentice Hall of India, New Delhi
4. Drones for Beginners, Udemy

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

(18OE1IT08) FUNDAMENTALS OF CYBER SECURITY

COURSE PRE-REQUISITES: Basic Knowledge of Computers, Basic Knowledge of Networking and Internet

COURSE OBJECTIVES:
- To identify the key components of cyber security in network
- To describe the techniques in protecting Information security
- To define types of analyzing and monitoring potential threats and attacks
- To access additional external resources to supplement knowledge of cyber forensics and laws

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand, appreciate, employ, design and implement appropriate security technologies
CO-2: Demonstrate policies to protect computers and digital information
CO-3: Identify& Evaluate Information Security threats and vulnerabilities in Information Systems
CO-4: Understanding computer forensics and analyzing them

UNIT – I:
Introduction to Cybersecurity, Cybersecurity objectives, Cybersecurity roles, Differences between Information Security & Cybersecurity, Cybersecurity Principles - Confidentiality, integrity, & availability, Authentication & nonrepudiation, The Trinity of IT Security (CIA), Computer Protocols, Cookies, The TCP/IP

UNIT – II:
Who are the cyber criminals, Classification of cybercrimes, E-mail Spoofing, Spamming, Cyber defamation, Internet Time Theft, Salami Attack/ Salami Technique, Data Diddling, Forgery, Web Jacking, Newsgroup Spam/ Crimes Emanating from Usenet Newsgroup, Industrial Spying/Industrial Espionage, Hacking, Online Frauds, Pornographic Offenses, Software Piracy, Computer Sabotage, E-mail Bombing/Mail Bombs, UseNet Newsgroup as the Source of Cybercrimes, Computer Network Intrusions, Password Sniffing, Credit Card Frauds, Identity Theft.

UNIT – III:
Cyber Offenses: How Criminals Plan Them: Introduction, Categories of Cybercrime, How Criminals Plan the Attacks, Reconnaissance, Passive Attacks, Active Attacks, Scamming and Scrutinizing Gathered Information, Attack (Gaining and Maintaining the System Access), Social Engineering, Classification of Social Engineering, Cyber stalking, Types of Stalkers, Cases Reported on Cyber stalking, How Stalking Works?, Real-Life Incident of Cyber stalking, Cyber cafe and Cybercrimes,

UNIT – IV:
Security Threats: Introduction to security threats-Virus, Worms, Trojan horse, Bombs, Trap Door, E-Mail Virus, Virus Life cycle, How virus works?, Malware, Network and

Services attack- Dos attacks, Types of Dos attacks, Methods of attacks, Examples of attacks-SYN flooding, TCP flooding ,UDP flooding ,ICMP flooding ,Smurf, Ping of death, Tear drop, Security threats to E-commerce-Electronic payment system, Credit card/Debit cards, Smart cards, E- money, Electronic Fund Transfer, E-commerce security System, Electronic Cash, Digital Signatures

UNIT – V:

Introduction to Computer Forensics: computer crimes, evidence, extraction, preservation, etc. Overview of hardware and operating systems: structure of storage media/devices; windows/Macintosh/ Linux -- registry, boot process, file systems, file metadata. Data recovery: identifying hidden data, Encryption/Decryption, Steganography, recovering deleted files. Digital evidence controls: uncovering attacks that evade detection by Event Viewer, Task Manager, and other Windows GUI tools, data acquisition, disk imaging, recovering swap files, temporary &cache files, Computer Forensic tools, Network Forensic. Computer crime and Legal issues: Intellectual property, privacy issues, Criminal Justice system for forensic, audit/investigative situations and digital crime scene, investigative procedure/standards for extraction, preservation, and deposition of legal evidence in a court of law.

UNIT – VI:

Fundamentals of Cyber law: Evolution of the IT Act, Genesis and Necessity , Salient features of the IT Act, 2000, various authorities under IT Act and their powers, Penalties & Offences, amendments, Impact on other related Acts Cyber Space Jurisdiction - Jurisdiction issues under IT Act, 2000- Traditional principals of Jurisdiction - Extra-terrestrial Jurisdiction- Case Laws on Cyber Space Jurisdiction Sensitive Personal Data or Information (SPDI) in Cyber Law (a) SPDI Definition and Reasonable Security Practices in India (b) Reasonable Security Practices – International perspective

TEXT BOOKS:

1. Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and SunitBelpure, Wiley
2. Fundamentals of Cyber Security, Mayank Bhusan, Rajkumar Singh Rathore, Aatif Jamshed, BPB Publications
3. Cyber Law & Cyber Crimes, Advocat Prashant Mali, Snow White Publications, Mumbai

REFERENCES:

1. Computer Forensics and Cyber Crime: An Introduction, Marjie T. Britz, 3rd Edition, 2013
2. Digital Forensics with Open-Source Tools. Cory Altheide and Harlan Carvey, Elsevier, 2011(ISBN: 978-1-59749- 586-8)
3. Network Forensics: Tracking Hackers Through Cyberspace, Sherri Davidoff, Jonathan Ham Prentice Hall, 2012
4. Cyber Law in India, Farooq Ahmad, Pioneer Books
5. Information Technology Law and Practice, Vakul Sharma, Universal Law Publishing Co. Pvt. Ltd.

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B.Tech.	L	T/P/D	C
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(18OE1IT09) FUNDAMENTALS OF DATA SCIENCE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration
- To explore data analysis, predictive modeling, descriptive modeling, data product creation, evaluation, and effective communication
- To understand the basic knowledge of algorithms and reasonable programming experience and some familiarity with basic linear algebra and basic probability and statistics
- To identify the importance of recommendation systems and data visualization techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data
CO-2: Discuss the significance of exploratory data analysis (EDA) in data science and to apply basic tools (plots, graphs, summary statistics) to carry out EDA
CO-3: Apply basic machine learning algorithms and to identify common approaches used for Feature Generation
CO-4: Analyze fundamental mathematical and algorithmic ingredients that constitute a Recommendation Engine and to Build their own recommendation system using existing components

UNIT – I:
Introduction: What is Data Science? - Big Data and Data Science hype – and getting past the hype - Why now? – Datafication - Current landscape of perspectives - Skill sets needed - Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model - Intro to R

UNIT – II:
Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Case Study: Real Direct (online real estate firm) - Three Basic Machine Learning Algorithms-Linear Regression - k-Nearest Neighbors (k-NN) - k-means

UNIT – III:
One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam

UNIT – IV:
Data Wrangling: APIs and other tools for scrapping the Web - Feature Generation and

Feature Selection (Extracting Meaning From Data) - Motivating application: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests

UNIT – V:

Recommendation Systems: Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis - Exercise: build your own recommendation system - Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighbourhood properties in graphs

UNIT – VI:

Data Visualization: Basic principles, ideas and tools for data visualization 3 - Examples of inspiring (industry) projects - Exercise: create your own visualization of a complex dataset - Data Science and Ethical Issues - Discussions on privacy, security, ethics - A look back at Data Science - Next-generation data scientists

TEXT BOOKS:

1. Doing Data Science, Straight Talk From The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014
2. Mining of Massive Datasets v2.1, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, Cambridge University Press, 2014
3. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, 2013 (ISBN 0262018020)

REFERENCES:

1. Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani and Jerome Friedman, 2nd Edition, 2009 (ISBN 0387952845)
2. Foundations of Data Science, Avrim Blum, John Hopcroft and Ravindran Kannan
3. Data Mining and Analysis: Fundamental Concepts and Algorithms, Mohammed J. Zaki and Wagner Miera Jr. Cambridge University Press, 2014
4. Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, 3rd Edition, 2011 (ISBN 0123814790)

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

(18OE1AE05) INTRODUCTION TO ADVANCED VEHICLE TECHNOLOGIES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the layout of an automobile and functionalities chassis elements
- To provide the concepts of automotive electrical systems and electric & hybrid vehicles
- To present various intelligent automotive systems and levels of vehicle autonomy

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the functionalities of automotive systems and subsystems
CO-2: Discuss the concepts of automotive electrical systems and electric & hybrid vehicles
CO-3: Describe various intelligent automotive systems and levels of vehicle autonomy

UNIT – I:
Introduction: Classification of automobiles, layout of an automobile and types of bodies.
Automotive Chassis: Introduction to chassis systems - engine, cooling, lubrication, fuel feed, ignition, electrical, driveline - clutch, transmission, propeller shaft, differential, axles, wheels and tyres, steering, suspension and braking.

UNIT – II:
Engine: Working principle of four stoke and two stroke SI and CI engines, fuel system – layout of petrol and diesel fuel systems, electronic fuel injection - multi-point fuel injection, gasoline direct injection, common rail direct injection.

UNIT – III:
Electrical System: Simple automotive wiring diagram and components of electrical system, starting system – starter circuit, standard Bendix and over running clutch drive, charging system – alternator, cut-outs and regulators, ignition system - conventional and electronic ignition system.

UNIT – IV:
Electric and Hybrid Vehicles: Electric vehicle – Layout, components, configurations, advantages and limitations. Hybrid vehicle - Concepts of hybrid electric drivetrain based on hybridization and powertrain configuration, architecture of series, parallel and series-parallel hybrid electric drivetrains, modes of operation, merits and demerits.

UNIT – V:
Intelligent Vehicle Systems: Automotive navigation, night vision, head-up display, airbag, seat belt tightening system, immobilizers, adaptive cruise control, forward collision warning, lane departure warning and anti-lock braking system.

UNIT – VI:

Autonomous Vehicles: Levels of automation, research, challenges, commercial development, sensor systems, sensor suits, environmental challenges, graceful degradation, V2V and V2I communication, sharing the drive, integrity, security, verification and policy implications.

TEXT BOOKS:

1. Advanced Vehicle Technology, Heinz Heisler, Butterworth Heinemann, 2002
2. Intelligent Vehicle Technologies: Theory and Applications, LjuboVlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann, Oxford, 2001
3. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, CRS Press, 2004

REFERENCES:

1. Automotive Mechanics, Giri N. K., Khanna Publications, 2006
2. Automotive Electrical Equipment, Kohli P. L., Tata McGraw-Hill Co. Ltd., New Delhi, 1975
3. Electric and Hybrid Vehicles – Design Fundamentals, Iqbal Husain, CRC Press, 2010
4. Autonomous Vehicle Technology-A Guide for Policymakers, James M. Anderson, Nidhi Kalra, Karlyn D. Stanley, Paul Sorensen, Constantine Samaras, Oluwatobi A. Oluwatola, RAND Corporation, Santa Monica, Calif., 2016

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

(18PC1ME15) DIGITAL MANUFACTURING

COURSE PRE-REQUISITES: Metrology, Solid modeling

COURSE OBJECTIVES:
- To know the need for and importance of Additive Manufacturing in product development and its applications
- To understand the different types of Additive Manufacturing systems
- To be familiar with the CAD formats involved in Additive Manufacturing
- To understand post-processing, inspection and testing involved in Additive Manufacturing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize the knowledge of Additive Manufacturing in product development and its applications
CO-2: Explain the liquid, solid and powder based Additive Manufacturing Systems
CO-3: Apply the knowledge of CAD Formats involved in Additive Manufacturing
CO-4: Plan post-processing techniques and perform inspection and testing in Additive Manufacturing

UNIT – I:
Introduction: Introduction, Need, Classification, Additive Manufacturing Technology in product development, Materials for Additive Manufacturing Technology, Tooling.
Applications: Brief overview of applications in Design, Engineering, Manufacturing and Tooling, Aerospace, Automotive, Biomedical, Jewelry, Coin and Tableware Industry.

UNIT – II:
Liquid Based Additive Manufacturing Systems: Introduction to Liquid based systems, Classification, Principles, Process, Advantages and Applications of Stereolithography Apparatus (SLA), Solid Ground Curing (SGC), Solid Creation System (SCS), Polyjet and Solid Object Ultraviolet-Laser Printer (SOUP).

UNIT – III:
Solid Based Additive Manufacturing Systems: Introduction to Solid based systems, Classification, Principles, Process, Advantages and Applications of Fused Deposition Modeling (FDM), Laminated Object Manufacturing (LOM), Paper Lamination Technology (PLT) and Multi-Jet Modeling (MJM).

UNIT – IV:
Powder Based Additive Manufacturing Systems: Introduction to Powder based systems, Classification, Principles, Process, Advantages and Applications of Selective Laser Sintering (SLS), Three-Dimensional Printing (3DP), Laser Engineered Net Shaping (LENS) and Electron Beam Melting (EBM).

UNIT – V:

CAD For Additive Manufacturing: Basic concept, Digitization techniques, CAD data formats, CAD model preparation, Part orientation and support generation, Data loss & repair, Model slicing, Tool path generation.

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, by Ian Gibson, David W. Rosen, Brent Stucker, Springer, 2010
2. Rapid Prototyping, Gebhardt A., Hanser, Gardener Publications, 2003

REFERENCES:

1. Rapid Prototyping: Principles and Applications, Chua C. K., Leong K. F., and Lim C. S., 3rd Edition, World Scientific Publishers, 2010
2. Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development, Liou L. W. and Liou F. W., CRC Press, 2007
3. Rapid Prototyping: Theory and practice, Kamrani A. K. and Nasr E. A., Springer, 2006
4. Rapid Tooling: Technologies and Industrial Applications, Hilton P. D. and Jacobs P. F., CRC Press, 2000

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

(18PE1ME11) FLUID POWER SYSTEMS

COURSE PRE-REQUISITES: Fluid Mechanics

COURSE OBJECTIVES:
- To understand the basics of hydraulics and pneumatics
- To improve knowledge on hydraulic pumps and various power supply sources
- To teach the fundamentals of hydraulic and pneumatic circuit design
- To know fluid power maintenance and troubleshooting

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify hydraulic and pneumatic system components and importance of fluid power technology in industries
CO-2: Select and develop hydraulic and pneumatic systems for certain industrial applications
CO-3: Explore the similarities and differences of the electrical, pneumatic and hydraulic systems
CO-4: Involve in the troubleshooting of fluid power systems in industry

UNIT – I:
Introduction To Fluid Power: Introduction to Fluid power- Hydraulics and Pneumatics - Advantages and Applications- Fluid power systems — Properties of fluids - Basics principles of Hydraulics – Pascal's Law – Work, Power and Torque. Properties of air– Perfect Gas Laws.

UNIT – II:
Hydraulic and Pneumatic Power Supply Source
Sources of Hydraulic Power: Pumping Theory – Pump Classification- Construction, Working, Design, Advantages, Disadvantages, Performance, graphical symbol.
HYDRAULIC ACTUATORS: CYLINDERS – Types and construction – graphical symbol – Motors –Types and construction

UNIT – III:
Hydraulic and Pneumatic Control Components
Hydraulic Motors Control Components: Direction control, Flow control and Pressure control valves- Types, Construction and Operation- Applications

UNIT – IV:
Hydraulic Circuits: Industrial hydraulic circuits- Control of single and double acting cylinder, Regenerative cylinder circuit- Fail-safe circuit, Speed control, Hydrostatic transmission.

UNIT – V:
Pneumatic System: Basics of Pneumatic circuit - design considerations -Compressors- Filter, Regulator, Lubricator, Muffler, Air control Valves, Pneumatic actuators

UNIT – VI:

Fluid Power System Maintenance: Introduction- Oxidation and corrosion of hydraulic fluids-Fire resistant fluids-Filters and Strainers- Beta Ratio of filters-Wear of moving parts-problems caused by Gases – Troubleshooting- Environmental issues.

TEXT BOOKS:

1. Fluid Power with Applications, Anthony Esposito, PHI / Pearson Education, 2005
2. Hydraulic and Pneumatic controls, Shanmugasundaram K., Chand & Co., 2006

REFRENCES:

1. Oil Hydraulics Systems- Principles and Maintenance, Majumdar S. R., Tata McGraw-Hill, 2001
2. Pneumatic Systems – Principles and Maintenance, Majumdar S. R., Tata McGraw-Hill, 2007
3. Power Hydraulics, Michael J., Pinches and Ashby J. G., Prentice Hall, 1989
4. Basic Fluid Power, Dudelyt A. Pease and John J. Pippenger, Prentice Hall, 1987
5. Hydraulic and Pneumatic Control, Srinivasan R., 2^{nd} Edition, Tata McGraw - Hill Education, 2012

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

(18PE1ME12) TOTAL QUALITY MANAGEMENT

COURSE PRE-REQUISITES: Knowledge of Industrial Engineering, Management, Quality, Mathematics & Statistics

COURSE OBJECTIVES:
- To understand Quality and its role in today's context
- To understand of Quality Management principles and process
- To understand Tools & Techniques of TQM and the Cost of Quality
- To understand how the quality is measured, existing standards present in general, and how to meet those quality certifications by implementing TQM

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the Principles, tools and techniques of quality management to manufacturing and services processes
CO-2: Design & Implement TQM in an industry
CO-3: Identify the quality systems in an organization and suggest improvements
CO-4: Transfer a simple traditional system to TQM and estimate the cost of Quality

UNIT – I:
Introduction: Introduction – Need for quality – Evolution of quality – Definitions of quality – Dimensions of product and service quality – Basic concepts of TQM – TQM Framework – Contributions of Deming, Juran and Crosby – Barriers to TQM – Quality statements – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention – Costs of quality.

UNIT – II:
TQM Principles: Leadership – Strategic quality planning, Quality Councils – Employee involvement – Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal – Continuous process improvement – PDCA cycle, 5S, Kaizen – Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT – III:
TQM Tools and Techniques-I: The seven traditional tools of quality – New management tools – Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – Failure Mode & Effects Analysis (FMEA) – Stages, Types.

UNIT – IV:
TQM Tools and Techniques-II: Control Charts – Process Capability – Concepts of Six Sigma – Quality Function Development (QFD) – Taguchi quality loss function – Total Productive Maintenance (TPM) – Concepts, improvement needs – Performance measures.

UNIT – V:

Quality Systems: Need for ISO 9000 – ISO 9001-2008 Quality System – Elements, Documentation, Quality Auditing – QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – TQM Implementation in manufacturing and service sectors.

UNIT – VI:

The Cost of Quality: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost Information, Accounting Systems and Quality Management.

TEXTBOOKS:

1. Total Quality Management, Dale H. Besterfiled et al., 3rd Edition, Indian Reprint, Pearson Education Asia, 2006
2. Total Quality Management, R. S. Naagarazan, 3rd Edition, New Age International, 2015

REFERENCES:

1. The Management and Control of Quality, James R. Evans and William M. Lindsay, 8th Edition, First Indian Edition, Cengage Learning, 2012
2. Total Quality Management, Suganthi L. and Anand Samuel, Prentice Hall (India) Pvt. Ltd., 2006
3. Total Quality Management – Text and Cases, Janakiraman B. and Gopal R. K., Prentice Hall (India) Pvt. Ltd., 2006
4. Total Quality Management, Principles, Practice and Cases, Sharma DD, Sultan Chand and Sons, New Delhi, India

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

(18PE1ME13) MECHANICAL VIBRATIONS

COURSE PRE-REQUISITES: Design of Machine Members, Engineering Mechanics, Engineering Mathematics

COURSE OBJECTIVES:
- To get aware of concepts and types of vibrations
- To understand Natural frequencies of physical problems
- To understand Vibration transmission and methods to reduce vibrations
- To understand and apply Numerical methods to solve multi degree systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply vibration analysis in mechanical design of machine parts that operate in vibratory conditions.
CO-2: Formulate a mathematical relation for various one DOF free and forced vibration
systems and continuous vibratory systems.
CO-3: Obtain the principal modes of 2DOF systems, and design vibration absorbers.
CO-4: Analyze the various multi degree freedom vibration systems using numerical methods.
CO-5: Analyze vibration of continuous systems under various conditions

UNIT – I:
Fundamental of Vibrations: Types, Causes, Effects, Terms in Vibration, Simple Harmonic Motion, Fourier series. Undamped Single Degree Freedom System: Equivalent System, Formulation of equation of motion: Newton method, Energy method, Natural Frequency of simple vibratory systems, Spring and Geared Systems.
Damped Single Degree Freedom System: Damping Models- Viscous Damping, Structural Damping, Coulomb Damping Single Degree Freedom System with Damping- Over Damped, Under Damped, Critically Damped, Logarithmic Decrement.

UNIT – II:
Single Degree Freedom System – Forced Vibrations: Response to harmonic excitations, solution of differential equation of motion, Vector approach, Magnification factor Resonance, Rotating/reciprocating unbalances, Force Transmissibility, Motion Transmissibility, Critical Speed of shaft.
Vibration Measuring Instruments: displacement, velocity and acceleration and frequency measuring instruments and seismic instruments.

UNIT – III:
Two Degree of Freedom Systems: Formulation of equation of motion: Equilibrium method, Lagrangian method, coordinate coupling, decoupling of equations of motion. Principal modes of vibrations, natural frequencies of systems (without damping) – Simple spring mass systems, double pendulum, torsional systems, combined rectilinear and angular systems, geared systems, and Problems.

Forced Vibration Response: Undamped dynamic vibration absorber and Problems.

UNIT – IV:

Multi Degree of Freedom Systems: Formulation of equations of motion, Free vibration response, matrix formulation, stiffness and flexibility influence coefficients, natural frequencies, and mode shapes (Eigen values and Eigen vectors), normal modes and their properties, modal analysis, method of matrix inversion, torsional vibrations of multi – rotor systems and geared systems

UNIT – V:

Numerical Methods for Multi Degree of Freedom Systems: Rayleigh's method, Dunkerley's method, Stodola's method, Rayleigh–Ritz method, method of matrix iteration and Holzer's method.

UNIT – VI:

Continuous Systems: Free vibration of strings, Longitudinal oscillations of bars, Traverse vibrations of beams, Torsional vibration of shafts. Critical speeds of shafts: Critical speeds without and with damping, secondary critical speed.

TEXT BOOKS:

1. Fundamentals of Vibrations, Leonard Meirovitch, McGraw-Hill
2. Mechanical Vibrations, Grover G. K., Nem Chand and Brothers
3. Mechanical Vibrations, Rao S. S., Pearson

REFERENCES:

1. Mechanical Vibrations, Rao V. Dukkipati& J. Srinivas, Prentice Hall
2. Vibration Problems in Engineering, S. P. Timoshenko
3. Mechanical Vibrations, S. Graham Kelly, Schaum's Outline, TMH
4. Mechanical Vibrations SETO, Schaumm Series, McGraw Hil Publications

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

(18PE1ME14) MECHANICS OF COMPOSITE MATERIALS

COURSE PRE-REQUISITES: Maths, Physics, Chemistry, Engineering Mechanics, Mechanics of Solids

COURSE OBJECTIVES:
- To understand composite materials and their properties, relationship between them and manufacturing methods
- To understand the principles of material science applied to composite materials
- To study the equations to analyze problems by making good assumptions and learn systematic engineering methods to solve practical composite mechanics problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply fundamental knowledge of mathematics to modeling and analysis of composite materials
CO-2: Understand the manufacturing methods of various composite materials
CO-3: Recognize the elastic behavior of composite materials
CO-4: Analyze the failure modes of composites

UNIT – I:
Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.
Matrices: classification of matrices – polymers, metals and ceramics – properties and applications

UNIT – II:
Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements.
Mechanical Behavior of Composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III:
Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications.
Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT – IV:
Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method

– Compression moulding – Reaction Injection moulding. Properties and applications, Introduction to Machining of Composites.

UNIT – V:

Elastic Behavior of Laminate: Basic assumptions, Strain-displacement relations, Stress-strain relation of layer within a laminate, Force and moment resultant, General load–deformation relations, Analysis of different types of laminates

UNIT – VI:

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first ply failure-insight, strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Analysis and Performance of Fiber Composites, B. D. Agarwal, 3rdEdition, Wiley Publishers
2. Mechanics of Composite Materials, Robert M. Jones, 2ndEdition, Scripta Book Company

REFERENCES:

1. Material Science and Technology, Vol. 13–Composites, R. W. Cahn – VCH, West Germany
2. Materials Science and Engineering-An Introduction, W. D. Callister Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian Edition, 2007
3. Composite Materials, K. K. Chawla
4. Composite Materials Science and Applications, Deborah D. L. Chung
5. Composite Materials Design and Applications, Danial Gay, Suong V. Hoa and Stephen W. Tasi

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(18PE1ME15) TOOL DESIGN

COURSE PRE-REQUISITES: Design Principles, Machine Tools, Process Engineering

COURSE OBJECTIVES:
- To analyze the properties of tool materials such as ferrous, non-ferrous, non-metallic materials and their heat treatment
- To design single and multi-point cutting tools for various applications
- To create Jigs and Fixtures design
- To analyze the design of sheet metal tools for blanking, piercing, bending, forming and drawing etc.
- To analyze the design of cutting tools for numerically controlled machine tools

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply an appropriate heat treatment for the tools
CO-2: Evaluate the single and multi-point cutting tools for various methods
CO-3: Analyze the design of jigs and fixtures for several components depending on quantity requirement
CO-4: Apply the sheet metal tools for blanking, piercing, bending, forming and drawing
CO-5: Apply the cutting tools for numerically controlled machine tools

UNIT – I:
Tool Materials: Properties of materials- Tools steels, Cast Iron, Mild or low carbon steels, Nonmetallic and Nonferrous materials and its Heat treatment.

UNIT – II:
Design of Cutting Tools: Basic requirements of a cutting tool, Single Point cutting tools, Milling cutters, Drills, Determination of shank size for Single Point carbide tools, determining the insert thickness for carbide tools

UNIT – III:
Design of Jigs and Fixtures: Basic principles of location, Locating methods and devices, Basic principles of clamping, Jigs-Definition, Types, General considerations in the design of Drill jigs, Fixtures- Vise fixtures, Milling, Lathe and Grinding fixtures.

UNIT – IV:
Design of Sheet Metal Blanking and Piercing Dies: Fundamentals of Die cutting operation, Power press types, General press information, cutting action in Punch, Die operations, Die clearance, Die design fundamentals-Blanking and piercing die construction.

UNIT – V:
Design of Sheet Metal Bending, Forming and Drawing Dies: Bending dies, drawing dies, forming dies, drawing operations, Variables that effect metal flow during drawing. Determination of blank size, Drawing force.

UNIT – VI:

Tool Design for Numerically Controlled Machine Tools: Introduction, the need for numerical control, a basic explanation of numeric control, cutting tools for numerical control, automatic tool changers and tool positioners.

TEXTS BOOKS:

1. Tool Design, Donaldson, Tata McGraw-Hill
2. Mechanical Metallurgy, George F. Dieter, Tata McGraw-Hill

REFERENCES:

1. American Society for Metals, Taylor Altm, Soollk-Oh and Harold L. Gegel - 1983
2. Handbook of Metal Forming, Kurt Lange, McGraw-Hill, 1987

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(18PE1ME16) COMPUTATIONAL FLUID DYNAMICS

COURSE PRE-REQUISITES: C Programming Skills, Numerical Methods, Fluid Mechanics, Heat and Mass Transfer.

COURSEOBJECTIVES:

- To familiarize with the differential equations for flow phenomena and numerical methods for their solution
- To understand different methods involved in solving problem numerically
- To formulate different kinds of physical problems with the different schemes and boundary conditions
- To develop a code in a programming language to numerically solve a practical problem

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Solve fluid flow and heat transfer problems using numerical methods & Programming
CO-2: critically analyze different mathematical models and computational methods for flow simulations
CO-3: Write algorithms to solve the complex nonlinear equations numerically and able to do a project demonstrating your understanding
CO-4: Conduct the stability analysis and check the applicability of different schemes.

UNIT – I:
Applied Numerical Methods: Solution of a system of simultaneous Linear Algebraic Equations, iterative schemes of Matrix Inversion, Direct Methods for Matrix inversion, Direct Methods for banded matrices
Introduction: Finite difference method, finite volume method, finite element method, governing equations, initial and boundary conditions, Derivation of finite difference equations. Mathematical Behavior of Partial differential Equations: the Impact on CFD: Hyperbolic Equation, Elliptic Equation and Parabolic Equation.

UNIT – II:
Finite Difference Equations: Taylor series Expansion, Basic Aspects of Discretization, Finite Difference Approximation of Mixed Partial derivatives, Parabolic: Explicit and Implicit Methods, two Space Dimensions, Elliptic Partial difference Equations; consistency, error and an analysis of stability.

UNIT – III:
Hyperbolic Equations: Von Neumann stability analysis, multistep methods, nonlinear problems, second order one-dimensional wave equations. Burgers equations: Explicit and implicit schemes, conservative property, the upwind scheme.

UNIT – IV:

Finite Difference Applications in Heat Conduction and Convection: Heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.

UNIT – V:

Fundamentals of Fluid Flow Modeling: Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations.

UNIT – VI:

Finite Volume Method: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

TEXT BOOKS:

1. Computational Fluid Flow and Heat Transfer, Muralidaran, Narosa Publications
2. Computational Fluid Dynamics: Basics with Applications, John D. Anderson, McGraw-Hill

REFERENCES:

1. Numerical Heat Transfer and Fluid Flow, Suhas V. Patankar, Hemashava Publishers Corporation &McGraw-Hill
2. Fundamentals of Computational Fluid Dynamics, Tapan K. Sengupta, Universities Press
3. An Introduction to Computational Fluid Dynamics, H. K. Versteeg and W.Malalasekera, Pearson Education Limited

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(18PE1ME17) OPTIMIZATION TECHNIQUES

COURSE PRE-REQUISITES: Mathematics, Operation Research

COURSE OBJECTIVES:

- To understand the classification of optimization techniques and its practical use
- To understand about the optimization of one-dimensional optimization methods, finds the characteristics of constrained problems
- To know about constrained minimization methods
- To understand Geometric and dynamic programing

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

CO-1: Analyse the different types of optimization techniques for different applications, applies one dimensional minimisation methods

CO-2: Formulates and solve the problems by using unconstrained minimization methods, can find characteristics of constrained problems

CO-3: Formulates and solve the problems (industrial/research) by using the geometric programming

CO-4: Formulate and solve the industrial problems by using the dynamic programming methods

UNIT – I:

Introduction: Engineering Applications; Statement of the Optimal Problem: Classification; Optimization Techniques. Classical Methods: Single Variable Optimization; Multivariable Optimization without any Constraints with Equality and Inequality Constraints.

UNIT – II:

One-Dimensional Minimization Methods: Uni-model Function; Elimination Methods – Dichotomous Search, Fibonacce and Golden Section Methods; Interpolation Methods – Quadratic and Cubic Interpolation Methods.

UNIT – III:

Unconstrained Minimization Methods: Univariate, Conjugate Directions, Gradient and Variable Metric Methods. Constrained Minimization Methods:

UNIT – IV:

Characteristics of a Constrained Problem; Direct Methods of feasible directions; Indirect Methods of interior and exterior penalty functions.

UNIT – V:

Geometric Programming: Formulation and Solutions of Unconstrained and Constrained geometric programming problems.

UNIT – VI:

Dynamic Programming: Concept of Sub-optimization and the principle of optimality; Calculus, Tabular and Computational Methods in Dynamic Programming; An Introduction to Continuous Dynamic Programming.

TEXT BOOKS:

1. Optimization (Theory & Applications), S. S. Rao, Wiley Eastern Ltd., New Delhi
2. Optimization Concepts and Applications in Engineering, Ashok D. Belegundu and Tirupathi R. Chandrupatla, Pearson Education

REFERENCES:

1. Optimization: Theory and Practice, C. S. G. Beveridge and R. S. Schechter, MGH, New York
2. Genetic Algorithms in Search, Optimization and Machine, Goldberg D. E., Addison-Wesley, NewYork
3. Optimization for Engineering Design Algorithms and Examples, Kalyanamoy Deb, Prentice Hall of India

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	3	**0**	**3**

(18PE1ME18) MECHANICAL BEHAVIOUR OF ENGINEERING MATERIALS

COURSE PRE-REQUISITES: Engineering Mechanics, Material Science, Strength of Materials

COURSE OBJECTIVES:

- To understand the fracture behaviour of metals and alloys
- To identify and learn linear, elastic/plastic fracture mechanics, three loading modes at crack tip, stress concentration factor
- To understand the fatigue and creep behaviour of metals
- To knows about the behaviour of non-metals (polymers)

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and apply the stress intensity fracture and fracture mechanics, mechanical behaviour of metals and alloys
CO-2: Analyze the different loading modes and applies the fracture mechanics for practical applications
CO-3: Apply and analyses the creep and fatigue failures for prediction of total life
CO-4: Evaluate the failure of non-metals

UNIT – I:
Introduction: Fracture behavior of metals and alloys. The ductile/brittle transition temperatures for notched and un-notched components, Ductile rupture as a failure mechanism Fracture at elevated temperature. Definitions of types of fracture and failure, Introduction to stress intensity factor and strain energy release rate, Equivalence of energy approach and stress intensity approach. Stress Intensity Factor and its use in Fracture Mechanics: Early concepts of stress concentrators and flaws, Ingles solution to stress round elliptical hole-implications of results. Stress intensity factor for a crack.

UNIT – II:
Linear Elastic Fracture Mechanics (LEFM): Three loading modes and the state of stress ahead of the crack tip, stress concentration factor, strain energy release rate, fracture energy, R. Modification for ductile materials, loading conditions. Stress intensity factor and the material parameter, the critical stress intensity factor.

UNIT – III:
Elastic/Plastic Fracture Mechanics: The crack opening displacement and J-integral approaches, Rcurve analysis Testing procedures, Measurement of these parameters, RAD, Fail sage and safe life design approaches, Practical applications. Advanced topics in EOFM.

UNIT – IV:
Fatigue: Definition of terms used to describe fatigue cycles, High Cycle Fatigue, Low Cycle Fatigue, Fatigue of Welded structures: Factors effecting the fatigue lives of welded joints. Mean stress R ratio, strain and load control. S-N curves. Goodman's rule

and Miners rule. Micro mechanisms of fatigue damage, fatigue limits and initiation and propagation control leading to a consideration of factors enhancing fatigue resistance. Total life and damage tolerant approaches to life prediction.

UNIT – V:

Creep Deformation: The evolution of creep damage, primary, secondary and tertiary creep, Micro mechanisms of creep in materials and the role of diffusion, Ashby creep deformation maps. Stress dependence of creep – power law dependence. Comparison of creep performance under different conditions – extrapolation and the use of Larson-Miller parameters, Creep-fatigue interactions, Creep integrals, Examples.

UNIT – VI:

Mechanical Behaviour of Polymeric Materials: introduction, time dependent mechanical behaviour, polymeric materials, structure of polymers, deformation of polymers, yielding criteria, rheology, viscoelastic behaviour, rubber elasticity, fracture and toughness

TEXT BOOKS:

1. Mechanical Metallurgy, Dieter, McGraw-Hill
2. Fracture Mechanics: Fundamental and Applications, Anderson T. L. & Boca Raton, CRC Press, Florida, 1998
3. Deformation and Fracture Mechanics of Engineering Materials, Richard W. Hertz, Wiley

REFERENCES:

1. Plasticity for Structural Engineers, W. F. Chen and D. J., Ha
2. Engineering Fracture Mechanics, D. R. J. Owen and A. J. Fawkes, Pincridge press, Swansea, UK
3. Fracture and Fatigue Control in Structures, S. T. Rolfe and J. M. Barsom, Prentice Hall, Eglewood Cliffs, N.J.
4. Fracture of Brittle Solids, B. R. Lawn and T. R. Wilshaw, Cambridge University Press
5. The Physics of Creep, F. R. N. Nabarro, H. L. deVilliers, Taylor and Francis, 1995

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

(18PE1ME19) MICROPROCESSORS IN AUTOMATION

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce students with the architecture and operation of typical microprocessors and microcontrollers
- To familiarize the students with the programming and interfacing of microprocessors and microcontrollers
- To introduce Programmable logic controller (PLC) basics
- To familiarize data Acquisition methods

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Describe the architecture of 8051
CO-2: Identify the addressing mode of an instruction
CO-3: Develop programming skills in assembly language
CO-4: Explain the need for different interfacing devices.

UNIT – I:
Number System:
Binary Data Representation: decimal system, binary system, octal system, hexadecimal system, binary coded decimal system, decimal conversion, decimal to Hexadecimal, arithmetic operations in binary, signed numbers, twos complement arithmetic, hexadecimal arithmetic, digital logic gates.

UNIT – II:
Microprocessors & Microcontroller: Difference between micro controller and microprocessor, Functional architecture of microprocessors, register, register data transfer, Timing register data transfer, Timing and control circuitry, Introduction to MC8051, criteria for choosing a microcontroller, internal architecture of MCS51 microcontroller and its family.

UNIT – III:
Peripheral Devices and their Interfacing: Introduction, memory and I/O interfacing, data transfer schemes, programmable peripheral interface (8255), programmable DMA controller (8257, 8237A), programmable interrupt controller (8259), programmable communication interface (8251), programmable counter/interval timer (8253 and 8254), special purpose interfacing devices, elements and circuits for interfacing.

UNIT – IV:
Programmable Logic Controller (PLC) Basics: Definition, Overview of PLC systems, input/output modules, Power supplies and Isolators.
Basic PLC Programming: Programming On-Off inputs/ outputs. Creating Ladder diagrams, Basic PLC functions, PLC Basic Functions, register basics, timer functions, counter functions.

UNIT – V:

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.

UNIT – VI:

Alternate programming languages of PLC, Auxiliary commands and functions, PLC installation, troubleshooting and maintenance, Communication protocol: Introduction to Field bus, HART protocol.

SCADA – Supervisory Control and Data Acquisition: Basic building blocks of computer control system – SCADA – MTU and RTU, Case studies on SCADA.

TEXT BOOKS:

1. Digital Design, Morris Mano, PHI, 3rd Edition, 2006
2. Microprocessors and interfacing, Douglas V. Hall, TMH, 2nd Edition, 1999
3. Programmable Logic Controllers, Principles and Applications, John W. Webb Ronald A. Reis, Fourth Edition, Prentice Hall Inc., New Jersey, 1998

REFERENCES:

1. Fundamentals of Logic Design, Charles H. Roth, Thomson Publications, 5th Edition, 2004
2. Advanced Microprocessors and Peripherals, A. K. Ray and K. M. Bhurchandi, TMH, 2000
3. Programmable Logic Controllers, Frank D. Petruzella, 2ndEdition, McGraw-Hill, New York, 1997

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PE1ME20) THEORY OF METAL CUTTING

COURSE PRE-REQUISITES: Production Technology, Machine Tools

COURSE OBJECTIVES:
- To evaluate the relations between the machining parameters and temperatures associated with the orthogonal cutting based on principles of metal cutting
- To evaluate the cutting tools geometry and their areas of application as per metal cutting theory
- To analyze tool wear, replacement strategy, cutting fluids, tool materials and their properties
- To analyze the economics of machining

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the relations for chip reduction coefficient, shear angle, shear strain, forces, power, specific energy and temperatures associated with orthogonal cutting
CO-2: Analyze a cutting tool, its geometry and arrive at the cutting process
CO-3: Create a cutting tool material and select cutting fluids for improving machinability and tool life
CO-4: Apply the methods to calculate the economics of machining

UNIT – I:
Introduction
Mechanics of Metal Cutting: Mechanism of chip formation, Orthogonal and Oblique cutting, Determination of shear plane angle, forces on the chips, forces in orthogonal cutting, merchant circle diagram and analysis, co-efficient of friction, power and energy relationship, velocity relationship, shear-strain relationship, factors affecting forces and power, types of chips, built-up edge, problems.

UNIT – II:
Measurement of Cutting Forces: Reasons for measuring cutting forces, Classification of cutting force dynamometers – mechanical, piezoelectric, and strain gage type dynamometers, Dynamometers for lathe, drilling, and milling, Calibration of dynamometers.
Tool Wear and Tool Life: Mechanisms of tool wear, Sudden, gradual wear, crater wear, flank wear, tool failure criteria, tool life equations, effect of process parameters on tool life.

UNIT – III:
Geometry of Cutting Tools: Single point and multi point cutting tools, tools in hand nomenclature, tool point reference systems, tool angle specifications – ISO and ASA systems, conversion from one system to another. Effect of cutting parameters on tool geometry.

UNIT – IV:

Tool Materials and their Properties: Characteristics of tools materials, types of tool materials – carbon tool steels, high speed steels, cast alloys, cemented carbides, ceramics, diamonds, sialon, CBN, UCON, recommended cutting speeds for the above tools.

UNIT – V:

Thermal Aspects in Metal Cutting: Heat sources in metal cutting, temperature in chip formation, temperature distribution, experimental determination of tool temperatures.
Cutting Fluids: Basic actions of cutting fluids, properties of cutting fluids, selection of cutting fluids, application of cutting fluids, recommended cutting fluids.

UNIT – VI:

Economics of Machining: Introduction, elements of total production cost, optimum cutting speed and tool life for minimum cost, optimum cutting speed and tool life for maximum production, problems.

TEXT BOOKS:

1. Principles of Metal Cutting, G. C. Sen and A. Bhattacharya, New Central Book Agency
2. Metal Cutting Principles, M. C. Shaw, Oxford and IBH Publications

REFERENCES:

1. Fundamentals of Machining Boothroyd, Edward Amold
2. Metal Cutting Theory and Cutting Tool Design, V. Arshinov& G. Alekseev, Mir Publishers, Moscow
3. Fundamentals of Metal Cutting and Machine Tools, B. L. Juneja, G. S. Sekhom& Nitin Seth, New Age International
4. Principles of Metal Cutting, G. Kuppuswamy, Universities Press

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

(18PC2ME10) MECHANICAL DRAWING PRACTICE LABORATORY

COURSE PRE-REQUISITES: Engineering Graphics

COURSE OBJECTIVES:
- To remember the principles of machine drawing conventions
- To analyze the machine elements like screw threads, nuts, bolts, keys and riveted joints
- To understand limits, fits and tolerances and represent in drawings
- To evaluate the different views of part drawings and based on that, draw the assembled parts of engine & machine parts

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the Knowledge of Material and Machine Drawing Conventions to draw the various Machine Elements
CO-2: Analyze all the parts & assemble them and produce with section views
CO-3: Use limits fits and tolerances and represent heat and surface symbols on part drawings
CO-4: Produce part and detailed drawings of various assemblies using CAD

UNIT – I:
CONVENTIONAL REPRESENTATION OF COMPONENTS
Need for drawing conventions – Introduction to IS conventions
a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears,
b) Welded joints and basic electrical, hydraulic and pneumatic circuits & symbols– methods of indicating notes on drawings.

UNIT - II:
DRAWING OF MACHINE ELEMENTS AND SIMPLE PARTS
a) Popular forms of screw threads, bolts, nuts, stud bolts.
b) Keys, cottered joint, knuckle joint, shaft coupling and spigot joint.
c) Journal and collar bearings.

UNIT – III:
ASSEMBLY DRAWINGS
Assembly drawings for the following, using conventions and easy drawing proportions:
a) Engine parts –Eccentric and I.C. engine connecting rod.
b) Other parts - screws jack and tailstock.

UNIT – IV:
a) **LIMITS, FITS AND TOLERANCES:** Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables.
b) **FORM AND POSITIONAL TOLERANCES:** Introduction and indication of the tolerances of form and position on drawings, deformation of runout and total runout and their indication.

UNIT – V:

a) **SURFACE ROUGHNESS AND ITS INDICATION:** Definitions – finishes obtainable from various manufacturing processes, recommended surface roughness on mechanical components,

b) Heat treatment and surface treatment symbols used on drawings.

UNIT – VI:

DETAILED AND PART DRAWINGS: Drawing of parts from assembly drawings of Stuffing box, Lathe Tool post, Revolving center and Non return valve with indications of size, tolerances, Roughness, form and position errors etc.

TEXT BOOKS:

1. Machine Drawing, K. L. Narayana, P. Kannaiah and K. Venkata Reddy, New Age Publishers
2. Production and Drawing, K. L. Narayana & P. Kannaiah, New Age

REFERENCES:

1. Machine Drawing, Siddheswar, Kannaiah and Sastry
2. Geometric Dimensioning and Tolerancing, James D. Meadows, B. S. Publications

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

(18PC2ME11) DIGITAL MANUFACTURING LABORATORY

COURSE PRE-REQUISITES: Rapid Prototyping, Additive Manufacturing Processes

COURSE OBJECTIVES:
- To demonstrate the knowledge of 3D Printing Technology
- To understand about the CAD model conversion to STL file format and rectification of errors in STL file
- To explain about build parameters, support structures and part orientation involved in 3D Printing
- To understand about the post processing, inspection and testing methods

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Develop CAD models and convert them to STL files for 3D Printing
CO-2: Apply the knowledge on CAD Files and be in a position to rectify the STL errors
CO-3: Decide the print parameters, part orientations and its support structures involved in 3D Printing
CO-4: Build a 3D printed engineering component and be in a position to perform inspection and post processing

- Overview of 3D Printing and introduction to FDM

- **3D Printing:**
- Introduction to CAD modeling and preparation of CAD models of simple mechanical engineering components
- Conversion of CAD model to STL file format and correction of errors
- Definition of build parameters for 3D printing including support structures
- Working with build orientation for optimum printing time
- Verification of 3D mesh model before printing
- 3D printing of modeled components
- Inspection of 3D printed models – visual inspection and dimensional measurements using digital caliper
- Post-processing of 3D printed models – support removal, sanding, gap filling, polishing

Demonstration of simple team design project

SOFTWARES: CATIA, Autodesk Netfabb, Makerbot Makerware

REFERENCES:

1. CATIA V5 Help Manual
2. Autodesk Netfabb User Manual
3. Makerbot User Manual

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

(18PE1ME21) GAS DYNAMICS AND JET PROPULSION

COURSE PRE-REQUISITES: Fluid Dynamics and Thermodynamics

COURSE OBJECTIVES:
- To understand the basic governing equations of fluid flow
- To understand simplified studies of one dimensional flow and certain special cases like Rayleigh flow and Fanno flow
- To understand the phenomenon of shock waves and its effect on flow.
- To understand concept of oblique shock as a consequence of two dimensional flows along with various conditions
- To gain some basic knowledge about jet propulsion and Rocket Propulsion.

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the basic governing equations of fluid flow
CO-2: Analyse one dimensional flow and certain special cases like Rayleigh flow and Fanno flow
CO-3: Analyse shock waves and its effect on flow
CO-4: Analyse oblique shock as a consequence of two dimensional flows along with various conditions
CO-5: To apply gas dynamics principles to jet and space propulsion systems

UNIT – I:
Introduction to Gas Dynamics: Control volume and system approaches acoustic waves and sonic velocity - Mach number - classification of fluid flow based on mach number - mach cone-compressibility factor - General features of one dimensional flow of a compressible fluid - continuity and momentum equations for a control volume.

UNIT – II:
Isentropic Flow of an Ideal Gas: Basic equation - stagnation enthalpy, temperature, pressure and density-stagnation, acoustic speed - critical speed of sound-dimensionless velocity-governing equations for isentropic flow of a perfect gas - critical flow area - stream thrust and impulse function. Steady one dimensional isentropic flow with area change-effect of area change on flow parameters-chocking- convergent nozzle - performance of a nozzle under decreasing back pressure -De lavel nozzle - optimum area ratio effect of back pressure - nozzle discharge coefficients - nozzle efficiencies

UNIT – III:
Simple Frictional Flow: Adiabatic flow with friction in a constant area duct-governing equations - fanno line limiting conditions - effect of wall friction on flow properties in an Isothermal flow with friction in a constant area duct-governing equations - limiting conditions. Steady one dimensional flow with heat transfer in constant area ducts-governing equations - Rayleigh line entropy change caused by heat transfer - conditions of maximum enthalpy and entropy

UNIT – IV:

Effect of Heat Transfer on Flow Parameters: Intersection of Fanno and Rayleigh lines. Shock waves in perfect gas- properties of flow across a normal shock - governing equations - Rankine Hugoniat equations - Prandtl's velocity relationship - converging diverging nozzle flow with shock thickness - shock strength.

UNIT – V:

Air Craft Propulsion: Types of jet engines - energy flow through jet engines, thrust, thrust power and propulsive efficiency turbojet components-diffuser, compressor, combustion chamber, turbines, exhaust systems. Performance of turbo propeller engines, ramjet and pulsejet, scramjet engines.

UNIT – VI:

Space Propulsion: Rocket propulsion - rocket engines, Basic theory of equations - thrust equation - effective jet velocity - specific impulse - rocket engine performance - solid and liquid propellant rockets - comparison of various propulsion systems.

TEXT BOOKS:

1. Fundamentals of Gas Dynamics, V. Babu, ANE Student Edition, 2008
2. Fundamentals of Propulsion, V. Babu, ANE Student Edition, 2009
3. Aircraft Propulsion and Gas Turbine Engines, Ahmed F. El-Sayed, CRC Press, 2008

REFERENCES:

1. Gas Dynamics and Jet Propulsions, Somasundaram PR. S. L., New Age International Publishers, 1996
2. Aircraft and Missile Propulsion, Vol. I& II, Zucrow N. J., John Wiley, 1975
3. Principles of Jet Propulsion and Gas Turbines, Zucrow N.J., John Wiley, New York, 1970
4. Dynamics and Thermodynamics of Compressible Fluid Flow, Shapiro A. H., John Wiley, New York, 1953
5. Gas Turbines, Ganesan V., Tata McGraw-Hill Publishing Co., New Delhi, 1999

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

(18PE1ME22) DESIGN FOR MANUFACTURING AND ASSEMBLY

COURSE PRE-REQUISITES: Production Technology, Metallurgy & Material Science, Design Concepts, Automation, Machine Tools

COURSE OBJECTIVES:
- To impart the knowledge on steps involved in design process and material selection
- To understand about the design rules involved in machining and casting
- To understand about the design rules involved in metal joining, forging, extrusion and sheet metal work
- To understand about the design principles involved in manual and automatic assembly transfer systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the knowledge on steps involved in design process and material selection
CO-2: Apply the knowledge on design rules involved in machining and casting
CO-3: Analyze the design rules involved in metal joining, forging, extrusion and sheet metal work
CO-4: Design and analyze the principles involved in manual and automatic assembly transfer systems

UNIT – I:
Introduction: Design philosophy, Steps in design process, General design rules for manufacturability, Basic principles of designing for economical production, Creativity in design - Design aspects covering environmental concerns, power consumption, operational safety and fool proofing.
Materials: Selection of materials for design, commonly used metal sections, Criteria for material selection, Material selection interrelationship with process selection, Process Selection charts.

UNIT – II:
Machining Process: Overview of various machining processes, General design rules for machining, Dimensional tolerance and surface roughness, Design for machining ease, Redesigning of components for machining ease with suitable examples, General design recommendations for machined parts.
Metal Casting: Appraisal of various casting processes, Selection of casting process, General design considerations for casting, Casting tolerances, Use of solidification simulation in casting design, Product design rules for sand casting.

UNIT – III:
Metal Joining: Appraisal of various welding processes, Factors in the design of weldments, General design guidelines - Pre and post treatment of welds, Effects of thermal stresses in weld joints, Design of brazed joints.

UNIT – IV:

Forging: Design factors for Forging, Closed die forging design, Parting lines of die drop forging die design, General design recommendations.

Extrusion and Sheet Metal Work: Design guidelines for extruded sections, Component design for Blanking.

UNIT – V:

Assembly Advantages: Development of the assembly process, Choice of assembly method, Assembly advantages, Social effects of automation.

Automatic Assembly Transfer Systems: Continuous transfer, Intermittent transfer, indexing mechanisms and an operator - paced free transfer machine.

UNIT – VI:

Design of Manual Assembly: General design guidelines for manual assembly, Development of the systematic DFA methodology, Assembly efficiency, Classification system for manual handling, Classification system for manual insertion and fastening, Effect of part symmetry on handling time, Effect of part thickness and size on handling time, Effect of weight on handling time.

TEXT BOOKS:

1. Assembly Automation and Product Design, Geoffrey Boothroyd, Marcel Dekker Inc.
2. Engineering Design – Material and Processing Approach, George E. Dieter, McGraw-Hill Intl.

REFERENCES:

1. Handbook of Product Design, Geoffrey Boothroyd, Marcel and Dekker
2. Computer Aided Assembly Planning, A. Delchambre, Springer

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

(18PE1ME23) ADVANCES IN CAD/CAM

COURSE PRE-REQUISITES: Basic Knowledge of CAD/CAM, Production Technology

COURSE OBJECTIVES:
- To comprehend the data exchange formats and know the different transformations in CAD modeling
- To understand parametric representation of synthetic entities
- To compare the different representation schemes and comprehend the applications of CAD
- To understand the NC Systems, NC part programming fundamentals & CNC Systems
- To understand the concept of Adaptive Control, and Computer Aided Inspection & Quality Control and implementation of CAD/CAM software and Post Processor.

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Asses the various data exchange formats used and perform the transformations in geometric modeling techniques
CO-2: Derive and apply the parametric representation of synthetic curves and surfaces
CO-3: Validate the solid models through B-rep and CSG representation schemes and illustrate the applications of CAD
CO-4: Work on NC & CNC systems and program
CO-5: Apply the concepts of AC and CAI & QC and implement CAD/CAM software and Post Processor

UNIT – I:
Geometric Modeling: Wireframe modeling - Wire frame entities, Curve representation; Surface modeling - Surface entities, Surface representation; Solid modeling - Solid Entities, Solid Representation.
2D & 3D Transformations: Translation, Rotation, Scaling, Reflection, Shear; Homogenous and Concatenated transformations.
Graphics Standards: Graphics standards – IGES & STEP structure and implementation.

UNIT – II:
Parametric Representation of Synthetic Entities: Parametric representation: Hermite Cubic Spline, Bezier curve, B-Spline curve; Hermite Bi-cubic surface, Bezier surface, B-Spline surface, COONs surface

UNIT – III:
Representation Schemes: Boundary Representation (B-Rep), Constructive Solid Geometry (CSG)
Advanced Modeling Applications: Feature Based and Parametric Modeling, Assembly Modeling – Bottom-Up and Top-Down approach, Mass property calculations, Finite Element Analysis

UNIT – IV:
NC Systems: NC Coordinate systems, elements of NC systems, Classification of NC Systems, Advantages & Disadvantages of NC Systems.
NC Part Programming: Manual Part Programming fundamentals, word address format, reparatory function, Feed, Speed, Tool Change functions, Dimensional words, Canned Cycles, Tool Offset, Tool Length Compensation, Tool nose radius compensation
CNC Systems: CNC, Features of CNC, Functions of CNC, Advantages

UNIT – V:
Introduction to CAD/CAM Software: Computer assisted part programming, NC programming using CAD/CAM software, Tool path generation using CAD/CAM SOFTWARE, TECHNOLOGY OF CAM
Post Processors for CNC: Introduction to post processors, necessity of a post processor, the general structure of a post processor, functions of a post processor
Tooling for CNC Machines: Tool pre-setting, Automatic Tool Changer, Modular fixturing

UNIT – VI:
Adaptive Control: Adaptive control with optimization, Adaptive control with constraints, Adaptive control in machining processes – turning and grinding
Computer Aided Inspection and Quality Control: CMM construction, Limitations of CMM, Computer Aided Testing, Optical inspection methods

TEXT BOOKS:

1. CAD/CAM Theory and Practice, Ibrahim Zeid, McGraw-Hill International
2. Computer Aided Design Manufacturing, K. Lalit Narayan, K. Mallikarjuna Rao and M. M. M. Sarcar, Prentice Hall of India
3. Computer Control of Manufacturing Systems, Yoram Koren, McGraw-Hill International

REFERENCES:

1. Mastering CAD-CAM, Ibrahim Zeid, McGraw-Hill international
2. CAD/CAM, P. N. Rao, Tata McGraw-Hill
3. Mathematical Elements for Computer Graphics, Roger D. F. and Adams A. McGraw-Hill Inc, NY, 1989
4. CAD/CAM Computer Aided Design and Manufacturing, Mikell P. Groover, EW Zimmers Jr., Prentice Hall of International
5. Computer Aided Manufacturing, T. C. Chang, Wysk, H. P. Wang, Pearson/ Prentice Hall International

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

(18PE1ME24) PRODUCT DESIGN AND PROCESS PLANNING

COURSE PRE-REQUISITES: Engineering Design, Manufacturing Processes, CAD/CAM

COURSE OBJECTIVES:

- To introduce the basic concepts of product design and product development process
- To introduce the concepts of product architecture, industrial design and DFM in product development
- To understand concept of process planning
- To understand approaches and implementation techniques of process planning

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the product design and development process and the integration of product specifications and customer requirements in product development
CO-2: Implement concepts of product architecture, industrial design DFM in product development
CO-3: Apply the concept of computer aided process planning
CO-4: Implement approaches and techniques of CAPP

UNIT – I:
Introduction to Product Development: Introduction to product design and development, Characteristics of successful product development, Composition of product development team, Challenges of product development, Generic product development process and its adaptation, Process flows for various product developments, Product development organizations, establishing the relative importance of needs.

UNIT – II:
Product Specifications: Definitions, When to establish specifications, Establishing target specifications, setting final specifications
Concept Generation, Selection & Testing: Activity of concept generation, five step method, Introduction to concept selection, Benefits of structured method, Concept screening, Concept scoring, Concept testing methodology.

UNIT – III:
Product Architecture: Introduction, Its implications, Establishing the architecture, Platform planning, Design issues
Industrial Design: Industrial design process – Need, Impact, Management and Assessment
Design for Manufacturing & Prototyping: DFM defined, DFM process, Introduction to prototyping - Principles Technologies, Planning for prototypes

UNIT – IV:

Introduction to CAPP: Introduction and definition of process planning, Scope of process planning, Information requirement for process planning system in CAD/CAM, Role of process planning, Advantages of conventional process planning over CAPP,

UNIT – V:

Approaches of Process Planning: Manual approach, CAPP approaches.

Generative CAPP System: Importance, Principle of Generative CAPP system, Knowledge based systems, Implementation, Benefits. Generative approach-Forward and backward planning,

Retrieval CAPP System: Significance, Group technology, Structure, Relative advantages, Implementation and applications. Examples of process planning system-CAM-I, Automated process planning, D-CLASS (CAPP).

UNIT – VI:

Implementation Techniques for CAPP: MIPLAN system, Computer programming languages for CAPP, Criteria for selecting a CAPP system and benefits of CAPP, Computer integrated planning systems and Capacity planning system. Practical use of CAPP in real Manufacturing area

TEXT BOOKS:

1. Product Design and Development, Karl T. Ulrich and Steven D. Eppinger, Tata McGraw-Hill
2. Automation, Production Systems and Computer Integrated Manufacturing System, Mikell P. Groover
3. Computer Aided Design and Manufacturing, Dr. Sadhu Singh

REFERENCES:

1. Product Design, Kevin Otto and Kristin Wood, Pearson Education, 2000
2. Computer Aided Process Planning, H. P. Wang & J. K. Li, 1st Edition, Elsevier science & Technology, 1991
3. Principles of Process Planning-A Logical Approach, Gideon Halevi and Roland D. Weill, Chapman & Hall, 1995

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

(18PE1ME25) METAL CASTING TECHNOLOGY

COURSE PRE-REQUISITES: Production Technology

COURSE OBJECTIVES:

- To comprehend the various casting processes, their applications and understand the use of patterns and their design
- To know the design of runner, riser and gating systems and allowances to be provided
- To understand the construction and working of various melting furnaces
- To understand the process of removing castings, inspection methods for defects present and their remedies

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Select appropriate casting process for a component meeting design specifications and identify the correct type of pattern
CO-2: Design a casting - gating and risering system for a specific part
CO-3: Distinguish the various type of melting furnaces for different materials
CO-4: Assess the castings for defects and apply remedies to the defects found through inspection
CO-5: Estimate the quality and cost of castings

UNIT – I:
Pattern and Foundry Sand: Foundry as manufacturing process- Types of patterns-Pattern Materials- Pattern Allowances- Pattern Layout, Pattern making- Various sands-Testing of foundry sand: Strength Permeability, Moisture Content.

UNIT – II:
Moulding Methods: Moulding methods: Green sand moulding- dry sand moulding- no bake moulding- shell moulding- Investment casting- Permanent moulding- die casting and Centrifugal casting. Modern moulding methods: Rheocasting- Thixocasting and Squeeze casting.

UNIT – III:
Gating and Risering: Solidification- Gates- their functions, design of gating system-Risers- their functions- design

UNIT – IV:
Melting: Selection and control of melting furnaces , Constructional details of Operation of crucible furnaces, Reverberatory furnaces- Cupola, Rotary furnace – Core type and Coreless type Induction furnaces - Arc furnace (direct and indirect arc furnaces).
Fluidity: Measurement of fluidity; effects of various parameters on fluidity.

UNIT – V:

Fettling: Removal of gates and risers, Grinding, Shot blasting and finishing, Casting defects, Remedies. Gases in Metal: Methods of elimination and control of dissolved gases in castings. Environment, Health and Safety aspects

UNIT – VI:

Inspection and Quality Control: Review of X ray and gamma ray radiography; magnetic particle; Penetrant and ultrasonic inspections; use of statistical quality control in foundry. Economics of casting

TEXT BOOKS:

1. Principles of Metal Casting, Heine R. W, Loper C. R. & Rosenthal P. C. Tata McGraw-Hill
2. Principles of Foundry Technology, Jain P. L., Tata McGraw-Hill
3. Fundamentals of Metal Casting, Flinn, Addison Wesley

REFERENCES:

1. Principles of Metal Casting, Heine, Loper& Rosenthal, McGraw-Hill
2. Foundry Technology, Beeley P. R., Butterworth
3. Foundry Engineering, Srinivasan N. K., Khanna
4. Casting Vol. 15, ASM Metals Handbook, ASM International

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	3	0	3

(18PE1ME26) POWER PLANT ENGINEERING

COURSE PRE-REQUISITES: Thermal Engineering and Basic Electrical Engineering

COURSE OBJECTIVES:
- To understand the layout of the different types of Power plants
- To understand the concept of power from non-conventional source
- To apply the Knowledge on various components in the power plants
- To understand the power plant economics and power distribution

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyzing the working principal of the power plant, scope for future expansion
CO-2: Understanding the concept on various equipments used in the plant
CO-3: Evaluating the power plant economics and environmental consideration
CO-4: Applying the Knowledge to the power distribution and load factor importance

UNIT – I:
Introduction to the Sources of Energy – Resources and Development of Power in India.
Steam Power Plant: Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, ash handling systems.
Combustion Process: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection.

UNIT – II:
Internal Combustion Engine Plant
Diesel Power Plant: Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – Cost of Diesel power Plant – Testing Diesel Power Plant Performance.

UNIT – III:
Gas Turbine Plant: Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison.
Hydro Electric Power Plant: Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways.
Hydro Projects and Plant: Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

UNIT – IV:
Power From Non-Conventional Sources: Utilization of Solar energy - Collectors- Fuel Cells-Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy.

UNIT – V:

Nuclear Power Station: Nuclear fuel – breeding and fertile materials – Nuclear reactor –reactor operation. Types of Reactors: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

UNIT -VI:

Power Plant Economics and Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load durationcurve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of
Pollution control.

TEXT BOOKS:

1. A Text Book of Power Plant Engineering, Rajput, Laxmi Publications
2. Power Plant Engineering, G. R. Nagpal, Khanna Publishers

REFERENCES:

1. Power Plant Engineering, P. K. Nag, II Edition, TMH
2. Power Plant Engineering, Ramalingam, Scitech Publishers
3. Power Plant Engineering, P. C. Sharma, S. K. Kataria Publishers
4. A Course in Power Plant Engineering, Arora and S. Domkundwar
5. Power Station Engineering, El Wakil, McGraw-Hill

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

(18PE1ME27) PLANT LAYOUT AND MATERIAL HANDLING SYSTEMS

COURSE PRE-REQUISITES: Manufacturing, Operations Research

COURSE OBJECTIVES:

- To understand plant layout system, its types and software tools used
- To identify and learn elements of various material handling systems
- To understand the benefit of an efficient material handling system and storage system
- To select the various load lifting attachments

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Evaluate an appropriate plant layout for a plant
CO-2: Create Flexible Plant layout to accommodate changes in product volume or product type, applies different software tools
CO-3: Classifies material handling systems-package, hoists, drives
CO-4: Analyze and evaluates an appropriate material handling system, -cranes, ropes and load lifting attachments

UNIT – I:
Plant Layouts, Fundamentals of plant layouts, Classification of layout, Advantages and limitations of different layouts. Layout design procedures. Process Layout and Product Layout: Comparison, Selection, Specification, Implementation and follow up. Group Layout and Fixed Position Layout

UNIT – II:
Quadratic assignment model, Branch and bound method. Software tools used for making plant layouts – ALDEP, CORELAP, CRAFT; Case studies, Elements of material handling system: Importance; Terminology; Objectives and benefits of better material handling; Principles and features of Material Handling System; Interrelationships between material handling and plant layout

UNIT – III:
Physical facilities and other organizational functions; Classification of material handling equipments. Selection of material handling equipments, Factors affecting for selection; Material handling equation; Choices of material handling equipment; General analysis procedures; Basic analytical techniques; The unit load concept; Selection of suitable types of systems for applications; Activity cost data and economic analysis for design of components of material handling systems

UNIT – IV:
Functions and parameters affecting service; Packing and storage of materials, Hoists, Drives for hoisting; Components and hoisting mechanisms; Rail travelling components and mechanisms; Hoisting gear operation during transient motion; Selecting the motor rating and determining breaking torque for hoisting mechanisms.

UNIT – V:

Cranes: Hand-propelled and electrically driven E.O.T. overhead traveling cranes; Traveling mechanisms of cantilever and monorail cranes; Design considerations for structures of rotary cranes with fixed radius; Fixed post and overhead travelling cranes; Stability of stationary rotary and travelling rotary cranes.ASRS-Introduction to ASRS and AGVS

UNIT – VI:

Load Lifting Attachments, Load chains and types of ropes used in material handling system; Forged, Standard and ramshorn hooks; Crane grabs and clamps; Grab buckets; Electromagnet; Design consideration for conveyor belts; Application of attachments. study of systems and equipments used for material storage: Objectives of storage; Bulk material handling; Gravity flow of solids through slides and chutes; Storage in bins and hoppers; Belt conveyors; Bucket-elevators; Screw conveyors; Vibratory conveyors; Cabin conveyors; Mobile racks etc.

TEXT BOOKS:

1. Operations Management A Quantitative Approach, P. B. Mahapatra, Prentice Hall International
2. Operations Management, S. Anil Kumar, N. Suresh, New Age Publishers
3. Material Handling Equipment, N. Rudenko, Peace publishers

REFERENCES:

1. Facility Layout, Location and Analytical Approach, R. L. Francis, L. F. McLinnis Jr., White; Prentice Hall International
2. Aspects of Material Handling, Dr. K. C. Arora & Shinde, Lakshmi Publications

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PE1ME28) ADVANCED MACHINE DESIGN

COURSE PRE-REQUISITES: Design of Machine Elements

COURSE OBJECTIVES:
- To study design concepts in order to enhance the basic design
- To study behaviour of mechanical components under fatigue and creep
- To study statistical techniques and its applications in mechanical design.

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Ability to analyze behaviour of mechanical elements under different loads
CO-2: Understand the design of different transmission elements of automobile
CO-3: Ability to analyze mechanical elements critically

UNIT – I:
Shafts and Axles: Introduction, Causes of failure in Shafts and Axles and Stresses in Shafts, Materials for Shafts and Axles, Methods of Manufacturing of Shafts, Designing of Straight Shafts, Pure Torsional Load, Designing for Rigidity and Stiffness, Design of Axles, Flexible Shafts.

UNIT – II:
Rope Drive: Fibre ropes, rope drives for power transmission, fibrous Ropes used in Hoisting Tackle, Wire Ropes, Materials, Wire Rope Construction, Applications of Ropes, properties of various types of Ropes, Approximate wire Diameters and Effective Cross-section of Ropes: Fiber cores for steel wire ropes, Working loads, Friction and Efficiency wire rope, sheaves and Drum, rope fasteners, Selection of wire rope, design procedure.

UNIT – III:
Chain Drives: Types of Chain drives, construction of Chains, Roller Chains, Silent Chains, selection of a chain, Design of the chain Drive, Good design practice.

UNIT – IV:
Gear Drives: Design calculations for helical gears, Definitions, double helical , Gear tooth proportions, Design calculations, forces acting in a Bevel gear, Worm gear drives, worm wheel, designation of a worm gear drive, Materials, efficiency of Drive, Heat Dissipation, Design of worm Gearing, Forces on worm gears, advantages and disadvantages of worm gear drives.

UNIT – V:
Power Screws: Friction, Types of Power screws, Multiple threads, Comparison of square and trapezoidal threads, Power screw drive, Efficiency of screws, square threads, Trapezoidal Threads, stresses in screws design calculations, design procedure, other types of screws, differential and compounds screws, ball baring screws.

UNIT – VI:
Springs: Introduction to springs, Design of Coil springs, Design of Helical springs, Design of Helical Extension springs, Design of Multi-Leaf springs

TEXT BOOKS:
1. Machine Design, Dr. P. C. Sharma, S. K. Kataria& Sons
2. Machine Design, Maleev and Hartman, CBS Publishers

REFERENCES:

1. Machine Design, Schaum Series
2. Mechanical Engineering Design, J. E. Shigley

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PE1ME29) FLEXIBLE MANUFACTURING SYSTEMS

COURSE PRE-REQUISITES: Knowledge of Manufacturing, Supply Chain Management.

COURSE OBJECTIVES:
- To understand the knowledge about the design, operation, and selection of Flexible
- To manufacturing Systems and their integration in today's production environments
- To understand the integration of components of FMS under different production management approaches
- To learn about simulation software and database of FMS
- To calculation of performance measures, including throughput, in-process inventory, and meeting production commitments

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the concepts of Probability & Statistics to develop the manufacturing systems
CO-2: Plan, schedule and control a developed FMS.
CO-3: Select suitable database and software required for FMS
CO-4: Apply preventive maintenance, Kan ban system effectively

UNIT – I:
Introduction to Flexible Manufacturing Systems: Planning and scheduling and control of FMS, Knowledge based scheduling, Types of Productions, Types of FMS, Types of FMS Layouts, advantages and disadvantages of FMS.

UNIT – II:
Hierarchy of Computer Control: Supervisory computer. Components of FMS, Types of flexibility, trade off, computer control and functions, coordinate measuring machines, types, working and capabilities.

UNIT – III:
Software for Simulation and Database of FMS: System issues, types of software, specification and selection, trends, Application of simulation software.

UNIT – IV:
Cutting tools and tool management, work holding considerations, acceptance testing.

UNIT – V:
Manufacturing Data Systems: Data flow, CAD/CAM considerations. Planning FMS database, Just in time characteristics, Pull method, Quality small lot sizes, Work station loads, Close supplier ties, Flexible workforce – Line flow strategy, types of FMS softwares.

UNIT – VI:
Preventive maintenance, Kanban system, Implementation issues, value engineering, MRP, lean manufacture.

TEXT BOOKS:

1. Hand Book of Flexible Manufacturing Systems, Jha N. K., Academic Press, 1991
2. Flexible Manufacturing Systems, Shivanand H. K., Benal M. M., Koti. V., New Age International (P) Limited, New Delhi 2006

REFERENCES:

1. Production System beyond Large Scale Production, Taiichi Ohno, Toyota, Productivity Press India Pvt. Ltd.
2. Flexible Manufacturing Systems: Recent Development Raouf A. And Ben-Daya M., Editors, Elsevier Science, 1995
3. Automation, Production Systems and Computer Integrated Manufacturing, Groover M.P., Prentice Hall of India Pvt., New Delhi, 1996
4. Handbook of Flexible Manufacturing Systems, Nand K. Jha (Eds.)

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

(18PE1ME30) COMPUTER INTEGRATED MANUFACTURING

COURSE PRE-REQUISITES: Computer Aided Design, Computer Aided Manufacturing, Machine Tools, Operations Research

COURSE OBJECTIVES:
- To understand planning required in manufacturing area now a days
- To learn the fundamentals of computer assisted numerical control programming
- To learn quality control and material handling
- To learn the guidelines and criteria for implementing CAD/CAM systems and assisted software's for manufacturing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the basics of manufacturing and application of group technology
CO-2: Develop CAPP systems and understand layouts of manufacturing systems
CO-3: Apply concept of quality control and material handling
CO-4: Design automated material handling and storage systems for a typical production system and balance the line

UNIT – I:
Introduction: Scope of computer integrated manufacturing, Product cycle, Production automation.
Cellular Manufacturing Systems and Group Technology: Part Families, Parts Classification and Coding, Features of Parts Classification and Coding Systems, Opitz of Parts Classification and Coding Systems, Role of group technology in CAD/CAM integration, methods for developing part families.

UNIT – II:
Computer Aided Process Planning: Importance, Principle of Generative CAPP system, Automation of logical decisions, Knowledge based systems, Criteria for selecting a CAPP system, Part feature recognition, Implementation, Benefits, Generative approach-Forward and backward planning.

UNIT – III:
Flexible Manufacturing Systems: Introduction to flexible manufacturing systems. Planning and scheduling and control of FMS, Knowledge based scheduling, Types of Productions, Types of FMS, Types of FMS Layouts, advantages and disadvantages of FMS.

UNIT – IV:
Computer Aided Quality Control: Terminology in quality control, contact inspection methods, Non- Contact inspection methods, Computer Aided Testing, Integration of CAQC with CAD/CAM, Quality assurance, Planning and control systems.

UNIT – V:

Computer Integrated Manufacturing Systems: Role of integrative manufacturing in CAD/CAM integration, over view of production control—Forecasting, Kanban system, M.R.P., Master production schedule, Types of manufacturing systems, Machine tools and related equipment, Material handling systems, Computer control Systems.

UNIT – VI:

Automated Material Handling and Assembly System: Workpart Transfer Mechanisms, Design Considerations in Material Handling, Automated Storage/Retrieval Systems Analysis.

TEXT BOOKS:

1. Automation, Production Systems and Computer Integrated Manufacturing, Mikell P. Groover, 3rd Edition, Prentice Hall Inc., New Delhi, 2007
2. Assembly Automation and Product Design, Geoffrey Boothroyd, Taylor and Francis
3. System Approach to Computer Integrated Manufacturing, Nanua Singh, Wiley & Sons Inc., 1996

REFERENCES:

1. Flexible Manufacturing Systems, Shivanand H. K., Benal M. M., Koti V., New Age International (P) Limited, New Delhi 2006
2. Computer Aided Design and Manufacturing, David D. Bedworth, Mark R. Henderson, Philip M. Wolfe, McGraw-Hill
3. CAD/CAM, Mikel P. Groover, Emery W. Zimmer, PHI Ltd.
4. Computer Aided Process Planning, Elsevier Science & Technology, H. P. Wang & J. K. Li, 1st Edition, 1991
5. Handbook of Flexible Manufacturing Systems, Jha N. K., Academic Press

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

(18PW4ME05) MAJOR PROJECT PHASE-I

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

(18PW4ME06) MAJOR PROJECT PHASE-II

COURSE OUTCOMES: After completion of the course, the student 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.