R19

TAMASOMA JYOTHIRGAMAYA

B.Tech. (AUTOMOBILE ENGINEERING)

B.Tech. R19 CBCS Curriculum

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous, ISO 9001:2015 & QS I-Gauge Diamond Rated Institute, Accredited by NAAC with 'A++' Grade
NBA Accreditation for B.Tech. CE, EEE, ME, ECE, CSE, EIE, IT Programmes
Approved by AICTE, New Delhi, Affiliated to JNTUH, NIRF 113 Rank in Engineering Category
Recognized as "College with Potential for Excellence" by UGC
Vignana Jyothi Nagar, Pragathi Nagar, Nizampet (S.O), Hyderabad – 500 090, TS, India.
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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

AUTOMOBILE ENGINEERING

VISION OF THE DEPARTMENT

To become and be one of the elite technical institutes acclaimed by the peers and industry with world class technical education, contemporary teaching facility and state-of-the-art laboratories to suit global standards

MISSION OF THE DEPARTMENT

- To provide engineering education with highest learning standards for designing and manufacturing of world class automobiles.
- To foster research, evolve innovative applications of state-of-the-art automotive technology, promote entrepreneurship and ultimately mould young men and women by inculcating ethical leadership qualities for the benefit of the society.

B.TECH.
(AUTOMOBILE ENGINEERING)

B.TECH. (AE)

PROGRAM EDUCATIONAL OBJECTIVES

PEO-I: Provide a strong foundation in mathematical, scientific and engineering fundamentals that enable the students to formulate, analyze and solve engineering problems and to prepare them for graduate studies.

PEO-II: Apply knowledge and concepts of automotive technology to synthesize data and solve multi-disciplinary engineering problems.

PEO-III: Continue to work as part of teams for successful career in automotive and ancillary industry that meet the needs of Indian and multinational companies.

PEO-IV: Undertake research and development projects with multi-disciplinary approach which are cost effective and efficient so as to resolve automotive engineering issues of social relevance.

PEO-V: Demonstrate professional, ethical and social responsibilities for a successful professional career and contribute their part for addressing various global issues.

B.TECH. (AE)

PROGRAM OUTCOMES

PO-1: Apply acquired knowledge from undergraduate engineering and other disciplines to identify, formulate and present solutions to technical problems related to various areas of Automobile Engineering.

PO-2: Learn advanced technologies and analyze complex problems in the fields of Automobile Engineering.

PO-3: Design and implementation of Automotive systems using Auto CAD/CREO/ANSYS/CATIA

PO-4: Addressing specific problems in the field of automotive system design in the form of mini projects, analysis, and interpretation of data and synthesis of information to provide valid conclusions.

PO-5: Use the techniques, skills, latest Modelling / Design / Analysis / Simulation tools, software and equipment necessary to evaluate and analyze the systems in automotive design environments.

PO-6: Become knowledgeable about contemporary developments in the society.

PO-7: Identify the engineering solutions for sustainable development.

PO-8: Understand and commit to professional ethics, social responsibilities and norms of engineering practice.

PO-9: Ability to correct the mistakes effectively and learn from them to become good leaders.

PO-10: Demonstrate effective oral and written communication skills in accordance with technical standards.

PO-11: Understand the scenario of global business.

PO-12: Develop confidence for self-education and imbibe professional values for lifelong learning.

B.TECH. (AE)

PROGRAM SPECIFIC OUTCOMES

PSO-1: Apply basic science and engineering concepts to understand, design and analyze the automotive systems.

PSO-2: Apply automotive and interdisciplinary concepts to develop sustainable products using latest techniques and software tools.

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

I SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19BS1MT01	Calculus for Engineers	3	1	0	4	4
19BS1PH01	Applied Physics	3	0	0	3	3
19ES1CS01	Programming through C	3	0	0	3	3
19ES1EE02	Basic Electrical and Electronics Engineering	3	0	0	3	3
19BS2PH01	Applied Physics Laboratory	0	0	2	2	1
19ES2CS01	Programming through C Laboratory	0	0	2	2	1
19ES2EE02	Basic Electrical and Electronics Engineering Laboratory	0	0	2	2	1
19ES3ME01	Engineering Graphics	0	0	6	6	3
19PW4AE01	Design Sensitization	0	0	2	2	1
Total		**12**	**1**	**14**	**27**	**20**
19MN6HS01	Induction Programme	-	-	-	-	-

II SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19BS1MT04	Linear Algebra and Advanced Calculus	3	0	0	3	3
19BS1CH01	Engineering Chemistry	3	0	0	3	3
19HS1EN01	English	3	0	0	3	3
19ES1CS02	Data Structures through C	3	0	0	3	3
19ES1ME01	Engineering Mechanics	3	0	0	3	3
19BS2CH01	Engineering Chemistry Laboratory	0	0	2	2	1
19HS2EN01	English Language Communication Skills Laboratory	0	0	2	2	1
19ES2CS02	Data Structures through C Laboratory	0	0	2	2	1
19ES2ME01	Workshop Practices	1	0	2	3	2
Total		**16**	**0**	**8**	**24**	**20**

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

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

III SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19BS1MT10	Partial Differential Equations and Numerical Methods	3	0	0	3	3
19PC1ME08	Mechanics of Solids	3	0	0	3	3
19PC1ME04	Thermodynamics	3	1	0	4	4
19PC1ME01	Metallurgy and Materials Engineering	3	0	0	3	3
19PC1AE01	Automotive Chassis	3	0	0	3	3
19PC2AE01	Automotive Chassis Laboratory	0	0	2	2	1
19PC2AE02	Metallurgy and Mechanics of Solids Laboratory	0	0	2	2	1
19PC2IT02	Python Programming Laboratory	0	0	2	2	1
Total		**15**	**1**	**6**	**22**	**19**

IV SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19PC1ME03	Fluid Mechanics and Machinery	3	0	0	3	3
19PC1AE02	Applied Thermodynamics	3	1	0	4	4
19PC1AE03	Theory of Machines	3	1	0	4	4
19PC1AE04	Automotive Engines	3	0	0	3	3
19PC1AE05	Manufacturing Technology	3	0	0	3	3
19PC2ME03	Fluid Mechanics and Machinery Laboratory	0	0	3	3	1.5
19PC2AE03	Theory of Machines Laboratory	0	0	3	3	1.5
19PC2AE04	Automotive Engines Laboratory	0	0	2	2	1
Total		**15**	**2**	**8**	**25**	**21**
19MN6HS02	Environmental Science	2	0	0	2	**0**

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

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

V SEMESTER **R19**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
19PC1ME13	Heat Transfer	3	0	0	3	3
19PC1AE06	Automotive Electrical and Electronics	3	0	0	3	3
19PC1AE07	Design of Automotive Components-I	3	1	0	4	4
	Professional Elective -I					
19PE1AE01	Alternative Fuels	**3**	**0**	**0**	**3**	**3**
19PE1AE02	Simulation of Automotive Engines					
19PE1ME07	Mechatronic Systems					
19PE1ME08	Unconventional Machining Processes					
19PE1AE03	Quality Engineering in Manufacturing					
	Open Elective -I	**3**	**0**	**0**	**3**	**3**
19PC2ME09	Heat Transfer Laboratory	0	0	2	2	1
19PC2AE05	Manufacturing Technology Laboratory	0	0	2	2	1
19PC2AE06	Automotive Electrical and Electronics Laboratory	0	0	2	2	1
19PW4AE02	Internship	0	0	2	2	1
Total		**15**	**1**	**8**	**24**	**20**
19MN6HS03	Gender Sensitization	2	0	0	2	0

VI SEMESTER **R19**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
19HS1MG02	Engineering Economics and Accountancy	3	0	0	3	3
19PC1ME14	CAD/CAM	3	0	0	3	3
19PC1AE08	Design of Automotive Components-II	3	0	0	3	3
19PC1AE09	Vehicle Dynamics	3	0	0	3	3
	Professional Elective -II					
19PE1AE04	Automotive Pollution and Control	**3**	**0**	**0**	**3**	**3**
19PE1AE05	Mechanics of Machinery					
19PE1AE06	Automotive Embedded Systems					
19PE1AE07	Aerodynamics of Road Vehicles					
19PE1ME06	Finite Element Methods					
	Open Elective -II	**3**	**0**	**0**	**3**	**3**
19HS2EN05	Advanced English Communication Skills Laboratory	0	0	2	2	1
19PC2ME10	CAD/CAM Laboratory	0	0	2	2	1
19PW4AE03	Design Thinking	0	0	4	4	2
Total		**18**	**0**	**8**	**26**	**22**

L – Lecture T – Tutorial P – Practical

OE TRACKS BASED ON MEZZANINE TECHNOLOGIES:

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

GENERAL POOL OF OE COURSES:

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

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

VII SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19PC1AE10	Electric and Hybrid Vehicles	3	0	0	3	3
19PC1AE11	Autonomous Vehicle Technologies	3	0	0	3	3
	Professional Elective - III					
19PE1AE08	Vehicle Body Engineering	3	0	0	3	3
19PE1AE09	Automotive Materials					
19PE1AE10	Automotive Control Systems					
19PE1AE11	Automotive Noise and Vibration Control					
19PE1AE12	Mechanical Measurements and Metrology					
	Professional Elective - IV					
19PE1AE13	Automotive Biomechanics	3	0	0	3	3
19PE1AE14	Industrial Engineering and Operations Research					
19PE1AE15	Automatic Transmission					
19PE1ME20	Design for Manufacturing and Assembly					
19PE1AE16	Vehicle Transport Management					
	Open Elective - III	3	0	0	3	3
19PC2AE07	Automotive Simulation Laboratory	0	0	2	2	1
19PC2AE08	Vehicle Maintenance and Testing Laboratory	0	0	2	2	1
19PW4AE04	Mini-Project*	0	0	4	4	2
19PW4AE05	Major Project Phase - I	0	0	8	8	4
Total		**15**	**0**	**16**	**31**	**23**

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

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VIII SEMESTER **R19**

Course Category	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
	Professional Elective - V					
19PE1AE17	Fuel Cell Technology	3	0	0	3	3
19PE1ME14	Computational Fluid Dynamics					
19PE1AE18	Automotive Testing					
19PE1AE19	Automotive Product Development Strategies					
19PE1ME27	Flexible Manufacturing Systems					
	Professional Elective - VI					
19PE1AE20	Two and Three Wheeler Technology	3	0	0	3	3
19PE1AE21	Auto Air-conditioning					
19PE1AE22	Automotive Instrumentation					
19PE1AE23	Special Purpose Vehicles					
19PE1AE24	Product Lifecycle Management					
	Open Elective - IV	3	0	0	3	3
19PW4AE06	Major Project Phase - II	0	0	12	12	6
Total		**9**	**0**	**12**	**21**	**15**

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19BS1MT01) CALCULUS FOR ENGINEERS

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

COURSE PRE-REQUISITES: Differentiation, Integration

COURSE OBJECTIVES:

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

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

CO-1: Solve problems involving Maxima and Minima

CO-2: Evaluate integrals using special functions

CO-3: Formulate and solve the problems of first and higher order differential equations

CO-4: Apply knowledge of differential equations to real world problems

CO-5: Use Laplace and Inverse Laplace transform as a tool to solve the problems.

UNIT-I:

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

UNIT-II:

Improper Integrals: Definition of Improper Integrals, Beta functions: Properties and other forms of beta functions (statements only) and problems.

Gamma functions: Properties of Gamma functions (statements only), Relation between the Beta and Gamma functions (without proofs) and Evaluation of improper integrals using Beta and Gamma functions.

UNIT-III:

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

UNIT-IV:

Second and Higher Order ODE with Constant Coefficients: Second order linear differential equations with constant coefficients: Solution of Homogenous, non homogeneous differential equations, Non-Homogeneous terms of the type e^{ax}, sin (ax), cos (ax), polynomials in x, e^{ax} V(x), x V(x).

UNIT-V:

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

UNIT-VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19BS1PH01) APPLIED PHYSICS

(Common to ME and AE)

COURSE PRE-REQUISITES: 10+2 Physics

COURSE OBJECTIVES:

- To apply various phenomena of light- Interference and Diffraction
- To apply the basic principles of lasers for various laser systems and optical fibers
- To interpret basic structures
- To analyze polarization mechanisms in dielectrics
- To discuss the magnetic and superconducting properties of materials

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Extend the importance of Interference in thin films and Fraunhofer diffraction
CO-2: Explain 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: Analyze the frequency dependence of different polarizabilities
CO-5: Illustrate 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 (Qualitative treatment) from a single slit, Double slit diffraction, Diffraction grating and a circular aperture.

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

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, 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, Resnick, Halliday and Krane, 5th Edition, Wiley, 2014.
2. Engineering Physics, R. K. Gaur and S. L. Gupta, Dhanpat Rai Publications, 2012.
3. Engineering Physics, B. K. Pandey and S. Chaturvedi, Cengage Learning, 2014.

REFERENCES:

1. A Textbook of Engineering Physics, M. N. Avadhanulu and P. G. Kshirsagar, S. Chand Publishers, 2010.
2. Optics, A. Ghatak, 6th Edition, McGraw Hill Education, 2017.
3. Applied Physics, P. K. Mittal, 2nd Edition, IK International Publishing House Pvt. Ltd, 2008.
4. Introduction to Solid State Physics, Charles Kittel, 8th Edition, Wiley, 2012.
5. Engineering Physics, P. K. Palanisamy, 3rd Edition, Scitech, 2013 .

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

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

COURSE PRE-REQUISITES: None

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

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

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

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

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

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

UNIT-V:

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

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

UNIT-VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19ES1EE02) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
(Common to ME and AE)

COURSE PRE-REQUISITES: None

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, 5th Edition, Oxford University Press, 2008.
2. Introduction to Electrical Engineering, M. S. Naidu and S. Kamakshaiah, TMH Publications, 2017.

REFERENCES:

1. Principles of Electrical and Electronics Engineering, V. K. Mehta, S. Chand & Co, 2010.
2. Basic Electrical Engineering, Kothari and Nagarath, 4th Edition, TMH Publications, 2019.
3. Basic Electrical Engineering, T. K. Nagasarkar and M. S. Sukhija, 3rd Edition, Oxford University Press, 2017.
4. Electrical & Electronics Technology, E. Hughes, 10th Edition, Pearson, 2010.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19BS2PH01) APPLIED PHYSICS LABORATORY

(Common to ME and AE)

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, Faculty of Physics, VNRVJIET.
2. Laboratory Manual of Engineering Physics by Y. Aparna & K. Venkateswara Rao, VGS Publications.

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

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

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

COURSE PRE-REQUISITES: None

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

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

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

WEEK1:
Familiarization with programming environment.

WEEK 2:
Simple computational problems using arithmetic expressions.

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

WEEK 4:
Iterative problems, sum of series.

WEEK 5:
1D Array manipulation.

WEEK 6:
Matrix problems, string operations.

WEEK 7:
Simple functions.

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

WEEK 10:
Recursive functions.

WEEK 11:
Pointers and structures.

WEEK 12:
File operations.

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

(19ES2EE02) 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 DC shunt machine. (Predetermination of efficiency of a given DC shunt machine working as motor and generator)
2. Brake test on DC 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

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B.Tech. I Semester	**L**	**T/P/D**	**C**
	0	**6**	**3**

(19ES3ME01) ENGINEERING GRAPHICS
(Common to ME and AE)

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- Know the conventions used in Engineering Graphics and comprehend the tools to be used in AutoCAD software
- Understand the importance of engineering scales and curves
- Learn to use the orthographic projections for points, lines, planes and solids in different positions
- Understand the development of sections and isometric projections
- Create simple solid models of various domain applications

COURSE OUTCOMES: At the end 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.
Customization & 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 Graphics: Principles of Engineering Graphics and their Significance, Conventions, 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.

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

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

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

(19PW4AE01) DESIGN SENSITISATION

COURSE PRE-REQUISITES: None

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

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

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

MODULE-1: Design Overview and Motivation
Design is Everywhere – Various perspectives including history; Design Vocabulary; Design in Indian Context; Art and Design; Importance of Design in Career

MODULE-2: Understanding Design
Design Engineering vs. Engineering Design; Good and Bad Design — Case Studies
Introduction to the Design Double Diamond: Discover-Define-Develop-Deliver; Importance of user-centricity for design

MODULE-3: Doing Design: Discover Phase

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

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

MODULE-4: Designing Customer Service Experience

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

MODULE-5: Communication Skills for Design

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

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

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

MODULE-6: Sustainable Design Approaches

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

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

COURSE PRE-REQUISITES: Matrices, Differentiation, Integration

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

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

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

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

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

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

UNIT-V:

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

UNIT-VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19BS1CH01) ENGINEERING CHEMISTRY

(Common to ME, CSE, IT and AE)

COURSE PRE-REQUISITES: Basic knowledge of Mathematics and Chemistry

COURSE OBJECTIVES:

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

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

CO-1: Identify & recognize the role of polymers, surfactants and lubricants in various fields

CO-2: Rationalize ideas about alternate sources of energy so as to reduce load on fossil fuels

CO-3: Summarise the effects of corrosion to indicate the use of alloys in various metallic structures

CO-4: Familiarize with the role of nanomaterials, environmental & green chemistry and assess the use of analytical techniques

UNIT-I:

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

UNIT-II:

Surfactants: Definition, cleaning mechanism, types of surfactants, micelles, reverse micelles and critical micelle concentration.

Lubricants: Definition, types, mechanism of lubrication-thick film lubrication, thin film lubrication and extreme pressure lubrication. Additives and selection of lubricants. Properties-viscosity, cloud and pour point, flash and fire point, saponification number-definition and significance.

UNIT-III:

Energy Science:

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

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

UNIT-IV:

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

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

UNIT-V:

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

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

UNIT-VI:

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19HS1EN01) ENGLISH

(Common to ME, CSE, IT and AE)

COURSE OBJECTIVES:

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

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

UNIT-I:

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

UNIT-II:

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

UNIT-III:

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

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

UNIT – IV:

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

UNTI-V:

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

UNIT-VI:

Organizational Patterns for writing

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

TEXT BOOKS:

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

RECOMMENDED BOOKS:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19ES1CS02) DATA STRUCTURES THROUGH C

(Common to CE, EEE, ME, EIE and AE)

COURSE OBJECTIVES:

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

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

CO-1: Find time complexity notations for various sorting techniques

CO-2: Implement the operations of creation, insertion, deletion on linear data structures

CO-3: Apply the operations of creation, insertion, deletion on non-linear data structures

CO-4: Develop the applications using data structure concepts

UNIT-I:

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

UNIT-II:

Linked List: Singly linked list implementation, insertion, deletion and searching operations on linear list, circular linked list implementation

Double linked list implementation, insertion, deletion and searching operations. Applications of Linked Lists – Polynomial addition and subtraction.

UNIT-III:

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

UNIT-IV:

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

UNIT-V:

Trees: Definitions, binary tree representation, binary search tree, binary tree traversals-Preorder, Inorder, Post order.

UNIT-VI:

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

TEXT BOOKS:

1. C Programming & Data Structures, B. A. Forouzan and R. F. Gilberg, Third Edition, Cengage Learning.
2. Data Structures Using C (Paperback), Aaron M. Tenenbaum.

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester

L	T/P/D	C
3	0	3

(19ES1ME01) ENGINEERING MECHANICS

(Common to ME and AE)

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, Wedge Friction, Screw jack & differential screw jack.

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.
MASS MOMENT OF INERTIA: Moment of Inertia of Masses – Transfer Formula for Mass moments of inertia – Mass moment of Inertia of composite bodies.

UNIT-V:

KINEMATICS OF PARTICLES: Kinematics of particles – Rectilinear motion – Curvilinear motion – Projectiles.

KINETICS OF 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, 5th Edition, TMH Publishers, 2016.
2. Singer's Engineering Mechanics, K. Vijaya Kumar Reddy & J. Suresh kumar, 3rd Edition, B. S. Publishers, 2011.

REFERENCES:

1. Engineering Mechanics, J. L. Meriam & L. G. Kraige, 7th Edition, Wiley Publishers, 2012.
2. Engineering Mechanics, R. C. Hibbeler, 12th Edition, Pearson Education, 2018.
3. Engineering Mechanics, A. K. Tayal, 14th Edition, Umesh Publications, 2012.
4. Engineering Mechanics, R. K. Rajput, 2nd Edition, Laxmi Publications, 2013.
5. A Text Book of Engineering Mechanics, R. K. Bansal, 5th Edition, Laxmi Publications, 2007.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19BS2CH01) ENGINEERING CHEMISTRY LABORATORY
(Common to ME, CSE, IT and AE)

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

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

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

LIST OF EXPERIMENTS:

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

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

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19HS2EN01) ENGLISH LANGUAGE COMMUNICATION SKILLS LABORATORY

(Common to ME, CSE, IT and AE)

COURSE OBJECTIVES:

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

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

UNIT-I:

1. Introduction of Self and others
2. Study & Referencing Skills

UNIT-II:

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

UNIT-III:

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

UNIT-IV:

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

UNTI-V:

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

UNIT-VI:

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

RECOMMENDED BOOKS:

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

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

(19ES2CS02) DATA STRUCTURES THROUGH C LABORATORY

(Common to CE, EEE, ME, EIE and AE)

COURSE OBJECTIVES:

- To impart the implementation of data structures such as linked lists, stacks and queue
- To introduce the various advanced data structures such as tree traversals
- To analyze the sorting algorithms
- To teach the various graph traversal algorithms

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

WEEK 1:
1. Merge Sort

WEEK 2:
2. Quick Sort
3. Radix Sort

WEEK 3:
4. SLL creation, insertion, deletion, searching, display operations.

WEEK 4:
5. CLL creation, insertion, deletion, searching, display operations.

WEEK 5:
6. DLL creation, insertion, deletion, searching, display operations.

WEEK 6:
7. STACK operations using arrays and Linked List.

WEEK 7:
8. Infix to postfix conversion.

WEEK 8:
9. Postfix evaluation.
10. Towers of Hanoi problem

WEEK 9:
11. QUEUE operations using arrays and LL.

WEEK 10:
12. CIRCULAR QUEUE operations using arrays.

WEEK 11:
13. DEQUEUE operations using arrays.

WEEK 12:
14. Binary tree traversals using recursion.

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19ES2ME01) WORKSHOP PRACTICES

(Common to ME, CSE, IT and AE)

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

CO-1: Exposed to various types of manufacturing Process

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

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

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

LECTURES & VIDEOS:

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

I. Carpentry

i. Cross lap joint
ii. Mortise & tenon joint

II. Fitting

i. Square fitting
ii. L-Fitting

III. Welding

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

IV. Smithy

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

V. Electrical & Electronics

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

VI. Machine Shop

i. Step turning on lathe
ii. Drilling & threading

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19BS1MT10) PARTIAL DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS
(Common to ME and AE)

COURSE PRE-REQUISITES: Differentiation, Integration

COURSE OBJECTIVES: Student will gain knowledge of
- Evaluation of Fourier coefficients
- Method of Separation of Variables to solve second order Partial Differential Equations
- Numerical methods to solve non-linear systems
- Various methods of interpolation and its application
- 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 Publishers
2. Advanced Engineering Mathematics - Erwin Kreyszig, 8th Edition; 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

(19PC1ME08) MECHANICS OF SOLIDS

COURSE PRE-REQUISITES: Mathematics, Physics and Engineering Mechanics

COURSE OBJECTIVES:
- To list and define the Material properties and show the relationships between them
- To describe principles of Mechanics, Stress and Strain
- To demonstrate thoroughly 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) by Gere, J. M., Goodno, B. J, Cengage Learning, 2012
2. Strength of Materials by S. S. Rattan, Publisher: Tata McGraw-Hill Education, 2nd Edition, 2011

REFERENCES:

1. Engineering Mechanics of Solids by Popov E.P Prentice Hall of India Private Limited, 2004
2. Mechanics of materials by Beer F.P., Johnson E.R., and DeWolf, J.T. Tata McGraw-Hill, 2004
3. Strength of Materials by Schaum's Series, Mcgraw-Hill Book Company, 6th Edition

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

(19PC1ME04) THERMODYNAMICS

COURSE PRE-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 Stirling 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 by P. K. Nag, McGraw-Hill
2. Fundamentals of Thermodynamics by C. Borgnakke, R. E. Sonntag, and G. J. Van Wylen; John Wiley

REFERENCES:

1. Engineering Thermodynamics by Burgadt, Harper & Row Publication
2. Thermodynamics — An Engineering Approach by Yunus Cengel and Boles; TMH
3. Engineering Thermodynamics by P. Chattopadhyay, Oxford University Press

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC1ME01) METALLURGY AND MATERIALS ENGINEERING
(Common to ME and AE)

COURSE PRE-REQUISITES: Physics and Chemistry

COURSE OBJECTIVES:
- 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 by Sidney H. Avner; McGraw-Hill
2. Materials Science and Metallurgy by Kodgire, Everest

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC1AE01) AUTOMOTIVE CHASSIS

COURSE OBJECTIVES:

- To illustrate the vehicle lay-out and body types
- To provide the working of transmission systems
- To learn the basic functionality of final drive, steering and suspension systems
- To present the construction and working of brake and wheel and tyre assembly

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the vehicle lay-out and body types
CO-2: Comprehend the working of drive line systems
CO-3: Appreciate the basic functionality of final drive, steering and suspension systems
CO-4: Describe the construction and working of brake and wheel and tyre assembly

UNIT – I:
Frame and Body: Classification of automobiles, layout of chassis and sub systems and their role, types of chassis - light, medium and heavy duty vehicle chassis. Role and requirement of a chassis frame, types of frames, materials, loading points and types of bodies.

UNIT – II:
Clutch and Gear Box: Types of clutch - single plate clutch, coil spring type and diaphragm spring type, multiple plate clutch, centrifugal clutch and clutch trouble diagnosis. Need for gearbox, types of gear box - sliding mesh, constant mesh and synchromesh, overdrives, transfer case, gear shifting mechanisms and transmission trouble diagnosis.

UNIT – III:
Automatic Transmission: Need for fluid coupling and torque converters, epicyclical gearbox, automatic transmission – automatic manual transmission, continuously variable transmission and fully automatic transmission, control mechanisms and limitations.

UNIT – IV:
Drive Line and Final Drive: Propeller shaft drive, torque reaction and drive thrust, Hotchkiss drive, torque tube drive and universal joints. Front axle and its types, stub axle and its types, rear axle and its types. Need for differential, working, non-slip differentials, differential lock and drive line and final drive trouble diagnosis.

UNIT – V:
Steering System: Principle of steering, Ackerman's and Davis steering mechanisms, steering layout, types of steering gearbox, types of front axle and stub axle, steering geometry. Purpose, working and types of power steering.
Suspension System: Types of suspension - rigid axle suspension and independent suspension, types of suspension spring - leaf spring, coil spring, torsion bar spring, air

spring, rubber spring and hydro elastic spring. Role and types of shock absorber, construction and working. Steering and suspension trouble diagnosis.

UNIT – VI:

Brake System: Stopping distance, time and braking efficiency, effect of weight transfer, braking torque, classification of brakes, drum and disc brakes, construction and working of mechanical, hydraulic, pneumatic, power-assisted brakes and servo brakes. Drum brake and disc brake trouble diagnosis.

Tyres and Wheels: Types and construction of wheel, tyre requirements, bias ply and radial ply tyres, tubeless tyres, wheel balancing and tyre rotation.

TEXTBOOKS:

1. Advanced Vehicle Technology, by Heinz Heisler, 2nd Edition, Butterworth Heinemann Publishers, 2002
2. Automotive Mechanics, by Giri N K, Khanna Publications, 2008

REFERENCES:

1. The Motor Vehicle, by Garrett T K, Newton K. and Steeds W., 13th Edition Butterworth Heinemann Publishers, 2001
2. Automotive Mechanics, by William Crouse and Donald Anglin, 10th Edition, McGraw- Hill Publication, 2010
3. Automotive Mechanics, by Srinivasan S, 2nd Edition, McGraw-Hill Publishing Company Ltd., 2003
4. Automotive Chassis, by Heldt P M, Chilton & Co., 1996

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC2AE01) AUTOMOTIVE CHASSIS LABORATORY

COURSE PRE-REQUISITES: Automotive Chassis

COURSE OBJECTIVES:
- To identify and study of automotive chassis systems
- To distinguish functionality of various running and control systems
- To understand the troubles and remedies chassis systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the principle and functionality of various automotive systems
CO-2: Dismantle and assemble chassis systems
CO-3: Inspect and identify the faults chassis systems

LIST OF EXPERIMENTS
ANY **10 EXPERIMENTS** TO BE CONDUCTED FROM THE FOLLOWING

1. Dismantling, inspection and assembling of clutch
2. Dismantling, inspection and assembling of sliding mesh gear box
3. Dismantling, inspection and assembling of constant mesh gear box
4. Dismantling, inspection and assembling of synchromesh gear box
5. Dismantling, inspection and assembling of automatic gear box
6. Dismantling, inspection and assembling of transaxle
7. Dismantling, inspection and assembling of transfer case
8. Dismantling, inspection and assembling of differential unit
9. Dismantling, inspection and assembling of brake system
10. Dismantling, inspection and assembling of suspension system
11. Dismantling, inspection and assembling of steering gear box
12. Dismantling, inspection and assembling of front and rear axle

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC2AE02) METALLURGY AND MECHANICS OF SOLIDS LABORATORY

COURSE PRE-REQUISITES: Metallurgy and Material Engineering and Mechanics of Solids

COURSE OBJECTIVES:
- To study the microstructure of different materials
- To understand the changes in microstructure after different heat treatments
- To analyze the various tests to be conducted on engineering materials
- To analyze the importance of tests in evaluating the corresponding mechanical properties

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify different materials with microstructure
CO-2: Inspect the microstructure of a given material after heat treatments
CO-3: Evaluate the result of test and comment on the mechanical properties of materials
CO-4: Decide a material and an appropriate test suitable for given application

LIST OF EXPERIMENTS
Any **10 experiments** to be conducted from the following

Metallurgy
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

Mechanics of Solids
1. Tension test
2. Bending test - Simply supported and cantilever beams
3. Torsion test
4. Hardness test – Brinell's and Rockwell hardness tests
5. Compression test on spring
6. Compression test on a cube
7. Impact test
8. Direct shear test

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC2IT02) PYTHON PROGRAMMING LABORATORY

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC1ME03) FLUID MECHANICS AND MACHINERY
(Common to ME and AE)

COURSE OBJECTIVES:

- To understanding the properties of fluids, principles of buoyancy, flow, force and head calculations
- To evaluation of types of fluid flow, Laminar and dynamic
- To knowledge on boundary layer principles applied to airfoils
- To principles of operation of different types of hydraulic machinery
- To understanding Hydraulic systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyzing the fluid properties to solveflow, force and velocity problems
CO-2: Evaluating the flow characterizing in static and dynamic nature of flow
CO-3: Applying fluid flow and dynamics insolving 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 Publication

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC1AE02) APPLIED THERMODYNAMICS

COURSE PRE-REQUISITES: Mathematics and Thermodynamics

COURSE OBJECTIVES:
- To extend thermodynamic principles to different thermodynamic systems
- To understand the energy conversion processes and equipment
- To provide basic concepts of refrigeration and psychrometry

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply thermodynamic principles to understand various thermodynamic systems
CO-2: Investigate the effectiveness of energy conversion processes/components in mechanical power generation
CO-3: Analyse the vapour compression refrigeration cycle and carry out basic psychrometric calculations

UNIT – I:
Steam Generators: 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, performance of boilers and equivalent evaporation.

UNIT – II:
Steam Condensers: Introduction, purpose and types of condenser, efficiency of condenser and Edward air pump.
Steam Nozzles: Functions of nozzle, applications, types, flow through nozzles, thermodynamic analysis, assumptions, velocity of nozzle at exit, ideal and actual expansion in nozzle, velocity co-efficient, condition for maximum discharge and critical pressure ratio.

UNIT – III:
Impulse Turbine: Mechanical details, velocity diagram, effect of friction, power developed, axial thrust, diagram efficiency, condition for maximum efficiency and methods to reduce rotor speed.
Reaction Turbine: Mechanical details, principle of operation, Thermodynamic analysis of a stage, Degree of reaction, velocity diagram, parson's reaction turbine and condition for maximum efficiency.

UNIT – IV:
Reciprocating Compressors: Principle of operation, work required, isothermal efficiency, volumetric efficiency and effect of clearance, multi stage compression, under cooling, saving of work and minimum work condition for stage compression.
Rotary Compressors: Classification, roots blower, vane blower, centrifugal compressor and axial compressor (Qualitative treatment only).

UNIT – V:

Gas Turbines: Classification of gas turbine plants, ideal cycle, essential components, parameters of performance, actual cycle, regeneration, inter cooling and reheating. **Jet and Rocket Propulsions:** Classification of Jet propulsion, turbo jet and turboprop. Solid and liquid propellant rockets.

UNIT – VI:

Refrigeration: Ideal refrigeration cycles - Vapor compression refrigeration cycle, Bell Coleman refrigeration cycle and vapour absorption refrigeration system **Psychrometry:** Psychrometric properties, psychrometric chart and psychrometric processes – Sensible heating and cooling, humidification and dehumidification, humidification with heating/cooling and dehumidification with heating/cooling.

TEXT BOOKS:

1. Thermal Engineering, by Mahesh M Rathore, McGraw Hill Education (India) Pvt. Ltd., 2016
2. Gas Turbines, by Ganesan V, TMH Publications, 2010

REFERENCES:

1. Thermal Engineering, by Rajput R K, Laxmi Publications, 2010
2. Thermodynamics and Heat Engines, by Yadav R, Central Book Depot, 2002
3. Thermal Engineering, by Ballaney P L, Khanna Publishers, 2010
4. Gas Turbines and Propulsive systems, by Khajuria P and Dubey S P, Dhanpat Rai & Sons, 2012

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC1AE03) THEORY OF MACHINES

COURSE PRE-REQUISITES: Engineering Mathematics, Engineering Mechanics and Engineering Graphics

COURSE OBJECTIVES:
- To know different machine elements and mechanisms
- To understand kinematic and dynamic characteristics of different mechanisms
- To select suitable drives and mechanisms for a particular application
- To discuss the concepts of governors and gyroscope

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify mechanisms and predict their motion
CO-2: Analyse kinematic and dynamic characteristics of different mechanisms
CO-3: Apply suitable drives and mechanisms
CO-4: Evaluate performance of governors and effects of gyroscopic couple

UNIT – I:
Mechanisms and Machines: Introduction, mechanism and machine, rigid and resistant bodies, link, kinematic pair, degrees of freedom, classification of kinematic pairs, kinematic chain linkage, mechanism and structure and mobility of mechanisms. The four-bar chain, the slider-crank chain and double slider-crank chain mechanisms, inversions of these mechanisms and mechanical advantage.

UNIT – II:
Kinematics: Velocity and acceleration-motion of link in machine - Determination of velocity and acceleration diagrams, relative velocity method, application of relative velocity method-four bar chain and single slider crank chain, Klein's construction, Coriolis acceleration, determination of Coriolis component of acceleration
Plane Motion of Body: Instantaneous center of rotation, centrode - relative motion between two bodies-Three centers in line theorem.

UNIT – III:
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.

UNIT – IV:
GEARS: 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, condition for minimum number of teeth to avoid interference, expression for arc of contact and path of contact.
Gear Trains: Introduction, train value, types - Simple and reverted gear trains, epicyclic gear train, methods of finding train value or velocity ratio and differential gear for an automobile.

UNIT – V:

Governors: Necessity of governor, Classification of Governors, Working principle of centrifugal governors- Watt, porter, Proell and Hartnell governors Stability of governor, Condition for stability, Concept of isochronism, Sensitivity of governor, Characteristics of governors, hunting of governors.

UNIT – VI:

Gyroscope: Angular velocity, angular acceleration, gyroscopic torque, gyroscopic effect on naval ships, stability of an automobile and stability of a two-wheel vehicle.

TEXT BOOKS:

1. "Theory of Machines", by Ratan S.S, 4th Edition, Tata McGraw Hill, 2017
2. "Theory of machines", by Gordon R. Pennock & Joseph E. Shigley John J. Uicker, 4th Edition, Oxford University Press, 2014

REFERENCES:

1. "Theory of Machines", by Thomas Bevan, 3rd Edition, Pearson Education, 2009
2. "Theory of machines", by Khurmi R. S & Gupta J. K, S.Chand Publishing, 1976
3. "Design of Machinery", by RobartL.Norton, 3rd Eedition, Tata McGraw Hill,2004
4. "Theory of machines", by Sadhu Singh, 3rd Edition, Pearson education, 2011
5. "Theory of Machines", by Ballaney, P. L, Khanna Publishers, 2003

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC1AE04) AUTOMOTIVE ENGINES

COURSE PRE-REQUISITES: Physics and chemistry

COURSE OBJECTIVES:
- To present the constructional details and combustion in automotive engines
- To learn the principle and functions of an automotive engine sub-systems
- To know engine measurements and performance characteristics
- To provide the concepts and working of unconventional engines

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the constructional details and combustion in automotive engines
CO-2: Describe the principle and functions of an automotive engine sub-systems
CO-3: Analyze engine measurements and performance characteristics
CO-4: Discuss the concepts and working of unconventional engines

UNIT – I:
Engine: Classification, principle, construction and working of four stoke and two stroke SI and CI engines. Theoretical and actual indicator, valve and port timing diagrams, stages of combustion in SI and CI engines, abnormal combustion and combustion chambers.

UNIT – II:
Fuel System: Air fuel ratio requirements, principle and working of carburetor, multi-point fuel injection and gasoline direct injection. Diesel fuel injection pump, types of nozzles and common rail direct injection.

UNIT – III:
Engine Sensors and Actuators: Role of engine management system, sensors – engine speed, mass air flow, manifold absolute pressure, throttle position, knock, temperature, exhaust oxygen level and accelerometers, actuators - solenoids, relays, piezoelectric force generators and stepper motors and engine mapping.

UNIT – IV:
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 – V:
Engine Performance and Supercharging: Engine power, measurement of friction power, engine efficiencies, performance characteristics and heat balance.
Supercharging - mechanical supercharging, turbocharging, types of superchargers and methods of supercharging.

UNIT – VI:
Unconventional Engines: Stiriling engine - Working Principle, two piston engine, control system, fuel requirement, emissions, merits and demerits. Wankel engine - Construction

and working, performance, emissions, merits and demerits. Variable compression ratio engine - Necessity, theoretical analysis, different methods. HCCI engine – principle and Strategies for Mixture Preparation, and stratified charge engine – methods of charge stratification.

TEXT BOOKS:

1. "Internal Combustion Engine Fundamentals", by John B Heywood, 2nd Edition, McGraw-Hill Education, 2018
2. "Internal Combustion Engines", by Mathur ML and Sharma RP, Dhanpat Rai Publications, New Delhi, 2014

REFERENCES:

1. "Internal Combustion Engines", by Ganesan V, 4th Edition, Tata McGraw Hill, New Delhi, 2017
2. Advanced Vehicle Technology, by Heinz Heisler, Butterworth Heinemann Publishers, 2002
3. Introduction to Internal Combustion Engines, by Richard Stone, SAE Publications,1999
4. Internal Combustion Engine, by Willard W Pulkrabek, Prentice Hall Publication, 1997

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC1AE05) MANUFACTURING TECHNOLOGY

COURSE PRE-REQUISITES: Metallurgy and Material Science and Workshop /Manufacturing Practices

COURSE OBJECTIVES:
- To understand about sand casting and metal casting techniques
- To impart the knowledge of various welding processes
- To understand about the importance of mechanical working processes
- To appreciate metal cutting process and working principles of various machine tools

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Select the suitable casting technique for making the components
CO-2: Perform different welding processes and understand importance of welding
CO-3: Know the various metal working processes
CO-4: Analyze the metal cutting process and perform various machining processes

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; Principles of Gating, Gating ratio; Risers- Types;
Special casting processes: Centrifugal, Die, Investment casting only, Cupola furnace and Electric arc furnace only.

UNIT – II:
Welding: Classification of welding processes, types of welded joints, Gas welding, TIG & MIG welding, Resistance welding, thermit welding, friction stir welding, Soldering and Brazing, Welding defects.

UNIT – III:
Mechanical Working-I: Hot working; Cold working; Strain hardening; Recovery; Recrystallisation and grain growth; Blanking and piercing; Bending and forming; Drawing and its types; Wire drawing and Tube drawing; Coining; Hot and cold spinning. {Limited to processes, advantages, disadvantages and applications only}

UNIT – IV:
Mechanical Working-II: 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; Forging defects. {Limited to processes, advantages, disadvantages and applications only}

UNIT – V:
Theory of Metal Cutting: Elements of cutting process, classification of cutting tools, geometry of single point tool, orthogonal cutting, chip formation and types of chips.

Force relationships (Merchant's force circle), velocity relationships, cutting speed, feed, depth of cut. Tool wear and tool life, coolants, machinability and tool materials. Engine Lathe: Principle of working, Classification, Specifications, Lathe parts, Work holders, Tool holders, Lathe attachments, Operations performed and Machining time.

UNIT – VI:
Milling Machine: Principle of working, Classification, Specifications, Features of horizontal, vertical and universal milling machines, Milling cutters, Operations performed, Overview on indexing and Machining time.
Shaping, Slotting and Planning Machines: Principle of working, parts, Specifications, Classification, Operations performed.
Drilling and Boring Machines: Principle of working, Parts, Specifications, Classification and Operations performed.
Overview on Grinding Process and Machines

TEXT BOOKS:

1. Manufacturing Technology Volume - I & II, by Rao P.N, 5th Edition, McGraw-Hill, 2018
2. Production Technology, by Jain R.K, Khanna Publishers, 2004

REFERENCES:

1. Manufacturing Engineering and Technology, by Kalpakjian S, Schmid R, 4th Edition, Pearson Publishers, 2002
2. Production Technology, by Sharma P C, 8th Edition, S. Chand publishing, 2014
3. Principles of Modern Manufacturing, by Mikell P. Groover, 5th Edition, Wiley,2014

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC2ME03) FLUID MECHANICS AND MACHINERY LABORATORY
(Common to ME and AE)

COURSE PRE-REQUISITES: Fluid Mechanics and Hydraulic Machines

COURSE OBJECTIVES:
- To analyzing 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 analyzing various pumps, water turbines, pipes and pressure measurement devices
- To evaluating efficiency for pumps and turbines

COURSE OUTCOMES: 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.

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

(19PC2AE03) THEORY OF MACHINES LABORATORY

COURSE PRE-REQUISITES: Theory of Machines

COURSE OBJECTIVES:

- To evaluate the follower movement and mass moment of Inertia
- To Understand the working of various governors
- To study the static and dynamic balancing and gyroscopic effects
- To analyze whirling of shaft and natural frequency of undamped and damped free vibration system

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

CO-1: Balance the static and dynamic forces and identify the effects of gyroscopic couple

CO-2: Calculate the natural frequency of Undamped and damped free vibration system

CO-3: Draw cam profile based on the follower movement and calculate the mass moment of inertia

CO-4: Analyse the various governors

LIST OF EXPERIMENTS

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

1. Pressure distribution in journal bearing
2. Follower and cam analysis
3. Hartnell governor test
4. Porter and Proell governor test
5. Static and dynamic balancing using rigid blocks
6. Motorized gyroscope
7. Bifilar and Trifilar suspension system test
8. Whirling speed of a given shaft
9. Undamped torsional vibration of a single rotor shaft and two rotor shaft system
10. Damped force vibration of a spring mass system
11. Undamped free vibration of an equivalent spring mass system
12. Coriolli's component of acceleration at various speeds of rotation
13. Study of epicyclic gear train

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC2AE04) AUTOMOTIVE ENGINES LABORATORY

COURSE PRE-REQUISITES: Automotive engines

COURSE OBJECTIVES:
- To show valve and port timing diagrams
- To test performance characteristics of IC engine and compressor
- To estimate optimum cooling and heat balancing of an engine
- To perform dismantling and assembling of an engine

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Illustrate valve and port timing diagrams
CO-2: Analyze performance characteristics of IC engine and compressor
CO-3: Evaluate optimum cooling and heat balancing of an engine
CO-4: Demonstrate dismantling and assembling of an engine

LIST OF EXPERIMENTS
Any **10 experiments** to be conducted from the following

1. Valve timing diagram for 4-stroke Diesel engine
2. Valve timing diagram for 4-stroke petrol engine
3. Port timing diagram for 2-stroke petrol engine
4. Performance test on 4-stroke single cylinder Diesel engine
5. Performance test on 4-stroke single cylinder petrol engine
6. Heat balance test on 4-stroke single cylinder Diesel engine
7. Morse test on multi-cylinder petrol engine
8. Optimum cooling temperature test on single cylinder Diesel engine
9. Performance evaluation on computerized Diesel engine
10. Performance test on reciprocating compressor test rig
11. Dismantling, inspection and assembling of multi-cylinder petrol engine
12. Dismantling inspection and assembling of multi-cylinder Diesel engine

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19MN6HS02) 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

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

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

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

(19PC1ME13) HEAT TRANSFER

COURSE PRE-REQUISITES: Basic integral and differential calculus, thermodynamics

COURSE OBJECTIVES:
- To Measure the conduction mode of heat transfer in physical environment and to derive general mathematical equation
- To measure the heat transfer through Homogeneous slabs, hollow cylinders, sphere, extended surfaces and fins
- To measure convective mode of heat transfer
- To measure heat transfer during radiation, boiling and condensation and 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 and Apply equations in problems related to conduction heat transfer through Homogeneous slabs, hollow cylinders, sphere, extended surfaces and fins
CO-2: Derive and apply the convective heat transfer equations to any flow and Quantify amount of Heat Transfer in Phase Change Heat Transfer
CO-3: Apply principles of Radiation to analyze and design Heat Transfer aspects of engineering systems
CO-4: Design the devices that transfers 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 - 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 NTU methods for parallel flow and counter flow

TEXT BOOKS:

1. Fundamentals of Engineering Heat and Mass Transfer, Sachdeva R.C., 5th Edition, New Age International, 2017
2. Heat and Mass Transfer Data Book, Kothandaraman C.P., 9th Edition, New Age International, 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**

(19PC1AE06) AUTOMOTIVE ELECTRICAL AND ELECTRONICS

COURSE PRE-REQUISITES: Basic Electrical and Electronics Engineering, Automotive Chassis and Automotive Engines

COURSE OBJECTIVES:

- To study the fundamentals, working and advanced concepts of automotive battery, ignition and starting systems
- To learn basics of automotive electronics and working principle of sensors and actuators
- To understand the working of basic and advanced concepts of automotive charging and lighting systems
- To provide an overview on control system concepts in engine control

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the fundamentals, working and advanced concepts of automotive battery, ignition and starting systems
CO-2: Discuss the working of basic and advanced concepts of automotive charging and lighting systems
CO-3: Present basics of automotive electronics and working principle of sensors and actuators
CO-4: Apply control system concepts in engine control

UNIT – I:
Starting System and Battery: Principle and construction of starter motor, working of different starter drive units and solenoid switches. Battery – Lead acid battery, rating, characteristics and testing.

UNIT – II:
Ignition System: Ignition system types and components, ignition timing, spark advance and retarding mechanisms, types of spark plugs. Electronic ignition systems, programmed ignition and distributor-less ignition.

UNIT – III:
Charging and Lighting System: Generator and alternator - principle, construction and working, third brush regulation, rectification, cut-outs, relays and regulators. Details of head light and side light, LED lighting system, head light dazzling and preventive methods.

UNIT – VI:
Accessories and Wiring: Horn, wiper, speedometer, fuel, oil and temperature gauges, power windows, mirrors, sun roof and defrosters. Fuses, cables, connectors,

automotive wiring - Insulated and earth return system, wiring diagrams, symbols and standards.

UNIT – V:

Fundamentals of Embedded System: Microcomputer - Fundamentals, tasks and operations, CPU registers, microprocessor architecture, reading instructions, microcomputer hardware and microcontroller applications in automotive systems.

UNIT – VI:

Electronic Management System: Role of engine management system, power train control Systems – air/fuel ratio control, control of spark timing, idle-speed control, transmission control, body control module, engine mapping and on-board diagnostics.

TEXTBOOKS:

1. Automobile Electrical Equipment, Crouse W H, McGraw Hill Book Co., Inc., New York 3rd Edition,1986
2. Understanding Automotive Electronics, William B Ribbens, 5th Edition, Butter worth Heinemann Woburn, 1998
3. Understanding Automotive Electronics, Bechhold SAE, 1998

REFERENCES:

1. Modern Electrical Equipment of Automobiles, Judge A W, Chapman & Hall, London,1992
2. Automotive Handbook, Robert Bosch, SAE, 5th Edition, 2000
3. Automotive Electrical Equipment, Kholi P L, Tata McGraw Hill Co., Ltd., New Delhi, 1975
4. Automotive Electrical Equipment, Young A P and Griffiths L, ELBS & New Press, 1999
5. Automotive Electrics Automotive Electronics, 4th Edition, Robert Bosch GmbH, 2004

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC1AE07) DESIGN OF AUTOMOTIVE COMPONENTS - I

COURSE PRE-REQUISITES: Engineering Mechanics, Mechanics of Solids, Automotive Materials.

COURSE OBJECTIVES:
- To know the basic design process of machine elements and failure theories
- To understand the design considerations for structural members under fluctuating loads
- To compare and evaluate different types of fasteners
- To appraise power transmitting elements in automobiles

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explicate the basic design process of machine elements and failure theories
CO-2: Analyse the behavior of structural members under fluctuating loads
CO-3: Select and design different types of fasteners
CO-4: Design power or force transmitting elements in automobiles

UNIT – I:
Engineering Materials and Design Considerations: The design phase / methodology and identification of need, evaluation and presentation, reliability and product liability. Mechanical properties of engineering materials, overall design considerations, factor of safety, preferred numbers. Standard and codes, design data handbook. Review of failure theories for static and dynamic loading

UNIT – II:
Design against Fluctuating Load: Stress concentration, stress concentration factors, reduction of stress concentration, critical sections in machine parts, fluctuating stresses. Fatigue strength, endurance Limit, fatigue test, S-N diagrams for steels, Low cycle and high cycle fatigue, notch sensitivity, design for finite and infinite life. Soderberg and Goodman line the fatigue strength modified Goodman theory, Soderberg theory and Gerber theory.

UNIT – III:
Threaded Joints: Bolted joints, bolted joint under initial loading and eccentrically loaded bolted joints under different static load conditions, torque requirement for bolt tightening.

UNIT – IV:
Welded Joints: welding symbols, butt and fillet welds, stress in the welded joints carries tension bending and shear loading, design of various types of welding joints and eccentrically loaded welded joints under different static load conditions.

UNIT – V:

Springs: Classification of springs, spring material, design of helical, leaf and torsion springs under constant loads.

Belt Drives: Introduction, classification of belts, belt materials, design of flat (rectangular) belts, ratio of belt tensions, V-Belts, power transmitted through V-Belt, design of V-Belts.

UNIT – VI:

Shafts, Keys and Couplings: Transmission shafts, design of solid and hollow shafts based on strength, rigidity and flexible shafts Key and classification of keys, stresses in the keys and design considerations. Rigid couplings Muff, split muff and flange couplings Bushed - pin flexible coupling.

TEXTBOOKS:

1. Design of Machine Elements, V B Bhandari, 5th Edition, McGraw Hill Education (India) Private Limited; New Delhi, 2017

REFERENCES:

1. Mechanical Engineering Design, Richard G. Budynas, J. Keith Nisbett, Shigley's 10th Edition, McGraw Hill Education (India) Private Limited; New Delhi, 2016
2. Fundamentals of Machine Component Design, Juvinal, R.C., Marshek K M, 5th Edition, John Wiley & Sons INC, ISBN-13 9781118012895, 2012
3. Design of Machine elements, Spottes, M.F., Prentice-Hall India, 1994
4. Mechanical Design – An Integrated Approach, R. L. Norton, Prentice Hall, 1998
5. Data Books: P.S.G. College of Technology

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PE1AE01) ALTERNATIVE FUELS

COURSE PRE-REQUISITES: Engineering Chemistry and Automotive Engines

COURSE OBJECTIVES:
- To identify various sources of alternative fuels for SI and CI engines
- To know the benefits and engine modifications required for using alternative fuels
- To provide the quality standards, regulations and third-party inspection for alternative fuel vehicles

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Select alternative fuels for using on SI and CI engines
CO-2: Explain the benefits and engine modifications required for using alternative fuels
CO-3: Recognize quality standards, regulations and third-party inspection for alternative fuel vehicles

UNIT – I:
Hydrogen: Properties, production, on-board storage, material compatibility, stationary storage, piping, dispensing, transportation, advantages and disadvantages, safety, standards, usage in IC engines and emissions.
Liquid Hydrogen: Properties, production, advantages and disadvantages, hazards, storage, transportation, piping, dispensing and emissions.

UNIT – II:
Compressed Natural Gas: Production, properties, storage, piping, advantages and disadvantages, dispensing, transportation, material compatibility, CNG fuel kits, engine modifications for CNG operations, CNG combustion, stoichiometric vs. lean burn CNG engines, engine optimization, vehicle emission, after treatment of exhaust, fueling station safety systems, CNG standards and regulations and third-party inspection for alternative fuels vehicles.
Liquefied Natural Gas: Production, properties, economics, advantages and disadvantages, transportation, storage, piping, dispensers, LNG to CNG conversion system, regulations for LNG, vehicle performance characteristics and emission.

UNIT – III:
Liquefied Petroleum Natural Gas: Production, properties, storage, dispensing and receptacles, material compatibility, piping, safety systems, transportation, advantages and disadvantages, LPG engine developments, LPG fuel kits, combustion, emissions and LPG Standards.
Landfill Gas or Marsh Gas: Production, properties, composition, monitoring pretreatment, usage, advantages and disadvantages, emissions and applications.

UNIT – IV:
Biogas or Biomethane: Production, composition, properties, biogas plants, treatment, storage, dispensing, advantages and disadvantages, hazards, emissions and regulations.

Methanol: Properties, production, applications, advantages and disadvantages, hazards, economics, storage, dispensing, combustion and emissions.
Ethanol: Properties, production, dry milling, material compatibility, storage, transportation, piping, dispensing, advantages and disadvantages, hazards, blends, engine modifications, combustion, emissions and standards.

UNIT – V:
Straight Vegetable Oils: Feedstock selection, iodine value, properties, production, degumming, storage, dispensing, material compatibility, advantages and disadvantages, engine modifications, combustion, emissions and standards.
Biodiesel: Feedstock selection, raw material, properties, production, storage, dispensing, material compatibility, standards, transportation, advantages and disadvantages, hazards, engine modifications, combustion and emissions.

UNIT – VI:
Synthetic Alternative Fuels: Properties, composition, production, storage, engine modifications, blends, combustion, performance and emission characteristics in SI and CI engines, advantages and disadvantages of HCNG and hythane, dimethyl ether, diehyl ether, syngas, plastic fuel and tyre pyrolysis oil.

TEXT BOOK:

1. Alternative Fuels, Thipse S. S., Jaico Publishers, 2010

REFERENCES:

1. A Textbook of Alternative Fuel of Automobile Engine, Rami Reddy and Yousuf, Front line Publishers
2. Powering Your Vehicle with Straight Vegetable Oil, Forest Gregg

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PE1AE02) SIMULATION OF AUTOMOTIVE ENGINES

COURSE PRE-REQUISITES: Thermodynamics, Applied Thermodynamics and Automotive Engines

COURSE OBJECTIVES:
- To identify the importance of IC engine modeling
- To impart knowledge in computer simulation of IC engine process
- To explain the concepts combustion and emission analysis
- To provide modeling and simulation for new concept engines

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Model IC engine
CO-2: Discuss combustion and analysis of IC engine
CO-3: Simulate IC engine
CO-4: Appreciate modeling and simulation for new concept engines

UNIT – I:
Introduction: First law and second law analysis, governing equation, conservation of mass, momentum and energy.

UNIT – II:
Combustion in SI Engines: Combustion in premixed flames - Stages of combustion, flame propagation, rate of pressure rise, cycle-to-cycle variation, abnormal combustion – Theories and effect of engine operating variables on combustion.

UNIT – III:
Combustion in CI Engines: Combustion in diffusion flames - Droplet and spray combustion theory, stages of combustion, delay period, peak pressure, heat release, gas temperature and diesel knock.

UNIT – IV:
Modeling of IC Engines: Heat of reaction - Hrp and Urp calculations, adiabatic, constant volume combustion, constant pressure combustion, temperature drop due to fuel vaporization, adiabatic flame temperature, mean effective pressure, torque and thermal efficiency at full throttle, part throttle and supercharged conditions. Spray models, flow models and combustion models.

UNIT – V:
Simulation of IC Engines: SI and CI engine simulation – Air standard cycle, fuel-air cycle, progressive combustion cycle and actual cycle simulation – Part throttle, full throttle and supercharged conditions.

UNIT – VI:
Simulation of New Engine Concept: Dual fuel engine, low heat rejection engine, lean burn engine, variable compression ratio engine, homogeneously charged compression ignition engine and controlled auto ignition engine.

TEXT BOOKS:

1. Computer Simulation of Spark-Ignition Engine Processes, Ganesan V, Universities Press (I) Ltd, Hyderabad, 1996
2. Computer Simulation of Compression-Ignition Engine Processes, Ganesan V., University Press (I) Ltd, Hyderabad, 2000

REFERENCES:

1. Internal Combustion Engines, Ganesan V., Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2008
2. Internal Combustion Engine Fundamentals, Heywood J.B., McGraw Hill Book Co., USA, 1988
3. Modeling of Internal Combustion Engines Processes, Ramoss A.L., McGraw Hill Publishing Co., 1992
4. Thermodynamic Analysis of Combustion Engines, Ashley Campbel, John Wiley & Sons, New York, 1986

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

(19PE1ME07) 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, Devdas Shetty, Richard A. Kolk
2. Mechatronic Systems: Modeling and Simulation with HDL's, Georg Pelz, 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. V Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PE1ME08) 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. V Semester	L	T/P/D	C
	3	0	3

(19PE1AE03) QUALITY ENGINEERING IN MANUFACTURING

COURSE OBJECTIVES:

- To understand the types of factors and principles of quality loss function
- To understand the robust design methodology in solving practical engineering problems
- To comprehend the various quality control tools

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Value the concept of quality, use quality tools and obtain the quality loss
CO-2: Utilize the analytical techniques to find out the variation in the data and obtain optimal results
CO-3: Select and use the proper orthogonal arrays in designing, conducting and analyzing the experiments
CO-4: Formulate parameter and tolerance design strategies

UNIT – I:
Quality Value and Engineering: An overall quality system, Quality engineering in product design, Quality engineering in design of production processes, Quality engineering in production.
Loss Function and Quality Level: Derivation and use of Quality Loss Function (QLF), Economic consequences of tightening tolerances as a means to improve quality, Evaluations and types tolerances - N-type, S-type and L-type.

UNIT – II:
Analysis of Variance (ANOVA): NO - way ANOVA, One-way ANOVA, Two-way ANOVA, Critique of F-test, ANOVA for four level factors and multiple level factors.

UNIT – III:
Orthogonal Arrays: Introduction to OA, Degrees of Freedom, Structure of OA, Linear Graphs &Interaction tables, Strategies in Experimentation - Typical test strategies, Better test strategies & Efficient test strategies, Steps in designing, conducting and analyzing an experiment.
Interpolation of Experimental Results: Interpretation methods, Percent contribution, estimating the mean.

UNIT – IV:
Tolerance Design and Tolerancing: Functional limits, Tolerance design for N-type, L-type and S-type characteristics and tolerance allocation for multiple components.

UNIT – V:
Parameter and Tolerance Design: Introduction to parameter design, Signal to noise ratios, Parameter design strategy, some of the case studies on parameter and tolerance designs.

UNIT – VI:

Quality Tools: ISO-9000 Quality System, Business Process Re-engineering (BPRE), Six-sigma, Bench making, Quality circles, Brain Storming, Fishbone diagram.

TEXT BOOKS:

1. Taguchi Techniques for Quality Engineering, Phillip J. Ross, McGraw Hill, Intl, 2nd Edition, 1995
2. Quality Engineering in Production Systems, G. Taguchi, Elsayed A., McGraw Hill Intl, Edition, 1989

REFERENCES:

1. Quality Engineering using Robust Design, Madhav S. Phadke, 1st Edition, Pearson Education, 1989
2. Total Quality Management, Poornima M. Charantimath, Pearson Education, 2003
3. Taguchi Methods Explained: Practical Steps to Robust Resign, Tapan P. Bagchi, Prentice Hall Ind Pvt. Ltd., New Delhi

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC2ME09) HEAT TRANSFER LABORATORY
(Common to ME & AE)

COURSE PRE-REQUISITES: Heat and mass transfer, thermodynamics

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 composite wall, lagged pipe, metal bar and insulating powder
CO-3: Evaluate Heat transfer coefficient for natural, forced convection and unsteady heat transfer
CO-4: Evaluate emissivity and Stefan Boltzmann constant 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**

(19PC2AE05) MANUFACTURING TECHNOLOGY LABORATORY

COURSE PRE-REQUISITES: Workshop, Manufacturing Technology, Metallurgy and Material Science

COURSE OBJECTIVES:
- To understand casting techniques and sand properties
- To learn different welding processes and their applications
- To apprehend various sheet metal working practices
- To practice various machining operations

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the knowledge in casting techniques
CO-2: Decide the selection of various welding techniques for different materials
CO-3: Practice the sheet metal working practices
CO-4: Perform various machining operations

LIST OF EXPERIMENTS:

Any 10 experiments to be conducted from the following

1. Pattern design and making
2. Moulding and casting
3. Moulding sand testing for strength and permeability
4. Spot welding
5. TIG welding
6. MIG welding
7. Brazing
8. Blanking and piercing
9. Bending
10. Injection moulding
11. Blow moulding
12. Machining horizontal surface on shaper
13. Plane milling /gear milling

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC2AE06) AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY

COURSE PRE-REQUISITES: Basic Electrical and Electronics Engineering and Automotive Electrical and Electronics

COURSE OBJECTIVES:

- To study and demonstrate different electrical and electronic systems in a vehicle
- To test and analyze automotive battery, starting, charging and ignition systems
- To calibrate automotive sensors for measurement
- To Interface automotive sensors with ADC

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstration different electrical and electronic systems in a vehicle
CO-2: Test automotive battery, starting, charging and ignition systems
CO-3: Calibrate and use automotive sensors for measurement
CO-4: Interface automotive sensors with ADC

LIST OF EXPERIMENTS:

Any 10 experiments to be conducted from the following

1. Study and demonstration of automobile electrical wiring system
2. Study and demonstration of electronic fuel injection system
3. Battery charging and maintenance
4. Starting motor and alternator testing
5. Diagnosis of ignition system
6. Temperature measurement and interfacing RTD with ADC
7. Temperature measurement and interfacing thermistor with ADC
8. Displacement measurement and interfacing LVDT with ADC
9. Load measurement and interfacing load cell with ADC
10. Pressure measurement and interfacing with ADC
11. Testing and control of DC motor

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PW4AE02) INTERNSHIP

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

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19MN6HS03) GENDER SENSITIZATION

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

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

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

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

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

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

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

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

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

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

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

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

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

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

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

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

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19PC1ME14) CAD/CAM

COURSE PRE-REQUISITES: Engineering Graphics, Engineering Design, Production Technology

COURSE OBJECTIVES:
- Understand the mathematics behind the transformations and projections in design of products on CAD devices
- Know the various types of modeling and drafting
- Learn the fundamentals of part programming required for manufacturing a product
- Appreciate the integration of design and manufacturing functions through CAD and CAM

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

UNIT – I:
Introduction: Computers in Industrial Manufacturing, Product cycle, CAD and CAM, Overview of CAD / CAM Hardware, Display devices, Hard copy devices.
Computer Graphics: Raster scan graphics, Coordinate systems, Database structure for graphics modeling, Transformation of geometry, 3D Transformations, Mathematics of projections, Clipping, Hidden surface removal.

UNIT – II:
Geometric Modeling: Introduction to Geometric Model, Types of modeling, Geometric construction methods, Curve representation, Surface representation methods

UNIT – III:
Solid Modeling: Introduction, advantages, limitations and applications, Solid Entities, Solid Representation schemes – Boundary Representation (B-Rep) scheme, Constructive Solid Geometry (CSG) scheme.
Drafting Systems: Basic geometric commands, Layers, Display control commands, Editing, Dimensioning.

UNIT – IV:
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 – V:

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.

UNIT – VI:

Computer Aided Quality Control: Introduction, Terminology in quality control, The computer in QC, Contact inspection methods, Noncontact inspection methods-optical and non-optical, Computer aided testing, Integration of CAQC with CAD/CAM.

Computer Integrated Manufacturing Systems: Introduction, Types of Manufacturing systems, Machine tools and related equipment, Material handling systems, Computer Control Systems, Human labor in the manufacturing systems, CIMS benefits.

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

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC1AE08) DESIGN OF AUTOMOTIVE COMPONENTS - II

COURSE OBJECTIVES:

- To provide selection of bearing and identification of materials
- To understand the design of engine components
- To compare and evaluate power transmission elements
- To know the design considerations for clutches and brakes

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Select bearings and identify the materials
CO-2: Design the engine components
CO-3: Select and design the power transmission elements
CO-4: Assess the design considerations for clutches and brakes

UNIT – I:
Bearings: Types of Journal bearings, lubrication, bearing modulus, full and partial bearings, clearance ratio, heat dissipation of bearings, bearing materials, journal bearing design, ball and roller bearings, static loading of ball and roller bearings, bearing life and bearing selection.

UNIT – II:
Engine Parts: Piston, forces acting on piston, construction, design and proportions of piston, cylinder and cylinder liners, bore and length of cylinder, thickness of cylinder wall, stresses in cylinder wall, cylinder head design of studs for cylinder head.

UNIT – III:
Connecting Rod and Crank shaft: Thrust in connecting rod, stress due to whipping action on connecting rod ends, cranks and crank shafts, strength and proportions of over hung and overview of center cranks; crank pins and crank shafts.
Flywheels: Flywheel governor, Flywheel materials, torque analysis, coefficient of fluctuation of energy, solid disk flywheel, stresses in rimmed flywheel.

UNIT – IV:
Spur and Helical Gear Drives: Spur gears, helical gears, load concentration factor, dynamic load factor, surface compressive strength, bending strength, design analysis of spur gears, estimation of centre distance, module and face width, check for plastic deformation and check for dynamic and wear considerations.

UNIT – V:
Clutches: Torque transmitting capacity, multi-disk clutches, friction materials, cone clutches, centrifugal clutches, energy equation and thermal considerations.

UNIT – VI:

Brakes: Energy equations, block break with short shoe, block break and pivoted block break with long shoe, internal expanding break, band breaks, disk brakes and thermal considerations.

TEXTBOOK:

1. Design of Machine Elements, V B Bhandari, 5th Edition, McGraw Hill Education (India) Private Limited; New Delhi, 2017

REFERENCES:

1. Mechanical Engineering Design, Richard G. Budynas, J. Keith Nisbett, Shigley's 10th Edition, McGraw Hill Education (India) Private Limited; New Delhi, 2016
2. Fundamentals of Machine Component Design, Juvinal, R.C., Marshek K M, 5th Edition, John Wiley & Sons INC, ISBN-13 9781118012895, 2012
3. Design of Machine elements, Spottes, M.F., Prentice-Hall India, 1994
4. Mechanical Design – An Integrated Approach, R. L. Norton, Prentice Hall, 1998
5. Data Books: P.S.G. College of Technology

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

(19PC1AE09) VEHICLE DYNAMICS

COURSE PRE-REQUISITES: Engineering Physics, Mathematics, Engineering Mechanics and Automotive Chassis

COURSE OBJECTIVES:
- To identify different vehicle performance parameters
- To provide knowledge on vehicle ride model
- To study vehicle handling characteristics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Illustrate different vehicle performance parameters
CO-2: Develop a vehicle ride model
CO-3: Understand vehicle handling characteristics

UNIT – I:
Vehicle Performance: Fundamental approach to modelling - lumped mass, vehicle fixed coordinate system, motion variables, earth fixed coordinate system, Euler angles, forces, newton's second law, dynamic axle loads - static loads on level ground, low-speed acceleration and loads on grades.
Acceleration Performance: Power-limited acceleration-engines, power train, automatic transmissions, traction-limited acceleration - transverse weight shift due to drive torque and traction limits.

UNIT – II:
Braking Performance: Constant deceleration, deceleration with wind resistance, energy/power, braking forces - rolling resistance aerodynamic drag, driveline drag, grade, brakes - brake factor, tyre-road friction – velocity, inflation pressure, vertical load, brake proportionating, anti-lock braking systems, braking efficiency, rear wheel lockup and pedal force gain.

UNIT – III:
Tyre Dynamics: Mechanics of pneumatic tyres, tyre forces and moments, rolling resistance of tyres, tractive (braking) effort and longitudinal slip (skid), cornering properties of tyres-slip angle and cornering force, slip angle and aligning torque, camber and camber thrust, performance of tyres on wet surfaces and ride properties of tyres.

UNIT – IV:
Road Loads: Aerodynamics - mechanics of air flow around a vehicle, pressure distribution on a vehicle, aerodynamic forces, drag components, aerodynamics aids - bumper spoilers, air dams, deck lid spoilers, window and pillar treatments, optimization, drag - air density, drag coefficient, side force, lift force, pitching moment, yawing moment, rolling moment, crosswind sensitivity.

UNIT – V:

Ride: Excitation sources - road roughness, tyre/wheel assembly, driveline excitation, engine/transmission, vehicle response properties - suspension isolation, suspension stiffness, suspension damping, active control, wheel hop responses, suspension nonlinearities, rigid body bounce/pitch motions and bounce pitch frequencies.

UNIT – VI:

Handling: Introduction, low speed turning, high speed cornering - tyre cornering forces and cornering equations, understeer gradient, characteristic speed, critical speed, lateral acceleration gain, yaw velocity gain, sideslip angle, static margin, suspension effects on cornering - roll moment distribution, camber change, roll steer, lateral force compliance steer, aligning torque, effect of tractive force on cornering and summery of under steer effects.

TEXT BOOK:

1. Fundamentals of Vehicle Dynamics, Thomas D. Gillespie, SAE, USA, 1992

REFERENCES:

1. Theory of Ground Vehicles, Wong J. Y., 4th Edition, John Wiley & Sons, USA, 2008
2. Automobile Mechanics, Giri N. K., 10th Edition, Khanna Pub, 2015

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

(19PE1AE04) AUTOMOTIVE POLLUTION AND CONTROL

COURSE PRE-REQUISITES: Automotive Engines

COURSE OBJECTIVES:
- To understand the sources of automotive emissions and their ill effects on environment and human beings
- To present the formation of pollutants from SI and CI and the operating parameters influences emission
- To learn various emission measurement techniques, standards and test procedures
- To provide different techniques used to control emission from SI and CI engine vehicles

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyse the sources of automotive emissions and their ill effects on environment and human beings
CO-2: Explain the formation of pollutants from SI and CI and the operating parameters influences emission
CO-3: Identify various pollution measurement techniques, standards and control of emissions
CO-4: Apply techniques used to control emission from SI and CI engine vehicles

UNIT – I:
Introduction: Types of emission and transient operational effects on pollution, sources of emission, effect of pollution on human health, emission standards for 2&3 wheelers, light duty vehicles and heavy-duty vehicle engines – Indian, European and US.

UNIT -II:
Pollutant Formation in IC Engines: Mechanism of carbon monoxide, oxides of nitrogen, unburned hydrocarbon, soot and particulate formation. Effects of design and operating variables in SI and CI engines.

UNIT – III:
Emission Test Procedures: Driving cycles – Indian driving cycle, modified Indian driving cycle, test cycles for light and medium duty vehicles, test cycles for heavy duty vehicle engines, test cycles for motor vehicles and evaporative emission test procedures and standards.

UNIT – IV:
Emission Measurement Techniques: NDIR analyzer, FID detector, NMHC measurement, Chemiluminescent analyzer, oxygen analyzer, formaldehyde measurement, constant volume sampling, diesel smoke measurement, PM and PN measurement.

UNIT – V:

Emission Control in SI Engines: Engine design parameters, add-on systems for emission control within the engine, thermal exhaust aftertreatment, catalytic exhaust aftertreatment, PM and PN emission control and on-board diagnosis systems.

UNIT – VI:

Emission Control in CI Engines: Fuel injection variables, exhaust gas recirculation, turbocharging, control of engine oil consumption, exhaust gas aftertreatment, catalytic exhaust aftertreatment and diesel particulate filters.

TEXT BOOKS:

1. Engine Emissions-Fundamentals and Advances in Control, Pundir B. P., 2nd Edition, Narosa Publishing House, 2017
2. Internal Combustion Engine Fundamentals, John B. Heywood, McGraw Hill International Edition, 1988

REFERENCES:

1. Internal Combustion Engines, Ganesan V., 4th Edition, Tata McGraw Hill, New Delhi, 2012
2. Internal Combustion Engine Analysis and Practice, Obert E. F., International Textbook Co., Scranton, Pennsylvania, 1988
3. SAE Transactions- Vehicle Emission-1982 (3 volumes)
4. Advanced Engine Technology, Heinz Heisler, SAE 1995

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

(19PE1AE05) MECHANICS OF MACHINERY

COURSE PRE-REQUISITES: Engineering Graphics, Engineering Mathematics and Theory of Machines

COURSE OBJECTIVES:
- To identify the significance of dynamic principles of equilibrium and Flywheel
- To understand designing and balancing of different mechanisms
- To know suitable clutches and breaks for different applications
- To discuss the concepts of various vibration systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze kinematic and dynamic characteristics of different mechanisms
CO-2: Design various mechanisms
CO-3: Apply suitable clutches and breaks for different applications
CO-4: Evaluate natural frequency of various vibration systems

UNIT – I:
Dynamic Force Analysis: Inertia force and Inertia torque, D Alembert's principle, Dynamic Analysis in reciprocating engines, Inertia effect of connecting rod, Bearing loads, Crank shaft torque, Turning moment diagrams, Fly Wheels and Flywheels of punching presses.

UNIT – II:
Synthesis of Linkages: Three position synthesis, four position synthesis, precision positions, structural error, Chebyshev's spacing, Freudenstein's Equation and problems.

UNIT – III:
Balancing: Static and dynamic balancing – Balancing of rotating masses, Balancing of several masses in different planes, Balancing of reciprocating mass, Partial balancing in engines, effects of partial balancing of locomotives, secondary balancing, balancing of in-line engines and V- engines

UNIT – IV:
Clutches: Single plate, multi plate, cone clutch, centrifugal clutches.
Brakes and Dynamometers: Simple block brake - Internal expanding brake band brake of vehicle. Dynamometers - absorption and transmission types, General description and methods of operation.

UNIT – V:
Free Vibration: Basic features of vibratory systems – Degrees of freedom – single degree of freedom – Free vibration – Equations of motion – Natural frequency – Types of Damping – Damped vibration– Torsional vibration of shaft – Critical speeds of shafts – Torsional vibration – Two and three rotor torsional systems.

UNIT – VI:

Forced Vibration: Response of one-degree freedom systems to periodic forcing – Harmonic disturbances –Disturbance caused by unbalance – Support motion – transmissibility – Vibration isolation vibration measurement.

TEXT BOOKS:

1. Theory of Machines, S.S. Ratan, 4th Edition, Tata McGraw Hill, 2017
2. Theory of Machines, Gordon R. Pennock & Joseph E. Shigley John J. Uicker, 4th Edition, Oxford University Press, 2014

REFERENCES:

1. Theory of Machines, R. S. Khurmi & J. K. Gupta, S. Chand Publications,2005
2. Theory of Machines, Thomas Bevan, 3rd Edition, Pearson Education, 2009
3. Design of Machinery, Robart L. Norton, 3rd Edition, Tata McGraw Hill, 2004
4. Theory of Machines: Kinematics and Dynamics, Sadhu Singh, 3rd Edition, Pearson education, 2011
5. Theory of Machines and mechanisms, P. L. Ballaney, 25th Edition, Khanna Publishers, 2003

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

(19PE1AE06) AUTOMOTIVE EMBEDDED SYSTEMS

COURSE PRE-REQUISITES: Basics of Electrical and Electronics Engineering, Automotive Chassis and Automotive Engines

COURSE OBJECTIVES:
- To understand characteristics and architectures of various microprocessors and microcontrollers
- To understand basic programming concepts and software tools
- To learn various interfacing circuits necessary for various applications
- To learn various interfacing concepts

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the architecture of microprocessor/ microcontroller and their operation
CO-2: Demonstrate programming skills in assembly language for processors and Controllers
CO-3: Analyze various interfacing techniques and apply them for the design of processor/ controller-based systems

UNIT – I:
Introduction to Embedded Systems: Embedded Systems Definition - Components of embedded systems - Hardware Module - Microprocessor, microcontrollers, on-chip peripherals - Program memory (PM), Data memory (DM), parallel port structures, timer, input capture & output compare units, ADC, PWM. Embedded system programming - Up-loaders, ISP, ROM emulators, in-circuit emulators. Debug Interfaces - BDM and JTAG.

UNIT – II:
Hardware Modules: 16-bit microcontrollers-architectural overview of C166 family-memory organization, fundamental CPU concepts and optimization measures, on-chip system resources, peripheral event controller (PEC) ad interrupt control, external bus interface, parallel ports, general purpose timers (GPT), watchdog timer, serial channels, capture/compare units, pulse width modulation unit, analog to digital converter, real time clock, on-chip I2C bus module, universal serial bus (USB) interface.

UNIT – III:
Software Development Tools: Introduction to Integrated development environment (IDE), creating new project, creating new file, adding files to project, options for target, compile and building project, simulation and debugging, set breakpoints, monitor on- chip peripherals using simulators, study of example programs.

UNIT – IV:
Integration of Hardware and Software: Introduction to microcontroller development kit (easy kit), developing project using IDE software, downloading embedded software into target system, introduction to on-chip debugging resources (JTAG), debugging target system using on-chip debugging support (OCDS).

UNIT – V:

Drive-by-Wire: Challenges and opportunities of X-by-wire system and design requirements, steer-by-wire, brake-by-wire, electronic throttle including adaptive cruise control, shift-by-wire.

UNIT – VI:

Automotive Control System Design: Digital Engine Control, Features, Control Modes for Fuel Control, Discrete Time Idle Speed Control, EGR Control, Variable Valve Timing Control, Electronic Ignition Control, Integrated Engine Control System, Summary of Control Modes, Cruise Control System, Cruise Control Electronics, Anti-locking Braking System, Electronic Suspension System

TEXT BOOKS:

1. Automotive Embedded Systems Handbook, Nicolas Navet and Françoise Simonot-Lion, CRC press, 2009
2. Embedded Systems – A contemporary Design Tool, James K. Peckol, John Wiley, 2008

REFERENCES:

1. Embedded System Design: An Introduction to Processes, Tools, and Techniques Arnold Berger, CMP Books, 2001
2. An Embedded Software Primer, David E Simon, Pearson Education, Asia, 2001
3. Computers as Components Wayne Wolf, Morgan Kaufmann Publishers, 2001

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PE1AE07) AERODYNAMICS OF ROAD VEHICLES

COURSE PRE-REQUISITES: Automotive Chassis and Vehicle Dynamics

COURSE OBJECTIVES:
- To understand of fundamentals of aerodynamics for high-performance cars and commercial vehicles
- To identify the road loads (aerodynamic, tractive, and rolling resistance) experienced by a vehicle
- To provide design aspects, stability, safety and comfort of the vehicles
- To describe wind tunnels and testing techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the fundamentals of vehicle aerodynamics for different types of vehicles
CO-2: Analyze the road loads (aerodynamic, tractive, and rolling resistance) experienced by a vehicle
CO-3: Design and analyze the stability, safety and comfort of the vehicles
CO-4: Carryout testing of vehicle bodies in wind tunnel

UNIT – I:
Introduction: Scope, historical developments, fundamentals of fluid mechanics, flow phenomenon related to vehicles, external and Internal flow problem, resistance to vehicle motion, performance, fuel consumption and performance potential of vehicle aerodynamics.

UNIT – II:
Engine Cooling, Heating, Ventilation and Air Conditioning: Engine cooling requirement, aspects of climate, components, air flow to passenger compartment, duct for air conditioning, cooling of transverse engine and rear engine.

UNIT – III:
Aerodynamic Drag of Cars: Cars as a bluff body, flow field around car, drag force, types of drag force, analysis of aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag profiles.

UNIT – IV:
Shape Optimization of Cars: Front end modification, front and rear wind shield angle, boat tailing, hatch back, fast back and square back, dust flow patterns at the rear, effects of gap configuration, effect of fasteners.

UNIT – V:
Vehicle Handling: Origin of forces and moments on a vehicle, lateral stability problems, methods to calculate forces and moments – vehicle dynamics under side winds, the effects of forces and moments, characteristics of forces and moments, dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles.

UNIT – VI:

Wind Tunnels for Automotive Aerodynamics: Introduction, principle of wind tunnel technology, limitation of simulation, stress with scale models, full scale wind tunnels, measurement techniques, equipment and transducers, road testing methods, numerical methods.

TEXT BOOK:

1. Aerodynamic of Road Vehicles, Hucho W. H., Butterworth Co. Ltd., 1997

REFERENCES:

1. Vehicle Aerodynamic, SP-1145, SAE, 1996
2. Pope A, Wind Tunnel Testing, John Wiley & Sons, New York, 1974
3. Automotive Aerodynamic, Update SP-706, SAE, 1987

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

(19PE1ME06) FINITE ELEMENT METHODS

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

COURSE OBJECTIVES:
- Quote different concepts of traditional methods to evaluate FEM
- Summarize the boundary conditions, formulations and other functional approaches of FEM
- Demonstrate simulation process using FEM software
- 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; Straindis placement 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**
	0	**2**	**1**

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize and synthesize information and produce technical writing that is required in academics as well as in the engineering profession
CO-2: Employ principles of TW and writing process to produce technical documents such as cover letters, resume, SOP, Project Proposals and Technical Reports
CO-3: Actively participate in group discussions/interviews and prepare & deliver effective presentations
CO-4: Become an effective individual through goal setting & Career Planning & function effectively in multi-disciplinary and heterogeneous teams through the knowledge of teamwork, Inter-personal relationships, conflict management and leadership quality

UNIT – I:
The Concept of Technical Communication:

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

UNIT – II:
Application Writing:

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

UNIT – III:
Presentation Skills:

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

UNIT – IV:

Report Writing:

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

UNIT – V:

Employability Skills-1:

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

UNIT – VI:

Employability Skills-2:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19PC2ME10) CAD/CAM 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

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

LIST OF EXPERIMENTS:

12 exercises from the following syllabus:

1. CAD:

i. 2D Drawing using Sketcher workbench – 1 exercise containing at least 3 drawings

ii. 3D modeling using 3D features –1 exercise containing at least 3 models

iii. Assembly and drafting – 1 exercise containing 1 assembly

iv. Surface Modeling – 1 exercise

v. Sheet Metal Working – 1 exercise

Softwares: AutoCAD, IronCAD, CATIA, CREO

2. CAM:

i. Part programming for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning operations.

ii. Part programming for Point to point motions, Linear motions, Circular interpolation, Contour motion, Pocket milling - Circular, Rectangular and Mirror commands.

iii. Part Programming using Fixed or Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing, Taper turning, Thread cutting.

iv. Generation of tool path, NC part program and its simulation.

v. Machining of small components using CNC Lathe, CNC Mill and CNC Turning center.

Softwares: CNC Offline Simulation, EdgeCAM

3. CAE:

i. Determination of deflection and stresses in 2D and 3D trusses and beams.
ii. Determination Principal/ Von-mises stresses and deflections, in plane stress/ plane strain/ axisymmetric models.
iii. Determination of stresses in 3D and shell structures

Softwares: Ansys

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

(19PW4AE03) DESIGN THINKING

COURSE OBJECTIVES:

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

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

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

OPEN ELECTIVE COURSES

SMART CITIES

SMART CITIES

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

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

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

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

What is the concept of a smart city?

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

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

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

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

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

Smart solutions

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

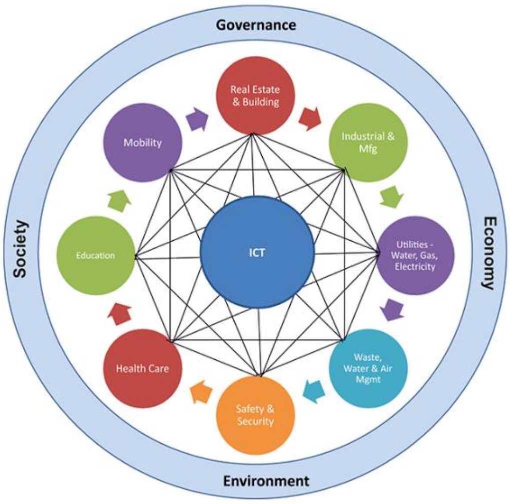
- Public information systems
- Redressal of grievances
- Electronic service delivery
- Maximum engagement of citizens
- Reduced energy and fuel usage
- Reduces the development of wastes
- Smart water monitoring
- Treatment of wastewater
- Sustainable monitoring water quality
- Maximum utilization of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

Advantages of a smart cities,

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

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

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



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

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

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

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

Conclusion

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1CE01) SMART CITIES PLANNING AND DEVELOPMENT

COURSE PRE-REQUISITES: None

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

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

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

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

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

UNIT – IV:
Smart Urban Energy Systems – II: Introduction to PV technology - PV of various scale for smart city applications - Energy efficiency - Policies of Solar PV in smart domains

(RPO, REC, Carbon credit, etc.) Definition, Structure of Smart Grid- Indian Perspective- Advantage & limitation.

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1CE02) GREEN BUILDING TECHNOLOGY

COURSE PRE-REQUISITES: Smart Cities Planning and Development

COURSE OBJECTIVES:

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

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

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

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

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

UNIT – IV:

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

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1CE03) SMART MATERIALS AND STRUCTURES

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

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

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

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

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

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

UNIT – IV:

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

UNIT-V:

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

UNIT –VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19OE1CE04) INTELLIGENT TRANSPORTATION SYSTEM

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

COURSE OBJECTIVES:

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

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

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

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

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

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

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

WASTE MANAGEMENT

WASTE MANAGEMENT

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

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

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

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

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

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

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

(19OE1CE05) SOLID WASTE MANAGEMENT

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

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

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

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

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

recovery – incineration – solidification and stabilization of hazardous wastes- treatment of biomedical wastes - Health considerations in the context of operation of facilities.

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1CE06) HAZARDOUS WASTE MANAGEMENT

COURSE PRE-REQUISITES: Solid Waste Management

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

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

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

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

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

UNIT – IV:

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

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19OE1CE07) WASTE TO ENERGY

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

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

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

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

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

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

UNIT – IV:
Biological Conversion Technologies: Nutritional requirement for microbial growth – types of microbial metabolism – types of microorganisms – environmental requirements – aerobic biological transformation – anaerobic biological transformation – aerobic composting – low solid anaerobic digestion – high solid anaerobic digestion – development of anaerobic digestion processes and technologies for treatment of the organic fraction of MSW – Biodegradation and

biodegradability of substrate; biochemistry and process parameters of biomethanation - other biological transformation processes.

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19OE1CE08) INTELLIGENT WASTE MANAGEMENT SYSTEM AND RECYCLING SYSTEM

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

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

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

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

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

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

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

SimaPro Software - LCA Assessment Methodology: Life Cycle Inventory Analysis - Life Cycle Impact Assessment – Interpretation - Sensitivity Analysis - Carbon-Footprint-Based SWM - The Global-Warming Potential Impact - GHG Accounting - GWP Assessment for Solid Waste Management.

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

GREEN ENERGY

1. RENEWABLE ENERGY SOURCES

What we are studying?

The climate landscape is changing rapidly, and new technologies and solutions keep arising to respond to global and local challenges.

Renewable energy sources course makes you discover how Solar Thermal Energy conversion system works. It makes you understand how a Solar Photo voltaic generation system generates electricity. Scope of the course also includes wind energy generation. It also navigates you through Biomass and geo thermal energy generation systems.

Job opportunities:

When it comes to the hottest and most buzzing careers in the 21st century, the majority of people think of hardcore technical domains such as data science, machine learning & artificial intelligence. Few people might also come up with biotechnology (or biosciences). But, quite often people forget about one of the dark horses – the Renewable Energy sector. Even Bill Gates lobbied for the Energy sector as one of the top three career choices for making an impactful career.

Reference:

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

2. RENEWABLE ENERGY TECHNOLOGIES

Within Crisis, there are seeds of opportunity..! We are at the wedge of fossil fuel end. After few years you can witness fuel crisis all over the world, as an engineer one must aware of the solution. To design sustainable systems those last for decades, one must use renewable energy as main or auxiliary source of energy. The application may be electrical or mechanical or chemical, one must convert energy from renewable source into electricity for ease of use.

Renewable Energy Technologies course will introduce you to Different types of Solar PV systems and their characteristics. Students will know the functionality of Power Converters such as Inverters etc., through block diagram approach. Fuel cell technology, which is one of the solutions for energy crisis will be discussed in detail. Course will conclude by discussing impact of PV panel production on environment and disposal of it.

Job Opportunities:

Green jobs in the renewable energy sector are expected to touch new figures with 6 digit monthly income. Following link may describe the interesting interdisciplinary careers for budding engineers.

Reference:

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

3. ENERGY STORAGE TECHNOLOGIES

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

Job opportunities:

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

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

4. ENERGY MANAGEMENT AND CONSERVATION

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

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

(19OE1EE01) RENEWABLE ENERGY SOURCES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

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

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

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

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

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCE:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1EE02) RENEWABLE ENERGY TECHNOLOGIES

COURSE PRE-REQUISITES: Renewable Energy Sources

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

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

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

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

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

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

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

UNIT – VI:

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

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

TEXT BOOKS:

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

REFERENCE:

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

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

(19OE1EE03) ENERGY STORAGE TECHNOLOGIES

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

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

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

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

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

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

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

UNIT – V:

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

UNIT –VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19OE1EE04) ENERGY MANAGEMENT AND CONSERVATION

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

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: To conduct Energy Audit of industries
CO-2: To manage energy Systems
CO-3: To specify the methods of improving efficiency of electric motor
CO-4: To improve power factor and to design a good illumination system
CO-5: To calculate pay back periods for energy saving equipment

UNIT – I:
Basic Principles of Energy Audit: Energy audit- definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit

UNIT – II:
Energy Management: Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting- Energy manager, Qualities and functions, language, Questionnaire - check list for top management

UNIT – III:
Energy Efficient Motors: Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed, variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit

UNIT – IV:
Power Factor Improvement, Lighting and Energy Instruments: Power factor – methods of improvement, location of capacitors, p.f with non-linear loads, effect of harmonics on p.f., p.f motor controllers – simple problems
Lighting Energy Audit and Energy Instruments: Good lighting system design and practice, lighting control, lighting energy audit - Energy Instruments- watt meter, data loggers, thermocouples, pyrometers, flux meters, tongue testers, application of PLC's

UNIT – V:

Economic Aspects and Analysis: Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis.

UNIT – VI:

Analysis of Energy Efficient Motor: Energy efficient motors- calculation of simple payback method, net present worth method- Power factor correction, lighting - Applications of life cycle costing analysis, return on investment.

TEXT BOOKS:

1. Energy Management, W. R. Murphy & G. Mckay, Butterworth-Heinemann Publications
2. Energy Management, Paul o' Callaghan, 1st Edition, McGraw Hill Book Company, 1998

REFERENCES:

1. Energy Efficient Electric Motors, John C. Andreas, 2nd Edition, Marcel Dekker Inc. Ltd., 1995
2. Energy Management Handbook, W. C. Turner, John Wiley and Sons
3. Energy Management and Good Lighting Practice: Fuel Efficiency Booklet12-EEO

3D PRINTING AND DESIGN

3D PRINTING AND DESIGN

3D Printing is a process for making a physical object from a three-dimensional digital model by laying down many successive thin layers of a material. It brings a digital CAD model into its physical form by adding layer by layer of materials. Thus called 'Additive Manufacturing'. It is the opposite of subtractive manufacturing i.e., removing material from an object using a mechanical machine. It enables to produce complex shapes using less material than traditional manufacturing methods. There are several different techniques to 3D print an object. It saves time through prototyping and is also responsible for manufacturing impossible shapes. Due to these, it has many applications in different fields like consumer products (eyewear, footwear, design, furniture, industrial products (manufacturing tools, prototypes, functional end-use parts, dental products, prosthetics, architectural scale models, reconstructing fossils, replicating ancient artefacts, reconstructing evidence in forensic pathology etc.

3D printing has good prospects from career perspective. Various positions that could be available are CAD designers, engineers, technical developers, software developers, electronics engineers, etc.

This OE track consists of 04 courses and is designed with an objective to provide an overview of all the constituents of 3D Printing starting from elements of CAD that are needed to create CAD models, followed by basics of 3D Printing required for setting the parameters, then the machines and tools used in 3D Printing for thorough understanding of systems and processes and finally the reverse engineering of 3D printing models from actual objects.

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

(19OE1ME01) ELEMENTS OF CAD

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand the basics of CAD and devices used
- To know the various types of modeling used in CAD
- To appreciate the concept of feature-based modeling and geometric transformations
- To comprehend the assembly modeling procedure and data exchange formats

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Know the fundamentals of CAD and devices used
CO-2: Identify the types of CAD modeling techniques and utilize them
CO-3: Evaluate the objects or models using geometric transformations and manipulations
CO-4: Perform the assembly modeling and asses the various data exchange formats

UNIT – I:
Fundamentals of CAD: Introduction to Computer Aided Design (CAD), Design process, Application of computers for Design and Manufacturing, Benefits of CAD, Brief overview of computer peripherals for CAD.

UNIT – II:
Geometric Modeling: Introduction to Geometric Model, Types of modeling, Curve representation
Wireframe Modeling: Introduction, advantages, limitations and applications, Wire frame entities-analytic and synthetic, Basic definitions of Cubic, Bezier and B-spline curves

UNIT – III:
Surface Modeling: Introduction, advantages, limitations and applications, surface entities, Basic definitions of analytic surfaces - planar surface, ruled surface, tabulated cylinder, surface of revolution; Basic definitions of synthetic surfaces - Bezier surface, B-spline surface

UNIT – IV:
Solid Modeling: Introduction, advantages, limitations and applications, Solid Entities, Solid Representation schemes – Boundary Representation (B-Rep) scheme, Constructive Solid Geometry (CSG) scheme.
Feature-based Modeling: Introduction, Feature entities, Feature representation, 3D Sketching, Parameter, Relations and Constraints

UNIT – V:
Geometric Transformations: Introduction to 2D & 3D transformations, Brief treatment on Translation, Scaling, Reflection and Rotation using Homogeneous and concatenated transformations

Manipulations: Displaying, Segmentation, Trimming, Intersection, Projection

UNIT – VI:

Assembly Modeling: Introduction, Assembly modeling, Assembly Tree, Mating Conditions, Bottom-up and Top-down approach

Product Data Exchange: Introduction, Graphics Standards, Types of translators, Importance of formats in 3D Printing, Data exchange formats - IGES, STEP and STL

TEXT BOOKS:

1. CAD/CAM Theory and Practice, Ibrahim Zeid, Tata McGraw Hill
2. Mastering CAD/CAM, Ibrahim Zeid, Tata McGraw Hill
3. CAD/CAM-Computer Aided Design and Manufacturing, Mikell P. Groover, E. W. Zimmers, Pearson Education/Prentice Hall

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

(19OE1ME02) INTRODUCTION TO 3D PRINTING

COURSE PRE-REQUISITES: Elements of CAD

COURSE OBJECTIVES:
- To understand the need of 3D Printing
- To understand about the process chain involved in 3D Printing
- To know about the two-dimensional layer by layer techniques, solid based systems & 3D Printing data exchange formats
- To know the post processing methods involved in 3D Printing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize the importance of 3D Printing
CO-2: Explain the process chain involved in 3D Printing
CO-3: Explain about two-dimensional layer-by-layer techniques, solid based systems and 3D printing data exchange formats
CO-4: Apply the knowledge gained in the post-processing methods

UNIT – I:
Introduction to 3D Printing: Introduction to 3D Printing, 3D Printing evolution, Classification of 3D Printing, Distinction between 3D Printing & CNC Machining, Advantages of 3D Printing

UNIT – II:
Generalized 3D Printing Process Chain: Process chain, Materials for 3D Printing, Design for 3D Printing and Overview of Medical Modeling & Reverse Engineering.

UNIT – III:
Two-Dimensional Layer-By-Layer Techniques: Stereolithography (SL), Selective Laser Sintering (SLS), Selective Powder Building (SPB), Advantages and Applications.

UNIT – IV:
Solid Based Systems: Introduction, basic principles, Fused Deposition Modeling, Multi-Jet Modeling, Laminated Object Manufacturing (LOM), Advantages and Applications.

UNIT – V:
3D Printing Data Exchange Formats: STL Format, STL File Problems, Brief Overview of other translations like IGES File, HP/GL File and CT data only.

UNIT – VI:
Post-Processing: Introduction, Support Material Removal, Surface Texture Improvements, Accuracy Improvements, Aesthetic Improvements.

TEXT BOOKS:

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W Rosen, Brent Stucker, Springer, 2010
2. Rapid Prototyping: Principles & Applications, Chuaa Chee Kai, Leong Kah Fai, World Scientific, 2010

REFERENCES:

1. Rapid Prototyping: Theory and Practice, Ali K. Karmani, Emand Abouel Nasr, Springer, 2006
2. Understanding Additive Manufacture: Rapid Prototyping, Rapid Tooling and Rapid Manufacture, Andreas Gebhardt, Hanser Publishers, 2013
3. Rapid Manufacturing: Advanced Research in Virtual and Rapid Prototyping, Hopkinson, N. Haque, and Dickens, Taylor and Francis, 2007

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

(19OE1ME03) 3D PRINTING-MACHINES, TOOLING AND SYSTEMS

COURSE PRE-REQUISITES: Elements of CAD, Introduction to 3D Printing

COURSE OBJECTIVES:
- To understand the need of prototyping
- To understand about the liquid and solid based 3D printing systems
- To know about the liquid-based 3D printing systems & rapid tooling
- To know the applications of 3D Printing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize the importance of 3D Printing
CO-2: Explain the process involved in liquid and solid based 3D printing systems
CO-3: Explain about the liquid-based 3D printing systems and rapid tooling
CO-4: Adapt the knowledge gained in applications of 3D Printing

UNIT – I:
Introduction: Prototype Fundamentals, Types of Prototypes, Roles of Prototypes, Phases of Development Leading to Rapid Prototyping, Fundamentals of Rapid Prototyping.

UNIT – II:
Liquid Based 3D Printing Systems: Introduction, Principles, Processes and Applications of Solid Ground Curing, Material Jetting & Binder Jetting

UNIT – III:
Solid Based 3D Printing Systems: Introduction, Principles, Processes and Applications of Fused Deposition Modelling (FDM), Paper Lamination Technology (PLT) and Laminated Object Manufacturing (LOM)

UNIT – IV:
Laser Based 3D Printing Systems: Selective Laser Sintering (SLS)-Principle, Process and Applications, Three-Dimensional Printing- Principle, Process and Applications, Laser Engineered Net Shaping (LENS)- Principle, Process and Applications

UNIT – V:
Rapid Tooling: Introduction and need for Rapid Tooling, Overview of Indirect and Direct Processes, Applications

UNIT – VI:
3D Printing Applications: Brief overview of Applications in Design, Engineering, Aerospace Industry, Automotive Industry and Biomedical Industry

TEXT BOOKS:

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W Rosen, Brent Stucker, Springer, 2010

2. Rapid Prototyping: Principles & Applications, Chuaa Chee Kai, Leong Kah Fai, World Scientific, 2010

REFERENCES:

1. Rapid Prototyping: Theory and Practice, Ali K. Karmani, Emand Abouel Nasr, Springer, 2006
2. Understanding Additive Manufacture: Rapid Prototyping, Rapid Tooling and Rapid Manufacture, Andreas Gebhardt, Hanser Publishers, 2013
3. Rapid Manufacturing: Advanced Research in Virtual and Rapid Prototyping, Hopkinson, N. Haque, and Dickens, Taylor and Francis, 2007

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

(19OE1ME04) REVERSE ENGINEERING

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

COURSE OBJECTIVES:
- To understand Reverse Engineering (RE) and its methodologies
- To comprehend Data Acquisition Techniques for Reverse Engineering
- To understand Integration Between Reverse Engineering and Additive manufacturing
- To know the applications of reverse engineering

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Basic understanding of Reverse Engineering and its methodologies
CO-2: Understanding the data acquisition techniques for reverse engineering
CO-3: Understanding of amalgamation Between Reverse Engineering and Additive manufacturing
CO-4: Adapt the knowledge gained in reverse engineering for various applications

UNIT – I:
Introduction to Reverse Engineering: Need, Definition, The Generic Process, History of Reverse Engineering, Overview of Applications

UNIT – II:
Methodologies and Techniques: Potential for Automation with 3-D Laser Scanners, Computer-aided (Forward) Engineering, Computer-aided Reverse Engineering, Computer Vision and Reverse Engineering

UNIT – III:
Data Acquisition Techniques: Contact Methods: Coordinate Measurement Machine and Robotic Arms

UNIT – IV:
Data Acquisition Techniques: Noncontact Methods: Triangulation, Structured Light and Destructive Method

UNIT – V:
Integration Between Reverse Engineering and Additive manufacturing: Modeling Cloud Data, Integration of RE and AM for Layer-based Model Generation, Adaptive Slicing Approach for Cloud Data Modeling.

UNIT – VI:
Applications:
Automotive: Workflow for Automotive Body Design, Reverse Engineering for Better Quality
Aerospace: RE in Aerospace–A Work in Progress, Reducing Costs of Hard Tooling
Medical: Orthodontics, Hearing Instruments, Knee Replacement

TEXT BOOKS:

1. Reverse Engineering: An Industrial Perspective, V. Raja and K. Fernandes, Springer-Verlag
2. Reverse Engineering, K. A. Ingle, McGraw-Hill
3. Reverse Engineering, L. Wills and P. Newcomb, 1st Edition, Springer-Verlag

REFERENCES

1. Smart Product Engineering, Michael Abramovici, Rainer stark, Springer Berlin Heidelberg
2. Product Design: Techniques in Reverse Engineering and New Product Development, K. Otto and K. Wood, Prentice Hall, 2001

INTERNET OF THINGS

INTERNET OF THINGS

Internet of Things: The IoT creates opportunities for more direct integration of the physical world into computer-based systems, resulting in efficiency improvements, economic benefits, and reduced human exertions. *IoT* **is changing how we live, work, travel, and do business. It is even the basis of a new industrial transformation, known as** Industry 4.0**, and key in the** digital transformation **of organizations, cities, and society overall.** The IoT track helps students to learn about how to

- Learn different protocols and connectivity technologies used in IOT.
- Expose the various sensors and transducers for measuring mechanical quantities.
- Develop simple applications using 8051 microcontrollers.
- Understand the key routing protocols for sensor networks and their design issues.

Some of the more common career paths in the Internet of Things path are

- IoT Developer. ...
- IoT Architect…
- IoT Embedded Systems Designer…
- IoT Solutions Engineer…
- Professional in Sensors and Actuators…
- Embedded Programs Engineer…
- Safety Engineer…

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

(19OE1EC01) SENSORS TRANSDUCERS AND ACTUATORS

COURSE PRE-REQUISITES: Engineering Physics, Electronic Measuring Instruments

COURSE OBJECTIVES:

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Classify and characterize various sensors and transducers
CO-2: Be familiar with the principle and working of various sensors and transducers
CO-3: Be familiar with the principle and working of various actuators
CO-4: Select proper Transducer / Sensor for a specific measurement application
CO-5: Select proper Actuator for a specific measurement application

UNIT – I:
Primary Sensing Elements and Transducers: Mechanical devices as primary detectors, mechanical spring devices, pressure sensitive primary devices, flow rate sensing elements, Transducers-electrical Transducers, classification of Transducers, characteristics and choice of Transducers, factors influencing the choice of Transducers.

UNIT – II:
Electric Transducers: Resistive transducers, Potentiometers, Strain gauges, Types of Strain gauges, Resistance thermometers, Thermistors, Thermocouples, variable Inductance Transducers, Linear Variable Differential Transformer, Synchros, Resolvers, Capacitive Transducers, Piezo electric Transducers.

UNIT – III:
Magnetic and Optical Transducers: Hall Effect Transducers, Magneto resistors, Magneto-Elastic and Magneto-Strictive Transducers, Opto electronic Transducers, Digital Encoding Transducers, Photo Optic Transducers.

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

UNIT – V:

Mechanical and Electrical Actuators: Mechanical Actuation Systems-Types of motion, Kinematic chains, Cams, Gears, Ratchet and pawl, Belt and chain drives, Bearings, Mechanical aspects of motor selection, Electrical Actuation Systems, Electrical systems, Mechanical switches, Solid-state switches, Solenoids, D.C. Motors, A.C. Motors, Stepper motors.

UNIT – VI:

Pneumatic and Hydraulic Actuators: Pneumatic and Hydraulic Actuation Systems-Actuation systems, Pneumatic and hydraulic systems, Directional Control valves, Pressure control valves, Cylinders, Servo and proportional control valves, Process control valves, Rotary actuators.

TEXT BOOKS:

1. A Course in Electrical and Electronic Measurements and Instrumentation, A. K. Sawhney, Puneet Sawhney,19th Edition, 2011
2. Sensors and Transducers, D. Patranabis, 2nd Edition, PHI Learning Private Limited, 2013
3. Mechatronics, W. Bolton, 7th Edition, Pearson Education Limited, 2018

REFERENCES:

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

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

(19OE1EC02) INTRODUCTION TO MICROCONTROLLER AND INTERFACING

COURSE PRE-REQUISITES: Sensors Transducers and Actuators

COURSE OBJECTIVES:
- To differentiate various number systems
- To understanding programming concepts
- To develop simple applications using 8051 microcontrollers

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand basic computing concepts
CO-2: Know architecture of 8051 microcontrollers
CO-3: Program internal resources of 8051 microcontroller
CO-4: Interface peripherals to 8051 microcontroller

UNIT – I:
Introduction to Computing: Numbering and Coding Systems: Binary, Decimal, Hexadecimal and conversions, Binary and Hexadecimal Arithmetic, Complements, Alphanumeric codes. Digital Premier, Inside the Computer

UNIT – II:
Embedded System Design: Embedded system - Definition, Characteristics of embedded computing applications, Design challenges, Requirements, Specification, Architecture design, Designing hardware and software components, system integration, Design example: Model train controller.

UNIT – III:
8051 Microcontroller: Microcontrollers and Embedded Processors, Architecture and Programming Model of 8051, Special Function Register formats, Memory Organization, Timers and Counters- Operating modes, Serial port, Interrupts

UNIT – IV:
8051 Programming in C: Data types, software delay generation, Logical operations, Accessing code and data space in 8051, I/O port programming, Timer/counter programming.

UNIT – V:
8051 Programming: Serial IO modes and their programming in C, interrupts programming in C: serial, timer and external interrupts.

UNIT – VI:
Introduction to Arduino: Features of Arduino, Arduino components and IDE, Interfacing: Seven Segment Display, Pulse Width Modulation, Analog Digital Converter, Wireless connectivity to Arduino. Case study: From BT To WiFi: Creating WiFi Controlled Arduino Robot Car.

TEXT BOOKS:

1. The 8051 Microcontroller: Programming, Architecture, Ayala & Gadre, 3rd Edition, Cengage Publications, 2008
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, 2nd Edition, 2005

REFERENCES:

1. Digital Design, Morris Mano, PHI, 3rd Edition, 2006
2. Embedded Systems: Architecture, Programming and Design, 2nd Edition, TMH

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
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(19OE1EC03) FUNDAMENTALS OF INTERNET OF THINGS

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

COURSE OBJECTIVES:
- To understand the basics of Internet of Things
- To learn about IOT and M2M
- To understand Cloud of Things
- To learn different applications with IoT

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the concepts of Internet of Things
CO-2: Understand the IOT, M2M
CO-3: Understand the concepts Cloud of Things
CO-4: Apply IOT to different applications in the real world

UNIT – I:
Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT-IoT Functional Blocks, IoT Communication Models, IoT Communication API's

UNIT – II:
IoT-enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Deployment Templates

UNIT – III:
IoT Platforms Design Methodology: Introduction, IoT Design Methodology- Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specification, IoT Level Specifications, Functional view Specification, Operational View Specification, Device & component Integration, Application Development

UNIT – IV:
IoT and M2M: Introduction, M2M, Difference between IoT and M2M – Communication Protocols, Machines in M2M Vs things in IoT, Hardware Vs Software emphasis, Data collection and analysis, applications, SDN and NFV for IoT

UNIT – V:
Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

UNIT – VI:
Domain Specific Applications of IoT: Applications of IoT– Home, Health, Environment, Energy, Agriculture, Industry and Smart City.

TEXT BOOKS:

1. Internet of Things: A Hands-On Approach, Vijay Madisetti, Arshdeep Bahga, Universities Press, 2015
2. The Internet of Things – Key Applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi, Wiley, 2012
3. The Internet of Things in the Cloud: A Middleware Perspective, Honbo Zhou, CRC Press, 2012

REFERENCES:

1. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers, 2013
2. Building the Internet of Things, Sara Cordoba, Wimer Hazenberg, Menno Huisman, BIS Publishers, 2011
3. Designing the Internet of Things, Adrian Mcewen, Hakin Cassimally, John Wiley and Sons, 2015

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

(19OE1EC08) WIRELESS SENSOR NETWORKS

COURSE PRE-REQUISITES: Sensors Transducers and Actuators, Introduction to Microcontrollers and Interfacing, IoT Protocols and its Applications

COURSE OBJECTIVES:
- To expose basic concepts of wireless sensor network technology
- To study medium access control protocols and various issues in a physical layer
- To understand the key routing protocols for sensor networks and their design issues
- To understand sensor management in networks and design requirements

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Appreciate various design issues of wireless sensor networks
CO-2: Understand the hardware details of different types of sensors and select the application specific sensor
CO-3: Understand radio standards and communication protocols to be used for wireless sensor networks

UNIT – I:
Introduction: Overview of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.

UNIT – II:
Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (Operating Systems): TinyOS, MANTIS, Contiki, and RetOS.

UNIT – III:
Programming Tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet, NetSim)

UNIT – IV:
Overview of Sensor Network Protocols (Details of at least 2 important protocol per layer): Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi- hop and cluster-based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

UNIT – V:
Data Dissemination and Processing: Differences compared with other database management systems, Query models, In-network data aggregation, data storage; query processing.

UNIT – VI:
Specialized Features: Energy preservation and efficiency; security challenges; Fault tolerance, Issues related to Localization, connectivity and topology, Sensor

deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

TEXT BOOKS:

1. Wireless Sensor Networks Technology, Protocols, and Applications, Kazem Sohraby, Daniel Minoli, Taieb Znati, John Wiley & Sons, 2007
2. Protocols and Architectures for Wireless Sensor Networks, H. Karl and A. Willig, John Wiley & Sons, India, 2012
3. Wireless Sensor Networks, C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, 1^{st} Indian Reprint, Springer Verlag, 2010

REFERENCES:

1. Wireless Sensor Networks: An Information Processing Approach, F. Zhao and L. Guibas, Morgan Kaufmann, 1^{st} Indian Reprint, 2013
2. Wireless Sensor Network and Applications, Yingshu Li, My T. Thai, Weili Wu, Springer Series on Signals and Communication Technology, 2008
3. Principles of Mobile Communications, Gordon L. Stuber, 2^{nd} Edition, Springer International, 2001

AUGMENTED REALITY (AR) / VIRTUAL REALITY (VR)

AUGMENTED REALITY (AR) / VIRTUAL REALITY (VR)

Augmented reality and virtual reality (AR & VR): Augmented reality (AR) and Virtual Reality (VR) bridge the digital and physical worlds. They allow you to take in information and content visually, in the same way you take in the world. AR dramatically expands the ways our devices can help with everyday activities like searching for information, shopping, and expressing yourself. VR lets you experience what it's like to go anywhere from the front row of a concert to distant planets in outer space.

Job Roles in Augmented reality and virtual reality (AR & VR) Track

- Design Architect. ...
- Software Designer. ...
- System Validation Engineers. ...
- Software Developer. ...
- 3D Artist…

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1EC04) INTRODUCTION TO C-SHARP

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand the foundations of CLR execution
- To learn the technologies of the .NET framework and object-oriented aspects of C#
- To be aware of application development in .NET
- To learn web-based applications on .NET (ASP.NET)

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain how C# fits into the .NET platform
CO-2: Analyze the basic structure of a C# application
CO-3: Develop programs using C# on .NET
CO-4: Design and develop Web based applications on .NET

UNIT – I:
Introduction to C#: Introducing C#, Understanding .NET, overview of C#, Literals, Variables, Data Types, Operators, checked and unchecked operators, Expressions, Branching, Looping, Methods, implicit and explicit casting, Constant, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing.

UNIT – II:
Object Oriented Aspects of C#: Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism, sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, events, errors and exception, Threading.

UNIT – III:
Application Development on .NET: Building windows application, Creating our own window forms with events and controls, menu creation, inheriting window forms, SDI and MDI application, Dialog Box (Modal and Modeless), accessing data with ADO.NET, DataSet, typed dataset, Data Adapter, updating database using stored procedures

UNIT – IV:
SQL Server with ADO.NET, handling exceptions, validating controls, windows application configuration.

UNIT – V:
Web Based Application Development on .NET: Programming web application with web forms, ASP.NET introduction, working with XML and .NET, Creating Virtual Directory and Web Application, session management techniques, web.config, web services, passing datasets, returning datasets from web services, handling transaction, handling exceptions, returning exceptions from SQL Server.

UNIT – VI:

CLR and .NET Framework: Assemblies, Versoning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, remoting, security in .NET

TEXT BOOKS:

1. The Complete Reference: C# 4.0, Herbert Schildt, Tata McGraw Hill, 2012
2. Professional C# 2012 with .NET 4.5, Christian Nagel et al. Wiley India, 2012

REFERENCES:

1. Pro C# 2010 and the .NET 4 Platform, Andrew Troelsen, 5th Edition, A Press, 2010
2. Programming C# 4.0, Ian Griffiths, Matthew Adams, Jesse Liberty, 6th Edition, O"Reilly, 2010

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

(19OE1EC05) INTRODUCTION TO SIGNAL PROCESSING

COURSE PRE-REQUISITES: Introduction to C Sharp

COURSE OBJECTIVES:
- To understand various fundamental characteristics of signals and systems
- To analyze signals in frequency domain
- To know principles of signal transmission through systems
- To understand fundamentals of digital signal

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Classify signals and implement various operations on signals
CO-2: Analyze the characteristics of signals and systems
CO-3: Understand the basics of filter design
CO-4: Appreciate the processes of Multirate systems

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

UNIT – II:
Representation of Systems: Classification of discrete time Systems, impulse response, Concept of convolution in time domain and frequency domain, response of a linear system, System function, Signal bandwidth, system bandwidth. Ideal filter characteristics.

UNIT – III:
Sampling Theorem: Representation of continuous time signals by its samples - Sampling theorem – Reconstruction of a Signal from its samples, aliasing
Z –Transform: Basic principles of z-transform, region of convergence, properties of ROC, Inverse z-transform using Partial fraction.

UNIT – IV:
Introduction to Digital Signal Processing: Applications of Z-Transforms- Solution of Linear Constant Coefficient Difference equations (LCCD), System function, Frequency Response of the system.

UNIT – V:
Discrete Fourier Transforms: Circular convolution, Comparison between linear and circular convolution, Computation of DFT.
IIR Digital Filters: Design of IIR Digital filters (H(s) to be given) - Impulse invariance transformation techniques, Bilinear transformation method.

UNIT – VI:

FIR Digital Filters: Characteristics of linear phase FIR filters and its frequency response, Comparison of IIR and FIR filters. Design of FIR filters using Fourier Method and Windowing Technique (only Hanning).

Realization of IIR and FIR Filters: Direct and Cascade forms.

TEXT BOOKS:

1. Signals, Systems and Communications, B. P. Lathi, BS Publications, 2009
2. Signals and Systems, Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, 2nd Edition, PHI
3. Digital Signal Processing: Principles, Algorithms and Applications, John G. Proakis, D. G. Manolakis, 4th Edition, Perason/PHI, 2009

REFERENCES:

1. Signals and Systems, Simon Haykin and Barry Van Veen, 2nd Edition, John Wiley
2. Signals, Systems and Transforms, C. L. Philips, J. M. Parr and Eve A. Riskin, 3rd Edition, Pearson, 2004
3. Signals and Systems, Schaum's Outlines, Hwei P. Hsu, Tata McGraw Hill, 2004
4. Digital Signal Processing – A Practical Approach, Emmanuel C. Ifeacher, Barrie W. Jervis, 2nd Edition, Pearson Education

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

(19OE1EC06) INTRODUCTION TO IMAGE AND VIDEO PROCESSING

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

COURSE OBJECTIVES:
- To introduce fundamentals of digital image and video processing
- To demonstrate digital signal processing techniques in spatial and frequency domains
- To study and compare various image and video compression algorithms
- To study applications of motion estimation in video processing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire, represent the digital image and transforms
CO-2: Apply various pixel position and intensity-based image processing techniques
CO-3: Understand and analyze the performance of block matching algorithms in MPEG video coding standards

UNIT – I:
Fundamentals of Image Processing and Image Transforms: Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels, 2–D Discrete Fourier Transform, Discrete Cosine Transform, Introduction to Wavelet transforms.

UNIT – II:
Image Enhancement-Spatial Domain Methods: Point Processing, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters.

UNIT – III:
Image Enhancement-Frequency Domain Methods: Basics of filtering in frequency domain, Image Smoothing, Image Sharpening, Selective Filtering.
Image Segmentation: Segmentation Concepts, Point, Line and Edge Detection, Thresholding, Region Based Segmentation.

UNIT – IV:
Image Compression: Image compression fundamentals – coding Redundancy, spatial and temporal redundancy.
Compression Models: Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding.

UNIT – V:
Basic Steps of Video Processing: Analog video, Digital Video, Time varying Image Formation models: 3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals.

UNIT – VI:

2-D Motion Estimation: Optical flow, pixel-based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Application of motion estimation in video coding.

TEXT BOOKS:

1. Digital Image Processing, Gonzaleze and Woods, 3rd Edition, Pearson
2. Video Processing and Communication, Yao Wang, Joem Ostarmann and Ya – Quin Zhang, 1st Edition, PHI

REFERENCES:

1. Digital Video Processing, M. Tekalp, Prentice Hall International
2. Image Acquisition and Processing with LabVIEW, Relf, Christopher G., CRC Press
3. Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms, Aner Ozdemi R., John Wiley & Sons
4. Fundamentals of Digital Image Processing, A Practical Approach with Examples in Matlab, Chris Solomon, Toby Breckon, John Wiley & Sons

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1EC07) FUNDAMENTALS OF AUGMENTED REALITY AND VIRTUAL REALITY

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

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

- To a review of current Virtual Reality (VR) and Augmented Reality (AR) technologies
- To the fundamentals of VR/AR modeling and programming
- To provides a detailed analysis of engineering scientific and functional aspects of VR/AR

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire knowledge in main applications VR / AR technologies
CO-2: Analyze different tools for VR/AR applications
CO-3: Developing VR/AR applications

UNIT – I:
Augmented Reality and Virtual Reality:
Augmented Reality: Introduction to Augmented Reality (AR), Fundamentals, Chronicle order of AR, features
Virtual Reality: Introduction to Virtual Reality (VR), Features of VR and Chronicle order of VR; Difference between AR and VR.

UNIT – II:
Types of Augmented Reality: Marker based AR, Marker less AR, Projection based AR, Super Imposition based AR, Applications of AR.

UNIT – III:
Types of Virtual Reality: Non- immersive simulation, Semi-immersive simulations, Fully immersive simulations; Applications VR.

UNIT – IV:
Making an AR App with Simple CUBE: Introduction to Unity, Installation steps, Fundamentals while implementing Project, importing a cube, Create an account in Vuforia, license manager, target manager, downloading database and uploading target database in unity.

UNIT – V:
AR App with Interaction: Introduction to C#, Scripting interactive objects, implementation C# Script using unity, uploading target object, deploying application into ANDROID Device.

UNIT – VI:

Creating an Virtual Reality: Creating an Virtual Reality Scene in unity, adding colliders, Settings of Unity to make the application compatible with Google cardboard.

TEXT BOOKS:

1. Augmented Reality for Developers, Build Practical Augmented Reality Applications with Unity, ARCore, ARKit, and Vuforia. Linowes, J., Babilinski, K United Kingdom, Packt Publishing, 2017
2. Building Virtual Reality with Unity and Steam VR, Murray, J. W., United Kingdom, CRC Press, 2020

REFERENCES:

1. Virtual Reality & Augmented Reality in Industry, Ma, D., Gausemeier, J., Fan, X., Grafe, M. (Eds.) Springer, 2011
2. Unity 2020 Virtual Reality Projects: Learn VR Development by Building Immersive Applications and Games with Unity 2019.4 and Later Versions, Linowes J 3rd Edition, United Kingdom, Packt Publishing, 2020

ARTIFICIAL INTELLIGENCE

ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) is a cognitive science with highly research activities in the major areas like Machine Learning, Robotics, Natural Language Processing and image processing. This track will cover basic foundations of artificial intelligence it will make the students industry-ready for artificial intelligence and data science job roles. Artificial intelligence is used in wide range of industrial applications such as healthcare, transportation, entertainment, insurance, transport and logistics, and customer service.

Future applications of AI would be utilized in automated transportation, cyborg technology, solving problems associated with climate change, deep-sea and space exploration.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1MT01) MATHEMATICS FOR ARTIFICIAL INTELLIGENCE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To introduce the basic concepts of probability and matrices in the field of Artificial Intelligence
- To identify, explore the complex problem-solving strategies
- To develop problem solving skills related to algorithmic analysis required for AI
- To apply and build mathematical model to solve real-world problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explore and demonstrate practical approaches related to implementation of the AI algorithms using probability concepts
CO-2: Formulate and solve the Artificial intelligence related problems by using the knowledge of matrices and vectors
CO-3: Demonstrate the understanding of mathematical ideas from artificial intelligence perspective and machine learning
CO-4: Analyze and solve the complexity of a given problem with suitable optimization techniques

UNIT – I:
Probability: Basic rules and axioms, events, sample space, frequentist approach, dependent and independent events, conditional probability, Random variables, continuous and discrete, expectation, variance, distributions - joint and conditional, Bayes' theorem, Popular distributions - Bernoulli, Binomial, Poisson, Normal.

UNIT – II:
Descriptive Statistics & Linear Regression: Classification and tabulation of univariate data, graphical representation, Frequency curves. Descriptive measures - Central tendency and Dispersion. Simple Linear Regression Models.

UNIT – III:
Vector Space: Vectors, definition, scalars, addition, scalar multiplication, inner product (dot product), vector projection, cosine similarity, orthogonal vectors, normal and orthonormal vectors, vector norm, vector space, linear combination, linear span, linear independence, basis vectors.

UNIT – IV:
Matrices: Matrices definition, rank, System of equations: Direct methods - LU decomposition method, Tri-diagonal system; Applications of linear systems - Network flows and Mechanical systems.

UNIT – V:

Eigen Values & Eigen Vectors: Eigen values & eigen vectors, concept, intuition, significance, how to find principle component analysis, concept, properties, applications, Singular value decomposition, concept, properties, applications.

UNIT – VI:

Multivariate Calculus: Functions, Scalar derivative, partial derivatives, Gradient, chain rule, properties, method for derivative of vector-valued function with respect to scalar, vector four combinations - Jacobian, Hessian, Gradient of vector valued function, Gradient of matrices. Local/global maxima and minima, saddle point, convex functions, gradient descent algorithms - Learning rate, momentum, stochastic, Constrained optimization (Lagrange Multiplier method), convex optimization.

TEXT BOOKS:

1. Mathematics for Machine Learning, Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Cambridge University Press, 2020
2. Linear Algebra and it's Applications, David C. Lay, 3rd Edition, Pearson Publications
3. Probability and Statistics for Engineers, Richard A. Johanson, 5th Edition, Prentice-Hall, 1995

REFERENCES:

1. Math for Machine Learning: Open Doors to Data Science and Artificial Intelligence, Richard Han, Paperback, 2018
2. Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning, James V Stone
3. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1CS01) FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence

COURSE OBJECTIVES:

- To understand and analyze the importance and basic concepts of artificial intelligence and the use of agents
- To identify, explore the complex problem-solving strategies and approaches
- To analyze the concepts of basic concepts of neural networks and learning process
- To explore and analyze the methodology used in machine learning

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the basic concepts of artificial intelligence and the use of agents into the real-world scenario
CO-2: Design and formulate complex problem solutions with the use of various searching techniques
CO-3: Estimate the skill for representing knowledge using the appropriate technique for a given problem
CO-4: Apply AI techniques to solve problems of game playing, and machine learning

UNIT – I:
Introduction to AI: Foundations of AI – History of AI - Applications of AI, Intelligent Agents – Agents and Environments – Nature of Environments – Structure of Agents – Problem solving Agents – Problem formulation – Example Problems.

UNIT – II:
Searching Techniques: Uninformed Search Strategies – Breadth first search – Depth first search – Depth limited search - Bidirectional search – comparison – Search with partial information - Heuristic search – Greedy best first search – A* search – Memory bounded heuristic search - Heuristic functions - Local search- Hill climbing – Simulated annealing search - Local beam search, Genetic algorithms.

UNIT – III:
Constraint Satisfaction Problems: Backtracking search for CSP's - local search for constraint satisfaction problem. *Adversarial search* – Games - Minimax algorithm, Alpha beta pruning, cutting-off search.

UNIT – IV:
Knowledge Representation and Reasoning: Propositional Logic, Rules of Inference, First Order Logic (FOL) Syntax, Semantics, Entailment.

UNIT – V:

Classical Planning: Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches.

UNIT – VI:

Planning and Acting in the Real World: Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent Planning.

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall, 2010
2. Machine Learning, Tom M. Mitchell, McGraw Hill Publications
3. Neural Networks A Comprehensive Foundation, Simon Haykin, Pearson Education, 2nd Edition, 2004

REFERENCES:

1. Artificial Intelligence, Elaine Rich & Kevin Knight, 2nd Edition, TMH
2. Artificial Intelligence-A New Synthesis, Nils J. Nilsson, Elsevier
3. Artificial Neural Networks, Yegnanarayana B., PHI

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

(19OE1CS02) MACHINE LEARNING TECHNIQUES

COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence, Fundamentals of Artificial Intelligence

COURSE OBJECTIVES:
- To understand applications in computational learning theory
- To analyse the pattern comparison techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and Familiarize the basics concept, notations used in machine learning and mathematics behind machine learning algorithms
CO-2: Demonstrate different types of machine learning algorithms
CO-3: Apply the suitable machine learning techniques and construct a machine learning model to solve real world applications
CO-4: Evaluate model accuracy and familiarize with advanced learning algorithms

UNIT – I:
Introduction to Machine Learning: Perspectives and issues in machine learning, Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation.

UNIT – II:
Supervised Learning: Classification, decision boundaries; nearest neighbor methods, Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, Linear classifiers Bayes' Rule and Naive Baye's classification
Regression: Regression types, gradient descent; features of Over fitting and complexity; training, validation, test data, Logistic regression and applications.

UNIT -III:
Unsupervised Learning: Clustering, k-means, hierarchical, partition-based clustering, overlapping clustering, Support vector machines, Support vector regression.

UNIT -IV:
Reinforcement Learning: Introduction to Reinforcement learning, the learning task, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

UNIT- V:
Instance-Based Learning: Introduction, k-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT – VI:

Neural Networks: Introduction to neural networks, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and Convolution neural networks.

TEXT BOOKS:

1. Machine Learning, Tom M. Mitchell, McGraw-Hill
2. Neural Networks and Learning Machines, S. Haykin, Pearson, 2008

REFERENCES:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis
2. Machine Learning: The Art and Science of Algorithms that make Sense of Data, Peter Flash, Cambridge, University Press
3. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, MIT Press, 2012

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

(19OE1CS03) DEEP LEARNING

COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence, Fundamentals of Artificial Intelligence, Machine Learning Techniques

COURSE OBJECTIVES:
- To introduce the foundations of deep learning
- To acquire the knowledge on Deep Learning Concepts

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify and select appropriate learning network models required for real world problems
CO-2: Design an efficient model with various deep learning techniques
CO-3: Implement deep learning algorithms and solve real-world problems
CO-4: Apply optimization strategies necessary for problem solving required for large scale applications

UNIT – I:
Introduction to Deep Learning: History of Deep Learning, Deep Learning Success Stories, Biological Neuron, Idea of computational units, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm and Convergence.

UNIT – II:
Feedforward Networks: Multilayer Perceptron, Gradient Descent, Back-propagation, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks.

UNIT – III:
Regularization for Deep Learning: Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, Multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier.

UNIT – IV:
Optimization for Training Deep Models: Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithm.

UNIT – V:
Convolutional Neural Networks: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Markov Networks, Object Detection, RCNN, Fast RCNN, Faster RCNN, YOLO

UNIT – VI:

Auto-Encoders: Regularization in auto-encoders, De-noising auto-encoders, Sparse auto-encoders, Contractive auto-encoders, Structured probabilistic models of deep learning.

TEXT BOOKS:

1. Deep Learning: An MIT Press Book, Ian Goodfellow and Yoshua Bengio and Aaron Courville
2. Neural Networks and Learning Machines, Simon Haykin, 3rd Edition, Pearson Prentice Hall

REFERENCES:

1. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
2. Pattern Recognition and Machine Learning, Christopher Bishop, 2007

BLOCKCHAIN TECHNOLOGIES

BLOCKCHAIN TECHNOLOGIES

The blockchain is one of the fastest growing skills in the IT sector today. This track will help the students to gain knowledge in blockchain technology, it has taken quite a turn in the industry given its popularity in providing safe and secured online transactions. Most individuals and organizations have started adopting blockchain because of the many benefits it offers to the industry today. It is used in many industry applications such as banking sector, voting, health care, real estate, the legal industry and government.

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

(19OE1CS04) FUNDAMENTALS OF COMPUTER NETWORKS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce the fundamental various types of computer networks
- To demonstrate the TCP/IP and OSI models with merits and demerits
- To explore the various layers of OSI model
- To introduce UDP and TCP models
- To have the concept of different routing techniques for data communications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and explore the basics of Computer Networks reference models and the functionalities of physical layer
CO-2: Learn major concepts, principles involved in Data Link Layer and Network Layer
CO-3: Analyze how to maintain QoS in Network and maintaining of Congestion Control
CO-4: Demonstrate the Application Layer functionalities and importance of Security in the Network

UNIT – I:
Introduction to Networks: Internet, Protocols and Standards, The OSI Model, Layers in OSI Model, TCP/IP Suite, Addressing.
Physical Layer: Multiplexing, Transmission Media, Circuit Switched Networks, Datagram Networks, and Virtual Circuit Networks.

UNIT – II:
Data Link Layer: Introduction, Checksum, Framing, Flow and Error Control, Noiseless Channels, Noisy Channels, Random Access Controlled Access, Channelization, IEEE Standards, Ethernet, Giga-Bit Ethernet, Wireless LANs, SONET-SDH, Frame Relay and ATM.

UNIT – III:
Network Layer: Logical Addressing, Internetworking, Tunneling, Address Mapping, ICMP, IGMP, Forwarding, Routing-Flooding, Bellman& Ford, Disjkstra's routing protocols, RIP, OSPF, BGP and Multicast Routing Protocols. Connecting Devices-Passive Hubs, Repeaters, Active Hubs, Bridges, Routers.

UNIT – IV:
Transport Layer: Process to Process Delivery, UDP, TCP and SCTP Protocols, Congestion, Congestion Control, Quality of Service.

UNIT – V:

Application Layer: Domain Name Space, DNS in Internet, Electronic Mail, File Transfer Protocol, WWW, HTTP, SNMP, Multi-Media.

UNIT – VI:

Network Security: Security services, mechanisms and attacks, IPSec, SSL, VPN, Firewall. Bluetooth, Zigbee, IPv4, IPv6.

TEXT BOOKS:

1. Data Communications and Networking, Behrouz A. Forouzan, 4th Edition, McGraw Hill Education, 2006
2. Computer Networks, Andrew S. Tanenbaum, 4th Edition, Pearson Education
3. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education

REFERENCES:

1. Data Communications and Networks, William Stallings
2. Data Communication and Networks, Bhusan Trivedi, Oxford University Press, 2016
3. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education
4. Understanding Communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning

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

(19OE1CS08) RELATIONAL DATABASE MANAGEMENT SYSTEMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the basic elements of a relational database management system
CO-2: Identify the data models for relevant problems
CO-3: Design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data
CO-4: Apply normalization for the development of application software

UNIT – I:
Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.
Introduction to Database Design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.
Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data.
Logical database Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT – II:
Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.
SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

UNIT – III:
Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

UNIT – IV:
Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

UNIT – V:
Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.
Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

UNIT – VI:
Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.
Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.
Hash-Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw Hill Education (India) Private Limited
2. Database System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, 6th Edition, McGraw Hill Education (India) Private Limited,
3. Database Systems, R. Elmasri, Shamkant B. Navathe, 6th Edition, Pearson Education

REFERENCES:

1. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning
2. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Introduction to Database Systems, C. J. Date, Pearson Education

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1CS05) DISTRIBUTED DATA BASES

COURSE PRE-REQUISITES: Fundamentals of Computer Networks

COURSE OBJECTIVES:

- To introducing distributed databases and exploring several algorithms for processing queries and be able to use them
- To describe the methods to translate complex conceptual data models into logical and Physical database designs
- To demonstrating query optimization and its algorithms
- To enumerating the concepts behind distributed transaction processing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze issues related to distributed database design
CO-2: Apply Partitioning techniques to databases
CO-3: Design and develop query processing strategies
CO-4: Demonstrate transaction processing and concurrency control in distributed databases

UNIT – I:
Introduction: Features of Distributed versus Centralized Databases,
Levels of Distribution Transparency: Reference Architecture for Distributed Databases, Types of Data Fragmentation, Distribution transparency for Read – only Applications, Distribution transparency for update Applications, Distributed database Access primitives, Integrity Constraints in Distributed Databases.

UNIT – II:
Distributed Database Design: A framework, the design of database fragmentation, the allocation of fragments.
Translation of Global Queries to Fragment Queries: Equivalence Transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries.

UNIT – III:
Optimization of Access Strategies: A Framework for Query Optimization, Join Queries, General Queries.

UNIT – IV:
The Management of Distributed Transactions: A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural aspects of Distributed Transactions.

UNIT – V:
Concurrency Control: Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.

UNIT – VI:

Reliability: Basic Concepts, Nonblocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart.

TEXT BOOKS:

1. Principles of Distributed Database Systems, M. Tamer OZSU and Patuck Valduriez, Pearson Education Asia, 2001
2. Distributed Databases, Stefano Ceri and Willipse Pelagatti, McGraw Hill

REFERENCES:

1. Database System Concepts, Henry F. Korth, A. Silberchatz and Sudershan, MGH
2. Database Management Systems, Raghuramakrishnan and Johhanes Gehrke, MGH

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1CS06) CRYPTOGRAPHY AND NETWORK SECURITY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases

COURSE OBJECTIVES:
- To outline security concepts, threats, attacks, services and mechanisms
- To describe various cryptosystems-symmetric key cryptography, public key cryptography
- To apply authentication services and Secure hash functions
- To discuss the concepts of IP Security, web security, viruses and firewalls

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the security attacks, services, goals and mechanism of security
CO-2: Develop a security model using conventional approach to prevent the attacks
CO-3: Apply public key cryptography principles, examine authenticity and integrity of the messages in the communication
CO-4: Build a model for IP security, firewall and test the security issues

UNIT – I:
Security Attacks: Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

UNIT – II:
Conventional Encryption: Classical Encryption techniques, Fiestel Cipher Structure, Data Encryption Standard, Block Cipher Design Principles and Modes of Operation, Triple DES, RC-4, Evaluation criteria for AES, AES Cipher, Placement of Encryption Function, Traffic Confidentiality.

UNIT – III:
Public Key Cryptography and Authentication: Confidentiality using Symmetric Encryption – Principles of Public key Cryptosystems, RSA algorithm, Key Management, Diffie-Hellman key Exchange, Elliptic Curve Cryptography.
Authentication requirements, Authentication functions, Message Authentication Codes

UNIT – IV:
Hash Functions: Hash Functions, Security of Hash Functions and MACs, MD5 message Digest algorithm, Secure Hash Algorithm, HMAC, Digital Signatures, Authentication

Protocols, Digital Signature Standard, Authentication Applications: Kerberos, X.509 Authentication Service

UNIT – V:
Network Security: Email Security and Web Security
Electronic Mail Security – PGP/ SMIME, IP security- Architecture, Authentication Header, Encapsulating Security Payload, Key Management, Web Security- Secure Socket Layer, Transport Layer Security and Secure Electronic Transaction

UNIT – VI:
System Level Security: Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

TEXT BOOKS:

1. Cryptography and Network Security – Principles and Practices, William Stallings, Prentice Hall of India, 4th Edition, 2005
2. Hack Proofing Your Network, Ryan Russell, Dan Kaminsky, Rain Forest, Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W. Manzuik and Ryan Permeh, Wiley Dreamtech

REFERENCES:

1. Network Security Essentials: Applications and Standards, William Stallings Prentice Hall,1999, ISBN 0130160938
2. Security in Computing, Charles B. Pfleeger, Shari Lawrence Pfleeger, 3rd Edition, Pearson Education, 2003

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

(19OE1CS07) BLOCKCHAIN TECHNOLOGY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases, Cryptography and Network Security

COURSE OBJECTIVES:
- To get the terminologies and overview of blockchain technologies
- To study the concepts and foundation of blockchain technology
- To understand security mechanism and consensus in blockchain
- To design use cases and architecture blockchain technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain a clear understanding of the concepts that underlie digital distributed ledger
CO-2: Understand key mechanisms like Decentralization, Transparency and trust, Immutability, High availability, Highly secure and different types of Blockchain
CO-3: Apply the concept of Hash Function and Related Hash Algorithm
CO-4: Design and implement applications using Blockchain Technology

UNIT – I:
Introduction to Blockchain Part I: Introduction to Centralized, Decentralized and Distributed system, History of Blockchain, Various technical definitions of Blockchain.
Introduction to Blockchain Technology Part II: Generic elements of a blockchain: Block, Transaction, Peer-to-peer network, Node, Smart contract, Why It's Called "Blockchain", Characteristics of Blockchain Technology, Advantages of blockchain technology.

UNIT – II:
Concept of Blockchain Technology Part I: Cryptography, Hashing, Nonce, Distributed database, Consensus, Smart Contract, Component of block, Structure of Block chain, Technical Characteristics of the Blockchain.
Concept of Blockchain Technology Part II: Applications of blockchain technology, Tiers of blockchain technology Blockchain 0, Blockchain 1, Blockchain 2, Blockchain 3, Generation of Blockchain X.

UNIT – III:
Technical Foundations Part I: Cryptography, Confidentiality, Integrity, Authentication, Cryptographic primitives, Public and private keys, RSA, Discrete logarithm problem, Hash Function: Message Digest (MD), Secure Hash Algorithms (SHAs), Design of Secure Hash Algorithms (SHA), SHA-256, Design of SHA3, Elliptic Curve Digital signature algorithm.
Technical Foundations Part II: Consensus algorithm: Proof of work (PoW), Proof-of-Stake (PoS), Byzantine Fault Tolerance (BFT)

UNIT – IV:

Types of Blockchain: Public blockchains, Private blockchains, Semi-private blockchains, Side chains, Permissioned ledger, Distributed ledger, Shared ledger, Fully private and proprietary blockchains, Tokenized blockchains, Tokenless blockchains, CAP theorem and blockchain

UNIT – V:

Financial markets and trading, Trading, Exchanges, Trade life cycle, Order anticipators, Market manipulation.

Crypto-Currency: Bitcoin, Bitcoin definition, Keys and addresses, Public keys in Bitcoin, Private keys in Bitcoin, Bitcoin currency units

UNIT – VI:

Implementation Platforms: Hyperledger as a protocol, Reference architecture, Hyperledger Fabric, Transaction Flow, Hyperledger Fabric Details, Fabric Membership, Fabric Membership

TEXT BOOKS:

1. Mastering Blockchain, Imaran Bashir, 2nd Edition, Packt
2. Blockchain Basic, Daniel Drescher, A Press

REFERENCES:

1. Blockchain For Dummies®, IBM Limited Edition, John Wiley & Sons Inc.

ROBOTICS

ROBOTICS

Robotics is a field of study that involves the design, construction and operation of robots. This field overlaps with electronics, computer science, mechatronics and artificial intelligence. Robotic companies are booming all over the world and are seeking engineers with skills for implementing **Next -Level Automation**. This Open Elective Track for Robotics consists of four courses and is intended for making students industry ready in the field of robotics.

The First course in this track" Fundamentals **of Robotics"** introduces various physical aspects of building a robot, exploring topics like how a robot perceives its environment using Sensors and how it interacts with its environment through various Actuators & Grippers. This course also inspects a variety of robot applications in different domains. Second Course in this track" Kinematics **& Dynamics of robots"** delves a level deeper discussing analysis and control of robots. It establishes strong mathematical foundation for describing and controlling robot movement. In this course students will learn in detail about Forward Kinematics, Inverse Kinematics, Workspace Analysis and Trajectory planning for robots.

Third Course in the Robotics track **"Drives and Control System for Robots"** explores in detail various Drive Mechanisms used in robotics such as Hydraulic, Pneumatic & Electric drives. After completing this course students will be able to analyze operational aspects of a drive system for a given robotic application. Fourth Course in the track **"Robot Programming and Intelligent Control System"** expands on Robot Programming, discussing various aspects of Robot Programming Languages and their functions. This course also dives deep into advanced topics like Artificial Intelligence, Neural Networks and Fuzzy control for robots.

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

(19OE1EI01) FUNDAMENTALS OF ROBOTICS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the basic components of a Robot
- To learn different types of Robot sensors and actuators used in Robotics
- To identify different types of Robot grippers and their applications
- To acquire basic Knowledge on Robot kinematics
- To expose to various application fields of Robotics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain knowledge about basic concepts of robots
CO-2: Appreciate the usage of different sensors and actuators in Robotics
CO-3: Select appropriate Gripping mechanism for a particular application
CO-4: Analyze the direct and the inverse kinematic problems
CO-5: Appreciate robot design deference's for various applications

UNIT – I:
Basic Concepts: An overview of Robotics, classification of Robots, Robot Components, Robot degrees of freedom, Robot Joints, Robot Coordinates, Robot reference frames, Programming modes, Robot Characteristics.

UNIT – II:
Sensors: Sensor characteristics, Position sensors, Velocity sensors, Acceleration sensors, Force and Pressure sensors, Torque sensors, Microswitches, Light and infrared sensors, Touch and tactile sensors, Proximity sensors, Range finders.

UNIT – III:
Actuators: Characteristics of actuating system, Comparison of actuating systems, Hydraulic actuators, Pneumatic devices, Electric motors, Magneto-strictive actuators, Shape-Memory Metals, Electro-active Polymer Actuators.

UNIT – IV:
Grippers: Classification of Grippers, Drive system for Grippers, Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Adhesive Grippers, Hooks and Scoops, Gripper Force analysis and design, Active and Passive Grippers.

UNIT – V:
Kinematics: Robots as Mechanisms, Matrix Representation, Homogeneous Transformation Matrices, Representation of Transformations, Inverse of Transformation Matrices, Forward and Inverse Kinematics with Equations.

UNIT – VI:
Applications: Industrial applications, material handling, processing, assembly application, inspection application, application planning, justification of robots, non-industrial applications, Robot safety.

TEXT BOOKS:

1. Introduction to Robotics: Analysis, Control, Applications, Saeed B. Niku, Wiley, 2nd Edition
2. Robotics Technology and Flexible Automation, Deb S. R., John Wiley
3. Robotics and Control, R. K. Mittal, I. J. Nagrath, McGraw Hill Education

REFERENCES:

1. Industrial Robotics, Technology programming and Applications, Mikell P. Groover, Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, McGraw Hill, 2012
2. Robotics-Control, Sensing, Vision and Intelligence, K. S. Fu, R. C. Gonzalez, C. S. G Lee, McGraw-Hill International Edition
3. Robotic Engineering–An Integrated Approach, Klafter R. D., Chimielewski T. A., Negin M., Prentice Hall of India, New Delhi, 2009

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

(19OE1EI02) KINEMATICS AND DYNAMICS OF ROBOTS

COURSE PRE-REQUISITES: Fundamentals of Robotics

COURSE OBJECTIVES:
- To understand the basics of robot coordinate frames and their representation
- To obtain knowledge about direct kinematics and inverse kinematics for a robot manipulator
- To examine techniques for planning robot motion in a workspace
- To understand various methods for developing dynamic models for manipulator
- To learn control techniques applied to robot manipulators

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Mathematically represent a Robot system
CO-2: Calculate robot hand position and orientation for specific joint angles
CO-3: Calculate joint angles to achieve a particular hand position
CO-4: Plan trajectories for robot tool to do meaningful tasks
CO-5: Analyze different controlling techniques used for robot manipulators

UNIT – I:
Introduction: Introduction, position and orientation of objects, objects coordinate frame Rotation matrix, Euler angles Roll, pitch and yaw angles coordinate Transformations, Joint variables and position of end effector, Dot and cross products.

UNIT – II:
Direct Kinematics: Coordinate frames, Rotations, Homogeneous coordinates, Link coordinates D-H Representation, The ARM equation. Direct kinematic analysis for Four axis SCARA Robot and three, five and six axis Articulated Robots.

UNIT – III:
Inverse Kinematics: The inverse kinematics problem, General properties of solutions. Tool configuration, Inverse kinematics of four axis SCARA robot and three and five axis Articulated robot.

UNIT – IV:
Workspace Analysis and Trajectory Planning: Workspace Analysis, work envelope of a Four axis SCARA robot and five axis articulated robot workspace fixtures, the pick and place operations, Joint space technique - continuous path motion, Interpolated motion, straight line motion and Cartesian space technique in trajectory planning.

UNIT – V:
Manipulator Dynamics: Introduction, Lagrange's equation kinetic and potential energy. Link inertia Tensor, link Jacobian Manipulator inertia tensor. Gravity, Generalized forces, Lagrange-Euler Dynamic model, Dynamic model of a Two-axis planar robot, Newton Euler formulation, Lagrange - Euler formulation, problems.

UNIT – VI:

Robot Control: The Control Problem, State Equations: one axis robot; three axis SCARA robot, Constant solutions, Linear Feedback Systems, Single Axis PID Control, PD-Gravity Control.

TEXT BOOKS:

1. Fundamentals of Robotics: Analysis & Control, Robert J. Schilling, Prentice Hall of India
2. Robotics and Control, R. K. Mittal, I. J. Nagrath, McGraw Hill Education

REFERENCES:

1. Robotic Engineering–An Integrated Approach, Klafter. R. D., Chimielewski. T. A., Negin M, Prentice Hall of India, New Delhi, 2009
2. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover & Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, Tata McGraw-Hill Education, 2012
3. Robotics-Control, Sensing, Vision and Intelligence, K. S. Fu, R. C. Gonzalez, C. S. G. Lee, McGraw-Hill International Edition

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

(19OE1EI03) DRIVES AND CONTROL SYSTEM FOR ROBOTICS

COURSE PRE-REQUISITES: Fundamentals of Robotics, Kinematics and Dynamics of Robotics

COURSE OBJECTIVES:
- To get acquainted with different robot drive mechanisms
- To understand in detail, working of hydraulic and pneumatic drives used in robotics
- To learn working principles of various electric drive systems for robotics
- To acquire basic Knowledge on servo systems for robot control

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Categorize various drive systems for robot movement
CO-2: Select appropriate drive system for a particular application
CO-3: Inspect different electric drives and their applications in robotics
CO-4: Analyze accurate positioning of robot end effector by servo control

UNIT – I:
Introduction: Objectives, motivation, open loop control, closed loop control with velocity and position feedback, Types of drive systems. Functions of drive system.

UNIT – II:
Robot Drive Mechanism: Lead Screws, Ball Screws, Chain & linkage drives, Belt drives, Gear drives, Precision gear boxes, Harmonic drives, Cyclo speed reducers.

UNIT – III:
Hydraulic Drives: Introduction, Requirements, Hydraulic piston and transfer valve, hydraulic circuit incorporating control amplifier, hydraulic fluid considerations, hydraulic actuators Rotary and linear actuators. Hydraulic components in robots.

UNIT – IV:
Pneumatic Drives: Introduction, Advantages, pistons-Linear Pistons, Rotary pistons, Motors-Flapper motor, Geared motor, Components used in pneumatic control. Pneumatic proportional controller, pneumatically controlled prismatic joint.

UNIT – V:
Electric Drives: Introduction, Types, DC electric motor, AC electric motor, stepper motors, half step mode operation, micro step mode. Types of stepper motors, Direct drive actuator.

UNIT – VI:
Servo Mechanism for Robot: Mathematical modeling of robot servos, error responses and steady state errors in robot servos, feedback and feed forward compensations, hydraulic position servo, computer-controlled servo system for robot applications, selection of robot drive systems.

TEXT BOOKS:

1. Engineering Foundation of Robotics, Francis N-Nagy Andras Siegler, Prentice Hall Inc.
2. Robotics Engineering - An Integrated Approach, Richard D. Klafter, Thomas A., Chri Elewski, Michael Negin, PHI Learning, 2009

REFERENCES:

1. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover & Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, Tata McGraw-Hill Education, 2012
2. Industrial Robotics, Bernard Hodges, 2nd Edition, Jaico Publishing House, 1993
3. Fundamentals of Robotics Analysis and Control, Robert J. Schilling, PHI Learning, 2009
4. Foundations of Robotics Analysis and Control, Tsuneo Yohikwa, MIT Press, 2003
5. Introduction to Robotics Mechanics and Control, John J. Craig, 3rd Edition, Pearson, 2008

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

(19OE1EI04) ROBOT PROGRAMMING AND INTELLIGENT CONTROL SYSTEM

COURSE PRE-REQUISITES: Fundamentals of Robotics, Kinematics and Dynamics of Robotics, Drives and Control Systems for Robotics

COURSE OBJECTIVES:
- To understand the fundamentals of robot programming
- To learn robot textual languages that are in common use
- To expose to artificial intelligence in robotics
- To acquire basic Knowledge on neural networks in robotics
- To acquire basic Knowledge on fuzzy logic in robotics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain knowledge about different methods of robot programming
CO-2: Examine various robot language elements and their functions
CO-3: Analyze different AI techniques employed in robotics
CO-4: Design basic neuro-controller for robot motion control
CO-5: Apply fuzzy logic to robot control systems

UNIT – I:
Robot Programming: Methods of robot programming, leadthrough programming methods, robot program as a path in space - defining position in space, speed control, motion interpolation, WAIT, SIGNAL, DELAY commands, Branching.

UNIT – II:
Robot Languages: Textual robot language, generations of robot languages, robot language structure, operating systems, Robot language Elements and functions, constraints and variables, aggregates and location variables.

UNIT – III:
Basic Commands and Operations: Motion commands- move and related statements, speed control, points in workspace, paths and frames. End effector and sensor commands- end effector operation, sensor operation, REACT statement. Computations and operation. Program control and subroutines. Communications and data processing. Monitor mode commands.

UNIT – IV:
AI for Robotics: Introduction to Artificial Intelligence, goals of AI research, AI techniques- knowledge representation, problem representation, search techniques. LISP programming. AI and Robotics. LISP in the factory. Robotic Paradigms.

UNIT – V:

Neural Network Approach in Robotics: Introduction, Connectionist Models, Learning Principles and Learning Rules: Supervised, unsupervised, reinforcement learning. Sensor based robot learning, Neural Network in Robotics: Control of robot hands by neural network, neural set approach to robot motion coordination, robotic motor control using reinforcement learning optimization.

UNIT – VI:

Fuzzy Logic Approach in Robotics: Introduction, Fuzzy sets, Operation of Fuzzy sets, Fuzzy relations, Fuzzy rule formation, Control rules, Fuzzy algorithm in robotics, Robot obstacle avoidance using fuzzy logic, Fuzzy logic for robot path tracking and behavior coordination, fuzzy control system in mobile robots, fuzzy controller design for robot systems, Case study of fuzzy logic in robotics.

TEXT BOOKS:

1. Industrial Robotics Technology, Programming and Applications, Mikell. P. Groover, McGraw Hill, 2012
2. Robotics Technology and Flexible Automation, Deb S. R., Tata McGraw Hill Publishing Company Limited

REFERENCES:

1. Design and Control of Intelligent Robotic Systems, (Studies in Computational Intelligence 177) M. Begum, F. Karray (auth.), Dikai Liu, Lingfeng Wang, Kay Chen Tan (eds.), Springer
2. Neural Networks in Robotics, Edited by George Bekey, Kenneth Y. Goldberg, Springer US, 2012
3. Neural Networks, Fuzzy Logic, Genetic Algorithm - Synthesis and Applications, Rajasekharan and Rai, PHI Publications
4. Introduction to Neural Networks using MATLAB 6.0, S. N. Sivanandam, S. Sumathi, S. N. Deepa, TMH, 2006

CYBER SECURITY

CYBER SECURITY

Cybersecurity is **important** because it incorporates everything that relates to protecting our sensitive data, personally identifiable information (PII), protected health information (PHI), personal information, intellectual property, data, and governmental and **industry** information systems from stealing and destruction endeavoured. The cyber security track helps students to learn about how to

- Defend networks and data from unapproved access.
- Enhanced information security and business endurance supervision.
- Upgraded stakeholder confidence in your information security preparations.
- Developed company authorizations with the correct security controls in place.

Some of the more common career paths in the cyber security path are

- Chief Information Security Officer. ...
- Forensic Computer Analyst. ...
- Information Security Analyst. ...
- Penetration Tester. ...
- Security Architect. ...
- IT Security Engineer. ...
- Security Systems Administrator. ...
- IT Security Consultant.

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

(19OE1CS04) FUNDAMENTALS OF COMPUTER NETWORKS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce the fundamental various types of computer networks
- To demonstrate the TCP/IP and OSI models with merits and demerits
- To explore the various layers of OSI model
- To introduce UDP and TCP models
- To have the concept of different routing techniques for data communications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and explore the basics of Computer Networks and Various Protocols and in a position to understand the World Wide Web concepts
CO-2: Administrate a network and flow of information
CO-3: Understand easily the concepts of network security, Mobile and ad-hoc networks

UNIT – I:
Introduction to Networks: Internet, Protocols and Standards, The OSI Model, Layers in OSI Model, TCP/IP Suite, Addressing.
Physical Layer: Multiplexing, Transmission Media, Circuit Switched Networks, Datagram Networks, and Virtual Circuit Networks.

UNIT – II:
Data Link Layer: Introduction, Checksum, Framing, Flow and Error Control, Noiseless Channels, Noisy Channels, Random Access Controlled Access, Channelization, IEEE Standards, Ethernet, Giga-Bit Ethernet, Wireless LANs, SONET-SDH, Frame Relay and ATM.

UNIT – III:
Network Layer: Logical Addressing, Internetworking, Tunneling, Address Mapping, ICMP, IGMP, Forwarding, Routing-Flooding, Bellman& Ford, Disjkstra's routing protocols, RIP, OSPF, BGP,- and Multicast Routing Protocols. Connecting Devices-Passive Hubs, Repeaters, Active Hubs, Bridges, Routers.

UNIT – IV:
Transport Layer: Process to Process Delivery, UDP, TCP and SCTP Protocols, Congestion, Congestion Control, Quality of Service.

UNIT – V:

Application Layer: Domain Name Space, DNS in Internet, Electronic Mail, File Transfer Protocol, WWW, HTTP, SNMP, Multi-Media.

UNIT – VI:

Network Security: Security services, mechanisms and attacks, IPSec, SSL, VPN, Firewall, Bluetooth, Zigbee, IPv4, IPv6.

TEXT BOOKS:

1. Data Communications and Networking, Behrouz A. Forouzan, 4th Edition, McGraw Hill Education, 2006
2. Computer Networks, Andrew S. Tanenbaum, 4th Edition, Pearson Education
3. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education

REFERENCES:

1. Data Communications and Networks, William Stallings
2. Data Communication and Networks, Bhusan Trivedi, Oxford University Press, 2016
3. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education
4. Understanding Communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning

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

(19OE1CS08) RELATIONAL DATABASE MANAGEMENT SYSTEMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the basic elements of a relational database management system
CO-2: Identify the data models for relevant problems
CO-3: Design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data
CO-4: Apply normalization for the development of application software

UNIT – I:
Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.
Introduction to Database Design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.
Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data,
Logical Database Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT – II:
Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.
SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

UNIT – III:
Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

UNIT – IV:

Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

UNIT – V:

Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

UNIT – VI:

Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.

Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.

Hash-Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw Hill Education (India) Private Limited
2. Database System Concepts, A. Silberschatz, Henry F. Korth, S. Sudarshan, 6th Edition, McGraw Hill Education (India) Private Limited
3. Database Systems, R. Elmasri, Shamkant B. Navathe, 6th Edition, Pearson Education

REFERENCES:

1. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning
2. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Introduction to Database Systems, C. J. Date, Pearson Education

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1CS06) CRYPTOGRAPHY AND NETWORK SECURITY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases

COURSE OBJECTIVES:

- To outline security concepts, threats, attacks, services and mechanisms
- To describe various cryptosystems- symmetric key cryptography, public key cryptography
- To apply authentication services and Secure hash functions
- To discuss the concepts of IP Security, web security, viruses and firewalls

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the security attacks, services, goals and mechanism of security
CO-2: Develop a security model using conventional approach to prevent the attacks
CO-3: Apply public key cryptography principles, examine authenticity and integrity of the messages in the communication
CO-4: Build a model for IP security, firewall and test the security issues

UNIT – I:
Security Attacks: Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

UNIT – II:
Conventional Encryption: Classical Encryption techniques, Fiestel Cipher Structure, Data Encryption Standard, Block Cipher Design Principles and Modes of Operation, Triple DES, RC-4, Evaluation criteria for AES, AES Cipher, Placement of Encryption Function, Traffic Confidentiality.

UNIT – III:
Public Key Cryptography and Authentication: Confidentiality using Symmetric Encryption – Principles of Public key Cryptosystems, RSA algorithm, Key Management, Diffie-Hellman key Exchange, Elliptic Curve Cryptography.
Authentication requirements, Authentication functions, Message Authentication Codes

UNIT – IV:
Hash Functions: Hash Functions, Security of Hash Functions and MACs, MD5 message Digest algorithm, Secure Hash Algorithm, HMAC, Digital Signatures, Authentication

Protocols, Digital Signature Standard, Authentication Applications: Kerberos, X.509 Authentication Service

UNIT – V:

Network Security: Email Security and Web Security

Electronic Mail Security – PGP/ SMIME, IP security- Architecture, Authentication Header, Encapsulating Security Payload, Key Management, Web Security- Secure Socket Layer, Transport Layer Security and Secure Electronic Transaction

UNIT – VI:

System Level Security: Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

TEXT BOOKS:

1. Cryptography and Network Security – Principles and Practices, William Stallings, 4th Edition, Prentice Hall of India, 2005
2. Hack Proofing your Network, Ryan Russell, Dan Kaminsky, Rain Forest, Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W. Manzuik and Ryan Permeh, Wiley Dreamtech

REFERENCES:

1. Network Security Essentials: Applications and Standards, William Stallings Prentice Hall,1999, ISBN 0130160938
2. Security in Computing, Charles B. Pfleeger, Shari Lawrence Pfleeger, 3rd Edition, Pearson Education, 2003

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1IT01) ESSENTIALS OF CYBER SECURITY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Cryptography and Network Security

COURSE OBJECTIVES:
- To identify the key components of cyber security in network
- To describe various security levels and categories, operating system security
- To define authentication issues and network security
- To describe memory management and protection measures

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Categorize cyber-crime and an understand social, political, ethical and psychological dimensions cyber security
CO-2: Demonstrate security levels and models with objects and access control
CO-3: Analyse tools and methods used in cybercrime
CO-4: Understand Organizational Implications and security risks

UNIT – I:
Introduction to Cybercrime: Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT – II:
Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT – III:
Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies an Measures in Mobile Computing Era, Laptops.

UNIT – IV:
Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT – V:

Cyber Security: Organizational Implications

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications.

UNIT – VI:

Social Media Marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

TEXT BOOKS:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley India

REFERENCES:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press
2. Introduction to Cyber Security, Chwan-Hwa (John) Wu, J. David Irwin, CRC Press T&F Group

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1IT02) COMPUTER FORENSICS

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Cryptography and Network Security, Essentials of Cyber Security

COURSE OBJECTIVES:

- To provide an understanding of computer forensics fundamentals
- To analyze various computer forensics technologies and to provide computer forensics systems
- To identify methods for data recovery
- To apply the methods for preservation of digital evidence

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Define and discuss the concepts of computer forensics
CO-2: Explain and apply the concepts of computer investigations
CO-3: Select and apply current computer forensics tools
CO-4: Identify and apply current practices for processing crime and incident scenes

UNIT – I:
Computer Forensics Fundamentals: What is Computer Forensics? Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists.

UNIT – II:
Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement — Computer Forensic Technology — Types of Business Computer Forensic Technology Computer Forensics Evidence and Capture: Data Recovery Defined — Data Back-up and Recovery — The Role of Back-up in Data Recovery — The Data-Recovery Solution.

UNIT – III:
Evidence Collection and Data Seizure: Why Collect Evidence? Collection Options — Obstacles — Types of Evidence — The Rules of Evidence — Volatile Evidence — General Procedure — Collection and Archiving — Methods of Collection — Artifacts — Collection Steps — Controlling Contamination: The Chain of Custody Duplication and Preservation of Digital Evidence: Preserving the Digital Crime Scene — Computer Evidence Processing Steps — Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer Image Verification and Authentication: Special Needs of Evidential Authentication — Practical Consideration —Practical Implementation.

UNIT – IV:
Computer Forensics Analysis and Validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing

remote acquisitions Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project. Processing Crime and Incident Scenes: Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case.

UNIT – V:

Current Computer Forensic Tools: Evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.
Cell Phone and Mobile Device Forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

UNIT – VI:

Working with Windows and DOS Systems: understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

TEXT BOOKS:

1. Computer Forensics, Computer Crime Investigation, John R. Vacca, Firewall Media, New Delhi
2. Computer Forensics and Investigations, Nelson, Phillips Enfinger, Steuart, Cengage Learning
3. Real Digital Forensics, Keith J. Jones, Richard Bejtiich, Curtis W. Rose, Addison Wesley, Pearson Education

REFERENCES:

1. Forensic Compiling, A Practitioners Guide, Tony Sammes and Brian Jenkinson, Springer International Edition
2. Computer Evidence Collection & Presentation, Christopher L. T. Brown, Firewall Media
3. Homeland Security, Techniques & Technologies, Jesus Mena, Firewall Media
4. Software Forensics Collecting Evidence from the Scene of a Digital Crime, Robert M. Slade, TMH 2005
5. Windows Forensics, Chad Steel, Wiley India Edition

DATA SCIENCES / BIG DATA AND ANALYTICS

DATA SCIENCES / BIG DATA AND ANALYTICS

Data science helps in risk evaluation and observing, possible deceitful comportment, payments, customer analysis, and experience, among much other exploitation. The capability to make **data**-driven choices generates a steadier financial situation and **data scientists** make the strength of the **industry.**
As such, **data science** track helps students to apply business concepts in banking, finance, manufacturing, transport, e-commerce, education, etc. that use **data science**. As a consequence, there are numerous **Data Science** Applications associated to it

Job Roles in Data Science Track

- Data Analyst
- Data Engineers
- Database Administrator
- Machine Learning Engineer
- Data Scientist
- Data Architect
- Statistician
- Business Analyst
- Data and Analytics Manager

Big Data analytics track helps the students to learn the process of gathering, establishing and examining large sets of **data** (called **Big Data**) to determine patterns and other beneficial information. Analysts occupied with **Big Data** characteristically want the acquaintance that comes from investigating the **data**.
Big data analytics is the practice of mining useful information by examining different **types** of big data sets. Big data analytics is utilized to determine concealed patterns, market developments and consumer favorites, for the advantage of organizational decision making.

Job responsibilities in a Big Data Analytics Track are

- To gather and accumulate data from disparate sources, clean it, organize it, process it, and analyse it to extract valuable insights and information.
- To identify new sources of data and develop methods to improve data mining, analysis, and reporting.
- To create data definitions for new database files or alterations made to the already existing ones for analysis purposes.
- To present the findings in reports (in table, chart, or graph format) to help the management team in the decision-making process.
- To apply statistical analysis methods for consumer data research and analysis purposes.
- To keep track of the trends and correlational patterns among complex data sets.
- To perform routine analysis tasks to support day-to-day business functioning and decision making.
- To collaborate with Data Scientists to develop innovative analytical tools.
- To work in close collaboration with both the IT team and the business management team to accomplish company goals.

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

(19OE1MT02) STATISTICAL METHODS FOR DATA SCIENCE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To provide insights about the basic roles of various statistical methods in building computer applications
- To develop a greater understanding of the importance of Data Visualization techniques
- To develop problem-solving skills
- To make inferences about the population parameters using sample data
- To provide an understanding on the importance and techniques of predicting a relationship between the two sets of data and determine the goodness of fitted model

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze an extremely large data set and perform exploratory data analysis to extract meaningful insights
CO-2: Develop various visualizations of the data in hand and communicate results of analysis effectively (visually and verbally)
CO-3: Examine a real-world problem and solve the same with the knowledge gained from various distributions study
CO-4: Use and fit a linear regression model to data and use it for prediction
CO-5: Fit a polynomial regression model to data and use it for prediction

UNIT – I:
Introduction to Statistics: Definition of statistics, basic objectives, applications in various branches of science with examples, collection of data: internal and external data, primary and secondary data, population and sample, representative sample.

UNIT – II:
Descriptive Statistics: Classification and tabulation of univariate data, graphical representation, frequency curves, descriptive measures - central tendency and dispersion, bivariate data, summarization, marginal and conditional frequency distribution.

UNIT – III:
Introduction to R: Introduction, Installing R and data types in R, programming using R: operators, conditional statements, looping, scripts, function creation, creating list, list operations, recursive list, creating a data frame, operations on data frames.

UNIT – IV:

Data Visualization using R: Import - export of data, measures of central tendency and measures of dispersion, data visualization – scatter plot, pie chart, histogram, bar chart, box plot, absolute and relative frequencies, frequency distribution.

UNIT – V:

Correlation & Linear Regression:

Correlation: Correlation, types of correlation, coefficient of correlation, rank correlation coefficient.

Linear Regression: Introduction, regression model, interval estimation, estimation of parameters of β_0 and β_1, Estimation of $\sigma^{2.}$

UNIT – VI:

Non-Linear Regression: Regression of second-degree polynomial (non-linear least square method for polynomial function), power function, exponential, estimation of coefficients, linear and polynomial regressions in R.

TEXT BOOKS:

1. Introductory Statistics, Thomas H. Wonnacott & Ronald J. Wonnacot, John Wiley & Sons Inc., 1969
2. Applied Statistics and Probability for Engineers, Douglas C. Montgomery, George C. Runger, 3rd Edition, John Wiley & Sons, Inc., 2003
3. R for Beginners, Sandip Rakshit, 1st Edition, McGraw-Hill Education, 2017

REFERENCES:

1. R-The Statistical Programming Language, Dr. Mark Gardner, Wiley India Pvt. Ltd, 2013
2. Introduction to the Theory of Statistics, A. M. Mood, F. A. Graybill and D. C. Boes, 3rd Edition, McGraw Hill Education, 2017
3. Introduction of Probability Models, S. M. Ross, 11th Edition, Academic Press, N.Y., 2014
4. Statistical Methods, S. P. Gupta, 42nd Revised Edition, Sultan Chand & Sons, 2012

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1IT03) COMPUTATIONAL THINKING USING PYTHON

COURSE PRE-REQUISITES: Statistical Methods for Data Science

COURSE OBJECTIVES:

- To understand why Python is a useful scripting language for developers
- To create and execute Python programs and to Learn how to use lists, tuples, and dictionaries in Python programs
- To learn how to build and package Python modules for reusability
- To learn how to design object-oriented programs with Python classes
- To learn how to use exception handling in Python applications for error handling

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms)
CO-2: Adequately use standard programming constructs: repetition, selection, functions, composition, modules, aggregated data (arrays, lists, etc.)
CO-3: Explain what a given program (in Python) does identify and repair coding errors in a program
CO-4: Understand and use object-based software concepts (constructing OO software will be dealt with in the course Software Engineering)
CO-5: Use library software for (e.g.) building a graphical user interface, web application, or mathematical software

UNIT – I:
Introduction: History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator, Conditional Statements-If
If- else Nested if-else Looping for While Nested loops Control Statements Break Continue Pass String Manipulation Accessing Strings Basic Operations String slices Function.

UNIT – II:
Methods, Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods,
Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods
Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties.

UNIT – III:
Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.
Modules: Creation, Importing module, Math module, Random module, Packages.

UNIT – IV:

Composition: Input-Output-Printing on screen, Reading data from keyboard, Opening and closing file Reading and writing files, Functions.

Exception Handling: Exception, Exception Handling, Except clause, Try? Finally clause, User Defined Exceptions

UNIT – V:

OOPs Concept: Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding, Regular expressions- Match function, Search function, Matching VS Searching, Modifiers, Patterns.

Multithreading: Thread, Starting a thread, Threading module, Synchronizing threads.

CGI: Introduction, Architecture, CGI environment variable, GET and POST methods, Cookies, File upload.

UNIT – VI:

Database: Introduction, Connections, Executing queries, Transactions Handling error,

Networking: Socket, Socket Module, Methods, Client and server, Internet modules, Sending email.

TEXT BOOKS:

1. Learning Python, David Ascher and Mark Lutz, O'Relly

REFERENCES:

1. Python Programming: An Introduction to Computer Science, John M. Zelle, 2nd Edition, Kindle Edition
2. Python Essential Reference, David M. Beazley, 4th Edition, Developer's Library

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

(19OE1IT04) FUNDAMENTALS OF DATA MINING

COURSE PRE-REQUISITES: Statistical Methods for Data Science, Computational Thinking using Python

COURSE OBJECTIVES:
- To introduce the basic concepts and techniques in building a Data Warehouse
- To apply preprocessing methods for any given raw data
- To develop skills of using recent data mining software for solving practical problems
- To implement and apply basic algorithms for supervised and unsupervised learning

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Assess raw input data and process it to provide suitable input for a range of data mining algorithms.
CO-2: Discover and measure interesting patterns from different kinds of databases
CO-3: Evaluate and select appropriate data-mining algorithms and apply, interpret and report the output appropriately
CO-4: Design and implement data-mining applications using sample, realistic data sets and modern tools

UNIT – I:
Data Warehousing & Modeling: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading.

UNIT – II:
Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.

UNIT – III:
Data Warehouse Implementation & Data Mining: Data Warehouse Architecture, What is data mining, Challenges, From Data Warehousing and Data Mining, Data Mining Tasks, Data Mining Functionalities, Major Issues in Data Mining. Data: Types of Data, Data Quality, Data Pre-processing, Measures of Similarity and Dissimilarity.

UNIT – IV:
Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.

UNIT – V:

Classification: Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.

UNIT – VI:

Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph- Based Clustering, Scalable Clustering Algorithms.

TEXT BOOKS:

1. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, First Impression, Pearson, 2014
2. Data Mining-Concepts and Techniques, Jiawei Han, Micheline Kamber, Jian Pei, 3rd Edition, Morgan Kaufmann, 2012

REFERENCES:

1. Data Warehousing in the Real World, Sam Anahory, Dennis Murray, Tenth Impression, Pearson, 2012
2. Mastering Data Mining, Michael J. Berry, Gordon S. Linoff, 2nd Edtion, Wiley, 2012

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

(19OE1IT05) DATA ANALYSIS AND VISUALIZATION

COURSE PRE-REQUISITES: Statistical Methods for Data Science, Computational Thinking using Python, Fundamentals of Data Mining

COURSE OBJECTIVES:
- To introduce concept and characteristics of probability distribution
- To introduce underlying design principles, properties and assumptions of linear and non-linear regression modelling
- To introduce design principles involved in identifying interesting classification and prediction of data patterns
- To introduce properties of time series data and perform time series analysis

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply probability distribution concepts to identify univariate data patterns
CO-2: Apply regression modelling to build efficient mathematical models for prediction and classification
CO-3: Apply decision and regression trees for supervised learning
CO-4: Visualize time series data by applying time series techniques

UNIT – I:
Data Definitions and Analysis Techniques: Elements, Variables, and Data categorization, Introduction to statistical learning, Descriptive Statistics: Measures of central tendency, Measures of location of dispersions.

UNIT – II:
Basic Analysis Techniques: Basic analysis techniques, Statistical hypothesis generation and testing, Chi-Square test, t-Test Analysis of variance, Correlation analysis, Maximum likelihood test.

UNIT – III:
Data Analysis Techniques: Regression analysis and visualization, Classification techniques and visualization, Clustering and visualization, Association rules analysis and visualization

UNIT – IV:
Time-series Analysis and Forecasting – Time-series components, Variation in Time Series, Cyclic Variation, Seasonal Variation, Irregular Variation.

UNIT – V:
Smoothing Techniques: A problem involving all four components of time series, Introduction to forecasting, forecasting models, Trend and Seasonal effects, Trend Analysis

UNIT – VI:

Case-studies and Projects: Understanding business scenarios, Feature engineering and visualization, Sensitivity Analysis.

TEXT BOOKS:

1. Data Mining and Analysis, Mohammed J. Zaki, Wagner Meira, Cambridge, 2012
2. Data Mining: Theories, Algorithms, and Examples, Nong Ye, CRC Press Taylor & Francis Group, 2014
3. Statistics for Management, David S. Rubin, Sanjay Rastogi, Masood Husain Siddiqui Richard I. Levin, 7th Edition, Pearson Learning

REFERENCES:

1. Probability & Statistics for Engineers & Scientists, Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, 9th Edition, Prentice Hall Inc.
2. The Elements of Statistical Learning, Data Mining, Inference and Prediction, Trevor Hastie, Robert Tibshirani, Jerome Friedman, 2nd Edition, Springer, 2014
3. An Introduction to Statistical Learning Mining Massive Data Sets, A. Rajaraman and J. Ullman, Cambridge University Press, 2012
4. Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers, Springer

AUTONOMOUS VEHICLES

AUTONOMOUS VEHICLES

The invention of the wheel marked a large step in the evolution of mankind. With mobility, man experienced a newfound freedom that opened the doors for several other inventions. Automobile engineering or automotive engineering is one of the most challenging careers in the field of engineering with a wide scope. This branch deals with the designing, developing, manufacturing, testing and servicing automobiles such as cars, trucks, motorcycles, scooters, etc. and the related engineering sub systems. For the perfect blend of designing and manufacturing automobiles, automobile engineering uses the features of different elements of engineering such as mechanical, electrical, electronic, instrumentation, civil, software and safety engineering. Exploring the topic from an interdisciplinary perspective is indispensable. Globalization and incredible growth of automobile industry have resulted in numerous opportunities for engineers both in India and abroad.

The 17^{th} and 18^{th} centuries were mostly about steam-powered vehicles transporting people and goods. While electric cars enjoyed popularity in the 19^{th} and early 20^{th} centuries, the later period saw the accelerated adoption of the petrol car, due to its advantages of power, mass production, cost and advances in the internal combustion engine. It is only in the 21^{st} century that interest in electric cars has come back, given the need for cleaner, greener modes of transport. The modern period is associated with several path breaking technologies. Over the last couple of decades, there has been an explosion of electronics in vehicles. Connected cars that include technology features are ever more popular. These smart cars come with internet access, GPS, wi-fi, superior infotainment, advanced telematics and navigation capabilities. More innovations in in-vehicle infotainment and electronics promise to give car users even more enhanced capabilities in the near future.

Today, safety has become a larger concern than ever before. While entertainment and infotainment have made car driving a pleasure, this has also given rise to a growing tribe of distracted drivers. Add to this, underdeveloped roads, which take a toll on drivers today. Increased distractions and fatigue can also contribute to human fatalities. The future certainly points in the direction of driverless cars, which promise to alleviate concerns of traffic congestion and road safety. Driverless cars, also known as autonomous cars, will usher in a paradigm shift in the evolution of the modern automobile. Self-driving cars can sense the environment and traffic with the help of RADAR, LIDAR, GPS and computer vision and navigate without human intervention. Autonomous cars are claimed to have greater accuracy, reliability and faster reaction time compared to human drivers. This would lead to fewer traffic collisions and less road congestion.

Autonomous driving is a popular subject of today's discussion and automakers are developing complex systems that allow cars to drive themselves. If technology continues on its current course, car will do the concentrating for you. Self-parking, automatic emergency braking, adaptive cruise control and lane keeping are just some of the technologies that have leapt into the market in the past few years. Put them all together, get a picture of driving to assisted driving to fully autonomous cars. The open elective track "Autonomous Vehicles" offered by the department of automobile engineering trains the students to meet the technological challenges and diverse needs of the industry and society in various areas of automobile engineering and equips them to excel in a truly competitive industry. With through knowledge in this filed, engineering graduates get opportunity to serve many top-notch automobile companies and IT companies as well.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1AE01) PRINCIPLES OF AUTOMOBILE ENGINEERING

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the layout of an automobile and functionalities subsystems
- To provide overview on concepts of engine, cooling, lubrication and fuel systems
- To present constructional features and working of automotive driveline and running systems
- To study the fundamentals and principles of automotive electrical systems

COURSE OUTCOMES After completion of the course, the student should be able to
CO-1: Explain the functionalities of automotive systems and subsystems
CO-2: Give an overview on engine and engine subsystems.
CO-3: Describe working of automotive driveline and running systems
CO-4: Discuss the concepts of automotive starting, ignition and charging systems

UNIT – I:
Introduction: Classification of automobiles, layout of an automobile, automobile sub systems and their role. Types of chassis, role and requirement of a chassis frame, types of frames, materials, loading points and types of bodies.

UNIT – II:
Engine: Classification and components of an engine, principle and working of four stoke and two stroke SI and CI engines, petrol fuel system - carburetor, diesel fuel system - diesel fuel pump, injectors, introduction to electronic fuel injection system – MPFI and CRDI.

UNIT – III:
Cooling and Lubrication: Necessity of cooling, air-cooling, water cooling - thermosyphon and pump cooling, radiator, pump, thermostat, antifreeze solution and radiator fan. Mist, splash and forced lubrication, oil filters and oil pumps.

UNIT – IV:
Drive Line: Clutches, principle, single plate clutch, multi plate clutch and centrifugal clutch. Gear box - Need, sliding mesh, constant mesh and synchromesh gear box. Propeller shaft, universal joint, differential, wheels and tyres.

UNIT – V:
Running Systems: Suspension systems – Objective, rigid axle and independent suspension system and torsion bar. Steering system – Layout, steering mechanism, steering geometry and steering gear boxes. Brake system –Principle, stopping distance, types of brakes and actuation.

UNIT – VI:
Electrical Systems: Starting system - Principle, working of different starter drive units and solenoid switches. Ignition system **-** Conventional ignition system types, ignition

advance and retarding mechanisms. Charging system – Alternator principle, construction and working, cut-outs and regulators.

TEXT BOOKS:

1. Advanced Vehicle Technology, Heinz Heisler, Butterworth Heinemann Publishers, 2002
2. Automobile Electrical Equipment, Crouse W. H., 3rd Edition, McGraw Hill Book Co., Inc., New York,1986

REFERENCES:

1. Motor Vehicle, Garrett T. K., Newton K. and Steeds W. ButterWorths & Co. Publishers Ltd., New Delhi, 2001
2. Automotive Electrical Equipment, Kohli P. L., Tata McGraw Hill Co., Ltd., New Delhi, 1975
3. Automotive Chassis and Body, Crouse W. H., McGraw Hill Book Co., 5th Edition, 1976
4. Automotive Mechanics, Giri N. K., Khanna Publications, 2006

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1AE02) MODERN AUTOMOTIVE TECHNOLOGIES

COURSE PRE-REQUISITES: Principles of Automobile Engineering

COURSE OBJECTIVES:
- To provide an overview on advanced engine control system concepts
- To know the interdisciplinary concepts and intelligent automotive systems
- To understand the interdisciplinary concepts and GPS-enabled applications in automobile
- To present intelligent vehicle technologies like comfort, safety and security systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply advanced engine control system concepts in engineering
CO-2: Discuss the need for implementation intelligent vehicle technologies
CO-3: Address the key technologies in automotive navigation
CO-4: Appreciate the technological advancements driver assistance systems

UNIT – I:
Advanced Engine Controls: Concept of an electronic engine control system, engine control module, powertrain control module, electronic fuel injection - throttle body fuel injection, multi-point fuel injection, gasoline direct injection, common rail direct injection, electronic ignition control, engine mapping, on-board diagnostics.

UNIT – II:
Introduction to Intelligent Vehicles: Driver information, driver perception, driver convenience, driver monitoring, general vehicle control, longitudinal and lateral control, collision avoidance, vehicle monitoring.

UNIT – III:
Telematics: Global positioning system, geographical information systems, navigation system, architecture, automotive vision system, road recognition.

UNIT – IV:
Comfort Systems: Adaptive cruise control system, active suspension system, power steering, collapsible and tiltable steering column, power windows.

UNIT – V:
Safety Systems: Active and passive safety, airbags, seat belt tightening system, forward collision warning systems, child lock, anti-lock braking systems, traction control system, lane departure warning system.

UNIT – VI:
Security Systems: Anti-theft technologies – mechanical, electromechanical and electronic immobilizers, alarm system, stolen vehicle tracking system, remote keyless entry, smart card system, number plate coding.

TEXT BOOKS:

1. Understanding Automotive Electronics, William B. Ribbens, 5th Edition, Butterworth Heinemann Woburn,1998
2. Intelligent Vehicle Technologies: Theory and Applications, Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann Publications, Oxford, 2001

REFERENCES:

1. Automotive Handbook, Robert Bosch, SAE, 5th Edition, 2000
2. Navigation and Intelligent Transportation Systems – Progress in Technology, Ronald K. Jurgen, Automotive Electronics Series, SAE, USA, 1998
3. Understanding Automotive Electronics, Bechhold, SAE, 1998

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

(19OE1AE03) ELECTRIC, HYBRID AND FUEL CELL VEHICLES

COURSE PRE-REQUISITES: Principles of Automobile Engineering, Modern Automotive Technologies

COURSE OBJECTIVES:
- To study the concepts and drivetrain configurations of electric and hybrid vehicles
- To understand about electric propulsion system
- To provide various energy storage devices
- To present principle, working and automotive applications of fuel cell and solar technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the concepts and drivetrain configurations of electric and hybrid vehicles
CO-2: Discuss various electric motors and controls
CO-3: Present various energy storage devices
CO-4: Describe automotive applications of fuel cell and solar technology

UNIT – I:
Electric Vehicles: Layout of an electric vehicle, system components, traction motor characteristics, transmission, electronic control system, advantage and limitations, performance and energy consumption of electric vehicles.

UNIT – II:
Hybrid Vehicles: Concepts of hybrid electric drivetrain based on hybridization and powertrain configuration, architecture of series, parallel and series-parallel hybrid electric drivetrains, modes of operation, merits and demerits, plug-in hybrid architecture, speed and torque coupling of hybrid electric drivetrains.

UNIT – III:
Electric Motors: Review of technology suited to automotive propulsion, requirements, DC motors, Induction motors, permanent magnet brushless DC motors and switched reluctance motors.

UNIT – IV:
Motor Drives: Speed and torque control, DC motor - Chopper based four quadrant operations, induction motor, permanent magnet motor and switched reluctance motor.

UNIT – V:
Energy Storages: Electromechanical batteries - Types, parameters, lead acid batteries, nickel-based batteries, lithium-based batteries, battery management system and ultracapacitors.

UNIT – VI:

Fuel Cell and Solar Vehicles: Fuel cell vehicle – Operating principle, types of fuel cells, fuel cell options for fuel cell vehicle and fuel cell hybrid vehicle. Solar vehicle - Solar photovoltaic cell, solar array, solar car electrical system and drive train.

TEXT BOOKS:

1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, CRC Press, 2004
2. Electric Vehicle Technology-Explained, James Larminie and John Loury, John Wiley & Sons Ltd., 2003

REFERENCES:

1. Electric and Hybrid Vehicles – Design Fundamentals, Iqbal Husain, CRC Press, 2010
2. Electric Vehicle Battery Systems, Sandeep Dhameja, Butterworth–Heinemann, 2002
3. Electric and Hybrid – Electric Vehicles, Ronald K. Jurgen, SAE, 2002
4. Light Weight Electric/Hybrid Vehicle Design, Ron Hodkinson and John Fenton, Butterworth–Heinemann

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

(19OE1AE04) CONNECTED AND AUTONOMOUS VEHICLES

COURSE PRE-REQUISITES: Principles of Automobile Engineering, Modern Automotive Technologies, Electric, Hybrid and Fuel Cell Vehicles

COURSE OBJECTIVES:
- To understand the fundamentals of vehicle communication and networking
- To provide state-of-the-art in wireless communication technology within and between vehicles
- To know various levels of vehicle autonomy and intelligent automotive systems
- To provide an overview on driver-assist and self-driving processes

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Present the fundamentals of vehicle communication and networking

CO-2: Appreciate intra-vehicle and inter-vehicle communication technologies
CO-3: Describe various levels of vehicle autonomy
CO-4: Discuss the driver-assist and self-driving processes

UNIT – I:
Introduction to Vehicle Communications: Intra-vehicle communications - communications protocols, systems and sensors (Braking, steering, power train, chassis systems, body electronics, instrument clusters, infotainment systems), inter-vehicle communications - cooperative driving (accident warning, frontal/rear collision prevention, lane change, assistance). Consumer assistance – traffic information, multimedia support and smart parking

UNIT – II:
Communication Fundamentals and Controller Area Network: Communication fundamentals – Frequency, bandwidth, power measurement, signal to noise ratio, transmission rate constraints, radio frequency spectrum allocation, RADAR operation and types of RADAR. CAN evolution, versions, types of controllers, layered architecture. CAN bus, message frames and error handling.

UNIT – III:
Intra-Vehicle Communications: Wired communication – Network comparison, two tier approach, LIN applications - Localized vehicle area support, general support areas, CAN applications - In vehicle operation, infotainment, wireless communication – Bluetooth vehicle applications, satellite services – satellite radio, vehicle care and traffic status.

UNIT – IV:
Inter-Vehicle Communication: Adhoc Communications –Applications in Vehicle traffic Monitoring, Collision and congestion avoidance, Highway lane reservation, Emission Control, Vehicle Frequency Utilization – AM Radio, Bluetooth, FM Radio, GPS, Short range RADAR, Wireless LAN, Intelligent Roadway-Infrastructure to vehicle and

vehicle to vehicle communications. Evolving smart vehicle – ECU, wireless networking, forward RADAR, side RADAR, GPS, cellular transmission and event Recorder.

UNIT – V:

Autonomous Vehicles: Importance, levels of automation, policy making, social costs, safety and crashes, congestion, land use, energy and emissions, costs and disadvantages

UNIT – VI:

Current State of Autonomous Vehicles: Research, challenges, commercial development, sensor systems, sensor suits, environmental challenges, graceful degradation, V2V and V2I communication, sharing the drive, integrity, security, verification and policy implications.

TEXT BOOKS:

1. Inter and Intra Vehicle Communications, Gilbert Held Auerbach Publications, 2008
2. Autonomous Vehicle Technology-A Guide for Policymakers, James M. Anderson, Nidhi Kalra, Karlyn D. Stanley, Paul Sorensen, Constantine Samaras, Oluwatobi A. Oluwatola, RAND Corporation, Santa Monica, Calif., 2016
3. Autonomous Driving - Technical, Legal and Social Aspects, Markus Maurer, J. Christian Gerdes, Barbara Lenz, Hermann Winner, Editors, Springer, 2016

REFERENCES:

1. Intelligent Vehicle Technologies: Theory and Applications, Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann Publications, Oxford, 2001
2. Navigation and Intelligent Transportation Systems – Progress in Technology, Ronald K. Jurgen, Automotive Electronics Series, SAE, USA, 1998
3. Automotive In–vehicle Networks, J. Gabrielleen, Wiley-Blackwell, 2008
4. In-Vehicle Network Architecture for the Next-Generation Vehicles, Syed Masud Mahmud, IGI
5. Communication Technologies for Vehicles, Mohamed Kassab Springer, 2015

GENERAL - COMPUTING

1. PROGRAMMING THROUGH JAVA

Java is an extensively **used** programming language specifically intended for use in the distributed environment of the internet. **Java** help students to create wide-ranging applications that possibly will run on a single workstation or be distributed among servers and clients in a network.

Java is an extremely fruitful language and an upper option for many developers for many years. The motive that it has remained so prevalent is since it still happens the needs of functioning across networks.

Students will have different roles and responsibilities by learning Java Programming

- Designing, implementing, and maintaining Java applications that are often high-volume and low-latency, required for mission-critical systems.
- Delivering high availability and performance.
- Contributing in all phases of the development lifecycle.
- Writing well-designed, efficient, and testable code.

2. RELATIONAL DATABASE MANAGEMENT SYSTEMS

A relational database permits you to effortlessly find precise information. It also consents you to sort based on any field and produce reports that comprise only definite fields from each record. With features like, Data Accuracy, Easy Access to Data, Data Integrity, Flexibility, Normalization, High Security, Feasible for Future Modifications

By learning RDBMS Students will have different roles in Database environment

- Data Administrator,
- Database Administrator
- Database Designer
- Application Programmer

3. COMPUTATIONAL THINKING USING PYTHON

The **python** language is one of the utmost accessible programming languages available because it has streamlined syntax and not complex, which gives more importance on natural language. Due to its comfort of learning and practice, **python** codes can be readily written and executed much quicker than former programming languages.

Data Science: The libraries and frameworks Python offers, e.g. PyBrain, PyMySQL, and NumPy are one of the big reasons. Another reason is diversity. Python experience allows you to do a lot more than any other language, e.g. you can create scripts to automate stuff, go into web development, and so much more.

Students will have various Job Profiles by learning Python

- Software Engineer.
- Python Developer.
- Research Analyst.
- Data Analyst.
- Data Scientist.
- Software Developer.

4. INTRODUCTION TO DATA ANALYTICS

Data Scientists and Analysts **use data analytics** techniques in their research, and businesses also **use** it to inform their conclusions. **Data analysis** can assistance corporations healthier comprehend their customers, assess their ad-campaigns, personalize gratified, create content approaches and progress products.

By learning Data Analytics students will get Jobs with different designations

- IT Systems Analyst. Systems analysts use and design systems to solve problems in information technology. ...
- Healthcare Data Analyst. ...
- Operations Analyst. ...
- Data Scientist. ...
- Data Engineer. ...
- Quantitative Analyst. ...
- Data Analytics Consultant. ...
- Digital Marketing Manager.

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

(19OE1IT06) PROGRAMMING THROUGH JAVA

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To introduce object-oriented programming concepts using the Java language
- To introduce the principles of inheritance and polymorphism; and demonstrates how they relate to the design of abstract classes
- To introduce the implementation of packages and interfaces
- To introduce exception handling, event handling and multithreading

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Develop applications for range of problems using object-oriented programming techniques
CO-2: Design simple graphical user interface applications
CO-3: Explore the design of graphical user interface using applets and swings

UNIT – I:
Object Oriented Thinking and Java Basics: Need for OOP Paradigm, Summary of OOP Concepts, Coping with Complexity, Abstraction Mechanisms, A Way of Viewing World – Agents, Responsibility, Messages, Methods, History of Java, Java Buzzwords, Data Types, Variables, Scope and Life Time of Variables, Arrays, Operators, Expressions, Control Statements, Type Conversion and Casting, Simple Java Program, Concepts of Classes, Objects, Constructors, Methods, Access Control, This Keyword, Garbage Collection, Overloading Methods and Constructors, Method Binding, Inheritance, Overriding and Exceptions, Parameter Passing, Recursion, Nested and Inner Classes, Exploring String Class.

UNIT – II:
Inheritance, Packages and Interfaces: Hierarchical Abstractions, Base Class Object, Subclass, Subtype, Substitutability, Forms of Inheritance- Specialization, Specification, Construction, Extension, Limitation, Combination, Benefits of Inheritance, Costs of Inheritance. Member Access Rules, Super Uses, Using Final with Inheritance, Polymorphism- Method Overriding, Abstract Classes, The Object Class.
Defining, Creating and Accessing a Package, Understanding Classpath, Importing Packages, Differences between Classes and Interfaces, Defining an Interface, Implementing Interface, Applying Interfaces, Variables in Interface and Extending Interfaces, Exploring Java.IO.

UNIT – III:
Exception Handling and Multi-threading: Concepts of Exception Handling, Benefits of Exception Handling, Termination or Resumptive Models, Exception Hierarchy, Usage of Try, Catch, Throw, Throws and Finally, Built in Exceptions, Creating Own Exception Sub Classes.
String Handling, Exploring Java. Util, Differences between Multi-Threading and Multitasking, Thread Life Cycle, Creating Threads, Thread Priorities, Synchronizing

Threads, Interthread Communication, Thread Groups, Daemon Threads. Enumerations, Autoboxing, Annotations, Generics.

UNIT – IV:

Event Handling: Events, Event Sources, Event Classes, Event Listeners, Delegation Event Model, Handling Mouse and Keyboard Events, Adapter Classes.

The AWT Class Hierarchy, User Interface Components- Labels, Button, Canvas, Scrollbars, Text Components, Check Box, Check Box Groups, Choices, Lists Panels – Scrollpane, Dialogs, Menubar, Graphics, Layout Manager – Layout Manager Types – Border, Grid, Flow, Card and Grid Bag.

UNIT – V:

Applets: Concepts f Applets, Differences between Applets and Applications, Life Cycle of an Applet, Types of Applets, Creating Applets, Passing Parameters to Applets.

UNIT – VI:

Swing: Introduction, Limitations of AWT, MVC Architecture, Components, Containers, Exploring Swing- Japplet, Jframe and Jcomponent, Icons and Labels, Text Fields, Buttons – The Jbutton Class, Check Boxes, Radio Buttons, Combo Boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

TEXT BOOKS:

1. Java The Complete Reference, Herbert Schildt, 7th Edition, TMH
2. Understanding OOP with Java Updated Edition, T. Budd, Pearson Education
3. An Introduction to Programming and OO Design using Java, J. Nino and F.A. Hosch, John Wiley & Sons

REFERENCES:

1. Introduction to Java Programming, Y. Daniel Liang, Pearson Education
2. An Introduction to Java Programming and Object-Oriented Application Development, R. A. Johnson, Thomson
3. Core Java 2, Vol. 1 - Fundamentals, Cay. S. Horstmann and Gary Cornell, 8th Edition, Pearson Education
4. Core Java 2, Vol. 2 - Advanced Features, Cay. S. Horstmann and Gary Cornell, 8th Edition, Pearson Education

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

(19OE1CS08) RELATIONAL DATABASE MANAGEMENT SYSTEMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the basic elements of a relational database management system
CO-2: Ability to identify the data models for relevant problems
CO-3: Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data
CO-4: Apply normalization for the development of application software

UNIT – I:
Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.
Introduction to Database design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.
Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data
Logical Database Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT – II:
Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.
SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

UNIT – III:
Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

UNIT – IV:
Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

UNIT – V:
Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.
Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

UNIT – VI:
Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.
Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.
Hash-Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw Hill Education (India) Private Limited
2. Database System Concepts, A. Silberschatz, Henry F. Korth, S. Sudarshan, 6th Edition, McGraw Hill Education (India) Private Limited
3. Database Systems, R. Elmasri, Shamkant B. Navathe, 6th Edition, Pearson Education

REFERENCES:

1. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning
2. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Introduction to Database Systems, C. J. Date, Pearson Education

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

(19OE1IT03) COMPUTATIONAL THINKING USING PYTHON

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand why Python is a useful scripting language for developers
- To create and execute Python programs and to Learn how to use lists, tuples, and dictionaries in Python programs
- To learn how to build and package Python modules for reusability
- To learn how to design object-oriented programs with Python classes
- To learn how to use exception handling in Python applications for error handling

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms)
CO-2: Adequately use standard programming constructs: repetition, selection, functions, composition, modules, aggregated data (arrays, lists, etc.)
CO-3: Explain what a given program (in Python) does identify and repair coding errors in a program
CO-4: Understand and use object-based software concepts (constructing OO software will be dealt with in the course Software Engineering)
CO-5: Use library software for (e.g.) building a graphical user interface, web application, or mathematical software

UNIT – I:
Introduction: History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator, Conditional Statements-If
If- else Nested if-else Looping for While Nested loops Control Statements Break
Continue Pass String Manipulation Accessing Strings Basic Operations String slices Function.

UNIT – II:
Methods, Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods, Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods
Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties.

UNIT – III:
Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.
Modules: Creation, Importing module, Math module, Random module, Packages.

UNIT – IV:

Composition: Input-Output-Printing on screen, Reading data from keyboard, Opening and closing file Reading and writing files, Functions.

Exception Handling: Exception, Exception Handling, Except clause, Try? Finally clause, User Defined Exceptions

UNIT – V:

OOPs Concept: Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding, Regular expressions- Match function, Search function, Matching VS Searching, Modifiers, Patterns.

Multithreading: Thread, Starting a thread, Threading module, Synchronizing threads.

CGI: Introduction, Architecture, CGI environment variable, GET and POST methods, Cookies, File upload.

UNIT – VI:

Database: Introduction, Connections, Executing queries, Transactions Handling error,

Networking: Socket, Socket Module, Methods, Client and server, Internet modules, Sending email.

TEXT BOOKS:

1. Learning Python, David Ascher and Mark Lutz, 2nd Edition, O'Relly, 2003

REFERENCES:

1. Python Programming: An Introduction to Computer Science, John M. Zelle, 2nd Edition, Kindle Edition
2. Python Essential Reference, David M. Beazley, 4th Edition, Developer's Library

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

(19OE1IT07) INTRODUCTION TO DATA ANALYTICS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To be exposed to conceptual framework of big data
- To understand different techniques of data analysis
- To be familiar with concepts of data streams
- To be exposed to item sets, clustering, frame works and Visualization

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand big data fundamentals
CO-2: Learn various data analysis techniques
CO-3: Implement various data streams
CO-4: Understand item sets, clustering, frame works & Visualizations

UNIT – I:
Introduction to Big Data: Introduction to Big Data Platform – Challenges of Conventional systems – Web data – Evolution of Analytic scalability, analytic process and tools, Analysis vs Reporting – Modern data analytic tools,
Statistical Concepts: Sampling distributions, resampling, statistical inference, prediction error.

UNIT – II:
Data Analysis: Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and Kernel methods
Analysis of Time Series: Linear systems analysis, nonlinear dynamics – Rule induction –
Neural Networks: Learning and and Generalisation, competitive learning, Principal component analysis and neural networks
Fuzzy Logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.

UNIT – III:
Mining Data Streams: Introduction to Streams Concepts – Stream data model and architecture – Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a Window – Decaying window – Real time Analytics Platform (RTAP) applications – case studies – real time sentiment analysis, stock market predictions.

UNIT – IV:
Frequent Itemsets and Clustering: Mining Frequent itemsets – Market based Modeling – Apriori Algorithm – Handling large data sets in Main Memory – Limited Pass Algorithm – Counting frequent itemsets in a Stream – Clustering Techniques – Hierarchical – K-Means.

UNIT – V:

Clustering high dimensional data – CLIQUE and ProCLUS – Frequent pattern-based clustering methods – Clustering in non-Euclidean space – Clustering for streams and Parallelism.

UNIT – VI:

Frameworks and Visualization: MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – S3 – Hadoop Distributed file systems – Visualizations – Visual data analysis techniques,

Interaction Techniques: Systems and Applications

TEXT BOOKS:

1. Intelligent Data Analysis, Michael Berthold, David J. Hand, Springer, 2007
2. Mining of Massive Datasets, Anand Rajaraman and Jeffrey David Ullman, Cambridge University Press, 2012

REFERENCES:

1. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks, John Wiley & Sons, 2012
2. Big Data Glossary, Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, Pete Warden, O'Reilly, 2011
3. Data Mining Concepts and Techniques, Jiawei Han, Micheline Kamber, 2nd Edition, Elsevier, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1CS11) FUNDAMENTALS OF COMPUTER ALGORITHMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To reinforce algorithms analysis methods
- To ability to analyse running time of an algorithm
- To understand different algorithm design strategies
- To familiarity with an assortment of important algorithms

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply algorithm design techniques and concepts to solve given engineering problem
CO-2: Analyze running times of algorithms using asymptotic analysis
CO-3: Develop efficient algorithms for computational tasks
CO-4: Computing complexity measures of algorithms

UNIT – I:
Introduction: Characteristics of algorithm. Analysis of algorithms: Asymptotic analysis of complexity bounds – best, average and worst-case behaviour; Performance measurements of Algorithm, Time and space trade-offs.

UNIT – II:
Divide and Conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication. Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

UNIT – III:
Greedy Method: General method, applications-Job sequencing with deadlines, 0/1 knapsack problem, Minimum cost spanning trees, Single source shortest path problem, Huffman Codes.

UNIT – IV:
Dynamic Programming-I: General method, Principle of optimality, applications-Multistage graphs, Matrix chain multiplication, Optimal binary search trees.

UNIT – V:
Dynamic Programming-II: 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem, Reliability design.

UNIT – VI:
Backtracking: General method, applications- N-Queen problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles.

TEXT BOOKS:
1. Fundamentals of Computer Algorithms, E. Horowitz et al, Galgotia Publications

2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Lieserson, Ronald L. Rivest and Clifford Stein, 4th Edition, MIT Press/McGraw-Hill

REFERENCES:

1. Algorithm Design, Jon Kleinberg and Eva Tardos, 1st Edition, Pearson
2. Algorithm Design: Foundations, Analysis and Internet Examples, Michael T. Goodrich and Roberto Tamassia, 2nd Edition, Wiley
3. Algorithms – A Creative Approach, Udi Manber, 3rd Edition, Addison-Wesley, Reading, MA
4. Introduction to the Design and Analysis of Algorithms, Anany Levitin, 3rd Edition, Pearson Publications

GENERAL

PROFESSIONAL ETHICS AND HUMAN VALUES

Ethics is a necessary and listed Graduate Attribute for all engineers according to the Washington Accord. As engineers deal with the society and provide for the society, it is important that the ethical concerns pertaining to technology are well-understood and addressed. Human Values form the basis for all Ethics and ethical theories help resolve professional dilemmas too. This course aims to create an appreciation for normative and applied ethics with special focus on professionalism and technology education and practice. Given the diverse set of roles an engineer or computer scientist may play in the society, there is an inherent societal need for engineers, technologists, and computer scientists to be ethical. The formative years of students of engineering are the best time to impress upon them the practical importance and application aspects of ethics. The curriculum is designed to include an inherent appreciation for the Indian Ethos and cover a wide variety of topics with suitable case studies and examples all through, so as to enable the learners to find practical contexts in global and contemporary careers of their future. The course also leads to attaining two other Graduate Attributes majorly, along with Ethics, *viz.* Engineer and Society, and Lifelong Learning.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1HS01) PROFESSIONAL ETHICS AND HUMAN VALUES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To emphasize on the importance of ethics for engineers and computer scientists
- To provide a toolkit for ethical behaviour in personal and professional settings
- To relate the profession of engineering to sociocultural as well as ethical and moral contexts in India and globally
- To develop more socially conscious engineers who create and conceive a better society and a better world without sacrificing or ignoring public good

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Distinguish morals, values, and ethics in Indian and global contexts
CO-2: Resolve moral and ethical dilemmas through ethical inquiries and appropriate ethical theories
CO-3: Realize the professional role of engineers in society and the support available in creating safe solutions for the society focusing on public welfare
CO-4: Conduct themselves ethically in various roles that present themselves in professional and business environments

UNIT – I:
Motivation and Introduction to Human Values: Motivation to study ethics in engineering with justifying case studies, historical events, and current affairs; Morals, Values, and Ethics – Definitions; Moral Judgement vs. Value Judgement; Moral Character and Moral Autonomy – Conscientiousness, Integrity, Empathy as basic building blocks; The Golden Rule; Maslow's Theory of Needs; Universal Human Values and Theories; Conventional and Constitutional Values in Indian Ethos; Anomie vs. Civic Virtue as a foundation for an ideal society; Ethics as a basis of legal framework; Privacy and Confidentiality – Increasing emphasis in personal and professional lives, technological considerations and examples; Profession, Professionalism – Definitions, Engineering as a Profession

UNIT – II:
Ethics, Ethical Theories, and Professionalism: Ethics through Spirituality, Religion, and beyond; Indian Philosophy and Ethos, ancient to modern – Family System, Ethical Pluralism, Unity in Diversity; Ethics as application of values and as moral philosophy – Kohlberg's theory vs. Gilligan's theory of moral development leading to ethics, examples; Moral and Ethical Dilemmas – Definition, Causes, Case Studies and Examples; Resolution of Ethical Dilemmas through Ethical Inquiries – Normative, Conceptual, and Factual Inquiries, Classification of Ethics by Character and Conduct – Consequentialism/ Utilitarianism, Deontological Ethics, Virtue Ethics and Theories, Rights Theories; Ethical Frameworks and examples; Practical application of ethical theories for decision-making in personal life

UNIT – III:

Professionalism, Engineering in the Societal Context: Professionalism – Professional Traits, Rights, Responsibilities, Roles, Virtues; Business Ethics; Engineering as Social Experimentation – Context with examples, Comparison with standard experiments, Application of Ethical Inquiries to gain knowledge and to gather relevant information, Responsibility of Experimenters, Accountability and Answerability, Consensus and Need for Informed Consent – how to address exceptions; Responsible Innovation – Social Context of Innovation, Responsible Research and Innovation, Data Privacy and Protection of Individual Rights, being Ethical by Design; Trust in the context of professionalism – confidentiality, non-disclosure agreements (NDA); Intellectual Property (IP) – IP Rights (IPR) as Professional Rights, Law, Moral Rights and Economic Rights, Patenting; Diverse roles of Engineers as Professionals – Manager, Leader, Consultant, and Expert Witness

UNIT – IV:

Professional Ethics, Ethics at Workplace and Roles of Engineers: Overview of Organizational Behaviour; Collegiality, Loyalty, Trust in professional context; Respect for Authority vs. Moral Autonomy, Moral Responsibility; Organizational context of Ethics – Minor, interpersonal, severe, organizational workplace deviances; Occupational Crime, Culpable mistakes, Collateral damage; Gifts and bribes; Industrial Ethics for non-professionals; Code of ethics and Code of Conduct – Role of professional societies in guiding, promoting, and protecting professionals and professions, Examples of common professional societies in Engineering and Science; Decision-making in professional context – Choosing the right guidance, choosing the right ethical theory; Conflicts in profession and at workplace - Employee Relations and Discrimination, Conflict of Interest, Conflict Management and Resolution, Framework for Conflict Resolution; Multinational Companies and Corporates – Work Culture and Respect for Diversity and Pluralism; Employee Rights vs. Professional Rights; Whistleblowing – Social, Organizational, and Legal context with examples

UNIT – V:

Public Welfare, Safety & Risk: Impact of engineering activities and technology on Public Welfare; Ethical Concerns of Public welfare in the context of Emerging Technologies – Artificial Intelligence, Machine Learning, Internet of Things, Cybersecurity and Cybercrime; Issues of Public Concern – Informed Consent, Health and environmental aspects, data security; Safety and Risk – Definitions; Risk Assessment – Known and Unintended consequences, Risk-Benefit Analysis, Reducing Risk, Optimum Level of Safety, Capability Curves, Safe Exit; Learning from the Past – Case Studies in Ethics Context: Titanic, Bhopal, Chernobyl; Environmental Ethics and Sustainable Development Goals; Computer Ethics and various Technology Ethics; Ethics in the context of War and Weapon Development; Ethics and Economics – Fair Trade, Capitalism vs. Communism, Developed vs. Developing vs. Underdeveloped economies

UNIT – VI:

Ethics for Lifelong Learning: Ethics in the context of Globalization; Moral Character and Ethical Leadership – Case Studies and Examples of success and failure; Overview and comparison of different schools of thought, comparison of the works of pioneering philosophers and social scientists – Immanuel Kant, John Rawls, Martin Heidegger, Swami Vivekananda, Jiddu Krishnamurti, Dr. Abdul Kalam, *etc.*; Impact of Ethical and Unethical Behaviour in personal and professional lives, developing and maintaining ethical behaviour, threats to moral autonomy and how to continue to be ethical in personal and professional lives

TEXT BOOKS:

1. Ethics in Engineering, Mike W. Martin, Roland Schinzinger, McGraw Hill Education, 2017 (ISBN: 978-9339204457)
2. Business Ethics: An Indian Perspective, A. C. Fernando, K. P. Muralidheeran, E. K. Satheesh, Pearson Education, 2019 (ISBN: 978-9353437442)
3. Professional Ethics, R. Subramanian, Oxford University Press, 2017 (ISBN: 978-0199475070)

REFERENCES:

1. Engineering Ethics: Concepts & Cases, Charles E. Harris, Jr., Michael S. Pritchard, Michael J. Rabins, Cengage Learning, 2012 (ISBN: 978-8131517291)
2. Classical Indian Ethical Thought: A Philosophical Study of Hindu, Jaina and Bauddha Morals, Kedar Nath Tiwari, Motilal Banarsidass Publishers, 2017 (ISBN: 978-8120816084)
3. The Manual for Indian Start-Ups, Dalai Lama, Ethics for the Whole World 978-9351360803 Vijay Kumar Ivaturi et al., Penguin Random House India, 2017 (ISBN: 978-0143428527)
4. To Be Human, Jiddu Krishnamurti, Shambhala, 2000 (ISBN: 978-1570625961)
5. On Ethics and Economics, Amartya Sen, Oxford India, 1999 (ISBN: 978-0195627619)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1HS02) ENTREPRENEURSHIP

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To motivate the engineers to inculcate the skills thereof in any professional role and to consider intrapreneurship or entrepreneurship as career choices for personal and societal growth
- To impart lean management principles and practices to plan, execute, and convert one's own idea into a sustainable business model
- To gain practical knowledge to design one's own lean startup
- To identify and avoid the potential pitfalls in validation, design, production, and marketing phases of an innovative product or service

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

CO-1: Discover societal problems as entrepreneurial opportunities and ideate to develop solutions through systematic and creative approaches to innovation and business strategy

CO-2: Apply lean methodology to startup ideas using Business Model Canvas and Lean Canvas and be able to create Business Plan

CO-3: Validate ideas, design, production, and marketing systematically using techniques such as 5 Whys, Innovation Accounting, Value and Growth Propositions

CO-4: To strategize during ideation, production, market research, marketing and facing competition

UNIT – I:

Entrepreneurial Skills and Opportunities : Role of Entrepreneurs in Indian and World Economy; Entrepreneurship as a career for engineers, scientists, and technologists; Personality and Skill Set of an Entrepreneur; Need for Ethics and Empathy for Entrepreneurs; Stories of Successful and Failed Enterprises; Current Business Trends; Entrepreneurial Management vs. Corporate Management – Roles and Scope; Concepts of Intrapreneurship, Social Entrepreneurship, Technopreneurship, Studentpreneurship; Opportunities in Telangana State and India – incubators, schemes, accelerators

UNIT – II:

Introduction to Lean Startup Methodology: Overview, Principles of Lean Startup, Lean vs. Traditional Startup; Vision-to-Steering, Start-Define-Learn-Experiment, Leap-Test-Measure-Pivot, Build-Measure-Learn

UNIT – III:

Business Model Concepts: Components of Business Plan; Business Model Canvas (BMC); Lean Canvas (LC); Pitch Deck; Elevator Pitch; Financial Aspects – Financing, Funding Stages, Inflows, Outflows; Market Research and Marketing

UNIT – IV:

Building Your Business Model: Desirability, Feasibility, and Viability; Minimum Viable Product (MVP), Proof of Concept (PoC), Prototype; Early Adopters; Value Proposition; Overview of opportunities in India – Financing and Support Schemes, Online and Offline Resources, Entrepreneurial Networks

UNIT – V:

Evaluating Your Business Model: Three Learning Milestones of Innovation; Root Cause Analysis (RCA) through 5 Whys; Pivot or Persevere; The Engines of Growth: Sticky, Viral, and Paid; Kan-ban Diagram for Project Planning and Resource Allocation

UNIT – VI:

Strengthen Your Business Model: Why startups fail? Value and Waste; Design Thinking for Business; Analogs and Antilogs; Paralysis by Analysis and Extinct by Instinct; The three A's: Actionable, Accessible, and Auditable Metrics and Vanity Metrics

TEXT BOOKS:

1. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Eric Ries, Penguin Portfolio, 2015 (ISBN: 978-0670921607)
2. Entrepreneurship, Robert D. Hisrich, Michael P. Peters and Dean A. Shepherd, Tata McGraw Hill, 11th Ed., 2020 (ISBN: 978-9390113316)
3. Entrepreneurship Simplified: From Idea to IPO, Ashok Soota, S R Gopalan, Penguin Random House India, 2016 (ISBN: 978-0670088959)

REFERENCES:

1. Measure What Matters: OKRs: The Simple Idea that Drives 10x Growth, John Doerr, Penguin Portfolio, 2018 (ISBN: 978-0241348482)
2. Entrepreneurship Development and Business Ethics, Abhik Kumar Mukherjee, Shaunae Roy, Oxford University Press, 2019 (ISBN: 978-0199494460)
3. The Manual for Indian Start-Ups, Vijay Kumar Ivaturi et al., Penguin Random House India, 2017 (ISBN: 978-0143428527)
4. Social Entrepreneurship in India: Quarter Idealism and a Pound of Pragmatism, Madhukar Shukla, SAGE Publications India Pvt Ltd, 2020 (ISBN: 978-9353882372)
5. Entrepreneurship: A South Asian perspective. Donald F Kuratko, T.V Rao. Cengage Learning, 2012

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

(19OE1HS03) PERSONALITY DEVELOPMENT AND PUBLIC SPEAKING

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To develop skills and techniques for Effective Communication and Public Speaking
- To develop Leadership qualities and increase Self – confidence
- To get along with people and Team-Building
- To enhance career opportunities by Goal setting
- To develop an acceptable PERSONALITY

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Communicate better and speak with confidence
CO-2: Exhibit Leadership qualities and increased Self – confidence
CO-3: Work towards Team-Building
CO-4: Use career opportunities by Goal setting
CO-5: Acquire a forceful personality to maintain a pleasant relationship between the seniors and subordinates and other stakeholders

UNIT – I:
EFECTIVE COMMUNICATION
i. Fundamentals of Effective Communication
ii. How to sell your ideas
iii. Communication within Industry (awareness of motivation, ego states, games, etc.)
iv. Guidelines on: Listening, Reading and Writing
v. Non-verbal Communication (Body Language)
vi. Barriers of Communication

UNIT – II:
PUBLIC SPEAKING (SPEECH COMMUNICATION)
i. How to develop courage and self-confidence
ii. Speech purposes, preparation patterns and outlining of speech
iii. Fundamentals and secrets of good delivery
iv. How to make your meaning clear and convince an audience / client
v. How to close effectively and get action?
vi. How to participate in conferences, group discussions and office meetings

UNIT – III:
PERSONALITY DEVELOPMENT -1
i. Leadership - qualities of a successful leader ; Leadership Styles; Leadership in Administration; Problem-solving & Decision-making
ii. Group Dynamics and Team Building
iii. Importance of groups in organization; Interactions in group, Group Decision Taking, Team Building, Interaction with the Team, Building a good team

UNIT – IV:

PERSONALITY DEVELOPMENT -2

i. Interpersonal Relations- Introduction; Transactional Analysis in communication Awareness of Ego states and their application in communication
ii. Conflict Management- Introduction & Causes of Conflict; Managing Conflict

UNIT – V:

PERSONALITY DEVELOPMENT -3

i. Positive Attitude & Ways to develop positive attitude
   Self Esteem & Confidence Building
ii. Motivation- Importance of self-motivation;
iii. Stress -Causes of Stress & Impact of Stress; Managing Stress

UNIT – VI:

PERSONALITY DEVELOPMENT -4

i. Goal Setting-Meaning; Short, medium and Long Term Goals;
   Importance of Goal setting & Steps for Goal Setting
ii. Creativity-Meaning; Barriers to Creativity & Steps to stimulate Creativity
   Understanding and Importance of Human Values; Ideals in Life; Becoming a Role Model
iii. Time Management - Time as a Resource; Techniques for better Time Management.

TEXT BOOKS:

1. Advance Speaking Skills, Jeremy Harmar & John Arnold, Essex, Longman Group Limited, 1978
2. Developing Soft Skills, Sherfield, R.M., Montgomery, R.J., Moody, P.G. 4th Edition, Pearson, 2010
3. Personality Development and Soft Skills, Barun K. Mitra, Oxford University Press, 2016

REFERENCES:

1. Body Language: A Guide for Professionals, Hedwig Lewis, Response Books (a division of Sage Publications India, Pvt. Ltd.,) New Delhi, 1998
2. Emotional Intelligence, Daniel Goldman, Bantam Books, 1995
3. Personality Development, Rajiv Mishra, Rupa & Co., 2004

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1HS04) FOREIGN LANGUAGE – FRENCH

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To communicate verbally in a simple way by asking and responding to simple questions related to everyday language needs
- To read and comprehend different kinds of texts (notices, informal letters, catalogues, menus etc.)
- To write clear, concise, and correct sentences and paragraphs on familiar topics.
- To recognize and use basic syntax and structures in French including articles, prepositions and connecting words as well as master basic vocabulary

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

CO-1: Use vocabulary contextually and effectively

CO-2: Use reading skills to comprehend different kinds of texts

CO-3: Understand everyday expressions dealing with simple and concrete everyday needs, in clear, slow and well-articulated speech and manage very short mini dialogues /conversations

CO-4: Demonstrate basic competence in Written French including grammar, sentence and paragraph structure, coherence

UNIT – I: Introduce oneself and introduce someone:

Reading: Read and understand an introduction about someone

Grammar: Question words, Subject verb agreement, Mas/fem and prepositions with cities and countries

Vocabulary: professions, nationalities, countries numbers, days of the week and verbs

Writing: Build basic sentences and Write about oneself

Life Skills: Greetings, Formal and Informal way of asking questions

UNIT – II: Express likes and dislikes and Talk about your locality:

Reading: Read and understand description of a place

Grammar: Articles, prepositions, possessive adjectives, basic connecting words such as **"like, and, but",** and Negation

Vocabulary: Adjectives, verbs of preference, different places, and basic vocabulary on leisure and sports activities.

Writing: Write about hobbies and pastimes

Life Skills: Conversation fillers

UNIT – III: Take / Fix an appointment with someone:

Reading: Understand propositions and counters

Grammar: How to say time, Interrogative adjectives

Vocabulary: Irregular verbs, days of the week, Fixed expressions with Etre and Avoir and expressions to ask for appointment or refuse/accept a proposed time
Life Skills: Telephone etiquette and colloquial expressions in French

UNIT – IV: Talk about your routine / Invite someone and Accept or refuse an invitation
Reading: Read and understand an invitation on basic info: date and time, venue, occasion, type of invitation etc.
Grammar: Question word Why, Connecting word "because", partitive and contracted articles, reflexive verbs
Vocabulary: Expressions to propose, thank / apologize and accept or refuse an invitation,
Writing: Respond to an invitation (Accept or refuse)
Life Skills: At the table

UNIT – V: Ask for information (timings, price, etc) and Ask for/ Give Directions
Reading: Understand signboards and instructions
Grammar: Imperative mode and prepositions.
Vocabulary: Directions, Expressions to ask information or seek precision
Writing: Give instructions and fill a form

UNIT – VI: Vacation (plan vacation, choose destination, visit, and appreciate)
Reading: Read and understand travel brochures for basic info on offers, locations, touristic attractions hotels and so on
Grammar: demonstrative adjectives and near future tense
Vocabulary: Weather forecast, modes of transport, and vacation activities
Writing: Write a post card
Life Skills: Types of vacation in France

TEXT BOOKS:

1. Painless French, Carol Chitin, M.S., Lynn Gore, Barrons Educational Series, 2016 (ISBN: 978-1438007700)
2. Language Learning University, French: Learn French for Beginners Including French Grammar, French Short Stories and 1000+ French Phrases, Createspace Independent Publications, 2018 (ISBN: 978-1726415002)
3. Language School, French Language for Beginners, 2019 (ISBN: 978-1700175700)

REFERENCES:

1. Practice Makes Perfect: Complete French All-in-One, Annie Heminway, McGraw-Hill Education, 2018 (ISBN: 978-1260121032)
2. Easy French Step-by-Step, Myrna Bell Rochester, McGraw-Hill Education, 2008 (ISBN: 978-0071453875)
3. Contacts: Langue et Culture Françaises, Jean-Paul Valette, Rebecca Valette, Wadsworth Publishing Co. Inc., 2012 (ISBN: 978-1133309581)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1CE09) SMART CITIES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

UNIT – I:
Introduction to Smart Cities: Introduction to Smart Cities - Understanding Smart Cities - Dimensions of Smart Cities – World urbanization, Global Experience of Smart Cities, Smart City case studies-Indian scenario - India "100 Smart Cities" Policy and Mission.

UNIT – II:
City as a System of Systems: Systems thinking – Developing a smart city approach – Core elements of a smart city – Relevant open data for a smart city – Sustainability – Privacy and Ethics – Energy systems for smarter cities.

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

UNIT – IV:
Smart Urban Energy Systems: Conventional vs. Smart, City components, Energy demand, Green approach to meet Energy demand, Index of Indian cities towards smartness – a statistical analysis -Meeting energy demand through direct and indirect solar resources- Efficiency of indirect solar resources and its utility, Capacity limit for

the indirect solar resources- Effectiveness in responsive environment in smart city; Smart communication using green resources- **Relevant case studies**

UNIT – V:

Smart Transportation Systems: Smart Transportation Technologies - Driverless and connected vehicles - ride sharing solutions - The "improve" pathway - The "shift" pathway – Smart Roads and Pavement systems – Relevant case studies

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(19OE1EE05) TRENDS IN ENERGY SOURCES FOR SUSTAINABLE DEVLOPMENT

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the role of sustainable energy
- To know components of solar PV and wind energy conversion systems
- To understand the principles of Biomass, geo-thermal and wave energy systems
- To learn various energy storage methods

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand various sources for sustainable energy
CO-2: Understand Solar Photo voltaic and wind energy systems
CO-3: Learnt the harnessing techniques of Biomass, geothermal and ocean energy
CO-4: Familiarize with energy storage methods

UNIT – I:
Introduction: Trends in energy consumption - Conventional and renewable sources, Energy sources and their availability, Energy Conservation status in India -need of new energies for sustainable development.

UNIT – II:
Fundamentals of Solar Radiation: Introduction-The Sun as Source of Energy, Extraterrestrial and Terrestrial Radiations, Spectral Power Distribution of Solar Radiation, instruments for measuring solar radiation and sunshine recorder.
Solar PV Conversion: The PV Cell-Crystalline Solar cells -Thin film and amorphous solar cells, Module, Array, Equivalent Electrical circuit- Open circuit voltage and Short circuit current, I-V, P-V Curves. Developments in efficient non silicon solar cells

UNIT – III:
Wind Energy: origin of winds-Global (or Planetary) Winds- Local Winds-Factors Affecting the Distribution of Wind Energy on the Surface of Earth, Wind Turbine – Types, construction of HAWT, VAWT, performance characteristics, Betz criteria.

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

UNIT – V:
Geothermal Energy: Resources, types of wells, methods of harnessing the energy
Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles.

Tidal and Wave Energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT – VI:

Energy Storage:

Electro Chemical Storage: lead-acid- nickel cadmium-nickel-metal-hydride and lithium type batteries-Principle of operation, Types, Advantages and disadvantages.

Non-Electric Storage: Methods of Energy storage –Pumped Energy Storage – Compressed air Energy Storage, Superconducting Magnet Energy Storage.

TEXT BOOKS:

1. Non-Conventional Energy Sources, G.D. Rai, 6th Edition, Khanna Publishers, 2004
2. Non-Convention Energy Resources, B.H. Khan, 3rd Edition, McGraw Hill, 2017

REFERENCES:

1. Renewable Energy Sources, Twidell & Weir, 3rd Edition, CRC Press, 2015
2. Solar Energy, Sukhatme, 3rd Edition, McGraw Hill, 2008
3. Non-Conventional Energy, Ashok V. Desai, Wiley Eastern, 1990

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1ME05) 3D PRINTING AND DESIGN

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the need and know about the applications of 3D Printing
- To understand the need of liquid and solid based 3D Printing systems
- To know about the laser-based 3D Printing systems and importance of CAD for 3D Printing
- To understand post-processing, inspection and testing involved in 3D Printing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize the importance of 3D Printing
CO-2: Explain the process involved in liquid and solid based 3D Printing Systems
CO-3: Explain about the laser-based 3D Printing systems and CAD for 3D Printing
CO-4: Plan post-processing techniques and perform inspection and testing in 3D Printing

UNIT – I:
Introduction: Introduction to 3D Printing, Classification, 3D Printing Process Chain, Materials for 3D Printing, Distinction between 3D Printing & Conventional Manufacturing.
Applications: Brief overview of applications in Aerospace, Automotive, Biomedical, Defense, Construction, Jewelry, Coin and Tableware Industry.

UNIT – II:
Liquid Based 3D Printing Systems: Introduction, Principle, Processes and Applications of Material Jetting and Stereolithography.

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

UNIT – IV:
Powder Based 3D Printing Systems: Introduction, Principle, Processes and Applications of Selective Laser Sintering (SLS), Three-Dimensional Printing (3DP).

UNIT – V:
CAD for 3D Printing: CAD data formats, CAD model preparation, Part orientation and support generation, Overview of 3D Printing softwares like MAGICS and MIMICS only.

UNIT – VI:
Post Processing: Introduction, Post Processing Techniques like Support material removal, Cleaning, Sanding and Polishing.

Inspection: Introduction, Significance, Inspection techniques like Dimensional measurement along X, Y and Z axes, visual inspection of the surface finish (overall aesthetics and intact features), flatness or warp check, and FOD (foreign objects or debris) check.

TEXT BOOKS:

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W. Rosen, Brent Stucker, Springer, 2010
2. Rapid Prototyping: Principles and Applications, Chua C. K., Leong K. F., and Lim C. S., 3rd Edition, World Scientific, 2010

REFERENCES:

1. Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development, Liou L. W. and Liou F. W., CRC Press, 2007
2. Rapid Prototyping: Theory and Practice, Kamrani A. K. and Nasr E. A., Springer, 2006
3. Rapid Tooling: Technologies and Industrial Applications, Hilton P. D. and Jacobs P. F., CRC Press, 2000
4. Rapid Prototyping, Gebhardt A. Hanser, Gardener Publications, 2003

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

(19OE1EC09) EMBEDDED SYSTEMS FOR IOT

COURSE PRE-REQUISITES: Programming through C

COURSE OBJECTIVES:

- To understand the basics of computing with embedded Systems
- To expose the students to various smart sensors
- To make the students familiar with the programming concepts of Embedded development board
- To understand the basics of Internet of Things and Cloud of things

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Familiarize with architectural and programming issues of Embedded Systems
CO-2: Select proper smart Sensor for a specific measurement application
CO-3: Analyze various protocols for Internet of Things
CO-4: Apply Internet of Things to different applications in the real world

UNIT – I:
Embedded System Design: Numbering and Coding Systems, Digital Premier, Inside the Computer
Embedded System: Definition, Characteristics of embedded computing applications, Design challenges, Requirements, Specification, Architecture design, Designing hardware and software components, system integration.

UNIT – II:
Smart Sensors & Applications: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation.

UNIT – III:
Sensors Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring.

UNIT – IV:
Micro Controller Board: Features of Arduino, Arduino components and IDE, Interfacing: Seven Segment Display, Pulse Width Modulation, Analog Digital Converter, Wireless connectivity to Arduino. Case study: From BT To WiFi: Creating WiFi Controlled Arduino Robot Car.

UNIT – V:
Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT enabled Technologies – Wireless Sensor Networks,

Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Deployment Templates, M2M, IoT vs M2M.

UNIT – VI:

Domain Specific Applications of IoT: IoT Design Methodology, Applications of IoT– Home, Health, Environment, Energy, Agriculture, Industry and Smart City.

TEXT BOOKS:

1. The 8051 Microcontroller: Programming, Architecture, Ayala & Gadre, 3rd Edition, Cengage Publications, 2008
2. Sensors and Transducers, D. Patranabis, 2nd Edition, PHI Learning Private Limited, 2013
3. Internet of Things: A Hands-On Approach, Vijay Madisetti, Arshdeep Bahga, Universities Press, 2015

REFERENCES:

1. Embedded Systems: Architecture, Programming and Design, 2nd Edition, TMH
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, 2nd Edition, 2005
3. Internet of Things with Raspberry Pi and Arduino, Singh R., Gehlot A., Gupta L., Singh B., Swain M., Boca Raton, CRC Press, 2020

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech.	L	T/P/D	C
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(19OE1CS09) ARTIFICIAL INTELLIGENCE – A BEGINNER'S GUIDE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand and analyze the basic concepts of artificial intelligence
- To identify, explore the complex problem-solving strategies and approaches
- To analyze the concepts of basic concepts of neural networks and learning process
- To explore and analyze the methodology used in machine learning and computer vision

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and apply the basic concepts of artificial intelligence and its use cases. lives
CO-2: Explore the various search strategies and approaches for problem solving
CO-3: Correlate the fields related to AI, and articulate various learning paradigms
CO-4: Describe several issues and ethical concerns surrounding AI

UNIT – I:
Introduction to AI: What is AI-On Overview, History of AI, Applications and Examples of AI, AI Concepts, Terminology, Key fields of AI. AI Issues, Concerns, and Ethical Considerations.

UNIT – II:
AI as Search Process: On overview of Search Strategy. Types of Searches- Uninformed, Informed, Bidirectional search, Heuristic search. Local search, Local beam search, Adversarial Search.

UNIT – III:
AI as Knowledge Exploration: Introduction to Propositional Logic, Rules of Inference, First Order Logic (FOL) Syntax, Semantics, Entailment, Tools to represent knowledge.

UNIT – IV:
AI as a Learning Task: Introduction to Learning, Learning types -Supervised, Unsupervised, Reinforcement Learning, Machine learning, Deep Learning, The link between AI, ML, DL.

UNIT – V:
AI as Neural Networks: Introduction to biological neural networks. Link between biological neuron and artificial neuron. Architecture of artificial neural network, Types of Neural networks-single layer, multilayer, Back propagation networks.

UNIT – VI:

The Future of AI: Computer Vision - Seeing the World Through AI, Bots - Conversation as a Platform, AI and the society, AI in action-the Use Cases, Building AI Projects.

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall, 2010
2. Machine Learning, Tom M. Mitchell, M. C. Graw Hill Publications
3. Neural Networks-A Comprehensive Foundation, Simon Haykin, 2nd Edition, Pearson Education, 2004

REFERENCES:

1. Artificial Intelligence, Elaine Rich & Kevin Knight, 2nd Edition, TMH
2. Artificial Intelligence, A New Synthesis, Nils J. Nilsson, Elsevier
3. Artificial Neural Networks, Yegnanarayana B., PHI

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	3	**0**	**3**

(19OE1CS10) BLOCKCHAIN TECHNOLOGY ESSENTIALS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce and get the technological overview of blockchain technologies
- To Study the foundation of Blockchain Technology and demonstrate the various types of Blockchain
- To explore the application area of Blockchain Technology
- To introduce smart contract, consensus algorithm and Security Mechanism
- Introduction to available platforms to implement Blockchain Technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and explore the Blockchain Technology
CO-2: Describe smart contract concepts
CO-3: Explore different types of Blockchain
CO-4: Develop the platforms to implement Blockchain Technology

UNIT – I:
Fundamental of Blockchain Part I: Introduction to Centralized, Decentralized and Distributed system, computer network peer to peer connection
Fundamental of Blockchain Part II: History of Blockchain, Various technical definitions of Blockchain. Generic elements of a blockchain: Block, Transaction, Node, Why It's Called "Blockchain", Characteristics of Blockchain Technology, Advantages of blockchain technology, Limitations of blockchain as a technology

UNIT – II:
Concept of Blockchain Technology Part I: Applications of blockchain technology, Tiers of blockchain technology Blockchain 0, Blockchain 1, Blockchain 2, Blockchain 3, Generation of Blockchain X, smart contract
Concept of Blockchain Technology Part II: Types of blockchain: Public blockchain, private blockchain, hybrid blockchain, examples of Public, private, hybrid blockchain and it merit and demerit.

UNIT – III:
Technical Foundations Part I: Component of block, Structure of Block chain, Technical Characteristics of the Blockchain, genesis block, Nonce
Technical Foundations Part II: Cryptography, Hashing, Distributed database, Consensus mechanisms, and basic of Cryptographic primitives, Technical Characteristics of Secure Hash Algorithms (SHA), Digital signature.

UNIT – IV:
Consensus Algorithm: Proof of work (PoW), Proof-of-Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of authority (PoA), Confidentiality, Integrity, Authentication,

Permissioned ledger, Distributed ledger, Shared ledger, Fully private and proprietary blockchains, Tokenized blockchains, Tokenless blockchains, CAP theorem and blockchain

UNIT – V:
E-Governance and other contract enforcement mechanisms, Financial markets and trading, Trading, Exchanges, Trade life cycle, Order anticipators, Market manipulation.
Crypto Currency: Bitcoin, Bitcoin definition, Keys and addresses, Public keys in Bitcoin, Private keys in Bitcoin, Bitcoin currency units

UNIT – VI:
Implementation Platforms: Hyperledger as a protocol, Reference architecture, Hyperledger Fabric, Transaction Flow, Hyperledger Fabric Details, Fabric Membership, Fabric Membership

TEXT BOOKS:
1. Mastering Blockchain, Imaran Bashir, 2nd Edition, Packt
2. Blockchain Basic, Daniel Drescher, A Press

REFERENCES:
1. Blockchain For Dummies®, IBM Limited Edition, John Wiley & Sons, Inc

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(19OE1EI05) FUNDAMENTALS OF ROBOTICS AND DRONES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To classify by coordinate system and control system
- To acquire knowledge on different types Power Sources and Sensors
- To classify different types of Manipulators, Actuators and Grippers
- To acquire knowledge on kinematics and Vision systems used for different Robots
- To acquire knowledge on the basics of Drones

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire knowledge on different types of Power Sources (actuators) and Sensors, Manipulators, Actuators and Grippers
CO-2: Acquire knowledge on different applications of various types of robots
CO-3: Analyze the direct and the inverse kinematic problems and calculate the manipulator dynamics
CO-4: Acquire knowledge on the applications of Machine Vision in Robotics
CO-5: Acquire Knowledge on the basics of Drones

UNIT – I:
Basic Concepts & Fundamentals: An overview of Robotics, classification of Robots, Robot Components, Robot degrees of freedom, Robot Joints, Robot Coordinates, Robot reference frames, Programming modes, Robot Characteristics.

UNIT – II:
Sensors and Actuators:
Sensors: Sensors characteristics, Position sensors, velocity sensors, acceleration sensors, torque sensors, micro switches, lighten infrared sensors, touch and tactile sensors, proximity sensors, range finders.
Actuators: Characteristics of activating system, comparison of activating system Hydraulic devices, Pneumatic devices, electric motors, magneto-strictive actuators.

UNIT – III:
Manipulators and Grippers:
Grippers: Robot end effectors, Classification, drive system for Gripper, Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Adhesive Grippers, Hooks, Scoops and other Miscellaneous Devices, Gripper force Analysis and Gripper Design, Active and passive Grippers.

UNIT – IV:
Kinematics: Matrix representation of translational and Rotational motion – Homogeneous Transformation-DH representation of standard configuration Robots-Inverse Kinematics. Joint space vs. Cartesian space-Basics of Trajectory planning in joint and Cartesian space.

UNIT – V:

Robot Vision: Low level and High-level vision

Image acquisition, Illumination Techniques, Imaging Geometry, Some Basic Relationships between Pixels, Segmentation, Description, Segmentation and Description of 3-D Structures, Recognition, Interpretation.

UNIT – VI:

Basics of Drones: Theory behind how drones work, individual components that makeup a drone, basic concepts involved radio-controlled model flying, building a complete quad copter drone from scratch

TEXT BOOKS:

1. Introduction To Robotics: Analysis, Control, Applications, Wiley, Saeed B. Niku, 2nd Edition
2. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover, Nicholas G Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, McGraw Hill, 2012

REFERENCES:

1. Robotics Technology and Flexible Automation, Deb S. R., John Wiley
2. Robots and Manufacturing Automation, Asfahl C. R., John Wiley
3. Robotic Engineering–An Integrated Approach, Klafter. R. D., Chimielewski. T. A., Negin. M, Prentice Hall of India, New Delhi
4. Drones for Beginners, Udemy

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

(19OE1IT08) FUNDAMENTALS OF CYBER SECURITY

COURSE PRE-REQUISITES: Basic Knowledge of Computers, Basic Knowledge of Networking and Internet

COURSE OBJECTIVES:
- To identify the key components of cyber security in network
- To describe the techniques in protecting Information security
- To define types of analyzing and monitoring potential threats and attacks
- To access additional external resources to supplement knowledge of cyber forensics and laws

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand, appreciate, employ, design and implement appropriate security technologies
CO-2: Demonstrate policies to protect computers and digital information
CO-3: Identify & Evaluate Information Security threats and vulnerabilities in Information Systems
CO-4: Understanding computer forensics and analyzing them

UNIT – I:
Introduction: Introduction to Cybersecurity, Cybersecurity objectives, Cybersecurity roles, Differences between Information Security & Cybersecurity, Cybersecurity Principles - Confidentiality, integrity, & availability, Authentication & nonrepudiation, The Trinity of IT Security (CIA), Computer Protocols, Cookies, The TCP/IP

UNIT – II:
Who are the cyber criminals, Classification of cybercrimes, E-mail Spoofing, Spamming, Cyber defamation, Internet Time Theft, Salami Attack/ Salami Technique, Data Diddling, Forgery, Web Jacking, Newsgroup Spam/ Crimes Emanating from Usenet Newsgroup, Industrial Spying/Industrial Espionage, Hacking, Online Frauds, Pornographic Offenses, Software Piracy, Computer Sabotage, E-mail Bombing/Mail Bombs, UseNet Newsgroup as the Source of Cybercrimes, Computer Network Intrusions, Password Sniffing, Credit Card Frauds, Identity Theft.

UNIT – III:
Cyber Offenses: How Criminals Plan Them: Introduction, Categories of Cybercrime, How Criminals Plan the Attacks, Reconnaissance, Passive Attacks, Active Attacks, Scamming and Scrutinizing Gathered Information, Attack (Gaining and Maintaining the System Access), Social Engineering, Classification of Social Engineering, Cyber stalking, Types of Stalkers, Cases Reported on Cyber stalking, How Stalking Works?, Real-Life Incident of Cyber stalking, Cyber cafe and Cybercrimes,

UNIT – IV:
Security Threats: Introduction to security threats-Virus, Worms, Trojan horse, Bombs, Trap Door, E-Mail Virus, Virus Life cycle, How virus works?, Malware, Network and Services attack- Dos attacks, Types of Dos attacks, Methods of attacks, Examples of

attacks-SYN flooding, TCP flooding ,UDP flooding ,ICMP flooding ,Smurf, Ping of death, Tear drop, Security threats to E-commerce-Electronic payment system, Credit card/Debit cards, Smart cards, E- money, Electronic Fund Transfer, E-commerce security System, Electronic Cash, Digital Signatures

UNIT – V:

Introduction to Computer Forensics: computer crimes, evidence, extraction, preservation, etc. Overview of hardware and operating systems: structure of storage media/devices; windows/Macintosh/ Linux -- registry, boot process, file systems, file metadata. Data recovery: identifying hidden data, Encryption/Decryption, Steganography, recovering deleted files. Digital evidence controls: uncovering attacks that evade detection by Event Viewer, Task Manager, and other Windows GUI tools, data acquisition, disk imaging, recovering swap files, temporary &cache files, Computer Forensic tools, Network Forensic. Computer crime and Legal issues: Intellectual property, privacy issues, Criminal Justice system for forensic, audit/investigative situations and digital crime scene, investigative procedure/standards for extraction, preservation, and deposition of legal evidence in a court of law.

UNIT – VI:

Fundamentals of Cyber Law: Evolution of the IT Act, Genesis and Necessity , Salient features of the IT Act, 2000, various authorities under IT Act and their powers, Penalties & Offences, amendments, Impact on other related Acts Cyber Space Jurisdiction - Jurisdiction issues under IT Act, 2000- Traditional principals of Jurisdiction - Extra-terrestrial Jurisdiction- Case Laws on Cyber Space Jurisdiction Sensitive Personal Data or Information (SPDI) in Cyber Law (a) SPDI Definition and Reasonable Security Practices in India (b) Reasonable Security Practices – International perspective

TEXT BOOKS:

1. Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunit Belpure, Wiley
2. Fundamentals of Cyber Security, Mayank Bhusan, Rajkumar Singh Rathore, Aatif Jamshed, BPB Publications
3. Cyber Law & Cyber Crimes, Advocate Prashant Mali, Snow White Publications, Mumbai

REFERENCES:

1. Computer Forensics and Cyber Crime: An Introduction, Marjie T. Britz, 3rd Edition, 2013
2. Digital Forensics with Open-Source Tools. Cory Altheide and Harlan Carvey, Elsevier, 2011(ISBN: 978-1-59749- 586-8)
3. Network Forensics: Tracking Hackers Through Cyberspace, Sherri Davidoff, Jonathan Ham Prentice Hall, 2012
4. Cyber Law in India, Farooq Ahmad, Pioneer Books
5. Information Technology Law and Practice, Vakul Sharma, Universal Law Publishing Co. Pvt. Ltd.

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(19OE1IT09) FUNDAMENTALS OF DATA SCIENCE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration
- To exploring data analysis, predictive modeling, descriptive modeling, data product creation, evaluation, and effective communication
- To understand the basic knowledge of algorithms and reasonable programming experience and some familiarity with basic linear algebra and basic probability and statistics
- To identify the importance of recommendation systems and data visualization techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data
CO-2: Discuss the significance of exploratory data analysis (EDA) in data science and to apply basic tools (plots, graphs, summary statistics) to carry out EDA
CO-3: Apply basic machine learning algorithms and to identify common approaches used for Feature Generation
CO-4: Analyze fundamental mathematical and algorithmic ingredients that constitute a Recommendation Engine and to Build their own recommendation system using existing components

UNIT – I:
Introduction: What is Data Science? - Big Data and Data Science hype – and getting past the hype - Why now? – Datafication - Current landscape of perspectives - Skill sets needed - Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model - Intro to R

UNIT – II:
Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - **Case Study:** Real Direct (online real estate firm) - Three Basic Machine Learning Algorithms-Linear Regression - k-Nearest Neighbors (k-NN) - k-means

UNIT – III:
One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam

UNIT – IV:
Data Wrangling: APIs and other tools for scrapping the Web - Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user

(customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests

UNIT – V:

Recommendation Systems: Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis - Exercise: build your own recommendation system - Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighbourhood properties in graphs

UNIT – VI:

Data Visualization: Basic principles, ideas and tools for data visualization 3 - Examples of inspiring (industry) projects - Exercise: create your own visualization of a complex dataset - Data Science and Ethical Issues - Discussions on privacy, security, ethics - A look back at Data Science - Next-generation data scientists

TEXT BOOKS:

1. Doing Data Science, Straight Talk From The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014
2. Mining of Massive Datasets v2.1, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, Cambridge University Press, 2014
3. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, 2013 (ISBN 0262018020)

REFERENCES:

1. Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani and Jerome Friedman, 2nd Edition, 2009 (ISBN 0387952845)
2. Foundations of Data Science, Avrim Blum, John Hopcroft and Ravindran Kannan
3. Data Mining and Analysis: Fundamental Concepts and Algorithms, Mohammed J. Zaki and Wagner Miera Jr. Cambridge University Press, 2014
4. Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, 3rd Edition, 2011 (ISBN 0123814790)

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B.Tech.	**L**	**T/P/D**	**C**
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(19OE1AE05) INTRODUCTION TO ADVANCED VEHICLE TECHNOLOGIES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the layout of an automobile and functionalities chassis elements
- To provide the concepts of automotive electrical systems and electric & hybrid vehicles
- To present various intelligent automotive systems and levels of vehicle autonomy

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the functionalities of automotive systems and subsystems
CO-2: Discuss the concepts of automotive electrical systems and electric & hybrid vehicles
CO-3: Describe various intelligent automotive systems and levels of vehicle autonomy

UNIT – I:
Introduction: Classification of automobiles, layout of an automobile and types of bodies.
Automotive Chassis: Introduction to chassis systems - engine, cooling, lubrication, fuel feed, ignition, electrical, driveline - clutch, transmission, propeller shaft, differential, axles, wheels and tyres, steering, suspension and braking.

UNIT – II:
Engine: Working principle of four stoke and two stroke SI and CI engines, fuel system – layout of petrol and diesel fuel systems, electronic fuel injection - multi-point fuel injection, gasoline direct injection, common rail direct injection.

UNIT – III:
Electrical System: Simple automotive wiring diagram and components of electrical system, starting system – starter circuit, standard Bendix and over running clutch drive, charging system – alternator, cut-outs and regulators, ignition system - conventional and electronic ignition system.

UNIT – IV:
Electric and Hybrid Vehicles: Electric vehicle – Layout, components, configurations, advantages and limitations. Hybrid vehicle - Concepts of hybrid electric drivetrain based on hybridization and powertrain configuration, architecture of series, parallel and series-parallel hybrid electric drivetrains, modes of operation, merits and demerits.

UNIT – V:
Intelligent Vehicle Systems: Automotive navigation, night vision, head-up display, airbag, seat belt tightening system, immobilizers, adaptive cruise control, forward collision warning, lane departure warning and anti-lock braking system.

UNIT – VI:
Autonomous Vehicles: Levels of automation, research, challenges, commercial

development, sensor systems, sensor suits, environmental challenges, graceful degradation, V2V and V2I communication, sharing the drive, integrity, security, verification and policy implications.

TEXT BOOKS:

1. Advanced Vehicle Technology, Heinz Heisler, Butterworth Heinemann, 2002
2. Intelligent Vehicle Technologies: Theory and Applications, Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann, Oxford, 2001
3. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, CRS Press, 2004

REFERENCES:

1. Automotive Mechanics, Giri N. K., Khanna Publications, 2006
2. Automotive Electrical Equipment, Kohli P. L., Tata McGraw Hill Co., Ltd., New Delhi, 1975
3. Electric and Hybrid Vehicles – Design Fundamentals, Iqbal Husain, CRC Press, 2010
4. Autonomous Vehicle Technology-A Guide for Policymakers, James M. Anderson, Nidhi Kalra, Karlyn D. Stanley, Paul Sorensen, Constantine Samaras, Oluwatobi A. Oluwatola, RAND Corporation, Santa Monica, Calif., 2016

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(19OE1CS12) INTRODUCTION TO APPLICATION DEVELOPMENT WITH C#

COURSE OBJECTIVES:

- To create an integrated development environment for object-oriented C# programs
- To build website menus with CSS and JavaScript
- To relate programming language constructs and problem solving techniques
- To analyze and Apply modifications to C# programs that solve real-world problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the fundamentals of HTML5 and define the styles for web pages using CSS
CO-2: Create web pages and add dynamic behavior to web pages using Javascript
CO-3: Communicate with the database using SQL
CO-4: Develop a simple CUI [Character User Interface] based application using C# & SQL

UNIT – I:
Computer, Software Engineering Fundamentals & OOP: Introduction to Computer Basics, Basics of Network, Networking Levels and Layers and Protocols, Protocol Stacks, Networking and Internet Service, Software Engineering Fundamentals - Overview of Requirement Analysis, Overview of Software Design, Overview of Software Implementation, Overview of Testing, Overview of Software Maintenance, Overview of Configuration management and version
Control, Agile Basics, OOP - Object Oriented Concepts, Objects and Classes, Principles in Object-
Oriented technology
Usecase: Create a class for BankAccount

UNIT – II:
HTML & CSS: Introduction to Web Technology, Introduction to HTML5, HTML5 Elements, Semantic Elements, Table, List, Working with Links, Image Handling, Form-Input Elements, HTML5 Form elements, HTML5 Attributes, Video & Audio, iframes, CSS - Introduction to CSS3, CSS Syntax, CSS Styling, Text and Fonts properties, CSS Selectors, Different color schemes, CSS Borders, CSS Margins, CSS Backgrounds
Use Case: Create a website for college

UNIT – III:
JavaScript, RDBMS Concepts and SQL: JavaScript basics, Functions in Javascript, Javascript validation, Events, Javascript event handling, JavaScript Strings, JavaScript Dates, Array in Javascript, Document Object Model (Window, Frame, Navigator Objects), Working with Document Object (Its Properties and methods, Cookie handling), Introduction to RDBMS Concepts, Introduction to SQL, Creating and

Managing Tables, Data Manipulation, Basic SQL SELECT Statements, Scalar & Aggregate Functions, Joins & Subqueries, Views & Index

Use Case: Apply validations for Telephone Complaint Registration Form

Use Case: Create student table for College Management System(CMS)

UNIT – IV:

Introduction to C# Programming: Introduction to .NET Framework 4.5 - What is .NET Framework, .NET Framework, Languages, and Tools, .NET Framework Major Components, Common Language Runtime (CLR), Compilation and Execution in .NET, Understand the .NET Framework 4.5stack, Exploring VS2017, Introduction to C# 6.0 - Features of C#, C# Compilation and Execution, General Structure of a C# Program, Creating and Using a DLL

Use Case: Create a Console Application (.exe) project called CalcClientApp

UNIT – V:

Language Fundamentals of C#: Language Fundamentals - Keywords, Value Types and Reference Types, Implicit and explicit type conversions, Boxing and Unboxing, Enum, Operators and Assignments,Variables and Literals, Flow

Control: C# Control Statements, Nullable, Classes and Objects, Strings, Array, Generic Collections

Use Case: Store employee objects using Generic Collections

UNIT – VI:

Basics of ADO.NET: Various Connection Architectures, Understanding ADO.NET and its class library, Important Classes in ADO.NET, Connection Class, Command Class, DataReader Class, DataAdapter Class, DataSet Class

Use Case: Implement ADO.NET classes that belong to both Connected and Disconnected Architectures

TEXT BOOKS:

1. Web Programming, Building Internet Applications, Chris Bates, 2nd Edition, Wiley Dreamtech
2. Introduction to Database Systems, C. J. Date, Pearson Education
3. Professional C# 2012 with .NET 4.5, Christian Nagel et al. Wiley India, 2012

REFERENCES:

1. Programming World Wide Web, Sebesta, Pearson
2. Internet and World Wide Web – How to Program, Dietel and Nieto PHI/Pearson Education Asia
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Pro C# 2010 and the .NET 4 Platform, Andrew Troelsen, 5th Edition, A Press, 2010
5. Programming C# 4.0, Ian Griffiths, Matthew Adams, Jesse Liberty, 6th Edition, O"Reilly, 2010

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B.Tech.	**L**	**T/P/D**	**C**
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(19OE1CS13) INTRODUCTION TO APPLICATION DEVELOPMENT WITH JAVA

COURSE OBJECTIVES:

- To create an integrated development environment for object-oriented Java programs
- To build website menus with CSS and JavaScript
- To relate programming language constructs and problem solving techniques
- To analyze and Apply modifications to Java programs that solve real-world problems

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

CO-1: Understand the fundamentals of HTML5 and define the styles for web pages using CSS

CO-2: Create web pages and add dynamic behavior to web pages using Javascript

CO-3: Communicate with the database using SQL

CO-4: Develop a simple CUI [Character User Interface] based application using Java & SQL

UNIT – I:

Computer: Computer Fundamentals, Preface to Networks, Networking Levels, Layers of Computer Networks, Protocol Stacks, Networking, and Internet Service

Software Engineering Fundamentals: Introduction, Requirements Collection & Analysis, Fundamentals of Software Design, Software Implementation, Types of Testing, Software Maintenance, Overview of Configuration management and version Control Tools, Basics of Agile Process

Object Oriented Programming: Object Oriented Paradigm, Classes and Objects, Principles in Object- Oriented technology

Use Case: Create a class for Bank Account

UNIT – II:

HTML: Introduction to Web Technology, HTML5 Introduction, HTML5 Elements, Semantic Elements, Table, List, Links in HTML5, Handling of Images, Form Elements, HTML5 Form elements and Attributes, Video & Audio, iframes

Style Sheets:

Introduction to CascadingStyleSheet3, CSS Syntax, CSS Styling, Text and Fonts properties, CSS Selectors, Color schemes, CSS Borders, CSS Margins, CSS Backgrounds

Use Case: Design a website for college

UNIT – III:

JavaScript: Introduction to JavaScript, JavaScript Functions, JavaScript validation, Event handling in JavaScript, JavaScript Strings, JavaScript Dates, Array in JavaScript, Document Object Model (Window, Frame, Navigator Objects), Document Object (Its Properties and methods, Cookie handling),

RDBMS Concepts and SQL: Introduction to RDBMS Concepts, Introduction to SQL, Creating and Managing Tables, Data Manipulation, Basic SQL SELECT Statements, Scalar & Aggregate Functions, Joins & Subqueries, Views & Index
Use Case: Check the validations for Telephone Complaint Registration Form
Use Case: Create student table for College Management System (CMS)

UNIT – IV:
Introduction to Java: Java Environment, Java Fundamentals - Keywords, Primitive Data Types, Operators and Assignments, Java's Control Statements, Wrapper Classes, Using Scanner Class, Strings - String Handling functions, Array - One dimensional array, Array of Objects, Using Arrays class, variable length arguments
Use Case: To keep track of customers data who are buying products from a store

UNIT – V:
The Collection Framework: Lists – Array List, LinkedList, Stack, Vector, Set – HashSet, Linked Hash Set, Tree Set, Map – HashMap, Linked HashMap, Hash table. Retrieving Elements from Collections – Enumeration, Iterator, List Iterator, String Tokenizer – Sorting using Comparable and Comparator.
Use Case: Store employee objects using collection framework

UNIT – VI:
JDBC: Overview of JDBC, JDBC Architecture, Types of JDBC Drivers. Process SQL with JDBC - Create Connection, Query, Update
Use Case: Write the menu driven program using JDBC which will have following options
a. Store
b. Display by id
c. Delete by id
d. Update salary by id
e. Exit

TEXT BOOKS:

1. Web Programming, Building Internet Applications, Chris Bates, 2nd Edition, Wiley Dreamtech
2. Introduction to Database Systems, C. J. Date, Pearson Education
3. Big Java, Cay Horstmann, John Wiley and Sons, 2nd Edition

REFERENCES:

1. Programming World Wide Web, Sebesta, Pearson
2. Internet and World Wide Web – How to program, Dietel and Nieto PHI/Pearson Education Asia
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Java How to Program, H. M. Dietel and P. J. Dietel, 6th Edition, Pearson Education/PHI
5. Core Java 2, Vol. 1, Fundamentals, CayS. Horstmann and Gary Cornell, 7th Edition, Pearson Education

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19OE1CS14) INTRODUCTION TO APPLICATION DEVELOPMENT WITH PYTHON

COURSE OBJECTIVES:

- To create an integrated development environment for object-oriented Python programs
- To build website menus with CSS and JavaScript
- To relate programming language constructs and problem solving techniques
- To analyze and Apply modifications to Python programs that solve real-world problems

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

CO-1: Understand the fundamentals of HTML5 and define the styles for web pages using CSS

CO-2: Create web pages and add dynamic behavior to web pages using Javascript

CO-3: Communicate with the database using SQL

CO-4: Develop a simple CUI [Character User Interface] based application using Python & SQL

UNIT – I:

Concepts of Networks, Overview of Software Engineering & OOP: Computer Basics, Network basics, Networking Levels, Layers and Protocols, Protocol Stacks, Networking and services of Internet

Software Engineering lifecycle - Overview of Requirement Analysis, Software Design, Implementation of software, Outline of Testing, Maintenance, Configuration management and version Control, Agile fundamentals

OOP - Object Oriented Concepts, OOP Principles

Use Case: Create a class for Employee Account

UNIT – II:

Introduction to Web Technology: Overview of Web Technology, Introduction to HTML5, HTML5 Elements, Semantic Elements, Table, List, Links, Image Handling, Form-Input Elements, HTML5 Form elements, HTML5 Attributes, Video & Audio, iframes,

CSS - Introduction to CSS3, CSS Syntax, CSS Styling, Text and Fonts properties, CSS Selectors, Different color schemes, CSS Borders, Margins, Backgrounds

Use Case: Create a website for an institution

UNIT – III:

Outline of JavaScript, RDBMS Concepts and SQL: JavaScript basics, Functions ,validations, Events, handling events ,Strings, Dates, Arrays, DOM(Window, Frame, Navigator Objects), Document Object -Properties and methods, handling of Cookies, RDBMS Concepts, SQL, Management of Tables, Manipulation of tables, SQL SELECT Statements, Scalar & Aggregate Functions, Joins &Sub queries, Views & Index

Use Case: Apply validations for Telephone Complaint Registration Form

Use Case: Create student table for College Management System (CMS)

UNIT – IV:

Introduction to Python: Introduction, Features of Python, Versions, Keywords and Identifiers, Statements & Comments, Variables, Datatypes, Type Conversion, I/O and import, Language Fundamentals - Operators, Namespace, Modules in Python, Python DateTime

Use Case: Develop an application using Python for accepting your personal details and display the same

UNIT – V:

Classes and Objects: Classes and Objects in Python? Advantages of Using Classes in Python, Defining a Class in Python, Creating an Object in Python, The self, The_init_() function in Python, class and instance variables, Python Inheritance and its Types, Strings, Lists, Sets, Tuples, Dictionary

Use Case: Store employee objects using various data structures

UNIT – VI:

Advance Concepts in Python: Array - What is an Array, Difference between Array and List in Python, Creating an Array, Accessing a Python Array Element, Basic Operations of Arrays, Functions - Creating a Function, Calling a Function, Pass by reference vs value, Required arguments, Keyword arguments, Default arguments, Variable-length arguments, The Anonymous Functions, The return Statement, Global vs. Local variables, Modules - What is a Module?, Create a Module, Use a Module, Variables in Module, Naming a Module, Renaming a Module, Built-in Modules, Using the dir() Function, Import From Module, Packages, NumPy

Use Case: Develop an application for Hospital Management System(HMS)

TEXT BOOKS:

1. Web Programming, Building Internet Applications, Chris Bates, 2nd Edition, Wiley Dreamtech
2. Introduction to Database Systems, C. J. Date, Pearson Education
3. Python Programming: A Modern Approach, Vamsi Kurama, Pearson

REFERENCES:

1. Programming World Wide Web, Sebesta, Pearson
2. Internet and World Wide Web – How to Program, Dietel and Nieto, PHI/Pearson Education Asia
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Core Python Programming, W. Chun, Pearson
5. Introduction to Python, Kenneth A. Lambert, Cengage

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC1AE10) ELECTRIC AND HYBRID VEHICLES

COURSE PRE-REQUISITES: Basic Electrical and Electronics Engineering, Automotive Chassis and Automotive Engines

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 and hybridization
- To identify and size powertrain components and of electric drive vehicles

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: Describe various electric motors and controls
CO-3: Summarize various energy storage devices and hybridization
CO-4: Analyze powertrain components for electric and hybrid vehicles

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, regenerative braking, 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, ultracapacitors, hybridization of energy storages, introduction to battery charging and infrastructure.

UNIT – VI:
Propulsion and Battery management System Analysis: Basic mechanics of a vehicle, energy requirements, driving cycles, powertrain component sizing. Battery

management system – state of charge, state of health, state of power, state of life, state of safety and charge balancing.

TEXTBOOKS:

1. 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
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-Heine

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PC1AE11) AUTONOMOUS VEHICLE TECHNOLOGIES

COURSE PREREQUISITES: Automotive Chassis, Automotive Engines and Automobile Electrical and Electronics

COARSE OBJECTIVES

- To know various levels of vehicle autonomy and intelligent automotive systems
- To provide an overview on driver-assist and self-driving processes
- To understand the growing technologies related to safety, security and comfort systems adaptive cruise control systems and comfort systems
- To identify the key technologies that behind the communication systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Describe various levels of vehicle autonomy
CO-2: Describe the driver-assist and self-driving processes
CO-3: Explain various growing technologies related to safety, security and comfort systems
CO-4: Outline the key technologies that behind the communication systems

UNIT – I:
Introduction: Vehicular sensors, lane and road detection, traffic sign recognition, vehicle detection, tracking and behavior analysis, scene understanding. Driver information, driver perception, driver convenience, driver monitoring, general vehicle control, longitudinal and lateral control, collision avoidance, vehicle monitoring.

UNIT – II:
Autonomous Vehicles: Importance, levels of automation, system architecture, policy making, social costs, safety and crashes, congestion, land use, energy and emissions, costs and disadvantages

UNIT – III:
Current State of Autonomous Vehicles: Research, challenges, commercial development, sensor systems, sensor suits, computer vision applications, environmental challenges, graceful degradation, V2V and V2I communication, sharing the drive, integrity, security, verification and policy implications.

UNIT – IV:
Telematics and Comfort Systems: Global positioning system, geographical information systems, navigation system, automotive vision system, road recognition, adaptive cruise control system, cooperative adaptive cruise control, active suspension system, power steering and power windows.

UNIT – V:
Safety and Security Systems: Active and passive safety, airbags, seat belt tightening system, collision warning systems, anti-lock braking systems, traction control system, electronic immobilizers, remote keyless entry, smart card system, number plate coding.

UNIT – VI:

Automotive Networking: Introduction to control networking, need and types of networks, standards, vehicle multiplexing, communication protocols in embedded systems – SPI, I^{2}C, USB, communication protocols – Introduction to CAN, LIN, FLEXRAY and MOST.

TEXTBOOKS:

1. Intelligent Vehicle Technologies: Theory and Applications, Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann Publications, Oxford, 2001
2. Navigation and Intelligent Transportation Systems – Progress in Technology, Ronald K. Jurgen, Automotive Electronics Series, SAE, USA, 1998
3. 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

REFERENCES:

1. Understanding Automotive Electronics, Bechhold, SAE, 1998
2. Autonomous Driving - Technical, Legal and Social Aspects, Markus Maurer, J. Christian Gerdes, Barbara Lenz and Hermann Winner, Springer, 2016
3. Automotive In–vehicle Networks, J. Gabriel leen, Wiley-Blackwell, 2008
4. In-Vehicle Network Architecture for the Next-Generation Vehicles, Syed Masud Mahmud, IGI

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
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(19PE1AE08) VEHICLE BODY ENGINEERING

COURSE PREREQUISITES: Metallurgy and Materials Engineering, Automotive Chassis

COURSE OBJECTIVES:
- To outline the history and material used for the vehicle body
- To understand the various automotive body details and driver's seat design
- To underline the importance of automotive body loads and stress analysis
- To know the importance of crashworthiness of vehicle body and test dummies

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Select the materials for vehicle body
CO-2: Categorize vehicle bodies, construction details
CO-3: Analyze loads on the vehicle bodies
CO-4: Summarize vehicle body and carryout testing of vehicle bodies

UNIT – I:
Introduction: History – Evolution and importance of vehicle body, customer expectation on body design, requirements of automotive body, problems faced by body engineers, vehicle body materials- Aluminium alloy sheet, steels - austenitic and ferritic stainless steels, alloy steels, composites-metal matrix and high strength, plastics-Thermo plastics, ABS and styrenes

UNIT – II:
Car Body: Body components, constructional details, various panels, driver's seat –seat material, constructional details, standards, visibility – regulations, driver's visibility, forward visibility, all round visibility of vehicle, blind spots, improvements in visibility and tests for visibility, driver ergonomics, safety aspects in design- bumper, front and rear end, modern painting process of a passenger car body and nanopaint.

UNIT – III:
Bus Body: Introduction to bus bodies, bus body panels and terminologies, types of bus body-based on capacity, distance travelled, shape and style, floor height, engine location, entrance and exit location, body lay-out for various types, types of metal sections used, construction of conventional type and integral type, bus body regulations and sequence of bus building operation construction.

UNIT – IV:
Commercial Vehicle: Introduction, classification, LCV, HCV, types of trucks, normal and forward control, based on body construction, constructional details, types of metal sections used, segmental design of driver's cab, compactness of driver's cab and dimensions of driver's seat in relation to controls.

UNIT – V:
Body Loads and Stress Analysis: Symmetric and asymmetrical vertical loads in a car, longitudinal loads, different loading situations, load distribution on vehicle structure,

stress analysis of bus body structure under bending and torsion, stress analysis in integral bus body, analysis of shock and impulse and simple structural surface method.

UNIT – VI:

Crashworthiness: Goals and requirements, preventive design, design for minimum injury. Impact analysis - front end collisions, rear end collisions and roll over protection. **Anthropomorphic Test Devices**: Hybrid dummies II, hybrid dummies III, CRABI Infant dummies and side impact dummies**.**

TEXTBOOKS:

1. Vehicle Body Engineering, Powloski J., Business Books Ltd., 1998
2. The Automotive Body Volume II: System Design, Lorenzo Morello, Springer

REFERENCES:

1. Automotive Chassis, Heldt P.M., chilton and Co.
2. Automotive Safety Handbook, Ulrich Seiffert and Lothar Wech, SAE International, SAE ISBN 978-0-7680-1798-4
3. Vehicle Crashworthiness and Occupant Protection, Paul Du Bois et al., American Iron and Steel Institute, 2004

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

(19PE1AE09) AUTOMOTIVE MATERIALS

COURSE OBJECTIVES:

- To understand mechanical behavior and material properties
- To know material selection process for automotive components
- To study about composite materials, nonmetallic materials and electrical materials
- To know various modern materials and alloys

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the mechanical behaviour and properties
CO-2: Identify various materials based on material selection processes for automotive components
CO-3: Discuss the concepts of composite materials, nonmetallic materials and electrical materials
CO-4: Select modern materials and alloys for various applications in automobile

UNIT – I:
Review of Mechanical Behavior of Materials: Plastic deformation in poly phase alloys - strengthening mechanisms - Griffith's theory of failure modes – brittle and ductile fractures - damping properties of materials - fracture toughness - initiation and propagation of fatigue cracks - creep mechanisms.

UNIT – II:
Material Selection for Powertrain Components: Cylinder block, head and liner, piston and piston rings, gudgeon pin, connecting rod, bearings, crankshaft, flywheel, camshaft, valves, valve seats, springs, gear train, chain and belt drives.

UNIT – III:
Material Selection for Body Components: body–in–white, crash worthiness, suspension systems, cabin interiors. Functional requirements, manufacturing processes and failure modes for each.

UNIT – IV:
Non-Metallic Materials: Introduction to composite materials, ceramics, refractories, abrasives, enamels, cement – glasses, polymers: thermosetting and thermoplastics, expanded polypropylene, types of polymerizations, elastomers and electrical conducting polymers.

UNIT – V:
Electrical and Magnetic Materials: P and N type semiconductors, single crystals, soft and hard magnets, superconductors, MEMS materials, nano science materials, smart materials and shape memory alloys

UNIT – VI:
Modern Materials and Alloys: Lightweight materials &implications on vehicle design, super alloys, carbon fiber, refractory metals, shape memory alloys, dual phase steels, micro alloyed, high strength low alloy steel, transformation induced plasticity (TRIP)

steel, maraging steel, SMART materials, metallic glass-quasi crystal and nano crystalline materials and metals foams.

TEXTBOOKS:

1. The Science and Technology of Materials in Automotive Engines, Hiroshi Yamagata Woodhead Publishing Ltd., 2005
2. Mechanical Behavior of Materials, Thomas H. Courtney, McGraw Hill, 2006
3. Introduction to physical metallurgy, Avner S. H., Tata McGraw Hill, 2006

REFERENCES:

1. Materials Science and Metallurgy, Daniel Yesudian C., Scitech Publications (India), 2004
2. Light Alloys, Polmear I. J., Arnold Publishers, 1995
3. Elements of Metallurgy, Swarup D. and Saxena M. N., Rastogi Publishers, Meerut, 1994
4. The Science of Engineering Materials, Srinivasan N. K. and Ramakrishnan S. S., Oxford and IBH Pub. Co., New Delhi, 1993
5. Elements of Materials Science and Engineering, Van Vlack L. H., Addison Wesley, New York, 1991

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B.Tech. VII Semester	**L**	**T/P/D**	**C**
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(19PE1AE10) AUTOMOTIVE CONTROL SYSTEMS

COURSE PRE-REQUISITES: Mathematics, Applied Physics and Automotive Electrical and Electronics

COURSE OBJECTIVES:
- To provide the concept of system representation
- To discuss time and frequency response analysis
- To discuss stability and root characteristics
- To present state variable analysis

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the concept of system representation
CO-2: Describe the time and frequency response analysis
CO-3: Describe the stability and root characteristics
CO-4: Explain state variable analysis

UNIT – I:
Introduction: Open loop and closed loop systems – Examples, Control system components.
System Representation: Transfer function of physical systems: Mechanical systems - Translational and Rotational systems, Electrical network, Thermal and hydraulic systems. Transfer function of DC Generator, DC servomotor, AC servomotor, Transfer function of overall systems. Block diagram - reduction techniques. Signal flow graphs – Mason' gain formula.

UNIT – II:
Time Response Analysis: Standard Test signals –Time response of zero, first and second order systems, Performance criteria, Type of systems. Steady-state error constants – position, velocity and acceleration error constants. Generalized error series – Feedback characteristics of control systems. Controllers – P, PI and PID control modes.

UNIT – III:
Frequency Response Analysis: Frequency domain specifications – peak resonance, resonant frequency, bandwidth and cut-off rate, correlation between time and frequency responses for second order systems. Polar plot, Bode plot – Gain Margin and Phase Margin.

UNIT – IV:
Stability of Systems: Characteristic equation – Location of roots of characteristic equation – Absolute stability and Relative stability. Routh-Hurwitz criterion of stability – Necessary and sufficient conditions. Nyquist Stability- Principle of argument – Nyquist path – Nyquist stability criterion – Determination of Nyquist stability – Assessment of relative stability. Bode Plot – Assessment of stability, Nichols Chart.

UNIT – V:

Root Locus and Compensators: Root locus concept, Rules for construction of root loci, problems, stability analysis. Lag, Lead and Lag-Lead Compensators – Transfer function and Characteristics.

UNIT – VI:

State Variable Analysis: Introduction to state-space analysis – Physical variable, Phase variable and Canonical variable forms. Transfer function from state-space representation.

TEXTBOOKS:

1. Control Systems – Principles and Design, Gopal M., Tata McGraw-Hill, New Delhi, 2012
2. Control System Engineering, Norman S. Nise, John Wiley & Sons, New Delhi, 2012

REFERENCES:

1. Control System Engineering, Nagrath I. J. and Gopal M., New Age International, New Delhi, 2011
2. Automatic Control Systems, Benjamin Kuo, Prentice Hall of India, New Delhi, 2010
3. Modern Control Engineering, Ogata K., Prentice Hall of India, New Delhi, 2010

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

(19PE1AE11) AUTOMOTIVE NOISE AND VIBRATION CONTROL

COURSE PRE-REQUISITES: Automotive Engines and Automotive Chassis

COURSE OBJECTIVES:
- To acquire knowledge on sources of noise, vibration and harshness
- To present various tools for measuring vehicle vibration and noise
- To explain the sound insulation material to control passive noise
- To explain various method to control interior noise of vehicle

COURSE OUTCOMES: After completion of the course the student should be able to
CO-1: Identify the various sources of noise, vibration and harshness in vehicles
CO-2: Demonstrate the various tools for measuring vehicle vibration and noise
CO-3: Apply the sound insulation material to control passive noise
CO-4: Analyse various method to control interior noise of vehicle

UNIT – I:
Basics of Vibration: Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and nonlinear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.

UNIT – II:
Introduction to Automotive NVH: Vibration of beams, plates and shells. Basics of sound propagation, quantification of sound, noise sources, pass-by noise limits, automotive NVH sources, interior noise of vehicles, sound quality, ride comfort, noise and vibration control in vehicles.

UNIT – III:
Transducers and Measurement Techniques: Transducers and exciters. Sound pressure, intensity and power measurement. Sound level meters, noise dosimeters, analyzers and signal generators, equipment for data acquisition and digital signal processing. Calibration of measurement microphones, calibration of shock and vibration transducers, metrology and traceability of vibration and shock measurements.

UNIT – IV:
Noise Source Identification Techniques: Frequency and order domain analysis, sound intensity and sound power mapping. Introduction to array techniques, acoustic holography and beam forming. Standard methods for evaluating sound absorption coefficient and transmission loss. Types of sound absorbers, prediction of transmission loss and flanking transmission, damping materials and their applications.

UNIT – V:
Passive Noise Treatments: Ducts and Mufflers - types of mufflers, performance parameters - acoustics and backpressure. Reactive and absorptive silencers, overall design considerations. Acoustic material characterization, sound transmission,

absorption and damping, behavior of acoustic material with respect to sound absorption and transmission.

UNIT – VI:

Interior Noise of Automobiles and Modal Analysis: Interior noise sources, structure borne noise, airborne noise, refinement techniques and sound insulation. Definition of modal properties, modal analysis theory, FEM and experimental modal analysis, excitation sources, applications of modal analysis.

TEXTBOOKS:

1. Vehicle Noise and Vibration Refinement, Xu Wang, Sawston, Cambridge: Woodhead Publishing Ltd, 2010
2. Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles, M. Harrison, Oxford: Butterworth-Heinemann Elsevier Ltd, 2004

REFERENCES:

1. Mechanical Vibrations and Noise Engineering, G. Ambekar, PHI Learning Publication, New Delhi, 2006
2. Understanding Active Noise Cancellation, C. H. Hansen, Spon Press, London, 2003
3. Vibration Monitoring, Testing, and Instrumentation, Boca Raton, C. W. de Silva, CRC Press, 2007
4. Engineering Noise Control: Theory and Practice, D. A. Bies and C. H. Hansen, Spon Press, London, 2009

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

(19PE1AE12) MECHANICAL MEASUREMENTS AND METROLOGY

COURSE PREREQUISITES: Applied Physics and Basic Manufacturing technology

COURSE OBJECTIVES:

- To demonstrate basic concepts of limits, fits and tolerances, selective assembly and Interchangeability
- To appraise working principles of various linear, angular, screw thread and surface roughness measuring devices
- To provide basic knowledge in transduction principles, sensors and transducer technology and measurement systems.
- 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: Use limits, fits and tolerances
CO-2: Select various measuring devices to measure linear, angular, screw thread, gear and surface roughness
CO-3: Adopt instrumentation system used in the industry
CO-4: Explain experimental applications and select appropriate engineering instrument

UNIT – I:
Introduction: Basic principles of measurement, Measurement systems, generalized configuration and functional descriptions of measuring instruments, examples. Static and Dynamic performance characteristics, Sources of error, Classification and elimination of error.
Measurement of Pressure: Units, classification, different principles used. Manometers, Bourdon pressure gauges, Bellows, Diaphragm gauges. Low pressure measurement - Thermal conductivity gauges, ionization pressure gauges, Mcleod pressure gauge.

UNIT – II:
Measurement of Level: Direct method and Indirect methods — Capacitive, Ultrasonic, Magnetic, Cryogenic fuel level indicators, Bubbler level indicators.
Flow Measurement: Rotameter, magnetic flow meter, Ultrasonic flow meter, Turbine flow meter, Hot wire anemometer, Laser Doppler Anemometer (LDA).
Measurement of Speed: Mechanical Tachometers, Electrical tachometers, Stroboscope, Non- contact type of tachometer.

UNIT – III:
Measurement of Acceleration and Vibration: Different simple instruments, Principles of Seismic instruments, Vibro meter and accelerator meter using this principle.
Strain Measurements: Various types of strain measurements, electrical strain gauge, gauge factor, method of usage of resistance strain gauge for bending compressive and tensile strains, usage for measuring torque, Strain gauge Rosettes.

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

UNIT – IV:

Systems of Limits and Fits: Introduction, normal size, tolerances, limits, deviations, allowances, fits and their types, unilateral and bilateral tolerance system, hole and shaft basis systems. Interchangeability and selective assembly. Introduction to standard systems. Taylor's principle – Design of Go and No Go gauges, plug, ring, snap, gap and taper gauges.

UNIT – V:

Linear and Angular Measurements: Length standard, line and end standards - slip gauges, dial indicator, vernier caliper and micrometer, Bevel protractor, slip gauges, spirit level and sine bar; surface plates.

Surface Roughness Measurement: Differences between surface roughness and surface waviness, numerical assessment of surface finish – CLA, Ra, R.M.S and Rz. Methods of measurement of surface finish – Profilograph.

UNIT – VI:

Screw Thread Measurement: Element of measurement, measurement of Major, minor, effective diameter, angle of thread and thread pitch. Optical Measuring Instruments: Tool maker's microscope - its uses.

Gear Measurement: Measuring instruments, Gear tooth profile, Measurement of diameters, pitch, and tooth thickness.

Coordinate Measuring Machine: Introduction, types of CMM, role of CMM and Applications.

TEXTBOOKS:

1. Mechanical Measurements & Control, D. S. Kumar, Metropolitan Book Co.
2. A Textbook of Engineering Metrology, Mahajan, Dhanpat Rai and Co.
3. Instrumentation, Measurement, and Analysis, B. C. Nakra and K. K. Choudhary, TMH

REFERENCES:

1. Basic Principles - Measurements (Instrumentation) & Control Systems, S. Bhaskar, Anuradha agencies
2. Metrology and Measurement, Anand K. Bewoor, Vinay A. Kulkarni, Tata McGraw Hill Education
3. Engineering Metrology, I. C. Gupta, Dhanpat Rai & Co. Ltd.
4. Mechanical Measurements and Instrumentation, R. K. Rajput, Katson Books

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

(19PE1AE13) AUTOMOTIVE BIOMECHANICS

COURSE OBJECTIVES:
- To study the concepts of biomechanics and modeling of human response
- To present the biomechanics of thorax/abdomen and head/brain
- To explain the restraint system and injury prevention

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the concepts of biomechanics and modeling of human response
CO-2: Describe the biomechanics of thorax/abdomen and head/brain
CO-3: Analyze the restraint system and injury prevention

UNIT – I:
Introduction to Biomechanics: Basics of Bio-mechanics- Relevance in automotive industries- Dummies – crash testing – rating Testing and Procedure

UNIT – II:
Modelling of Human Response: Human body modelling- Dummies and mathematical model development- impact rating and criterion, classification of injuries, injury criteria, injury scale, injury risks, restraints and design- Estimating Effects of Vehicle Mass and Active Safety Technologies on Injury/Fatality Risk.

UNIT – III:
Biomechanics of the Thorax/Abdomen: Basics and modelling – critical injury criteria-design for minimization of injury – Rating – Restraint design- Computational injury biomechanics – difference between male female occupants and driver.

UNIT – IV:
Head/Brain Biomechanics; Introduction- basic of head injuries and criterion- restraint design- vehicle body design and optimization- Skull protection- multiple injury mitigation – Male –female injury mechanics - Human and ATD Response to High-Speed Vertical Loading- neck injury biomechanics.

UNIT – V:
Restraint and Protective System Injury Assessment and Evaluation: Introduction- Overlap/angled frontal crash testing and real-world performance- Computational injury biomechanics -Biomechanical injury data analysis -Development of future vehicle safety features.

UNIT – VI:
Injury Prevention: Prevention of head injuries, soft tissue neck injury, head restraint geometry and padding material, self-aligning head restraint, WHIP seat, damping seat side, WipGARD, Prevention of pelvic injuries and lower extremities.

TEXTBOOKS:
1. Biomechanics: Mechanical Properties of Living Tissues, Fung Y. C., Springer, 2nd Edition, 1993

2. Basic Biomechanics, Susan J. Hall, 4th Edition, Tata Mcgraw Hill, 2004

REFERENCES

1. Medical Instrumentation –Application & Design, Webster J. G., 3rd Edition, John Wiley and Sons Inc., 2003
2. Biomechanics-Principles and Applications, Schneck D. J. and Bronzino J. D., 2nd Edition, CRC Press, 2000
3. Fundamentals of Biomechanics, Duane Knudson, 2nd Edition, Springer, 2007

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B.Tech. VII Semester	L	T/P/D	C
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(19PE1AE14) INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

COURSE PRE-REQUISITES: Engineering Mathematics

COURSE OBJECTIVES:
- To formulate and solve using linear programming
- To solve transportation, sequencing, replacement and queuing problems
- To understand the role and application of industrial engineering
- To explain the theory of games, replacement and inventory and their solution methodology for solving problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze linear programming models in practical and their practical use
CO-2: Evaluate transportation, sequencing, replacement and queuing problems and their solution methodology
CO-3: Outline the role and application of industrial engineering
CO-4: Apply theory of games, replacement and inventory models for solving problems

UNIT – I:
Introduction: Origin, development, definition, characteristics and phases, types of OR models, applications and limitations.
Allocation: Linear programming problem formulation, graphical solution, simplex method, artificial variables technique, two phase method, big-M method and 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.
Sequencing: Introduction, flow shop sequencing-n jobs through two machines-n jobs through three machines-Job shop sequencing-two jobs through m machines.

UNIT – III:
Replacement: Introduction, replacement of items that deteriorate with time-when money value is not counted and counted-Replacement of items that fail completely and group replacement
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*2and 2*n games-graphical method.

UNIT – IV:
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. Introduction to supply chain management.

UNIT – VI:

Marketing: Functions of marketing, marketing mix, product lifecycle, channels of distribution and sales management. Manufacturing planning - MRP, MRP-II, JIT and CIM.

Work Study: Concept of productivity, method study - Basic steps in method study, process charts, diagrams, models and templates, principles of motion economy, micro motion study, therbligs and SIMO Chart. Work Measurement - Stopwatch procedure of time study, performance rating, allowances, work sampling and simple problems.

TEXTBOOKS:

1. Operations Research, Sharma J. K., 5th Edition, McMilan, 2012
2. Operations Research, Pannerselvam R., Kindle Edition, Prentice Hall International, 2012
3. Operations Research, Natarajan A. M., Balasubramani P., Tamilarasi A, 1st Edition, Pearson Education, 2005

REFERENCES

1. Introduction to OR, Hamdy A. Taha, 10th Edition, Pearson, 2019
2. Operations Research, Wagner, 2nd Edition, Prentice Hall International, 1975
3. Operations Research, Sharma S. D., Kedarnath, 2012
4. Introduction to Operations Research, Hiller and Liebermann, 9th Edition, Tata McGraw Hill, 2011
5. Industrial Engineering Management, Khanna O. P., Dhanpat Rai Publications, 2018

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PE1AE15) AUTOMATIC TRANSMISSION

COURSE PRE-REQUISITES: Automotive chassis, Fluid Mechanics and Hydraulic Machinery and Basic Electrical and Electronics Engineering

COURSE OBJECTIVES:

- To understand the fundamental concepts of automatic transmission systems
- To discuss the basic functionality of various types of torque multiplication
- To provide working of various hydraulic transmission systems
- To learn the features and working of electric drives

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Describe the concepts and technologies available in of automatic transmission
CO-2: Explain functionality of various types of torque multiplication
CO-3: Explain working of various hydraulic transmission systems
CO41: Describe constructional features and working of electric drives

UNIT – I:
Concept: Principles of automatic transmission, advantages, limitations, types - Mechanical, hydrodynamic, hydro mechanical, hydro static and electric.

UNIT – II:
Mechanical: Principle of centrifugal clutches, comparison between conventional and centrifugal clutches, centrifugal clutches used in two wheelers, over drives – Principle, operation, types, advantages and limitations.

UNIT – III:
Hydrodynamic Drives: Principle of fluid coupling, construction, operation and characteristics, fluid coupling with conventional gear boxes. Introduction to torque converters, comparison between fluid coupling and torque converters, performance characteristics, slip, principles of torque multiplication, types of torque converters.

UNIT – IV:
Hydro-Mechanical Drives: Major components, principle of planetary gear trains, actuating mechanism, controls system – Types - Manual, governor, throttle and hydraulic control systems. Principle of automatic gear shifting. Typical automatic transmissions.

UNIT – V:
Hydrostatic Drives: Principles of hydrostatic drives, different systems of hydrostatic drives, fixed displacement pump and fixed displacement motor, variable displacement pump and fixed displacement motor, fixed displacement pump and variable displacement motor, variable displacement pump and variable displacement motor, applications, plunger type pump and plunger type motor, advantages and limitations, typical hydrostatic drives.

UNIT – VI:

Electric Drives: Early Ward Leonard control system - Main features, generator, merits, reverse motion, modified Ward Leonard control system - Main features, modifications. Modern electric drives - Main features, performance characteristics, advantages and limitations.

TEXTBOOKS:

1. Automatic Transmissions, Jack Erjavec, Delmar Publishers, 2005
2. Advanced Vehicle Technology, Heinz Heisler, SAE, 2002

REFERENCES

1. Fundamentals of Electrical Engineering and Electronics, Theraja B. L., S. Chand & Company Ltd, 2009
2. Automatic Transmission, Tucker H. F., Van Nostrand Reinhold Company, 1980
3. Automatic Transmission, Mathias F. B., Prentice Hall, 1998
4. Industrial Hydraulics, John J. P., Tyler G. H., McGraw Hill Publishers, 1980

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

(19PE1ME20) 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 and sustainability, 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, Overview of design for additive manufacturing.

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 and Dekker Inc.
2. Engineering Design – Material and Processing Approach, George E. Dieter, McGraw Hill Int.

REFERENCES:

1. HandBook of Product Design, Geoffrey Boothroyd, Marcel and Dekker Inc.
2. Computer Aided Assembly Planning, A. Delchambre, Springer

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PE1AE16) VEHICLE TRANSPORT MANAGEMENT

COURSE OBJECTIVES:
- To provide knowledge on modes of road transport, equipment and maintenance
- To understand the business and management practices on vehicles in fleets and their maintenance
- To give knowledge on vehicle scheduling, fixation of fare and its structure
- To identify the type of vehicle and operating costs

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the road infrastructure and about garage equipments
CO-2: Classify business and management practices on vehicles in fleets and their maintenance
CO-3: Demonstrate effective vehicle management skills such as scheduling, fare fixation for optimal usage on roads
CO-4: Analyze operating costs based on the type of vehicle

UNIT – I:
Historical Background: Introduction, the growth of a network, trams, trolley buses, private car's subsidies.
Infrastructure: Road, Approach Road. Highways National, State, District, traffic condition, relief of congestion, pedestrians, zebra lines, margins, shopping centers. Bus-stops. shelters. Bus stations. Garages layout of premises, equipment, use of machinery, conveyance of staff, facilities for passengers. Maintenance, preventive, breakdown, overhauling, major, minor.

UNIT – II:
Organisation and Management: Forms of ownership, principle of transport, management, internal organization, centralized condition, decentralized condition (Engineering, traffic and administration), staff administration: industrial relation, administration, recruitment and training, welfare, health and safety.
Public Relations Divisions: Dissemination of information, maintaining goodwill-handling complaints, traffic advisory, committees- local contractors co-operation with the press news and articles-, facilities for visitors- forms of publicity importance of quality, inter departmental liaison advertisements, signs, notice and directions general appearance of premises, specialized publicity.

UNIT – III:
Prevention of Accidents: Emphasis of safe driving-annual awards bonus encouragement vehicle design platform, layout, location of steps, scheduled route hazards records elimination of accident prone devices.
Route Planning: Source of traffic, town planning. turning points, stopping places, shelters survey of route preliminary schedule test runs elimination of hazards factors affecting. Frequency direction of traffic flow estimated traffic possibility single verses double deck.

UNIT – IV:

Timing, Bus Working and Schedules: Timetable layout uses of flat graph method of presentation preparation of vehicle and crew schedule preparation of the duty roster, co-operation with employer's use of the vehicle running numbering determination of vehicle efficiency, checking efficiency of crew, duty arrangements.

UNIT – V:

Fare Collections Systems: Principles of collection the waybill, bell punch system reduced ticket stocks wilk brew system T.I.M and straight /M/C/S. The verometer lenson parason coach tickets exchanges, box system personal and common stock flat fare platform, control.

Fare Structure: Basis of fares historical background effects of competition and control calculating average zone system straight and tapered scale elastic and inelastic demand coordination of fares concessions fares changes for workman. Anomalies double booking inter availability through booking and summation private hire charges.

UNIT – VI:

Operating Cost and Types of Vehicles: Classification costs, average speed running costs supplementary costs depreciation obsolescence, life of vehicles sinking fund factor affecting post per vehicles mile incidence of wages and overheads 100 seats miles basis, average seating capacity vehicles size and spread overs, types of vehicle economic considerations authorization of trolley, bus services, statuary procedure taxes and hire cars.

TEXTBOOKS:

1. Bus Operation, Kitchin L. D., Illiffe and Sons Ltd., London, 1992
2. Bus and Coach Operation, Rex W. Faulks, Butterworth,1987
3. The Motor Vehicle Act, Government Publication, 1988

REFERENCES:

1. Compendium of Transport Terms, CIRT, Pune
2. M. V. Act 1988 Central Law Agency, Allahabad
3. The Elements of Transportation, R. J. Eaton
4. Goods Vehicle Operation, C. S. Dubbar
5. Road Transport Law, L. D. Kitchen

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

(19PC2AE07) AUTOMOTIVE SIMULATION LABORATORY

COURSE PRE-REQUISITES: Automotive Chassis, Automotive Engines, Automotive Electrical and Electronics, Vehicle Dynamics and Electric and Hybrid Vehicles

COURSE OBJECTIVES:
- To introduce the basics of MATLAB & Simulink
- To model and simulate vehicle subsystems
- To model and simulate various powertrain systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the fundamentals of MATLAB & Simulink
CO-2: Model and simulate vehicle subsystems
CO-3: Model and simulate various powertrain systems

LIST OF EXPERIMENTS:
Any **10 experiments** to be conducted from the following

1. Create variables and perform calculations using built-in functions
2. Create vectors, matrices and perform calculations on arrays
3. Data visualization using plot functions
4. Visualization of signal values and data exchange between Simulink and MATLAB
5. Modelling and simulation of mass spring damper
6. Modelling and simulation of a quarter car model
7. Modelling and simulation of cruise control model
8. Modelling and simulation of IC engine powered vehicle
9. Modelling and simulation of a DC motor
10. Modelling and simulation of an electric vehicle
11. Getting started with roadrunner and exploring different road layout tools
12. Creating a custom junction using roadrunner

Software: MATLAB & Simulink

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

(19PC2AE08) VEHICLE MAINTENANCE AND TESTING LABORATORY

COURSE PRE-REQUISITES: Automotive Chassis, Automotive Engines, Automotive Electrical and Electronics, Vehicle Dynamics and Electric & Hybrid Vehicles

COURSE OBJECTIVES:
- To provide hands on training on vehicle inspection
- To demonstrate wheel balancing and alignment tests
- To conduct vehicle pollution test
- To diagnosis and troubleshoot the vehicle using suitable test equipment

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Examine the vehicle and engine subsystems
CO-2: Experiment wheel balancing and steering
CO-3: Analyse vehicle emission
CO-4: Diagnosis and troubleshoot the vehicle

LIST OF EXPERIMENTS:

1. Vehicle inspection
2. Engine compression test
3. Engine manifold vacuum test
4. Ignition timing test
5. Automotive battery test
6. Wheel balancing of wheel and tyre assembly
7. Headlight alignment test
8. Petrol vehicle exhaust analysis
9. Diesel smoke measurement
10. Study of wheel geometry and Ackerman steering mechanism

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

(19PW4AE04) MINI-PROJECT

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand the formulated industry / technical problem
CO-2: Analyze and / or devlop models for providing solution to Industry / Technical problems
CO-3: Interpret and arrive at conclusions from the project carried out
CO-4: Demonstrate effective communication skills through oral presentation
CO-5: Engage in effective written communication through project report

COURSE OUTLINE:

- A student shall undergo an industry oriented mini-project, in collaboration with an industry of their specialization, during the summer vacation after sixth semester (III year II semester) of the B.Tech. programme.
- Mini-project shall be carried out for a minimum period of 04 weeks and maximum of 06 weeks.
- Evaluation of the mini-project shall be done by a Project Review Committee (PRC) consisting of the Head of the Department, faculty supervisor and a senior faculty member of the department.
- The industry oriented mini-project shall be submitted in a report form and presented before the Project Review Committee (PRC) for evaluation.

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

(19PE1AE17) FUEL CELL TECHNOLOGY

COURSE PRE-REQUISITES: Physics and Chemistry

COURSE OBJECTIVES:

- To study the concepts, principle and working of fuel cell
- To present the components and automotive applications of fuel cell
- To explain the fueling techniques for fuel cell
- To provide the performance and analysis of fuel cell

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the concepts, principle and working of fuel cell
CO-2: Describe the components and automotive applications of fuel cell
CO-3: Outline the fueling techniques for fuel cell
CO-4: Analyze the performance of fuel cell

UNIT – I:
Introduction to Fuel Cells: Introduction, working and types of fuel cell, low, medium and high temperature fuel cell, liquid and methanol types, proton exchange membrane fuel cell solid oxide, hydrogen fuel cells, thermodynamics and electrochemical kinetics of fuel cells.

UNIT – II:
Sample Calculations: Unit operations - fuel cell calculations, fuel processing calculations, power conditioners, System issues - efficiency calculations, thermodynamic considerations, cost calculations - cost of electricity, capital cost development, common conversion factors and automotive design calculations.

UNIT – III:
Fuel Cell Components and their Impact on Performance: Fuel cell performance characteristics, current/voltage, voltage efficiency and power density, Ohmic resistance, kinetic performance, mass transfer effects, membrane electrode assembly components, fuel cell stack, bi-polar plate, humidifiers and cooling plates.

UNIT – IV:
Fueling: Hydrogen storage technology – pressure cylinders, liquid hydrogen and metal hydrides, methods of hydrogen production, carbon fibers, reformer technology – steam reforming, partial oxidation, auto thermal reforming, CO removal and fuel cell technology based on removal like biomass.

UNIT – V:
Fuel Cycle Analysis: Introduction to fuel cycle analysis, application to fuel cell and other competing technologies like battery powered vehicles. SI engine fuelled by natural gas and hydrogen and hybrid electric vehicle.
Solar Vehicle: Solar photovoltaic cell, solar array, solar car electrical system and drive train.

UNIT – VI:

Fuel Cells for Automotive Applications: Fuel cells for automotive applications, technology advances in fuel cell vehicle systems, onboard hydrogen storage, liquid hydrogen and compressed hydrogen, metal hydrides, fuel cell control system, alkaline fuel cell and road map to market.

TEXTBOOKS:

1. Fuel Cells: Principles and Applications, Viswanathan B. and Scibioh Aulice M., University Press, 2006
2. Fuel Cells for Automotive Applications – Professional Engineering Publishing UK, 2004
3. Fuel Cell Handbook, 7^{th} Edition, EG & G Technical Services, Inc.

REFERENCES:

1. PEM Fuel Cells: Theory and Practice, Frano Barbir, Elsevier Academic Press, USA, 2005
2. 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
3. Fuel Cell Technology Handbook, SAE International, Gregor Hoogers, 1^{st} Edition, CRC Press, 2003

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

(19PE1ME14) COMPUTATIONAL FLUID DYNAMICS

COURSE PRE-REQUISITES: C Programming Skills, Numerical Methods, Fluid Mechanics, Heat and Mass Transfer

COURSE OBJECTIVES:
- To familiar with the differential equations for flow phenomena
- To understand different numerical methods involved in problem solving
- To formulate different kinds of physical problems with the different schemes and boundary conditions
- To apply the FVM to physical problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Develop the fluid flow and heat transfer governing equations
CO-2: Apply and analyze different mathematical models and computational methods for flow and heat transfer simulations
CO-3: Conduct the stability analysis and check the applicability of different schemes
CO-4: Solve computational problems related to fluid flow and heat transfer with FDM and FVM

UNIT – I:
Introduction to Computational Fluid Dynamics: Computational Fluid Dynamics: Computational Fluid Dynamics as a Research Tool, Computational Fluid Dynamics as a Design Tool, The Impact of computational fuel dynamics - some other examples: Automobile and Engine Applications, Industrial Manufacturing Applications, Civil Engineering Applications, Environmental Engineering Applications, Naval Architecture Applications, Impact of CFD.

UNIT – II:
The Governing Equations of Fluid Dynamics: Introduction, Models of the Flow: Finite Control Volume, Infinitesimal Fluid Element, The Substantial Derivative (Time Rate of Change Following a Moving Fluid Element), The Divergence of the Velocity: Its Physical Meaning.

UNIT – III:
The Governing Equations of Fluid Dynamics (continuation): The Continuity Equation: Model of the Finite Control Volume, Fixed in Space, Model of the Finite Control Volume Moving with the Fluid, Model of an Infinitesimally Small Element Fixe in Space, Model of an Infinitesimally small fluid element Moving with the Flow, Integral versus Differential Form of the Equations, The Momentum Equation, The Energy Equation, Equations for viscous flow (the Navier – stokes equation), Equations for Inviscid Flow (the Euler Equations), Physical Boundary Conditions

UNIT –IV:
Mathematical Behavior of Partial Differential Equations: The Impact on CFD: Introduction, Classification of Quasi-Linear Partial Differential Equations, A General Method of Determining the Classification of Partial Differential Equations: The

Eigenvalue Method, General Behavior of the Different Classes of Partial Differential Equations: Impact on Physical and Computational Fluid Dynamics - Hyperbolic Equations, Parabolic Equations, Elliptic Equations.

UNIT – V:
Basic Aspects of Discretization: Introduction, Finite Differences, Difference Equations, Explicit and Implicit Approaches: Definitions and Contrasts, errors and analysis of stability

UNIT – VI:
Finite Volume Methods : Introduction, Two-Dimensional Problems, Node-Centered Control Volume, Cell-Centered Control Volume, Cell-Centered Average Scheme, Three-Dimensional Problems, 3-D Geometry Data Structure, Three-Dimensional FVM Equations, FVM-FDV Formulation

TEXT BOOKS:

1. Computational Fluid Dynamics: Basics with Applications, John D. Anderson, McGraw Hill
2. Computational Fluid Dynamics, T. J. Chung, Cambridge University

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
4. Computational Fluid Flow and Heat Transfer, Muralidaran, Narosa Publications

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

(19PE1AE18) AUTOMOTIVE TESTING

COURSE PRE-REQUISITES: Automotive Chassis and Automotive Engines

COURSE OBJECTIVES:
- To describe wind tunnels and testing techniques
- To understand of fundamentals of aerodynamics for high-performance cars and commercial vehicles.
- To identify the road loads (aerodynamic, tractive and rolling resistance) experienced by a vehicle
- To provide design aspects, stability, safety and comfort of the vehicles

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Describe the testing of vehicle bodies in wind tunnel
CO-2: Explain the fundamentals of vehicle aerodynamics for different types of vehicles
CO-3: Analyze the road loads (aerodynamic, tractive, and rolling resistance) experienced by a vehicle
CO-4: Design and analyze the stability, safety and comfort of the vehicles

UNIT – I:
Wind Tunnel Test: Test requirements – ground boundary simulation-wind tunnel selection and Reynolds number capability, model requirements, model details, model mounting, test procedure. Crash test –types

UNIT – II:
Steering Control System Directional Control Test: Analysis of constant radius test, constant steer angle test, constant speed variable radius test, constant speed variable steer angle test, response gain test.

UNIT – III:
Ride Vibration and Body Test: Vibration measurement instrument – accelerometer and signal conditioning, graphical presentation. Dynamic simulation sled testing, methodology, vehicle acceleration measurement and documentation. Dolly roll over test, dolly role over fixture, photographic / video coverage, instrumentation. Vehicle roof strength test – test procedure and test measurements. Door system crush test – procedure and measurements.

UNIT – IV:
Fuel Consumption Test: Type I & II, test route selection, vehicle test speeds, cargo weights, driver selection, test data form, calculations. Test on rough terrain, potholes with laden and unladen conditions.
Energy Consumption Test: Engine cooling fan, air conditioning and brake compressors, hydraulic pumps power consumption. Antilock brake systems energy consumption.

UNIT – V:

Suspension and Stability for Directional Control: Measurement of dimensional and geometric characteristics, measurement of center of gravity position, measurement of moments and products of inertia, measurement of suspension kinematic characteristics, measurement of suspension elastic and coulomb friction characteristics, measurement of shock absorber characteristics.

UNIT – VI:

Wheels and Braking Performance Test: Dynamic cornering fatigue, dynamic radial fatigue tests – procedure, bending moment and radial load calculations. Impact test – road hazard impact test for wheel and tyre assemblies, test procedures, failure criteria and performance criteria. Bumpers - types of tests, pendulum test, fixed collision barrier test, procedure, performance criteria. Air and hydraulic brake test, air brake actuator, valves test, performance requirements. Parking brake – drawbar pull test, grade holding test

TEXTBOOKS:

1. Automotive Mechanics, Crouse W. H. and Anglin D. L., Tata McGraw Hill Publishing Company, 2004
2. Instrumentation, Rangan, Mani and Sharma, Tata McGraw Hill Publishers, New Delhi, 2004

REFERENCES:

1. SAE Handbook, Vol. 3, SAE Publications, 2000
2. Mechanical and Industrial Measurements, Jain R. K., Khanna Publishers, Delhi, 1999
3. Automotive Service, Tim Gilles, Delmar Publishers, 1998
4. Mechanical Measurements, Beckwith T. G. and Buck N. L., Addition Wesley Publishing Company Limited, 1995

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

(19PE1AE19) AUTOMOTIVE PRODUCT DEVELOPMENT STRATEGIES

COURSE PRE-REQUISITES: Automotive Engines and Automotive Chassis

COURSE OBJECTIVES:
- To understand and appreciate the principles and applications relevant to the planning, design, and operations of manufacturing/service firms
- To develop skills necessary to effectively analyze and synthesize the many inter-relationships inherent in complex socio-economic productive systems
- To provide knowledge and skills in the lifecycle of industrial products and current issues in the product portfolios according to global industry and market shift
- To learn to integrate lifecycle management strategies and knowledge to develop new and/or formulate appropriate engineering design solutions in engineering environment

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Design and operate processes with minimal impact on the environment
CO-2: Explain PLM concepts, particularly product data management, change management, workflows and configurations
CO-3: Demonstrate literacy in the application of a PDM tool to support product development processes
CO-4: Summarize knowledge and skills in the lifecycle of industrial products and current issues in the product portfolios according to global industry and market shifts

UNIT – I:
Introduction to Product Design: Introduction, principles of new product development, success and failure in new products, risk management, funnel and its stages, quality control of product development and meeting targets. The principles of product styling-virtual perception of product style, attractiveness and product styling process.

UNIT – II:
Product Planning: Product planning process, aim and opportunities in product planning, competing product analysis, style planning, factors of contextual styling and Intrinsic styling, styling specifications.

UNIT – III:
Global Products and its Problems: Importance, challenges and opportunities of global products, changes and complexity in global products, global product problems – addressing potential problems, multiple causes and its effects, root cause and network of causes and measures, everyday product problems and action.

UNIT – IV:
PLM Enabling Global Products: Product lifecycle management (PLM), key characteristics and functions, importance, benefits of PLM, metrics and targets of PLM, PLM applications – data/document management, part/product management, process/workflow management, program/project management etc.

UNIT – V:

Changes for Global Products: Changing roles of product organizations, increased regulation of product, better managed product, multiple of new products, breakthrough computer aided product development.

UNIT – VI:

Organizational Issues in Product Design and Development: Interactions across organizational functions within respondents organization and industry as a whole, basic elements of the product development process, effectiveness of communication methods and organizational barriers.

TEXTBOOKS:

1. Global Products, John Stark, Springer-Verlag London Ltd., 2010
2. Product Design, Mike Baxter, Stanley Thornes Publishers Ltd., UK, 1999

REFERENCES:

1. Product Design and Development, Karl T. Ulrich and Steven D. Eppinger, Tata McGraw-Hill Publication, 2003
2. Product Innovation, David L. Rainey, Cambridge University Press, 2005
3. Product Development, Anil Mital, Anoop Desai, Anand Subramanian and Aashi Mital, Butterworth-Heinemann Publications, 2008
4. New Product Development, Michael Z. Brooke and William Ronald Mills, Jaico Publishing House, 2008

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

(19PE1ME27) 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 manufacturing Systems and their integration in todays 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: To understand the concepts and advantages of flexible 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:
Automated Material Handling: Objectives of material handling, principles of material handling, selection of material handling equipments, material handing equipments.
Automated Storage and Retrieval Systems: Function of storage systems and definition of AS/RS, AS/RS components, Type of AS/RS.

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 software.

UNIT – VI:

Preventive maintenance, Kanban system, Implementation issues, value engineering, MRD JIT, lean manufacture.

TEXT BOOKS:

1. Hand Book of Flexible Manufacturing Systems, Jha N. K., Academic Press, 1991
2. Flexible Manufacturing Systems, Shivanad 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.)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(19PE1AE20) TWO AND THREE WHEELER TECHNOLOGY

COURSE PRE-REQUISITES: Automotive Chassis and Automotive Engines

COURSE OBJECTIVES:
- To understand the fundamental concepts of two and three wheelers
- To know the various aspects of power unit.
- To discuss functionality of transmission and running systems
- To outline the road performance and maintenance

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Illustrate the concepts and layouts available in two and three wheelers
CO-2: Explain the different sub systems in power unit
CO-3: Explain working of transmission and running systems
CO-4: Analyze the road performance and maintenance

UNIT – I:
Introduction: Development, classification, layouts of two wheelers, motorcycles, scooters, mopeds and three wheelers, applications & capacity – goods & passengers, study of technical specification of two & three wheelers.
Frames & Body: Types of frames, construction, loads, design consideration, materials, types of three wheeler bodies, layout, aerodynamic, aesthetic & ergonomics considerations for bodywork.

UNIT – II:
Power Unit: Selection of engine for two and three wheeler, design considerations for two and three wheeler power plants, special systems requirements for lubrication, cooling and starting. Recent engine developments and electric two and three wheelers.

UNIT – III:
Transmission System: Clutch – requirements, different types used in two and three wheelers, need of primary reduction, selection of transmission, gear transmission, gear shift mechanism, belt transmission, continuous variable transmission, final drive and differential for three wheeler and wheel drive arrangement

UNIT – IV:
Steering and Suspension System: Steering geometry, steering column construction, steering system for three wheelers suspension requirements, design considerations, trailing and leading link, swinging arm, springs and shock absorbers.

UNIT – V:
Brake System: Brake, Design consideration of brake, types of brakes – disc, drum, and braking mechanism – mechanical, hydraulic and servo, wheel types - spokes, disc, split, special tyre requirements for two & three wheelers

UNIT – VI:

Road Performance: Handling characteristics, driver and seating arrangement, ergonomics and comfort, road holding and vehicle stability, riding characteristics, safety arrangements, racing bikes –requirements.

Maintenance: Preventive and brake down maintenance, factors affecting fuel economy & emission.

TEXTBOOKS:

1. Motorcycle Design and Technology, Gaetano Cocco, Giorgio Nada Editore, 2013
2. Two and Three Wheeler Technology, Dhruv U. Panchal, PHI Learning Pvt. Ltd. 2015

REFERENCES:

1. Motorcycle: Evolution, Design and Passion, Mick Walker, Johns Hopkins, 2006
2. Encyclopedia of Motor Cycling, 20 Volumes, Marshall Cavensih, New York and London, 1989
3. Motorcycle Tuning: Chassis, John Robinson, Butterworth-Heinemann, 2001
4. Service Manuals of Manufacturers of Indian Two & Three wheelers

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

(19PE1AE21) AUTO AIR-CONDITIONING

COURSE PRE-REQUISITES: Thermodynamics and Applied Thermodynamics

COURSE OBJECTIVES:

- To understand various refrigeration cycles and working of conventional and unconventional refrigeration systems
- To estimate vehicle cooling load
- To explain heating ventilation and air conditioning systems and components
- To diagnose and troubleshooting of air conditioners and heating systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply refrigeration cycles in conventional and unconventional refrigeration systems
CO-2: Evaluate vehicle cooling loads and capacity of refrigeration and air conditioning systems
CO-3: Describe heating ventilation and air conditioning systems and components
CO-4: Examine and servicing of air conditioners and heating systems

UNIT – I:
Vapour Compression Refrigeration: Working principle, refrigeration cycle in T-s and P-h coordinates, effect of sub cooling and super heating and cycle analysis. Vehicle cooling, load estimation, capacity requirements of air conditioning system, refrigerants used in automobiles and properties.

UNIT – II:
Vapor Absorption System: Aqua-Ammonia system and Lithium-Bromide system.
Steam Jet Refrigeration System: Representation on T-s and h-s diagrams, limitations and applications.
Unconventional Refrigeration System: Thermo-electric, vortex tube and pulse tube – working principles.

UNIT – III:
Introduction to Air Conditioning: Psychrometric properties and processes, sensible and latent heat loads, characterization and SHF load for ventilation and filtration, concepts of RSHF and SHF ESHF and ADP, concepts of human comfort and effective temperature.

UNIT – IV:
Components of Air Conditioners: Air-conditioning components: Compressor, evaporator, condenser, expansion valve, receiver, drier, filters, mufflers, special features and compressor protection anti freezing relay.

UNIT – V:
Operation of an Air-Conditioning System: Type of air conditioners, heaters, vehicle ventilation, combination heater and air conditioner, manually controlled air

conditioner and heater system, automatically controlled air conditioner and heater systems.
Air Heating Equipment: Ducts, registers and grills, blowers and filters.

UNIT – VI:
Trouble Shooting and Services: Servicing of heating systems, causes of air conditioner failure, leak testing guide, discharging the system, evacuating the system, charging the system and troubleshooting air conditioner heater Systems
Servicing of Air Conditioners: Heating Systems, Air conditioner maintenance and service, compressor trouble shooting and service, clutch service, shaft seal leakage compressor, seal removal checking oil level, oil addition and repairs on compressors.

TEXTBOOKS:

1. Refrigeration & Air Conditioning, Aurora C. P., 1st Edition, McGraw Hill Education, 2008
2. Automotive Air Conditioning, William H. Crouse and Donald L. Angtin, 2nd Edition, McGraw-Hill, 1983

REFERENCES:

1. Refrigeration & Air Conditioning, Dhanpat Rai Aurora & Domkundwar, 1899
2. Refrigeration and Air Conditioning, Manohar Prasad, 2nd Edition, New Age Publishers, 2009
3. Refrigeration and Air Conditioning, Stoecker, 2nd Edition, McGraw Hill, 1983
4. Refrigeration and Air Conditioning, Dossat, McGraw Hill
5. Refrigeration and Air Conditioning, Domkundwar, 8th Edition, Dhanpat Rai & Co. (P) Limited, 2016

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

(19PE1AE22) AUTOMOTIVE INSTRUMENTATION

COURSE PRE-REQUISITES: Automotive Engines, Automotive Chassis and Automotive Electronics

COURSE OBJECTIVES:
- To learn basics and working principle of automotive electronics sensors
- To study the fundamentals electronics and signal conditioning
- To understand the working of instruments in the dashboard and servicing
- To identification of noise and vibration sources, control and measuring techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the basics of automotive sensors
CO-2: Describe the fundamentals of electronics and signal conditioning
CO-3: Identify and troubleshoot the problems in instrument cluster
CO-4: Experiment wind tunnel test to analyze vehicle aerodynamics and NVH analysis

UNIT – I:
Introduction to Transducers and Sensors: Transducers- types-resistive, capacitive and inductive based sensors with linear transfer characteristics- thermistor- LVDT- inductive pickup- capacitance- strain gauges- semiconductors- piezoelectric accelerometer-proximity sensors- micro switches-encoders- piezoelectric pressure sensors-instruments- ammeter- voltmeter- speedometer--pressure gauge- vacuum gauge-analog and digital- calibration- cathode ray oscilloscope.

UNIT – II:
Amplifiers and Signal Conditioning Circuits: Analogue signal acquisition with operational amplifier circuits basics- analysis of operational amplifiers circuits - selected examples of basic circuits (Amplifier, Integrator, Adder, Sign Switch, Comparator and Schmitt Trigger) -digital signal acquisition- theory of digital to analog and analog to digital conversion- DAC principles- ADC circuits- recorders- signal conditioning and filtering.

UNIT – III:
Vehicle Instrument Cluster: Typical INS cluster- analog and digital dash instruments – speedometer – odometer –warning - temperature – pressure – ABS – signaling circuits – seat belt restrainer – fuel level – Tyre pressure monitoring – infotainment and telematics – overview- diagnostic trouble codes (DTC) – on-board diagnostics (OBD).

UNIT – IV:
Vehicle Servicing Instrumentation: Wheel alignment gauges - laser alignment- exhaust gas analyzer- emission norm standards - flasher instrumentations - wheel balancing – calibrations- dynamometer- starter motor- dynamometer calibrations - fuel ignition calibration - ignition timer calibration – stroboscope- tacho generator- tyre air pressure instrument- head light alignment - head light intensity study- smoke meter- macro inspection of interior parts using fiber optics-boroscopes.

UNIT – V:

Wind Tunnel Test: Test requirements –ground boundary simulation-wind tunnel selection and Reynolds number capability, model requirements, model details, model mounting, test procedure.

UNIT – VI:

Noise and Vibration: Sound level meters - acoustic measurement t- FFT analyzer- anechoic chamber- varechoic chamber- sound level measurements- NVH standard- Torque measuring instruments, dynamometers.

Data acquisition and processing: General data acquisition system examples, storage, processing,

TEXTBOOKS:

1. Diagnosis and Troubleshooting of Automotive Electrical, Electronics and Computer Systems, Halderman J., Professional Technical Series, Pearson Education, 2012
2. Measurement Systems – Application and Design, Ernest O. Doebelin, McGraw Hill, 2010

REFERENCES:

1. Mechanical Measurements, Beakwith T. G. and Buck N. L., Pearson Education, New Delhi, 2007
2. Automotive Electronics Handbook, Jurgen R., McGraw Hill New York, 2000
3. Advanced Automotive Fault Diagnosis, Tom Denton, Elsevier Butterworth-Heinemann, 2006

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

(19PE1AE23) SPECIAL PURPOSE VEHICLES

COURSE PRE-REQUISITES: Automotive Chassis

COARSE OBJECTIVES:

- To give knowledge of various special purpose vehicles and their applications
- To understand the design considerations and features of special purpose vehicles
- To provide an overview of the subsystems and components
- To identify the purpose and requirement for the selection of subsystems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the need and functions of different types of tractors, cranes and excavators
CO-2: Discuss the types of graders and their merits and demerits
CO-3: Describe the specific functions of haulage vehicles, rooters and scrapers
CO-4: Summarize the requirements and features of various special purpose vehicles

UNIT – I:
Tractors: General description, specification and functions, light, medium and heavy duty wheeled tractors, crawler tractors. Bull dozers, tilt dozers and angle dozers, front end loaders, factors affecting efficiency of output of tractors, simple problems, merits and demerits.

UNIT – II:
Cranes and Excavators: General description, specifications and functions, of cranes, mobile cranes with strut and cantilever type jibs, tractor towed and tractor mounted cranes. General description, specification and functions of excavators classification based on attachments, face shovel, drag shovel, hoe, drag-line and grab or clam shell, advantages and limitations.

UNIT – III:
Graders: Description, specification of tractor towed graders and motor graders, classification and functions of graders, functional details of spreading, mixing, ditching, bank sloping, snow removal, stripping, scarifying, and finishing, elementary details of transmission system (coupling, clutches, gear box, driving axles, propeller shafts), running gear and operating equipment air braking system; hydraulic system and its components, merits and limitations of graders.

UNIT – IV:
Haulage Vehicles and Lift Trucks: General description, specification and functions, self-propelled and tractor towed haulage vehicles, dumpers – front tipping; trucks – rear tipping, tractor towed semi-trailers and trailers (rear and side tipping, bottom dumping). General description, specification and functions, forklift trucks, alternative front end equipment (attachments) – Jib arm, shovel bucket, squeeze clamp, boom, fork extensions, barrel forks. Scissors lift trucks - Applications in industry, advantages and disadvantages.

UNIT – V:

Rooters, Scarifiers and Scrapers: General description, specification and functions, tractor towed rooters and scarifiers - Heavy duty, light duty. General description, specification and functions, tractor towed and motorized scrapers, scraper work in cutting, cambering, side hill cutting, spreading on embankments, compaction of fill merits and demerits.

UNIT – VI:

Compaction Vehicles and other Special Purpose Vehicles: General description, specification and functions, smooth wheeled rollers, pneumatic tired rollers, agricultural Rollers, sheep's foot rollers, vibrating compactors. General description, specification and functions, Ambulance, oil tankers, surveillance vehicle, television recording mobile unit, reefer vehicle, double decker bus, vestibule bus, fire fighting vehicle.

TEXTBOOKS:

1. Construction Planning, Equipment and Methods, Peurifoy R. L., Tata McGraw-Hill Publishing Company, New Delhi, 2002
2. Off-Road vehicles, Ian Graham, Heinemann Library, 2008

REFERENCES:

1. Terramechanics and Off-Road Vehicle Engineering, Wong J., Butterworth-Heinemann, 2009
2. Mechatronics and Intelligent Systems for Off-road Vehicles, RoviraMás, Francisco, Zhang, Qin, Hansen, Alan C., Springer, 2011
3. Motor Graders, Roninson E. G., MIR Publications, Moscow, 1985
4. Tractors and Automobiles, Rodhiev and Rodhiev, MIR Publishers, Moscow, 1984

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

(19PE1AE24) PRODUCT LIFECYCLE MANAGEMENT

COURSE PRE-REQUISITES: Mathematics, Computers and Use of Software Packages

COURSE OBJECTIVES:
- To understand PLM Strategies
- To know the principles of product lifecycle
- To understand business process
- To understand importance of forecasting

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Forecast the demand of the product
CO-2: Formulate a new product strategy
CO-3: Predict the lifecycle of product
CO-4: Interpret the lifecycle process of individual items

UNIT – I:
Introduction to PLM: Need for PLM, opportunities and benefits of PLM, different views of PLM, components of PLM, phases of PLM, PLM feasibility study, PLM visioning.
PLM Strategies: Industrial strategies, strategy elements, its identification, selection and implementation, change management for PLM.

UNIT – II:
Product Data Management (PDM): PDM systems and importance, reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation.

UNIT – III:
Product Design: Engineering design, organization and decomposition in product design, product design process, methodical evolution in product design, concurrent engineering, design for 'X' and design central development model. Strategies for recovery at end of life, recycling, human factors in product design. Modeling and simulation in product design.

UNIT – IV:
New Product Development: Structuring new product development, building decision support system, estimating market opportunities for new product, new product financial control, implementing new product development, market entry decision, launching and tracking new product program, Concept of redesign of product.

UNIT – V:
Technology Forecasting: Future mapping, invocating rates of technological change, methods of technology forecasting such as relevance trees, morphological methods and mission flow diagram, combining forecast of different technologies, uses in manufacture alternative.

UNIT – VI:

Product Conception Process: Business processes, data-process relationship, from the idea to waste disposal Product structures: Variant management, product configuration, material master data, product description data, Data models, Lifecycles of individual items, status of items.

TEXTBOOKS:

1. Product Design for the Environment-A Lifecycle Approach, Taylor Fabio Giudice, Guido La Rosa, and Francis, 2006
2. NPD: Managing and Forecasting for Strategic Processes, Robert J. Thomas

REFERENCES:

1. Product Lifecycle Management Paradigm for 21st Century Product Realization, John Stark, Springer-Verlag, London, 2006
2. Product Lifecycle Management, Michael Grieves, Tata McGraw Hill, 2006
3. Technological Forecasting for Decision Making, Martins Joseph, 2nd Edition, North Holland

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

(19PW4AE05) MAJOR PROJECT PHASE-I

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

(19PW4AE06) MAJOR PROJECT PHASE-II

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify and formulate the problem (Industry/technical/societal)
CO-2: Analyze, design and develop a solution to industry/technical/societal problems
CO-3: Implement and execute the solution
CO-4: Demonstrate effective communication skills through oral presentation
CO-5: Engage in effective written communication through project report

COURSE OUTLINE:

- A student shall initiate major project in seventh semester (IV year I semester) and continue it in the eighth semester (IV year II semester).
- Major project shall be carried out in two phases i.e., Major Project Phase-I in the seventh semester and Major Project Phase-II in the eighth semester.
- Major project shall be evaluated for a total of 200 marks. Out of which, Major Project Phase-I shall be evaluated for 100 marks in seventh semester and Major Project Phase-II for 100 marks in eighth semester.
- Evaluation of Major Project Phase-I and Major Project Phase-II shall consist of both CIE and SEE in each semester.
- CIE shall be done by a Project Review Committee (PRC) consisting of Head of the Department, project supervisor and senior faculty member of the Department.
- CIE shall be done on the basis of two seminars conducted in each semester as per the academic calendar and as per the evaluation format provided by the DoA.
- A student shall submit project progress in prescribed report format during each of the project reviews.
- SEE shall be carried out in both Major Project Phase-I and Major Project Phase-II.
- SEE in Major Project Phase-I shall be conducted by a committee consisting of Head of the Department, the project supervisor and one senior faculty of the programme.
- SEE in Major Project Phase-II (project viva-voce) shall be conducted by a committee consisting of an external examiner, Head of the Department, the project supervisor and one senior faculty of the programme.