R18

B.Tech. (CIVIL ENGINEERING)

B.Tech. R18 CBCS Curriculum

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous, ISO 9001:2015 & QS I-Gauge Diamond Rated Institute, Accredited by NAAC with 'A++' Grade
NBA Accreditation for B.Tech. CE, EEE, ME, ECE, CSE, EIE, IT Programmes
Approved by AICTE, New Delhi, Affiliated to JNTUH, NIRF 135 Rank in Engineering Category
Recognized as "College with Potential for Excellence" by UGC
Vignana Jyothi Nagar, Pragathi Nagar, Nizampet (S.O), Hyderabad – 500 090, TS, India.
Telephone No: 040-2304 2758/59/60, Fax: 040-23042761
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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

CIVIL ENGINEERING

VISION OF THE DEPARTMENT

To develop Civil Engineering Department as a Centre of excellence for imparting value based education to the students at undergraduate and post-graduate level to meet industry needs and to develop as a major research center meeting national and international standards.

MISSION OF THE DEPARTMENT

- To impart in-depth and up-to-date knowledge of Civil Engineering concepts with focus on character enhancement, leadership qualities, effective communication, social responsibility and pursuit of lifelong learning and professional development.

- To provide a platform to the students to engage in original innovative research.

B.TECH.
(CIVIL ENGINEERING)

B.TECH. (CE)

PROGRAM EDUCATIONAL OBJECTIVES

PEO -1: To provide students with a solid foundation in Basic and Engineering Sciences to understand, analyze and evaluate the information to achieve expertise in core areas of Civil Engineering.

PEO- II: To prepare the students to achieve high level technical expertise in the fields of Civil Engineering and to excel in the design and construction of various components or systems of Civil Engineering and to make the students capable of pursuing higher studies and research.

PEO- III: To establish acquaintance with the practical implementation of the theoretical concepts through laboratories, by bringing the real world into the academics through virtual industry labs and to enhance experimental skills of students beyond curriculum and encouraging them to identify and solve complex engineering problems.

PEO- IV: To equip students with modern professional abilities such as effective communication, collaborative work in diverse teams, ethical decision making, successful management of personal and professional career objectives and passion for continuous development through lifelong learning.

PEO – V: To prepare the students to guide their professional development by bringing awareness of professional society activities, professional licensure requirements and opportunities for further education in graduate school.

B.TECH. (CE)

PROGRAM OUTCOMES

PO-1: Engineering Knowledge: The student is capable of applying the principles of basic sciences and mathematics in learning the Civil Engineering subjects. Graduates will be proficient in the core principles of Civil Engineering as they pertain to the sub-fields of Environmental Engineering, Geo-Technical Engineering, Structural Engineering, Transportation Engineering, Water Resources Engineering and will be able to apply these principles in engineering practice.

PO-2: Problem Analysis: The Graduates will possess critical thinking skills, problem solving abilities and familiarity with the computational procedures essential to the field.

PO-3: Design & Development of Solutions: The student is able to plan, analyze, design and look after the construction of various types of Civil Engineering structures with appropriate consideration for public health and safety, cultural, societal and environmental considerations.

PO-4: Conduct investigations of complex problems: The student will use research based methods to design, conduct experiments, to analyze and interpret experimental data.

PO-5: Modern Tool Usage: The student will get hands on training in the various modern Civil Engineering software and modern equipment.

PO-6: The Engineer and Society: The students will apply reasoning and uses appropriate knowledge to assess societal, health, safety, legal and cultural issues.

PO-7: Environment and Sustainability: As the students possess substantial knowledge in multi disciplinary subjects, they will be able to plan various projects keeping in view of its environmental effects on other related fields.

PO-8: Ethics: The student will apply ethical principles and commitment to profession and responsibilities of their profession.

PO-9: Individual and Team work: The graduate is capable of working productively as an individual, as a member or a leader in driver set teams.

PO-10: Communication: The student will possess mastery in good communication skills, expressing ideas, writing technical reports and effective managerial skills.

PO-11: Project Management and Finance: The graduates will acquire knowledge and understanding of the critical issues for professional practices such as the procurement of works, interaction with contractors during the construction phase of a project, financial and managerial capabilities.

PO-12: Life-Long learning: The student will have an awareness of contemporary issues and will contribute to the well being of the community with life-long learning in the broadest context of ever growing technology.

B.TECH. (CE)

PROGRAM SPECIFIC OUTCOMES

PSO-1: Survey, Plot & Plan layout for Civil Engineering Structures and alignment for Canals & Roads.

PSO-2: Analyze the problems related to structural components for Buildings, Pavements and Waterways and recommend suitable measures with appropriate consideration for public health, safety and Environmental sustainability.

PSO-3: Specify, design, supervise, test & evaluate foundations & superstructures for Buildings, Industries. Hydraulic structures, Powerhouses, Highways, Railways, Airways, Water supply systems & Sewage treatment plants.

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

I SEMESTER **R18**

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

II SEMESTER **R18**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
18BS1MT02	Linear Algebra and Ordinary Differential Equations	3	1	0	4	4
18BS1PH01	Applied Physics	3	1	0	4	4
18ES1ME01	Engineering Mechanics	3	1	0	4	4
18ES3CE01	Geometrical Drawing	1	0	5	6	3.5
18BS2PH01	Applied Physics Laboratory	0	0	3	3	1.5
18PW4CE01	Design Sensitization	0	0	2	2	1
Total		**10**	**3**	**10**	**23**	**18**

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

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

III SEMESTER **R18**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
18BS1MT08	Probability, Statistics and Time Series	3	0	0	3	3
18PC1CE01	Strength of Materials - I	3	0	0	3	3
18PC1CE02	Fluid Mechanics	3	0	0	3	3
18PC1CE03	Building Materials, Construction and Planning	3	0	0	3	3
18PC1CE04	Surveying and Geomatics	3	0	0	3	3
18PC1CE05	Disaster Management	2	0	0	2	2
18PC2CE01	Strength of Materials Laboratory	0	0	2	2	1
18PC2CE02	Surveying and Geomatics Laboratory	0	0	2	2	1
18PC3CE01	Computer Aided Civil Engineering Drawing	0	0	2	2	1
Total		**17**	**0**	**6**	**23**	**20**

IV SEMESTER **R18**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
18PC1CE06	Strength of Materials - II	3	0	0	3	3
18PC1CE07	Structural Analysis	3	0	0	3	3
18PC1CE08	Concrete Technology	3	0	0	3	3
18PC1CE09	Hydraulic Engineering and Hydraulic Machines	3	0	0	3	3
18PC1ME17	Basic Mechanical Engineering	2	0	0	2	2
18ES1EE03	Elements of Electrical and Electronics Engineering	3	0	0	3	3
18PC2CE03	Fluid Mechanics and Hydraulic Machines Laboratory	0	0	2	2	1
18PC2CE04	Concrete Laboratory	0	0	2	2	1
18ES2EE03	Elements of Electrical and Electronics Engineering Laboratory	0	0	2	2	1
Total		**17**	**0**	**6**	**23**	**20**
18MN6HS03	Gender Sensitization	0	0	2	2	0

L – Lecture T – Tutorial P – Practical

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

V SEMESTER **R18**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
18PC1CE10	Design of Reinforced Concrete Structures	3	0	0	3	3
18PC1CE11	Engineering Hydrology	3	0	0	3	3
18PC1CE12	Transportation Engineering	3	1	0	4	4
18PC1CE13	Engineering Geology	3	0	0	3	3
	Professional Elective -I					
18PE1CE01	Advanced Structural Analysis	3	0	0	3	3
18PE1CE02	Green Buildings					
18PE1CE03	Repair, Rehabilitation and Retrofitting of Structures					
18PE1CE04	Masonry Structures					
18PE1CE05	Engineering Materials for Sustainability					
	Open Elective -I	3	0	0	3	3
18PC2CE05	Engineering Geology Laboratory	0	0	2	2	1
18PC2CE06	Transportation Engineering Laboratory	0	0	2	2	1
18PW4CE02	Internship*	0	0	2	2	1
Total		**18**	**1**	**6**	**25**	**22**

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

VI SEMESTER **R18**

Course Code	Title of the Course	L	T	P	Contact Hours/ Week	Credits
18PC1CE14	Design of Steel Structures	3	0	0	3	3
18PC1CE15	Soil Mechanics	3	0	0	3	3
18PC1CE16	Irrigation Engineering	3	0	0	3	3
18PC1CE17	Estimation and Costing	3	0	0	3	3
	Professional Elective -II					
18PE1CE06	Air Pollution Control	3	0	0	3	3
18PE1CE07	Solid Waste Management					
18PE1CE08	Environment Impact Assessment					
18PE1CE09	Rural Water Supply and Sanitation					
18PE1CE10	Water Supply Engineering					
	Open Elective -II	3	0	0	3	3
18PC2CE07	Soil Mechanics Laboratory	0	0	2	2	1
18HS2EN02	Advanced English Communication Skills Laboratory	0	0	2	2	1
18PW4CE03	Design Thinking	0	0	4	4	2
Total		**18**	**0**	**8**	**26**	**22**
18MN6HS02	Environmental Sciences	2	0	0	2	0

L – Lecture T – Tutorial P – Practical

OE TRACKS BASED ON MEZZANINE TECHNOLOGIES:

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

GENERAL POOL OF OE COURSES:

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

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

VII SEMESTER **R18**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
18PC1CE18	Wastewater Engineering	3	0	0	3	3
18HS1MG01	Engineering Economics and Accountancy	3	0	0	3	3
	Professional Elective - III					
18PE1CE11	Foundation Engineering	3	0	0	3	3
18PE1CE12	Advanced Structural Design					
18PE1CE13	Urban Transport and Planning					
18PE1CE14	Finite Element Methods					
18PE1CE15	Geo - Environmental Engineering					
	Professional Elective - IV					
18PE1CE16	Geo Synthetics and Soil Reinforcement	3	0	0	3	3
18PE1CE17	Earthquake Resistance Design of Buildings					
18PE1CE18	Traffic Engineering					
18PE1CE19	Remote Sensing and GIS					
18PE1CE20	Subsurface Investigations and Instrumentation					
	Open Elective - III	3	0	0	3	3
18PC2CE08	CAD and GIS Laboratory	0	0	2	2	1
18PC2CE09	Environmental Engineering Laboratory	0	0	2	2	1
18PW4CE04	Mini-Project*	0	0	4	4	2
18PW4CE05	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**

VIII SEMESTER **R18**

Course Category	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
	Professional Elective - V					
18PE1CE21	Rock Mechanics	3	0	0	3	3
18PE1CE22	Pre-Engineered Buildings					
18PE1CE23	Pavement Analysis Design and Evaluation					
18PE1CE24	Industrial Wastewater Treatment					
18PE1CE25	Structural Health Monitoring					
	Professional Elective - VI					
18PE1CE26	Ground Improvement Techniques	3	0	0	3	3
18PE1CE27	Pre-Stressed Concrete					
18PE1CE28	Intelligent Transport System					
18PE1CE29	Construction Technology and Project Management					
18PE1CE30	Railway, Airport and Harbour Engineering					
	Open Elective - IV	3	0	0	3	3
18PW4CE06	Major Project Phase - II	0	0	12	12	6
Total		**9**	**0**	**12**	**21**	**15**

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18BS1MT01) ADVANCED CALCULUS

COURSE PRE-REQUISITES: None

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

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

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

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

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

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

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

UNIT-V:

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

UNIT-VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18BS1CH01) ENGINEERING CHEMISTRY

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

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

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18HS1EN01) ENGLISH

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

UNIT-I:

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

UNIT-II:

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

UNIT-III:

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

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

UNIT-IV:

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

UNIT-V:

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

UNIT-VI:

Organizational Patterns for writing

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

TEXT BOOK:

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

REFERENCES:

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

SUGGESTED READINGS:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18ES1CS01) PROGRAMMING THROUGH C

COURSE PRE-REQUISITES: None

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

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

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

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

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

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

UNIT-V:

Structures: Defining structures and array of structures.

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

UNIT-VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18ES2CS01) PROGRAMMING THROUGH C LABORATORY

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

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

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

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

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

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

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

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

Tutorial 7: Functions, call by value:
Lab 7: Simple functions.

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

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

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

Tutorial 12: File handling
Lab 12: File operations.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18BS2CH01) ENGINEERING CHEMISTRY LABORATORY

COURSE PRE-REQUISITES: None

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

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

LIST OF EXPERIMENTS:

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

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

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18HS2EN01) ENGLISH LANGUAGE COMMUNICATION SKILLS LABORATORY

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

UNIT-I:

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

UNIT-II:

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

UNIT-III:

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

UNIT-IV:

1. Speaking Activity: Oral Presentation

2. Accuracy in listening- listening to discussion on specific issues
3. Reading Comprehension

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

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

SUGGESTED READINGS:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18ES2ME01) WORKSHOP PRACTICES

COURSE PRE-REQUISITES: None

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

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

LECTURES & VIDEOS:

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

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

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

III. Welding

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

IV. Smithy

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

V. Electrical & Electronics

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

VI. Machine Shop

i. Step turning on lathe
ii. Drilling & threading

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18BS1MT02) LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS

COURSE PRE-REQUISITES: Matrices, Differentiation and Integration

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

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

UNIT-I:
Linear Algebra-Matrices: Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method; System of linear equations; Consistency of Homogeneous and Non-Homogeneous equations, Gauss Jacobi and Seidel Iteration Method.

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

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

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

UNIT-V:

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

UNIT-VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18BS1PH01) APPLIED PHYSICS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

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

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

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

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

UNIT-V:

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

UNIT-VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18ES1ME01) ENGINEERING MECHANICS

COURSE PRE-REQUISITES: Mathematics, Physics

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

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

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

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

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

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

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

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

UNIT-VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Semester–CE	**L**	**T/P/D**	**C**
	1	**53.5**	

(18ES3CE01) GEOMETRICAL DRAWING

COURSE OBJECTIVES:

- To learn basic AutoCAD skills
- To learn various curves used in engineering practice, orthographic projections and projection of planes & solids
- To learn Sections and Sectional views of prisms, pyramids, cylinders and cones
- To learn Isometric projections, transformation of Projections & Perspective Projections

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Draw various types of scales and curves used in engineering practice using AutoCAD
CO-2: Draw orthographic projections and sectional views of planes and solids
CO-3: Draw Isometric projection and Transformation of Projections & Perspective Projections
CO-4: Draw sign conventions of building materials and line plan of single room

UNIT–I:
Introduction to Engineering Drawing: Principles of engineering graphics and their significance. Size of drawing sheets, Types of lines, lettering, Dimensioning, Title block - Drawing instruments and their uses - Different types of scales, scale of chords
Introduction to AutoCAD: User Interface – Menu system – Different types of file formats – setting up a drawing space – coordinate systems – tool bars (draw, modify, annotations, layers etc) – status bar (ortho, grid, snap, iso etc) – display control commands (pan, zoom etc) – printing setup.

UNIT–II:
Curves used in Engineering Practice: Conic Sections – Construction of Ellipse, Parabola, Hyperbola & Rectangular hyperbola – General Method only.
Principles of Orthographic Projections: Introduction – First angle projection – Third angle projection. Projection of Points. Projection of straight lines inclined to both planes by first angle projection method.

UNIT–III:
Projection of Planes: Projections of regular Planes – planes parallel to one and perpendicular to other plane, planes perpendicular to one and inclined to the other, planes inclined to both planes - Auxiliary Projections.
Projection of solids: Projections of Regular Solids - inclined to one and inclined to both the planes - Auxiliary Projections.

UNIT–IV:
Sections of Right Regular Solids: Sections of right regular solids - prisms, pyramids, cylinders and cones. Sections of solids cut by planes parallel to one plane and perpendicular to other plane and Oblique plane.

UNIT–V:

Isometric Projections: Principles of isometric projections, Isometric scale, isometric views, conventions, isometric views of lines, planes, simple solids.

Transformation of Projections Conversion of isometric views to orthographic views-conventions and vice versa.

Perspective Projections Perspective view of points, lines, plane figures and simple solids, vanishing point method & visual ray method.

UNIT – VI:

Sign Conventions: Brick, Stone, Sand filling, Mortar, Concrete, Glass, Steel, Aluminium, Earth, Rock and Timber, doors and windows.

Introduction to Line Plan and Sectional Plan of Buildings

Introduction to Building Information Modeling (BIM)

TEXT BOOKS:

1. Engineering Drawing, N.D.Bhatt, 53rdEdition, Charotar Publishing House Pvt.Ltd., 2014
2. Engineering Drawing, Basant Agrawal, 1st Edition, McGraw-Hill Education (India) Pvt. Ltd., 2013

REFERENCES:

1. Engineering Drawing with AutoCAD, K.Venkata Reddy, 4th Edition, B.S. Publications, 2009
2. Civil Engineering Drawing-I, N.Sreenivasulu, S.Rama Rao,2nd Edition, Radiant Publishing House, 2013
3. Engineering Drawing, M. B. Shah, 2nd Edition,Pearson Education India, 2009
4. Engineering Drawing and Graphics, K. Venugopal, 5th Edition, New Age International, 2004

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18BS2PH01) APPLIED PHYSICS LABORATORY

COURSE PRE-REQUISITES: None

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the optical phenomena with formation of Newton Rings, pure spectrum through prism and to evaluate grating parameters
CO-2: Illustrate periodic motion by measuring rigidity modulus of a material and also discharging of a capacitor
CO-3: Differentiate resonance phenomenon in Melde's experiment and Sonometer experiment
CO-4: Realize tangent law of magnetism
CO-5: Correlate the experimental results with the class room learning

LIST OF EXPERIMENTS:

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

REFERENCES:

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

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PW4CE01) DESIGN SENSITISATION

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

Students' Responsibilities:

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

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

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

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

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

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

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

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

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18BS1MT08) PROBABILITY, STATISTICS AND TIME SERIES

COURSE PRE-REQUISITES: Permutations and combinations, basic statistics

COURSE OBJECTIVES:
- To know elementary ideas in basic probability
- To know different types of probability distribution functions
- To know correlation and regression
- To know testing a hypotheses
- To know Time series and its utility in engineering applications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Solve problems involving basic probability
CO-2: Evaluate statistical parameters of different probability distributions
CO-3: Calculate correlation, regression, rank correlation coefficients
CO-4: Apply the knowledge of different probability distributions to Test of Hypothesis
CO-5: Apply least squares method to compute time series

UNIT-I:
Basic Probability: Sample space and events, Probability - The axioms of probability, some elementary theorems, conditional probability, Baye's theorem, Random variables - discrete and continuous distributions - Expectation of Discrete Random Variables, Moments, Variance of a sum.

UNIT-II:
Probability Distributions: Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions –related properties.

UNIT-III:
Correlation and Regression: Coefficient of correlation, regression coefficient, the lines of regression, rank correlation

UNIT-IV:
Testing of Hypothesis - Large Sample: Tests of hypothesis - null hypothesis, alternate hypothesis, type I, type II errors, critical region. Inferences concerning means and proportions. Test of hypothesis for single mean and difference between the means. Test of hypothesis for the proportions- single and difference between the proportions, confidence interval for the mean and proportions for large samples.

UNIT-V:
Tests of Significance - Small Samples: Tests of significance, t-distribution, F-distribution, Chi square distribution and their confidence intervals.

UNIT-VI:

Time Series: Time series- utility of time series analysis, components of time series. Preliminary adjustments before analyzing time series, Measurement of trend by the method of least squares, method of moments.

TEXT BOOKS:

1. Statistical Methods, S. P. Gupta, 2011, Sultan Chand and Sons
2. Probability and Statistics for Engineers, Richard A. Johanson, 1995, 5^{th} Edition,Prentice-Hall
3. Probability and Statistics for Engineering & Sciences, Jay L. Devore, 8^{th} Edition, Cengage Learning

REFERENCES:

1. A Textbook of Engineering Mathematics, N. P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2010
2. Advanced Engineering Mathematics,Erwin Kreyszig, 9^{th} Edition, John Wiley & Sons, 2006
3. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 35^{th} Edition, 2000

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1CE01) STRENGTH OF MATERIALS – I

COURSE OBJECTIVES:
- To define various types of stresses and strains
- To understand the concept of shear force and bending moment
- To draw the bending stress and shear stress distribution across various cross-sections
- To distinguish between various methods of determining the slopes and deflections

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Determine the stresses and strains in determinate and indeterminate systems
CO-2: Draw the shear force and bending moment diagrams for determinate beams
CO-3: Evaluate the bending stress and shear stress for the designing flexural members
CO-4: Determine the slopes and deflections for determinate beams

UNIT – I:
Simple Stresses and Strains : Mechanical properties of solids – Elasticity, Plasticity, Ductility, Brittleness, Malleability, Toughness, Hardness - Stress, Strain - Hooke's law – Types of Stresses and Strains – Stress-Strain curves for ductile and brittle materials – Principle of superposition - Bars of varying sections – Bar of tapering section - Working stress – Factor of safety – Lateral Strain – Poisson's Ratio - Volumetric Strain – Elastic moduli - Relationship between different Elastic moduli.

UNIT – II:
Statically Indeterminate Systems: Members subjected to self-weight acting axially and their articulation for uniform stress – Equations of Equilibrium and Compatibility – Composite bars – Temperature stresses
Strain Energy: Strain energy due to axial loads - gradually applied, suddenly applied and impact loads.

UNIT – III:
Shear Force and Bending Moment: Types of supports, loads, beams – Concept of shear force and bending moment – Relation between SF, BM and Rate of loading - SF and BM diagrams for statically determinate beams – Cantilevers, Simply supported beams, Overhanging beams - Point of contra flexure and its significance.

UNIT – IV:
Bending Stresses: Theory of Simple bending – Assumptions - Neutral axis – Derivation of flexure formula – Section modulus for various sections - Bending stress distribution – Strength of a section - Design of simple beam sections.

UNIT-V:
Shear Stresses: Derivation of Shear stress formula – Shear stress distribution across depth of various beam sections like Rectangular, Circular, Triangular, I and T sections.

UNIT-VI:
Deflection of Beams: Slope, Deflection and Radius of curvature – Differential equation for the deflection curve of a beam – Slope and Deflection of beams using Successive

Integration method – Macaulay's method – Mohr's Moment Area method – Conjugate beam method – Application to Cantilever and Simply supported beams.

TEXT BOOKS:

1. Mechanics of Materials, R. C. Hibbeler, Pearson Education
2. Mechanics of Materials, James Gere, Cengage Learning

REFERENCES:

1. Strength of Materials, B. C. Punmia, Ashok Jain, Arun Jain - Laxmi Publications
2. Strength of Materials, R. K. Bansal - Laxmi Publications
3. Strength of Materials, S. S. Rattan, McGraw-Hill Education (India) Pvt. Ltd.
4. Strength of Materials, R. K. Rajput, S. Chand & Company Ltd.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1CE02) FLUID MECHANICS

COURSE OBJECTIVES:
- To identify and obtain values of fluid properties and relationship between them
- To explain the principles of continuity, momentum, and energy as applied to fluid motions
- To apply these principles in the form of mathematical equations
- To solve these equations as applied to practical fluid mechanics problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Define fundamental concepts of fluid mechanics to **solve** the problems related to Civil Engineering.
CO-2: Discuss and **derive** the fundamental mathematical equations of fluid mechanics
CO-3: Solve the fluid mechanics problems related to water conveyance in pipes, orifices, mouth pieces, notches and weirs
CO-4: Evaluate the various assumptions made in the application of equations to avoid the common pitfalls

UNIT – I:
Properties of Fluid: Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapor pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.
Fluid Statics: Fluid Pressure: Pressure at a point, Pascal's law, pressure variation with temperature, density and altitude, Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micromanometers, Pressure gauges; Hydrostatic pressure and force: horizontal, vertical and inclined surfaces; Buoyancy and stability of floating bodies.

UNIT – II:
Fluid Kinematics: Classification of fluid flow; steady, unsteady, uniform and non-uniform flows; Laminar and turbulent flows; One, two and three-dimensional flows; Irrotational and rotational flows; Ideal and real flows; Stream line, streak line, path line and stream tube; stream function, velocity potential function; Equation of acceleration; Convective and local acceleration; One-, two- and three -dimensional continuity equations in Cartesian coordinates; Flow net.

UNIT – III:
Fluid Dynamics: Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation: venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced

UNIT – IV:

Flow Measurement: Measurement of velocity by Pilot tube; Discharge through venture meter; Discharge through office meter; Discharge through flow nozzle; Flow through orifices; Determination of coefficients for an orifice; Flow through mouth piece; Flow through rectangular; triangular and trapezoidal notches and weirs; End contractions; Velocity of approach; Broad crested weir.

UNIT – V:

Analysis of Pipe Flow: Reynolds experiment Classification of Laminar & Turbulent flows. Steady laminar flow through circular pipes. Energy losses in pipelines: Minor losses, Darcy Weisbach equation; Pipes in series and parallel; Branching of pipes, three reservoir problem Total energy line and hydraulic gradient line. Resistance to flow of fluid on smooth and rough pipes; Moody's diagram.

UNIT – VI:

Theory of Boundary Layer: Boundary layer and its growth, Boundary layer thickness, displacement, momentum & energy thickness; Characteristics of Boundary layer along a thin flat plate, Laminar and Turbulent Boundary layers (no derivations), Boundary layer Separation and Control. Flow around submerged objects – Drag and Lift – Magnus effect.

TEXT BOOKS:

1. Fluid Mechanics and Hydraulic Machines, Modi and Seth, Standard Book House
2. Fluid Mechanics & Hydraulic Machines - Problems and Solutions, K. Subramanya McGraw-Hill Education (I) Pvt. Ltd.
3. Fluid Mechanics and Machineries, C. P. S. Ohja, P. N. Chandramouli, and R. Berndtsson

REFERENCES:

1. Fluid Mechanics, V. L. Streeter, E. Benjamin Wiley and W. Bedford, McGraw-Hill Company
2. Fluid Mechanics, Frank M. White, Tata McGraw-Hill Pvt. Ltd.
3. Fluid Mechanics and Hydraulics Machines, R. K. Bansal, Laxmi Publications

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1CE03) BUILDING MATERIALS, CONSTRUCTION AND PLANNING

COURSE OBJECTIVES:

- To list different construction materials, their properties and applications
- To identify and explain major building components
- To understand the building bye-laws
- To explain the services required for different types of buildings

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the properties of different construction materials and their behaviour
CO-2: Appraise various conventional and new-age building materials
CO-3: Explain various building components and finishes
CO-4: Plan a building with appropriate building services

UNIT-I:
Stones, Bricks and Tiles: Stones – classification and quarrying – properties – structural requirements – dressing of stones; Bricks – composition of Brick earth – manufacturing and properties of bricks; Ceramics – Tiles – manufacturing - specifications of tiles.

UNIT-II:
Lime, Cement, Wood, Aluminum, Steel and Glass: Lime – ingredients of lime, classification, manufacturing; Cement- ingredients of cement – manufacturing; Wood – structure – types and properties – seasoning – defects; Aluminum and Steel – composition, material properties and behavior; Glass, Fiber reinforced plastic- material properties.

UNIT-III:
Building Components: Basic Structural and Non- structural components; Foundations – types; Damp Proof Course - methods adopted, treatment in buildings; Lintels – Types; Arches – types; Walls – load bearing and non-load bearing walls; Stair cases – types; Floors - types – mud and muram, wood/timber, marbles, tiles, concrete, flag stones, bricks, mosaic, terrazzo floors; Roofs - types – pitched, flat, curved, lean-to-roof, coupled roofs, trussed roof – king and queen post trusses; Doors – Windows – types.

UNIT-IV:
Masonry: Brick Masonry – types – bonds; Stone masonry – types; Composite Masonry – reinforced brick, cement concrete.
Formwork and Finishing: Scaffolding – types; Shoring; Underpinning; Finishes – plastering, pointing, painting, claddings – types.

UNIT-V:
Building Services: Plumbing Services, Water Distribution, Sanitary – Lines & Fittings; Ventilators: Functional requirements, systems of ventilators. Air conditioning – Essentials and Types; Acoustics – characteristic – absorption – Acoustic design; Fire protection – Fire hazards

UNIT-VI:

Building Planning: Principles of Building Planning, classification of buildings and Building bye laws – Building Information System – Green building concepts.

TEXT BOOKS:

1. Building Materials, Duggal, New Age International
2. Building Construction, B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications (P) Ltd., New Delhi

REFERENCES:

1. Materials Science and Engineering, An Introduction, William D. Callister, Jr., John Wiley and Sons, New York
2. Engineering Materials, S. C. Rangwala, Charotar Publishing House, Anand
3. Building Construction, Arora and Bindra, Dhanpat Rai Publications
4. Building Construction, S. C. Rangwala, Charotar Publishing House, Anand
5. Building Construction, P. C. Varghese, PHI

Codes:

1. National Building Code - 2016
2. Building Bye Laws, State and Central Governments and Municipal Corporations

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1CE04) SURVEYING AND GEOMATICS

COURSE OBJECTIVES:
- To understand methods of measuring horizontal distances using chain and compass instruments
- To evaluate reduced levels and apply in the preparation of contour maps, earthwork and reservoir capacity estimation
- To implement the principles of trigonometry and optics for the determination of horizontal and vertical distances
- To correlate the importance of modern surveying techniques adopted in real world situation

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply principles of surveying for linear measurement
CO-2: Develop contour map and **estimate** the quantity of earthwork required for road and railway constructions
CO-3: Identify appropriate methods for curve setting, elevations, and distances
CO-4: Appraise modern instruments in geomatics

UNIT – I:
Introduction to Surveying: Definition; Classification; Principles of surveying; Errors in surveying: Types of errors; Ranging, Principles of chain surveying; Basic definitions.
Compass Surveying: Prismatic compass; Local attraction; angular measurements Bearings.

UNIT – II:
Simple Leveling: Basic definitions; Curvature and Refraction; classification of methods of leveling; Sources of errors in leveling. Contour; contour interval; Characteristics of contours; Methods of plotting of contours; Uses of contour maps.
Areas and Volumes: Introduction; Simpson's rule; Boundaries with offsets at irregular intervals; coordinate method; planimeter; level section; two level section; trapezoidal and prismoidal rule; volume from contour plan; capacity of a reservoir.

UNIT – III:
Theodolite Survey & Traversing: Theodolite components parts; basic definitions, fundamental lines; measurement of a horizontal angle; repetition and reiteration method and measurement of vertical angle.
Trigonometric Leveling: Base of the object accessible, base of an inclined object accessible, reduced level of the elevated points with inaccessible bases.

UNIT – IV:
Tacheometric Surveying: Basic systems of tacheometric measurements; Inclined sight with staff held vertical; inclined sight with staff held normal to the inclined line of sight.
Curves: Basic definitions; designation of a curve; relationship between radius and degree of curve; types of curve; elements of a simple circular; methods of setting out for simple.

UNIT – V:

Modern Field Survey Systems: Principle of Electronic Distance measurement; types of EDM instruments, total station, parts, accessories – advantages and applications, field procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments.

UNIT – VI:

Photogrammetry Surveying: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping; photographic mapping.

TEXT BOOKS:

1. SurveyingVol. I, II and III, Arora K. R., Standard Book House, 2015
2. Elementary Surveying, Charles D. Ghilani, Paul R. Wolf., Prentice Hall, 2012
3. Surveying Vol. I & II, Duggal S. K., Tata McGraw-Hill Education, 2013

REFERENCES:

1. Surveying I & II,B. C. Punmia, Ashok Kumar Jain, Ashok Kr. Jain, Arun Kr. Jain., Laxmi Publications, 2005
2. Advanced Surveying: Total Station, GIS and Remote Sensing, Madhu N., Sathikumar R. and Satheesh Gobi, Pearson India, 2006
3. Surveying & Levelling, R. Subramanian, Oxford University Press, New Delhi, 2011

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC1CE05) DISASTER MANAGEMENT

COURSE OBJECTIVES:

- To understand the basic concepts, definitions, terminology used in Disaster
- To categorize the types of Disasters and their imposing various impacts to society, structure, environment etc.
- To understand and Compare various phases of Disaster Management to achieve Disaster Risk Reduction
- To identify the role of Traditional Knowledge in Sustainable Development

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Correlate various terminology of Disaster
CO-2: Classify the natural and man-made disasters, causes behind them, frequency of occurrence and analyse the various impacts to society, public/private property, and services
CO-3: Recognize the role of each phase of Disaster Management and responsibility of each stakeholder to achieve Disaster Risk Reduction
CO-4: Analyse the relationship between development and disasters and propose sustainable solutions using traditional knowledge

UNIT – I:
Disaster Concepts: Concepts and Definitions: Disaster, Hazard, Risk, Resilience and Vulnerability. Hazard and vulnerable profile of India.

UNIT – II:
Disasters: Classifications and Causes: Disasters classification; Natural disasters: floods, drought, cyclones, volcanoes, earthquakes, tsunami, landslides, soil erosion, forest fires etc; Man-made disasters: industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, wars, stampede etc.

UNIT – III:
Impacts of Natural & Man-made Disasters: Environmental, physical, social, ecological, economic, political, health, psycho-social issues; demographic aspects (gender, age, special needs); Global and national disaster trends; climate change and urban disasters; Pandemics and Complex emergencies.

UNIT – IV:
Approaches to Disaster Risk Reduction (DRR): Disaster management cycle (its phases) - prevention, mitigation, preparedness, response, relief and recovery; structural and non-structural measures; early warning systems; Post disaster public health response (water, sanitation, food safety, waste management, disease control, security, communications)

UNIT – V:

Roles of Stakeholders: Roles and responsibilities of government, community based DRR, local institutions – PRIs and ULBs, NGOs and other stakeholders; Policies and legislation for DRR programmes in India and other international bodies (such as UNISDR, etc) and the activities of National Disaster Management Authority (NDMA).

UNIT – VI:

Disasters, Environment and Development: Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including dams, land use changes, urbanization etc.). Climate change adaptation. Relevance of Indigenous Traditional Knowledge, appropriate technology and local resources.

TEXT BOOKS:

1. Disaster Risk Reduction in South Asia, Pradeep Sahni, Prentice Hall, 2004
2. Disaster Mitigation: Experiences and Reflections,Pardeep Sahni, Alka Dhameja and Uma Medhury, PHI Learning Pvt. Ltd., Delhi, 2015
3. Citizen's Guide to Disaster Management: How to Save Your Own Life and Help Others, Satish Modh, Macmillan India Ltd, Kundli, 2007

REFERENCES:

1. Handbook of Disaster Management: Techniques & Guidelines, Singh B.K., Rajat Publication, 2008
2. Indigenous Knowledge for Disaster Risk Reduction: Good Practices and Lessons Learned from Experiences in the Asia-Pacific Region, ISDR, 2008
3. NDMA & IGNOU Training Manual, Booklet-1, 2, 3, 4
4. Training Module on Village Disaster Management Plan, Ajinder Walia and Sushma Guleria, NIDM, MHA, New Delhi, 2012
5. Protection of Indigeneous Knowledge and Intellectual Property Right (IPR), The Tradition, Singh B., Vol. 05, 18-21, 2007

WEBSITE:

http://ndma.gov.in/ (Home page of National Disaster Management Authority)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC2CE01) STRENGTH OF MATERIALS LABORATORY

COURSE OBJECTIVES:
- To study the need to test various structural and non-structural materials
- To test various materials against various types of straining actions
- To know the nature of the material and its performance under loading
- To understand the mechanism of the various machines

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Prepare the specimens for assessing strengths against various straining actions
CO-2: Determine the characteristics of engineering materials
CO-3: Evaluate the suitability of a material for a certain application
CO-4: Perform experiments making use of load / deformation measuring instruments

LIST OF EXPERIMENTS:

1. Uni-axial tension test on a ductile material
2. Torsion test on a ductile material
3. Direct shear test on mild steel
4. Compression test on brick / concrete
5. Compression test on closely coiled helical spring
6. Bending test on cantilever beam
7. Bending test on simply supported beam
8. Bending test on continuous beam
9. Brinell's Hardness test
10. Rockwell Hardness test
11. Izod Impact test
12. Charpy Impact test

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC2CE02) SURVERYING AND GEOMATICS LABORATORY

COURSE OBJECTIVES:
- To apply the concepts of leveling for determining longitudinal and cross sectional profile
- To develop contour maps through in-direct method of leveling
- To understand the principles of trigonometric and tachometric surveying for measurement of horizontal and vertical distances
- To appreciate the applications of modern instruments in measurement of area determination and contouring

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Establish bench mark and **develop** ground profiles
CO-2: Determine inaccessible distances from angular measurements
CO-3: Construct horizontal curves using modern instruments
CO-4: Appraise the given plots and profiles using advanced instruments

CYCLE – I
Chain and Compass Survey:
1. Chaining of a line using chain, measurements of area by cross staff survey.
2. Traversing by compass and plotting after adjustments Leveling.
3. Fly Leveling.
4. Longitudinal Leveling & Cross – section Leveling.
5. Plotting of Contours by Indirect Method.

Theodolite Surveying:

6. Measurement of horizontal angles and vertical angles.
7. Distance between two inaccessible points using the principles of tachometer surveying.

CYCLE - II
Total Station:

8. Area Measurement.
9. Remote Elevation Measurement & Missing Line Measurement.
10. Longitudinal and Cross Section Profile.
11. Stake Out.
12. Contouring – Indirect method.
13. Setting out of a Simple curve.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC3CE01) COMPUTER AIDED CIVIL ENGINEERING DRAWING

COURSE OBJECTIVES:
- To understand various types of conventional signs and brick bonds
- To use AutoCAD tools to draw building plans, sections and elevations from a given line diagram and specifications
- To draw center line diagram for a specific plan
- To develop working drawings of residential buildings

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Draft plan section elevation of buildings using computer aided drafting tool
CO-2: Draw and **Detail** the different components of Stair cases
CO-3: Draw structural drawings for beams, footings and columns
CO-4: Generate layouts for electrical and plumbing services for residential buildings

LIST OF EXPERIMENTS:

1. Introduction to Computer Aided Drafting and Conventional Signs
2. Brick bonds: English bond & Flemish bond – Odd and Even courses
3. Drawing plans of single storied residential buildings.
4. Developing sections and elevations of single storied residential buildings.
5. Drawing of plans of two storied Residential buildings.
6. Developing sections and elevations of two storied residential buildings.
7. Drawing of plans and sections of various staircases.
8. Structural detailing of isolated footing and column.
9. Structural detailing of beam.
10. Development of working drawings of buildings – Electrical Layout
11. Development of working drawings of buildings – Plumbing Layout

TEXT BOOKS:
1. Civil Engineering Drawing-I, N. Sreenivasulu, S. Rama Rao, Radiant Publishing House
2. Civil Engineering Drawing-II, N. Sreenivasulu, Radiant Publishing House

REFERENCES:
1. Engineering Graphics, P. J. Sha, S. Chand & Co.
2. Civil Engineering Drawing-I, S. Mahaboob Basha, Falcon Publishers
3. Building Drawing, M. G. Shah, Tata McGraw-Hill Education
4. Structural Engineering Drawing, S. Mahaboob Basha, Falcon Publishers

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

(18PC1CE06) STRENGTH OF MATERIALS – II

COURSE OBJECTIVES:

- To determine the stresses on an inclined plane
- To understand the concept of torsion and different types of springs
- To distinguish between Thin and Thick cylinders
- To find out the crippling load on columns by various formulae

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Determine the principal stresses and strains and design according to theories of failure
CO-2: Analyze the shafts subjected to torsion and **determine** the deflections in close and open coiled helical springs
CO-3: Evaluate the stresses in Thin and Thick cylinders
CO-4: Determine the direct and combined stresses in structural members

UNIT – I:
Principal Stresses and Strains: Stresses on an inclined plane at a section of a bar under axial loading – Compound stresses – Normal and Tangential stresses on an inclined plane for biaxial stresses – Two perpendicular stresses accompanied by a state of simple shear –Mohr's Circle of stresses – Principal stresses and strains – Analytical and graphical solutions.

UNIT – II:
Torsion of Circular Shafts: Theory of pure torsion – Assumptions - Derivation of Torsion equation – Torsional moment of resistance – Polar moment of Inertia - Torsional rigidity – Shafts in series and parallel - Power transmitted by shafts.
Springs: Types of springs – Close coiled helical springs under axial pull and axial couple – Open coiled helical springs under axial pull and axial couple - Springs in series and parallel.

UNIT – III:
Thin Cylinders: Thin cylindrical shells - Derivation of formula for longitudinal and circumferential stresses - hoop, longitudinal and volumetric strains – changes in diameter, length and volume of thin cylinders – Wire wound thin cylinders - Thin spherical shells.
Thick Cylinders: Lame's Theory for thick cylinders – Derivation of Lame's equations - Distribution of hoop and radial stresses across the thickness – Compound cylinders

UNIT – IV:
Columns and Struts: Short and Long columns – Euler's theorem for long columns – Assumptions – Derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column – Slenderness ratio – Euler's critical stress - Limitations of Euler's theory – Rankine's formula – Long columns subjected to eccentric loading – Secant formula.

UNIT – V:

Direct and Bending Stresses: Stresses under the combined action of axial loading and bending moment – Core/Kernel of a section – Middle-Third rule - Determination of stresses in Chimneys, Retaining walls and Dams.

UNIT – VI:

Theories of Failure: Maximum principal stress theory - Maximum principal strain theory – Maximum shear stress theory – Maximum strain energy theory – Maximum shear strain energy theory.

TEXT BOOKS:

1. Mechanics of Materials, R. C. Hibbeler, Pearson Education
2. Mechanics of Materials, James Gere, Cengage Learning

REFERENCES:

1. Strength of Materials, B. C. Punmia, Ashok Jain, Arun Jain, Laxmi Publications
2. Strength of Materials, R. K. Bansal, Laxmi Publications
3. Strength of Materials, S. S. Rattan, McGraw-Hill Education (India) Pvt. Ltd.
4. Strength of Materials, R. K. Rajput, S. Chand & Company Ltd.

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(18PC1CE07) STRUCTURAL ANALYSIS

COURSE OBJECTIVES:
- To differentiate between statically determinate and indeterminate structures
- To solve the statically indeterminate structures by applying the principles of equilibrium and compatibility of deformations
- To analyze the statically determinate beams, arches and frames
- To draw the Influence line diagrams for various types of moving loads on beams

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze statically determinate system
CO-2: Analyze statically indeterminate system
CO-3: Determine the slopes and deflections in structural systems
CO-4: Evaluate the shear force and bending moment for moving loads

UNIT – I:
Pin Jointed Plane Frames: Types of frames – Assumptions - Analysis of pin jointed frames by Method of joints, Method of sections.

UNIT – II:
Three Hinged Arches: Elastic theory of arches – Eddy's theorem – Determination of horizontal thrust, bending moment, normal thrust and radial shear – Supports at different levels – Effect of temperature.

UNIT – III:
Energy Theorems: Strain energy due to bending moment – Castigliano's first theorem – Deflection of simple beams and pin jointed trusses.
Castigliano's second theorem – Analysis of indeterminate beams and trusses with single degree of indeterminacy.

UNIT – IV:
Propped Cantilevers: Introduction to statically indeterminate beams – Analysis of propped cantilevers – shear force and bending moment diagrams
Fixed Beams: Analysis of Fixed beams – Effect of sinking of support, rotation of support - Shear force and bending moment diagrams.

UNIT – V:
Continuous Beams: Clapeyron's theorem of three moments - Analysis of continuous beams with constant and varying moment of inertia – Effect of sinking of supports – Shear force and bending moment diagrams.

UNIT – VI:
Influence Lines: Definition of influence line for reaction, SF and BM - load position for maximum SF and BM at a section - single point load, udl longer than the span, udl shorter than the span, two points loads with fixed distance between them and several point loads.

Moving Loads: Absolute maximum SF and BM due to single concentrated load, udl longer than the span, udl shorter than the span, two point loads with fixed distance between them and several point loads - Equivalent uniformly distributed load.

TEXT BOOKS:

1. Structural Analysis, Devdas Menon, Narosa Publishers
2. Structural Analysis, R. C. Hibbeler, Pearson Education

REFERENCES:

1. Theory of Structures, S. P. Timoshenko, D. H. Young, McGraw-Hill International Edition
2. Analysis of Structures, V. N. Vazirani, M. M. Ratwani and S. K. Duggal, Khanna Publishers
3. Theory of Structures, B. C. Punmia, Ashok Kumar Jain, A. K. Jain, Laxmi Publications
4. Basic Structural Analysis, K. U. Muthu, Azmi Ibrahim, M. Vijayanand and M. Janardhana, I. K. International Publishing House

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(18PC1CE08) CONCRETE TECHNOLOGY

COURSE OBJECTIVES:
- To use different types of cements as per their properties for different field applications
- To design economic concrete mix proportion for different exposure conditions and intended purposes
- To supervise various concreting operations
- To conduct field and laboratory tests on concrete in fresh and hardened state

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the properties of concrete making materials
CO-2: Understand the behaviour of various admixtures in concrete
CO-3: Explain the properties of concrete in fresh and hardened state and their test procedures
CO-4: Design the mix proportions of concrete

UNIT – I:
Cement: Manufacture of Portland Cement, Basic cement chemistry, Hydration of cement, Heat of hydration - Tests on cement – Fineness, consistency, setting times, soundness and strength - Types of cements – Ordinary Portland Cement, Rapid-hardening cement, Low-heat portland cement, Sulfate resisting cement, Portland pozzolan cement, White and colouredportland cement, High-alumina cement.

UNIT – II:
Aggregates: Classification of aggregates – size, shape and texture, Mechanical properties of aggregates – bond, strength, toughness and hardness - Physical properties – specific gravity, bulk density, porosity and absorption, moisture content, bulking of sand, Sieve analysis, Grading curves, Fineness modulus, Grading requirements, Maximum aggregate size, Gap graded aggregate, Quality of water for mixing and curing of concrete.

UNIT – III:
Admixtures and Fresh Concrete: Admixtures – plasticizers, superplasticizers, retarders, accelerators, air-entraining admixtures, pozzolanic admixtures, Fresh concrete – workability, factors affecting workability, cohesion and segregation, bleeding, Workability tests – slump, compaction factor, vee bee test, Setting time of concrete, Effect of time and temperature on workability.

UNIT – IV:
Strength, Elasticity, Creep and Shrinkage of Concrete: Water/cement ratio, Gel/space ratio, Maturity concept of concrete, Factors affecting strength of concrete, Relation between tensile and compressive strength, bond to reinforcement. Elasticity, Factors influencing modulus of elasticity, Poisson's ratio, Creep, Factors influencing creep, Effects of creep, Shrinkage, Factors influencing shrinkage, Types and effects of cracking.

UNIT – V:

Testing and Conformity: Strength tests – compressive strength, tensile strength, Test cores, Accelerated curing, Schmidt hammer, Penetration resistance, Pull-out test, Ultrasonic pulse velocity test, Variability of strength, acceptance and conformity.

UNIT – VI:

Concrete Mix Design and Special Concretes: Factors in the choice of mix proportions, Concrete mix design as per IS 10262, Special concretes – Introduction to light weight concrete, Aerated concrete, No-fines concrete, Recycled aggregate concrete, Fibre reinforced concrete, Ferrocement, Roller compacted concrete, High performance concrete, Self-consolidating concrete.

TEXT BOOKS:

1. Concrete Technology, A. M. Neville and J. J. Brooks, Prentice Hall Publication
2. Concrete Technology, M. S. Shetty, S. Chand & Co. Publication

REFERENCES:

1. Concrete Technology, A. R. Santha Kumar, Oxford University Press
2. Concrete Technology, M. L. Gambhir, Tata McGraw-Hill Press
3. Properties of Concrete, A. M. Neville, Pearson Publication
4. Concrete: Microstructure, Properties and Materials, P. K. Mehta and J. M. Monteiro, McGraw-Hill Publishers

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
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(18PC1CE09) HYDRAULIC ENGINEERING AND HYDRAULIC MACHINES

COURSE OBJECTIVES:
- To define the fundamental principles of fluid mechanics for the solution of practical civil engineering problems of water conveyance in open channels
- To discuss Dimensional analysis and design of channels in uniform and non-uniform flow conditions, hydraulic machinery (pumps and turbines) and the factors affecting their operation and specifications as well as the operation in a system
- To solve problems on open channel flow and efficiency of pumps and turbines
- To study and Analyze different types, elements of hydro-electric power plants and operational characteristics of turbines and pumps. Study about CFD

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the basics of Open Channel Flows and **Design** them under different flow conditions
CO-2: Interpret and **apply** dimensional analysis and similarity to develop models and testing
CO-3: Design the appropriate hydraulic machines and **Apply** them in Hydropower plants
CO-4: Explain the elements and **Compare** the factors of supply and demand from Hydropower Plants

UNIT – I:
Open Channel Flow-I: Introduction to Open Channel Flow-Comparison between open channel flow and pipe flow; geometrical parameters of a channel; classification of open channels, classification of open channel flow, Velocity Distribution of channel section.
Continuity Equation; Energy Equation and Momentum Equation; Characteristics of uniform flow; Chezy's formula; Manning's formula; Factors affecting Manning's Roughness Coefficient; Most economical section of channel; Computation of Uniform flow, Normal depth.
Critical Flow: Specific energy – critical depth - computation of critical depth – critical, sub critical and super critical flows

UNIT – II
Open Channel Flow – II: Non uniform flow: Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile; Computation of water surface profile by Direct Step method.
Rapidly Varied Flow: Theory of hydraulic jump; Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, types, and applications of hydraulic jump; Energy dissipation. Introduction to Positive and negative surges.

UNIT – III:

Dimensional Analysis and Hydraulic Similitude: Dimensional homogeneity; Rayleigh method; Buckingham's Pi method; Dimensionless groups; Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problem.

UNIT – IV:

Basics of Hydraulic Machines: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, Jet striking centrally and at tip, Velocity triangles at inlet and outlet, expressions for work done and efficiency – Angular momentum principle, applications to radial flow turbines.

Hydropower Engineering

Classification of Hydropower plants – Definition of terms – load factor, utilization factor, capacity factor, estimation of hydropower potential.

UNIT – V:

Hydraulic Turbines: Elements of a typical Hydropower installation – Heads and efficiencies – Classification of turbines – Pelton wheel – Francis turbine – Kaplan turbine - Working, working proportions, velocity diagram, work done and efficiency, hydraulic design, draft tube – theory and function, efficiency. Governing of turbines – Surge tanks – Unit and specific turbines – Unit speed – Unit quantity – Unit power – Specific speed – Performance characteristics – Geometric similarity – Cavitation.

UNIT – VI:

Centrifugal Pumps: Pump installation details – classification – work done – Manometric head – minimum starting speed – losses and efficiencies – specific speed. Multistage pumps – pumps in parallel – performance of pumps – characteristic curves – NPSH – Cavitation.

TEXT BOOKS:

1. Fluid Mechanics and Hydraulic machines, Modi and Seth, Standard Book House
2. Open Channel Flow, K. Subramanya, Tata McGraw-Hill Pvt. Ltd., 2008

REFERENCES:

1. Open Channel Hydraulics, V. T. Chow, McGraw-Hill, 1959
2. Fluid Mechanics & Hydraulic Machines - Problems and Solutions, K. Subramanya McGraw-Hill Education. (I) Pvt. Ltd., 2011
3. Computational Fluid Dynamics - The Basics with Applications, Jr., John D. Anderson, McGraw-Hill Pvt. Ltd., 2017
4. Fluid Mechanics and Hydraulics Machines, R. K. Bansal, Lakshmi Publications

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	2	**0**	**2**

(18PC1ME17) BASIC MECHANICAL ENGINEERING

COURSE OBJECTIVES:

- To apply the basic concepts of Thermodynamics, Thermodynamic laws, concept of power cycles and IC engines
- To apply the principles of Steam Power plant, Boiler, Steam Turbines and Gas turbine
- To principles of operation of different types of Hydraulic machinery and Refrigeration& Air conditioning systems
- To understand about Foundry, Welding, Mechanical working, Press working operations
- To remember the principle of working of lath machine, shaper, drilling, milling, grinding and NC & CNC machine tools

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire the knowledge of Thermodynamics, Thermodynamic laws, concept of power cycles, IC engines Steam Power plant, Boiler, Steam Turbines and Gas turbine
CO-2: Understand the knowledge on Principles of operation of different types of Hydraulic machinery and Refrigeration & Air conditioning systems
CO-3: Know the importance of Foundry, Welding, Mechanical working, Press working operations
CO-4: Identify various cutting tools and decide the sequence of operations for lathe machine, shaper, drilling, milling, grinding and NC & CNC machine tools operations

UNIT – I:
Thermodynamics: Basic concepts of Thermodynamics, Property of gases, Zeroth Law. First Law of Thermodynamics and its applications, Second Law of Thermodynamics, Carnot cycle, Air standard cycles – Otto, Diesel Cycles.
Internal Combustion Engines: Definition, classification, components, working of two-stroke, four stroke cycle engines, SI and CI Engines.

UNIT – II:
Steam Power Plant, Boiler, Steam Turbines: Layout of steam power plant, Water tube and Fire tube Boilers :- "Cochron", Babcock and Wilcox Boiler and High Pressure Boilers. (Benson & La-mount only).
Steam Turbines: Classification, Impulse & Reaction Turbines
Gas Turbine-Power Plants: Classification of gas turbines, Closed & Open cycle types

UNIT – III:
Hydraulic Pumps & Turbines: Centrifugal Pumps, Pelton wheel, Francis turbine and Kaplan Turbine -- Layout of Hydro electric power plant
Refrigeration & Air Conditioning Systems: Description of Vapour Compression and Vapour Absorption systems, Classification of air conditioning systems, working principles.

UNIT – IV:
Foundry Practice: Patterns, Moulding and Moulding materials, casting methods-Sand Casting, Shell mould Casting, Investment Casting, Die Casting ,Centrifugal casting – Principle and Application of these processes
Welding: Types of Welding- Electric Arc welding - Coated electrode, TIG welding & MIG welding, Gas welding and cutting, Resistance welding- Spot welding, Soldering and Brazing.

UNIT – V:
Mechanical Working: Hot and Cold working, Rolling, Types of Rolling mills, Forging-operations, forging methods, Extrusion-methods, Metal Spinning and Wire Drawing
Press Working Operations: Cutting, Bending, Drawing and Squeezing

UNIT – VI
Machine Tools: Construction of lathe, shaper, drilling, milling, grinding and NC & CNC machine tools-Advantages, Machine controls.

TEXT BOOKS:
1. Elements of Mechanical Engineering, Mathur M. L., Mehta F. S. and Tiwari R. P., Jain Brothers, New Delhi, 2005
2. Elements of Mechanical Engineering,R. K. Rajput, Laxmi Publications, 1994

REFERENCES:
1. Elements of Mechanical Engineering,P. N. Gupta, M. P. Poonia, Standard Publishers Distributors, Delhi
2. Mechanical Engineering,R. C. Gupta, Khanna Publishers, Delhi

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

(18ES1EE03) ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE OBJECTIVES:
- To study and understand the performance of basic electric circuits
- To understand the performance of electrical machines
- To know the utilization of electrical energy in day to day to affairs
- To understand the operation of diode and transistor

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyse the performance of electrical circuits
CO-2: Test, analyse and find the applications of different electric machines
CO-3: Know the use of electric power for domestic and industrial purposes
CO-4: Understand the principles of semiconductor devices and their applications

UNIT – I:
Fundamentals of Electrical Circuits: Basic R-L-C parameters, Ohm's Law, kirchhoff's Laws, Series-parallel connections, Star/Delta Transformation, Generation of A.C, Average, RMS values and Form Factor of Sinusoidal Voltages, AC through RL,RC and RLC, concept of impedance, power, power factor, simple problems

UNIT – II:
D.C Machines: D.C Generator, Basic Construction, Operation, emf Equation, types, Open Circuit Characteristics, simple problems. D.C Motor-principle-back emf-Torque equation, Speed control, swinburne's test

UNIT – III:
A.C Machines: Single phase transformer: principle-emf equation-types-OC and SC tests- Voltage Regulation -Efficiency-Simple problems, Three phase induction motor : Working principle – slip- torque equation- Torque slip characteristics, Principle of Alternator.

UNIT – IV:
Electrical Power Systems and Utilization: Hydro Power Plant: Lay out -Efficiency Calculation, Illumination: Definitions-Laws of Illumination- working of Incandescent-Fluorescent lamps, Steel corrosion in concrete-Electrochemical Protection-Impressed current-Sacrificial anodic protections.

UNIT – V:
Electronics Devices: Semiconductor materials, Review of P-N junction, Diode Characteristics, Basic Operation of Half-wave and Full wave Rectifiers, Zener Diode as Voltage Regulator, BJT, biasing, Characteristics, applications,

UNIT – VI:
Digital Circuits and Transducers: Logic gates, Combinational Logic circuits, Basic operation of SR-JK-T and D Flip-Flops, Transducers -Overview - Passive Sensors - Working

of Strain Gauge, Pressure Gauge, Dial Gauge - Piezoelectric Accelerometer Model-Galvanometer.

TEXT BOOKS:

1. Principles of Electrical and Electronics Engineering, V. K. Mehta, S. Chand & Co.
2. Fundamentals of Electrical Engineering, Ashafaq Hussain, 2ndEdition, Dhanpat Rai & Co.
3. Electronic Devices and Circuits, S. Salivahanan, N. Suresh Kumar, 3rd Edition, McGraw-Hill Education

REFERENCES:

1. Electrical Technology, Edward Hughes, ELBS Longman Publisher
2. Basic Electrical Engineering, D. P. Kothari & I. J. Nagrath, TMH Publications, 2nd Edition
3. Utilization of Electric Power and Electric Traction, G. C. Garg, Khanna Publishers

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

(18PC2CE03) FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY

COURSE OBJECTIVES:
- To identify the behaviour of analytical models introduced in lecture to the actual behaviour of real fluid flows
- To explain the standard measurement techniques of fluid mechanics and their applications
- To illustrate the students with the components and working principles of the hydraulic machines- different types of Turbines, Pumps, and other miscellaneous hydraulics machines
- To analyse the laboratory measurements and to document the results in an appropriate format

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Describe the basic measurement techniques of fluid mechanics and its appropriate application.
CO-2: Interpret the results obtained in the laboratory for various experiments.
CO-3: Discover the practical working of Hydraulic machines- different types of Turbines, Pumps, etc.
CO-4: Compare the results of analytical models introduced in lecture to the actual behaviour of real fluid flows and **draw** correct and sustainable conclusions.

LIST OF EXPERIMENTS:

1. Verification of Bernoulli's equation
2. Determination of Coefficient of discharge for a small orifice by a constant head method.
3. Calibration of Venturimeter / Orifice Meter
4. Calibration of Triangular / Trapezoidal Notch
5. Study of Minor losses in pipe flow
6. Determination of Friction factor of a pipe line
7. Impact of jet on vanes
8. Study of Hydraulic jump
9. Main characteristics of Pelton wheel turbine
10. Performance test on Francis turbine
11. Main characteristics of a single stage / multi stage Centrifugal Pump
12. Operating characteristics of Reciprocating Pump

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	0	2	1

(18PC2CE04) CONCRETE LABORATORY

COURSE OBJECTIVES:
- To know the various procedures to determine the characteristics of cement
- To understand the test procedures to evaluate the characteristics of aggregates
- To know the test procedures to find the properties of fresh concrete
- To understand the test procedures to find mechanical properties of hardened concrete

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Perform various tests required to assess the characteristics of cement
CO-2: Test and **evaluate** the properties of fine and coarse aggregates and determine its suitability for construction
CO-3: Evaluate the fresh and hardened properties of concrete
CO-4: Design the concrete mix for required strength and test its performance characteristics

LIST OF EXERCISES:

Cycle -I
I. **Tests on Cement:**
a) Standard consistency.
b) Initial and final Setting Time.
c) Specific gravity.
d) Fineness.
e) Soundness.
f) Compressive strength.
II. **Tests on Aggregates**:
a) Specific gravity of fine aggregate.
b) Specific gravity of coarse aggregate.
c) Bulking of fine aggregate.
d) Grading of fine aggregate

CYCLE -II
III. **IS method of mix design of normal concrete as per IS : 10262**
IV. **Tests on Fresh Concrete**:
a) Slump cone test.
b) Compacting factor test.
c) Vee-Bee consistometer test.
V. **Tests on Hardened Concrete**:
a) Compressive & Tensile strength tests.
b) Modulus of elasticity of concrete.
c) Non-destructive testing of concrete

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	0	**2**	**1**

(18ES2EE03) ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

COURSE PRE-REQUISITES: Physics

COURSE OBJECTIVES:

- To understand the performance of basic electric circuits
- To understand the measuring procedures for power
- To understand the performance of electrical machines
- To understand the operation of diode and transistor

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

CO-1: Analyse the performance of electrical circuits

CO-2: Analyse the power using voltmeter and ammeter method

CO-3: Assess the performance of transformer and electrical machines

CO-4: Understand the principles of semiconductor devices and their applications

LIST OF EXPERIMENTS:

1. Verification of KVL& KCL.
2. Analysis of series RL and RC circuits
3. Single phase power measurement by three voltmeters and three ammeters method
4. Load test on 1- φ Transformer
5. OC & SC test on 1- φ Transformer.
6. Speed control DC shunts Motor.
7. Swinburne test on DC shunt machine
8. V-I characteristics of P-N junction Diode.
9. Performance of Full wave rectifier.
10. Input and output characteristics of transistor.

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B.Tech. IV Semester

	L	T/P/D	C
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(18MN6HS03) GENDER SENSITIZATION

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

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

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

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

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

MODULE 2: Gender Roles and Relations

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

MODULE 3: Gender Development Issues

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

MODULE 4: Gender-based Violence

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

MODULE 5: Gender and Culture

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

MODULE 6: Gender and Studies

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

TEXT BOOK:

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

REFERENCES:

1. More than One Million Women are Missing, Sen, Amartya, 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. By the Numbers: Where Indian Women Work, TriptiLahiri, 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. I Fought For My Life ...and Won, Abdulali Sohaila, Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/
4. The Violence of Development: The Politics of Identity, Gender and Social Inequalities in India, K. Kapadia, Zed Books, 2002
5. Just Development: Beyond Adjustment with a Human Face, T. Banuri and M. Mahmood, Oxford University Press, 1997

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

(18PC1CE10) DESIGN OF REINFORCED CONCRETE STRUCTURES

COURSE OBJECTIVES:
- To describe the salient features of Limit State Method of design of RC structures
- To identify and tell the various codal provisions given in IS. 456 for the design of structural members
- To analyze the behaviour and design the of RC members under flexure, shear and compression
- To describe the concepts of limit state of collapse and limit state of serviceability

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyse and **Design** beams using limit state method and check for serviceability
CO-2: Design compression members subjected to axial loads and moments
CO-3: Design one-way and two-way slabs
CO-4: Design isolated flat square and rectangular footings

UNIT – I:
Introduction to Limit State Design & Limit State of Flexure (Singly Reinforced Beams): Objectives and Methods of Analysis and Design - Limit State Design - Basic statistical principles - Characteristic loads - Characteristic strength - Partial safety factors – Stress - Strain behavior of steel and concrete - Methods of design - Limit State method – Assumptions - Stress block parameters
Limit State of Collapse - Flexure: Analysis of Singly Reinforced Section- Neutral Axis – Balanced - Under Reinforced - Over Reinforced Sections - Moment of Resistance - Design Parameters - Design examples

UNIT – II:
Limit State of Flexure (Doubly Reinforced and Flanged Beams): Analysis and Design of Doubly Reinforced Beams: Necessity of Doubly Reinforced sections - Analysis of Doubly Reinforced Section - Moment of Resistance - Design parameters – Design Examples
Analysis and Design of Flanged Beams: Effective flange width - Analysis of flanged RC section - Singly and Doubly Reinforced sections - Moment of Resistance - Design examples

UNIT – III:
Limit State of Collapse – Shear: Limit state design of beams for shear and torsion - Concept of bond - Anchorage and Development length - Design examples in simply supported and continuous beams

UNIT – IV:
Limit State of Flexure (Slabs): Design of one-way slabs - Design of continuous slabs using IS coefficients - Design of two-way simply supported and restrained slabs

UNIT – V:

Limit State of Collapse – Compression: Design of axially loaded short columns - Design of short columns under uniaxial bending and bi-axial bending using SP-16 charts

UNIT – VI:

Design of Footings and Limit State of Serviceability: Different types of footings - Design of flat type isolated square - Rectangular footings – Limit State of Serviceability for Deflection and Cracking

TEXT BOOK:

1. Limit State Design of Reinforced Concrete, P.C. Varghese, 2nd Edition, PHI, New Delhi, 2011
2. Fundamentals of Reinforced Concrete Design, M.L. Gambhir, 2nd Edition, PHI, New Delhi, 2010
3. Limit State Design, B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, 3rd Edition, Laxmi Publications Pvt. Ltd., New Delhi, 2007

REFERENCES:

1. Reinforced Concrete Design, S. Unnikrishna Pillai &Devdas Menon, 3rd Edition, TMH, New Delhi, 2009
2. Reinforced Concrete Design, N. Krishna Raju and R.N. Pranesh, 8th Edition, New Age International, New Delhi, 2004
3. Fundamentals of Reinforced Concrete, N.C. Sinha and S.K. Roy, 4th Edition, S. Chand, 2004

CODE BOOKS:

1. IS 456: 2000 Plain and Reinforced Concrete - Code of Practice
2. SP-16 Design Aids for Reinforced Concrete

NOTE: Question paper pattern for Final Examination: The end examination paper should consist of Part-A and Part-B. Part-A consists of two questions in Design and Drawing out of which one question is to be answered for 24 marks. Part-B consists of Five questions on design out of which three are to be answered for 36 marks (12 x 3)

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(18PC1CE11) ENGINEERING HYDROLOGY

COURSE OBJECTIVES:
- To describe the fundamentals concepts of Engineering Hydrology
- To estimate and interpret precipitations and abstractions from precipitation in a watershed
- To apply the knowledge to estimate runoff, hydrograph and flood discharge for design of hydraulic structures
- To identify the basic aquifer parameters and calculate discharge from wells in steadystate conditions

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the interaction among various processes in hydrologic cycle
CO-2: Estimate and **interpret** precipitation and abstractions from precipitation in a watershed
CO-3: Apply the knowledge to estimate runoff, hydrograph and flood discharge for design of hydraulic structures
CO-4: Identify the basic aquifer parameters and **calculate** discharge from wells in steady state conditions

UNIT – I:
Introduction: Hydrologic cycle, Water-budget Equation, History of Hydrology, World Water Balance, Applications in Engineering, Sources of Data.

UNIT – II:
Precipitation: Forms of Precipitation, Characteristics of Precipitation in India, Measurement of Precipitation, Rain gauge network, Missing Rainfall Data – estimation, Mean Precipitation over an Area, Depth-Area-Duration Relationships, Maximum Intensity/Depth-Duration-
Frequency Relationship, Probable Maximum Precipitation (PMP), Rainfall Data in India.

UNIT – III:
Abstractions from Precipitation: Evaporation process, Evaporimeters, Analytical Methods of Evaporation Estimation, Reservoir Evaporation and Methods for its Reduction, Evapotranspiration, Measurement of Evapotranspiration, Evapotranspiration Equations, Potential Evapotranspiration, Actual Evapotranspiration, Interception, Depression Storage, Infiltration, Infiltration Capacity, Measurement of Infiltration, Modeling Infiltration Capacity,
Classification of Infiltration Capacities, Infiltration Indices.

UNIT – IV:
Runoff: Runoff Volume, SCS-CN Method of Estimating Runoff Volume, Flow Duration Curve, Flow-Mass Curve, Hydrograph, Factors Affecting Runoff Hydrograph, Components of Hydrograph, Base Flow Separation, Effective Rainfall, Unit Hydrograph, S-Curve Technique.

UNIT – V:

Floods: Rational Method, Flood Frequency Studies-Gumbel's method, Risk, reliability and safety factor, Flood Routing-Basic equations, Hydrologic Storage Routing, Hydrologic channel routing

UNIT – VI:

Ground Water and Well Hydrology: Forms of Subsurface Water, Saturated Formation, Aquifer Properties, Geologic Formations of Aquifers, Well Hydraulics: Steady State Flow in Wells, Equilibrium Equations for Confined and Unconfined Aquifers.

TEXT BOOKS:

1. Engineering Hydrology, K. Subramanya, McGraw-Hill, 2013
2. Hydrology, Madan Mohan Das and Mimi Das Saikia, PHI, 2014

REFERENCES:

1. Engineering Hydrology, C. S. P. Ojha, R.Berndtsson and P.Bhunya, Oxford, 2008
2. Ground Water Hydrology, David Keith Todd, John Wiley & Son, New York, 2005
3. Applied Hydrology, Ven Te Chow, David Maidment, Larry Mays, McGraw-Hill, 2013
4. Engineering Hydrology, Jaya Rami Reddy, Laxmi Publications, 2013

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(18PC1CE12) TRANSPORATION ENGINEERING

COURSE OBJECTIVES:
- To introduce classification of highways, urban roads and its related planning process
- To analyse different elements used in design of road geometrics
- To formulate the concepts of railway engineering, geometric design and its related railway components
- To recognize the importance of aircraft parts, site selection and carry out runway design

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the concepts of highway alignment for planning road networks
CO-2: Design the road geometrical elements
CO-3: Analyze the track components for designing railway track geometry.
CO-4: Investigate the atmospheric variables and determine runway length

UNIT – I:
Highway Development and Planning: Importance of transportation – History of Planned Highway Development in India- Twenty Year Road development plans - Classification of roads – Road patterns.
Highway Alignment: Highway alignment – Basic requirements – Controlling factors – Engineering surveys for highway location –Points considered in a new highway project.

UNIT – II:
Geometric Design of Streets and Highways: Introduction – Factors controlling geometric design – Cross sectional elements – Sight distances: Stopping sight distance, Overtaking sight distance – Definitions and derivation of equations for computing sight distances – Horizontal alignment – Super elevation – Design of super elevation – Extra-widening on curves – Transition curve – Objectives of providing transition curves – Methods of computing the length of transition curve – Vertical curves - Intersections – Rotary intersection – Grade separated intersections (interchanges).

UNIT – III:
Highway Materials: Pavement types – Components and their functions – CBR test, Plate bearing test, tests on aggregate - test on bitumen – Mix design by marshal method.

UNIT – IV:
Introduction to Railway Engineering: Role of Indian Railways in National Development – Railways for Urban Transportation –LRT, Mono Rail, Metro rail & MRTS. Permanent Way: Components and their Functions: Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels, Creeps and kinks Sleepers – Functions, Materials, Density – Functions, Materials, Ballast less Tracks.

UNIT – V:

Geometric Design of Railway Track: Gradients and Grade Compensation, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal, Vertical Curves. Points and Crossings – Turnouts.

UNIT – VI:

Airport Engineering: Introduction to Air Transportation - Aircraft Characteristics - Factors Affecting Selection of site for Airport – Aprons – Taxiway – Hanger – Geometric design - Computation of Runway Length, Correction for Runway Length, Orientation of Runway, Wind Rose Diagram

TEXT BOOKS:

1. Highway Engineering, Khanna S.K., Justo C.E.G. and Veeraragavan, A Revised 10th Edition, Nem Chand & Bros, 2017
2. Railway Engineering, Chandra S. and M.M. Agarwal, 2nd Edition, Oxford University Press, New Delhi, India, 2007
3. Airport Planning and Design, Khanna S. K., Arora M. G., and Jain S. S, 6th Edition, Nem Chand and Bros, Roorkee, 2012

REFERENCES:

1. Introduction to Transportation Engineering, John Khisty, Prentice Hall Publications, India, 2008
2. Principles of Transportation Engineering, ParthaChakroborty and Animesh Das, 2nd Edition, PHI learning, New Delhi, 2017
3. Railway Engineering, Saxena S.C. and S.P. Arora,Dhanpat Rai and Sons, New Delhi India, 1997
4. Airport Engineering (Planning and Design), Kumar V., and Chandra S. Galgotia CBS Publications & Distributors, 2007

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(18PC1CE13) ENGINEERING GEOLOGY

COURSE OBJECTIVES:

- To define basic geological concepts from civil engineering point of view
- To identify the various physical properties of minerals, rocks and to understand the concept of structural geology
- To understand the significance of Geology as applied to Civil Engineering
- To apply structural geology knowledge to dams, roads, tunnels and slopes

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyse different concepts and terms used in Engineering Geology
CO-2: Identify and **determine** the properties of various types of minerals and rocks
CO-3: Apply the various concepts of Engineering Geology to the civil engineering
CO-4: Examine and **select** the sites related to dams, roads, tunnels, and slopes

UNIT – I:
Introduction: Definition of Geology, Engineering Geology. Importance of geology from Civil Engineering point of view. Importance of physical geology, petrology and structural geology. Case studies of failures of few civil engineering constructions, weathering of rocks and its effect on the properties of rocks, importance of weathering with reference to dams, reservoirs and
tunnels.

UNIT – II:
Mineralogy: Definition of mineral, mineralogy, Importance of study of minerals: rock forming and ore forming minerals. Different methods of study of minerals. Study of minerals by physical identification method and their properties. Determination of Physical properties of following minerals: Feldspar, Quartz, Flint, Jasper, Olivine, Augite, Hornblende, Muscovite, Biotite, Asbestos, Chlorite, Kyanite, Garnet, Talc, Calcite. Study of ore forming minerals such as Pyrite, Hematite, Magnetite, Amethyst, Galena, Pyrolusite, Graphite, Magnesite and Bauxite. Coral reefs.

UNIT – III:
Petrology: Definition of a rock, petrology. Classification of rocks-Geological classification of rocks. Rock Cycle. Classification of forms, structures and textures of igneous rocks. Classification of sedimentary rocks, and its structures and textures. Classification of metamorphic rocks, its structures and textures. Megascopic Study of Granite, Dolerite, Basalt, Pegmatite, Charnockite, Sandstone, Shale, Limestone, Gneiss, Schist, Quartzite, Marble and Slate.

UNIT-IV:
Structural Geology: Strength behavior of Rocks- Stress and Strain in rocks. Deformation & Tectonics. Out Crop, Study of geological structures associated with rocks such as folds, faults, joints, unconformities-their important types. Significance of Strike and dip in geological structures. Importance of structural elements in engineering operations.

Consequences of failure as land sliding, Earthquake and Subsidence. Strength of Igneous rock structures.

UNIT-V:

Geological Hazards: Earthquakes, their causes and effects, shield areas and seismic belts, seismic waves Richter scale, Precautions to be taken for building construction in seismic areas. Landslides, their causes and effects, measures to be taken to prevent their occurrence; Ground Water, water table, common types of ground water, springs, geological controls of ground water movement, ground water exploration.

UNIT-VI:

Geophysical Investigations: Importance, Principles of geophysical methods. Electrical resistivity method and seismic refraction method from civil engineering point of view. Types of Dams, Importance of geological considerations in the site selection of dams, reservoirs and tunnels. Case histories of dams, geological factors affecting the water tightness and life of a reservoir. Purpose of tunnelling, types of tunnels, overbreak, lining of tunnels.

TEXT BOOKS:

1. Textbook of Engineering Geology, N. ChennaKesavulu, 2nd Edition, Macmillan Publishers India, 2009
2. Engineering and General Geology, Parbin Singh, 8th Edition, S. K.Kataria& Sons, 2010

REFERENCES:

1. Geology for Geotechnical Engineers, J.C. Harvey, Cambridge University Press, 1982
2. Engineering Geology, D. Venkat Reddy, Vikas Publications, New Delhi

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(18PE1CE01) ADVANCED STRUCTURAL ANALYSIS

COURSE OBJECTIVES:
- To identify the various straining actions in arches
- To understand displacement methods of analysis for statically indeterminate structures
- To differentiate the various methods of analysis for indeterminate structures
- To find the degree of static and kinematic indeterminacies of the structures

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the two hinged arches and cables
CO-2: Solve statically indeterminate beams and portal frames using classical methods
CO-3: Draw the shear force and bending moment diagrams for indeterminate structures
CO-4: Analyse the beams using matrix methods

UNIT – I:
Two Hinged Arches: Determination of horizontal thrust, bending moment, normal thrust and radial shear – Rib shortening – effect of temperature.
Cables: Introduction, Properties of a suspended cable, Equilibrium of a loaded cord, Cable carrying a udl, Temperature stresses in the cable.

UNIT – II:
Slope Deflection Method: Introduction, derivation of slope deflection equations, application to continuous beams with and without settlement of supports, application to portal frames

UNIT – III:
Moment Distribution Method: Stiffness and carry over factors – Distribution factors – Analysis of continuous beams with and without sinking of supports, Application to portal frames – Non-sway, Sway.

UNIT – IV:
Kani's Method: Analysis of continuous beams including settlement of supports and single bay single storey portal frames with and without side sway.

UNIT – V:
Stiffness Method: Determination of kinematic indeterminacy, Formulation of stiffness matrix, Application to continuous beams.

UNIT – VI:
Flexibility Method: Determination of static indeterminacy, Formulation of flexibility matrix, Application to continuous beams.

TEXT BOOKS:

1. Analysis of Structures – Vol. II, Prof. V.N. Vazirani, Dr. M.M. Ratwani& Dr. S.K.Duggal, Khanna Publishers
2. Theory of Structures, B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, LaxmiPublications

REFERENCES:

1. Theory of Structures, S.P. Timoshenko, D.H. Young, McGraw-Hill InternationalEdition
2. Structural Analysis, Devdas Menon, Narosa Publishers
3. Theory of Structures – Vol. II, S.P. Gupta, G.S. Pandit, R. Gupta, Tata McGraw-Hill
4. Indeterminate Structural Analysis, K. U. Muthu, H. Narendra, M. Janardhana, M. Vijayanand, I K International Publishing House

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(18PE1CE02) GREEN BUILDINGS

COURSE OBJECTIVES:
- To know the concepts of green buildings
- To remember the quality and uses of green building materials
- To acquire the concepts of design and construction of green buildings
- To remember and Understand the policies and rating systems of green buildings

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the importance of green buildings and their features
CO-2: Apply the knowledge of green building materials for construction
CO-3: Explain the concepts of green building design and construction
CO-4: Understand the green building policies and incentives and rate green buildings

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

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

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

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

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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(18PE1CE03) REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES

COURSE OBJECTIVES:
- To understand the causes of deterioration of structures
- To understand various Non-Destructive Evaluation tests for assessment of health of a structure
- To know various repair materials and their properties
- To understand various repair strategies for rehabilitation and retrofitting of structures

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: **Identify** the causes of deterioration of structures
CO-2: Perform various Non-Destructive Evaluation tests and **asses** the health of a structure
CO-3: Identify suitable repair material for concrete
CO-4: Suggest suitable repair technique for the rehabilitation of a structure

UNIT – I:
Causes of Deterioration and Durability Aspects: Holistic Model for Deterioration of RCC; Permeability of Concrete: Capillary Porosity, Air Void, Micro and Macro Cracks; **Aggressive Deteriorating Chemical Agents:** Corrosion of reinforcing bars, Sulphate Attack, Alkali Silica Reaction, Intrinsic and Extrinsic Causes and Stages of Distress.

UNIT – II:
Condition Survey and Non-Destructive Evaluation: Definition, Objective, Stages, Consideration for Repair Strategy.
Non-Destructive Evaluation Tests: Concrete Strength Assessment: Rebound Hammer Test, Ultrasonic Pulse Velocity (UPV) Test, Penetration Resistance (Windsor Probe and; PNR Test), Pull-out (LOK) Test, Core Sampling and Testing; Chemical Tests: Carbonation Test, Chloride Content.
Corrosion Potential Assessment: Cover meter survey, Half-cell potential survey, Resistivity Measurement; Interpretation and Evaluation of test result data.
Concrete Strength Assessment: Rebound Hammer Test, Ultrasonic Pulse Velocity (UPV) Test, Penetration Resistance (Windsor Probe and; PNR Test), Pull-out (LOK) Test, Core Sampling and Testing
Chemical Tests: Carbonation Test, Chloride Content
Corrosion Potential Assessment: Cover meter survey, Half-cell potential survey, Resistivity Measurement;
Interpretation and Evaluation of test result data.

UNIT – III:
Selection of Repair Materials for Concrete: Essential Parameters for Repair Materials; Materials for Repair: Premixed Cement Concrete/Mortars: Cements, Mineral and Chemical Admixtures, Water Cement Ratio; Epoxies and Epoxy Systems including Epoxy Mortars/Concretes: Epoxies, Modifies Epoxy Systems, Precautions to be taken,

Field of Applications; Polyester Resins; Surface Coatings: Essential Parameters for coatings, Types of surface coatings.

UNIT – IV:
Polymer Modified Mortars and Concrete (PMM/PMC): Materials, Process of Polymer Modification in Cement Concrete/Mortar, Composition of Polymers, General Requirements, Classification and Properties of Polymer Latexes, Physical and Mechanical Properties of Polymer Modified Mortars/Concretes, Mix Proportioning, General Guidelines and; Precautions for use of Polymer Modified Cement Mortar/Concrete, Field of Applications.

UNIT – V:
Rehabilitation and Retrofitting Methods: Repair options; Performance Requirements of Repair Systems; Important factors to be considered for Selection of Repair Methods; Repair Stages; Repair Methods: Repairs using Mortars, Dry Pack and Epoxy Bonded Dry Pack, Pre- placed Aggregate Concrete (PAC), Shotcrete, Concrete Replacement, Epoxy Bonded Concrete, Silica Fume Concrete, Polymer Concrete System, Strengthening Concrete by Surface Impregnation using Vacuum Methods, Thin Polymer Overlays, Thin Epoxy Overlays, Resin/Polymer Modified Cement Slurry Injection, Protective Seal Coats on the Entire Surface.

UNIT – VI:
Repair Methods: Ferro-cement, Plate Bonding, RCC Jacketing, Propping and Supporting, Fibre Wrap Technique, Foundation Rehabilitation Methods, Chemical and Electro-chemical Methods of Repair; Repair/Rehabilitation Strategies – Stress Reduction, Repair/Strengthening of Columns, Beams and Slabs, Compressive Strength of Concrete, Cracks/Joints, Masonry, Protection, Foundation, Base Isolation.

TEXT BOOKS:

1. Handbook on Repair and Rehabilitation of RCC Buildings, Director General (Works), Central Public Works Department (CPWD), Government of India Press, New Delhi
2. Concrete – Microstructure, Properties and Materials, Mehta P.K. and Monteiro P.J. 3rd Edition, McGraw-Hill, New Delhi

REFERENCES:

1. Concrete Structures – Repair, Rehabilitation and Retrofitting, J. Bhattacharjee, CBS Publishers & Distributors Pvt. Ltd., New Delhi
2. Concrete Structures – Protection, Repair and Rehabilitation, Woodson R.D., Butterworth-Heinemann, Elsevier
3. Advanced Concrete Technology, Zongjin LI, John Wiley & Sons, Inc., New Jersey

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(18PE1CE04) MASONRY STRUCTURES

COURSE OBJECTIVES:
- To understand the masonry design approaches
- To understand the principles of design and construction of masonry structures
- To evaluate the strength and stability of the masonry structures
- To summarize the masonry Characteristics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Achieve Knowledge of design and development of problem-solving skills
CO-2: Analyze Reinforced Masonry Members
CO-3: Determine interactions between members, shear strength and ductility of Reinforced Masonry members
CO-4: Check the stability of walls and Perform elastic and Inelastic analysis of masonry walls

UNIT – I:
Masonry Units, Materials, Types and Masonry Construction: Bricks, Stone and Block masonry units- strength, modulus of elasticity and water absorption of masonry materials – classification and properties of mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks.

UNIT – II:
Strength and Stability: Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.
Permissible Stresses: Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses.

UNIT – III:
Design Considerations: Effective height of walls and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars
Load Considerations and Design of Masonry Subjected to Axial Loads: Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.

UNIT – IV:
Design of Walls Subjected to Concentrated Axial Loads: Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings.

UNIT – V:

Design of Walls Subjected to Eccentric Loads: Design criteria – stress distribution under eccentric loads – problems on eccentrically loaded solid walls, cavity walls, walls with piers.

UNIT – VI:

Design of Laterally and Transversely Loaded Walls: Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls. Introduction to reinforced brick masonry, lintels and slabs.

TEXT BOOKS:

1. Brick and Reinforced Brick Structures, Dayaratnam P., Oxford & IBH Publishing
2. Masonry Structures: Behaviour& Design, Drysdale R. G., Hamid A. H. and BakerL.R., Prentice Hall

REFERENCES:

1. Design of Masonry Structures, A.W. Hendry, B.P. Sinha and Davis S.R, E&FN Spon, UK
2. Design of Reinforced and Prestressed Masonry, Curtin, Thomas Telford
3. Structural Masonry, Sahlin S., Prentice Hall
4. Reinforced Masonry Design, R.S. Schneider and W.L. Dickey, Prentice Hall

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(18PE1CE05) ENGINEERING MATERIALS FOR SUSTAINABILITY

COURSE OBJECTIVES:
- **To describe** the housing strategies for the urban poor
- **To identify** the various technology and their applications in sustainable Housing
- **To describe** different sustainable alternative materials for construction
- **To describe** construction in disaster prone areas

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Decide the type of Schemes for housing the urban poor
CO-2: Apply knowledge of innovative cost-effective construction techniques
CO-3: Describe different sustainable alternative materials for construction low-cost Infrastructure services
CO-4: Decide the type of construction in Disaster Prone areas for different Engineering structures

UNIT – I:
Housing the Urban Poor: Introduction- Living conditions in slums- Approaches and strategies for housing urban poor.

UNIT – II:
Development and Adopting Sustainable Construction Technology: Introduction- Adoption of innovative cost effective construction techniques- Adoption of pre-cast elements in partial prefabrication- Adopting of total prefabrication of mass housing in India- General remarks on pre cast rooting/flooring systems- Economical wall system- Single Brick thick loading bearing wall- 19cm thick load bearing masonry walls- Half brick thick load bearing wall- Fly ash-gypsum brick for masonry- Stone Block masonry- Adoption of pre-cast R.C. plank and join system for roof/floor in the building.

UNIT – III:
Alternative Building Materials for Sustainable Construction: Introduction- Substitute for scarce materials- Ferro-cement- Gypsum boards- Timber substitutions- Industrial wastes- Agricultural wastes – cement-soil blocks for masonry – stabilized mud construction.

UNIT –IV:
Low-Cost Infrastructure Services: Introducing- Present status- Technological options- Low cost sanitation's- Domestic wall- Water supply- energy.

UNIT – V:
Rural Housing: Introduction- traditional practice of rural housing continuous- Mud Housing technology- Mud roofs- Characteristics of mud- Fire resistant treatment for thatched roof- Soil stabilization- Rural Housing programs.

UNIT – VI:

Construction in Disaster Prone Areas: Introduction- Earthquake- Damages to houses- Traditional Housing in disaster prone areas- Type of Damages of non-engineered buildings- Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions- Requirements of structural safety of thin pre-cast roofing units against - Earthquake forces- Status of R& D in earthquake strengthening measures- Floods- cyclone- future safety.

TEXT BOOKS:

1. Modern Trends in Housing in Developing Countries, A.G. Madhava Rao, D.S. Ramachandra Murthy & G. Annamalai
2. Properties of Concrete, Neville A.M. Pitman Publishing Limited, London

REFERENCES:

1. Building Materials for Low–Income Houses, International Council for Building Research Studies and Documentation
2. Handbook of Low-Cost Housing, A.K. Lal, New Age international Publishers
3. Light Weight Concrete, Academic Kiado, Rudhai G., Publishing Home of Hungarian Academy of Sciences, 1963
4. Low-Cost Housing, G.C. Mathur

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

(18PC2CE05) ENGINEERING GEOLOGY LABORATORY

COURSE OBJECTIVES:
- To identify the minerals by studying its physical properties
- To classify various types of rocks
- To understand the various concepts of Structural Geology
- To interpret geological maps

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify and **determine** various minerals
CO-2: Distinguish and **identify** the rocks
CO-3: Examine and **interpret** various types of folds, faults, and joints
CO-4: Sketch the sections from geological maps

LIST OF EXPERIMENTS:

1. Study of physical properties and identification of **Rock** forming minerals.
Feldspar, Quartz, Flint, Jasper, Olivine, Augite, Hornblende, Muscovite, Biotite, Asbestos, Chlorite, Kyanite, Garnet, Talc, Calcite.
Study of physical properties and identification of **Ore** forming minerals.
Pyrite, Hematite, Magnetite, Amethyst, Galena, Pyrolusite, Graphite, Magnesite, and Bauxite
2. Megascopic description and identification of rocks referred under theory.
   a) **Igneous Rocks:** Granite, Dolerite, Basalt, Pegmatite, Charnockite,
   b) **Sedimentary Rocks:** Sandstone, Shale, Limestone. Conglomerate.
   c) **Metamorphic Rocks:** Gneiss, Schist, Quartzite, Marble and Slate.
3. Drawing of sections for geological maps showing horizontal beds, vertical beds, inclined beds, folds, faults, unconformities and their interpretation.

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

(18PC2CE06) TRANSPORTATION ENGINEERING LABORATORY

COURSE OBJECTIVES:
- To learn on test on aggregates materials used road constructions
- To gain knowledge on bitumen grading used for flexible pavement construction
- To analyze different tests on bitumen materials along with its specifications
- To examine test performed for bituminous mixes

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Categorize aggregate used in pavements along with its suitability
CO-2: Appraise the grades for bitumen binders
CO-3: Judge the binder content for bituminous mixes
CO-4: Evaluate the Marshall parameters for preparation of bituminous mixes

TEST ON ROAD AGGREGATES:
1. Aggregate Crushing Value
2. Aggregate Impact Value
3. Los Angeles Abrasion Test
4. Shape Tests a) Elongation Index, b) Flakiness Index, c) Angularity Number
5. Specific Gravity & Water Absorption

TEST ON BITUMEN:
6. Penetration Test, Softening Point Test
7. Ductility Test
8. Flash & Fire Point Test
9. Absolute Viscosity
10. Kinematic Viscosity
11. Bitumen Extraction Test
    a) Centrifugal Apparatus
    b) Soxhlet Apparatus

TEST ON BITUMINOUS MIXES
12. Marshal Stability Test

***Note:** Bituminous Mix design is carried as per MoRTH& IRC specifications.

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

(18PW4CE02) INTERNSHIP

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

COURSE OUTLINE:

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

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

(18PC1CE14) DESIGN OF STEEL STRUCTURS

COURSE OBJECTIVE:
- To describe the salient features of Limit State Method of design of Steel structures
- To identify and understand the various codal provisions given in IS 800
- To understand the behavior of steel structures under tension, compression and flexure
- To design the tension, compression, flexural members and welded plate girder

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Design the simple and eccentric connections
CO-2: Design the tension members, compression members and column bases
CO-3: Design the beams including built-up sections
CO-4: Understand and **Design** various components of welded plate girder including stiffeners

UNIT-I:
Introduction to Limit State Design and Connections: Concept of limit state design-Bolted connections-IS 800:2007 specifications - Design strength - efficiency of joint - prying action-welded connections-Types of welded joints specifications-design requirements.

UNIT-II:
Tension Members & Compression Members: Design of tension members-Design strength- Design procedure- splice-lug angles; Compression members - buckling - slenderness ratio – Load carrying capacity - Design of compression members - splice

UNIT-III:
Built-up Compression Members: Laced columns-battened column s- -column base: Slab base-Gusseted base

UNIT-IV:
Design of Beams: Design of beams-plastic moment-bending and shear strength/buckling- built up sections laterally supported beams

UNIT –V:
Welded Plate Girders: Design of welded plate girder- Components of Plate Girder-Optimum depth – Bending Strength – Shear Strength – Shear Buckling- design of main section connections between web and flange-design of bearing stiffener-intermediate stiffeners

UNIT –VI:
Design of Eccentric Connections: Design of Brackets- Type-1 and Type 2 – Moment Resistant connections - Design Examples.

TEXT BOOKS:

1. Limit State Design of Steel Structures, S. K. Duggal, 1st Edition, TMH New Delhi, 2011
2. Design of Steel Structures, N. Subramanian, 1st Edition, Oxford University Press, 2011

REFERENCES:

1. Design of Steel Structures, S.S. Bhavikatti, 1st Edition, I.K. International Publishing House Pvt. Ltd., 2011
2. Limit State Design of Steel Structures, Dr. V. L. Shaw, 1st Edition, Structures Publications, Pune, 2010

CODE BOOKS:

1. IS: 875 (Part III)
2. IS 800: 2007 - Indian Code of Practice for Construction in Steel
3. Handbook of Steel Tables

NOTE: Question paper pattern for Final Examination: The end examination paper should consist of Part-A and Part-B. Part-A consists of two questions in Design and Drawing out of which one question is to be answered for 24 marks. Part-B consists of Five questions on design out of which three are to be answered for 36 marks (12 x 3)

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

(18PC1CE15) SOIL MECHANICS

COURSE OBJECTIVES:
- To improve the basic knowledge of the index and engineering properties
- To understand the basic principles of Soil Mechanics and their applications to solve problems related to Geotechnical Engineering
- To analyze the permeability and seepage problems
- To evaluate and determine the strength parameters

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify the properties of soils to solve engineering problems
CO-2: Examine the behaviour of soil based on plasticity character
CO-3: Formulate and **analyse** Geotechnical engineering problems
CO-4: Differentiate and **determine** the compaction and consolidation characteristics

UNIT – I:
Introduction: Types of soils, their formation and deposition, Definitions: soil mechanics, Soil engineering, rock mechanics, geotechnical engineering. Scope of soil engineering. Comparison and difference between soil and rock. Index and engineering properties of soil. Basic Definitions and Relationships-Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity. Relationship between volume weight, voids ratio- moisture content, unit weight- percent air voids, saturation moisture content, moisture content- specific gravity. Determination of various parameters such as: Moisture content by oven dry method, pycnometer, sand bath method, torsional balance method, nuclear method, alcohol method. Specific gravity by density bottle method, pycnometer method. Unit weight by core-cutter method, sand-replacement
method.

UNIT – II:
Plasticity Characteristics of Soil: Introduction to definitions of plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Determination of liquid limit, plastic limit and shrinkage limit. Use of consistency limits. Classification of Soils-Introduction of soil classification: particle size classification, textural classification, unified soil classification system, Indian standard soil classification system. Identification: field identification of soils, general characteristics of soil in different groups.

UNIT – III:
Permeability of Soil: Darcy's law, validity of Darcy's law. Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method. Field method: pumping- in test, pumping- out test. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Seepage Analysis Introduction,

stream and potential functions, characteristics of flow nets, graphical method to plot flow nets.

UNIT – IV:

Effective Stress Principle: Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition.

UNIT – V:

Compaction of Soil: Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density, zero air void line. Compaction in field, compaction specifications and field control.

Consolidation of Soil: Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, basic definitions, Terzaghi's theory of consolidation, determination of coefficient of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.

UNIT – VI:

Shear Strength: Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits and demerits of direct shear test, triaxial compression tests, test behaviour of UU, CU and CD tests, pore pressure measurement, computation of effective shear strength parameters. unconfined compression test, vane shear test.

TEXT BOOKS:

1. Basic and Applied Soil Mechanics, Gopal Ranjan and A.S.R. Rao, Second Edition, New Age International Publishers, 2012
2. Soil Mechanics, Foundation Engineering, V.N.S. Murthy, First Edition, CBS Publishers & Distributors Pvt. Ltd., 2013

REFERENCES:

1. Soil Mechanics and Foundation Engineering, Dr. K.R. Arora, 7th Edition, Standard Publishers, 2011
2. Principles of Geotechnical Engineering, Braja M. Das, Cengage Learning
3. Geotechnical Engineering, Dr. C. Venkataramiah, 6th Edition, New Age International
4. Geotechnical Engineering, Debashish Moitra, Universities Press

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

(18PC1CE16) IRRIGATION ENGINEERING

COURSE OBJECTIVES:

- To describe and explain the fundamental principles and terminologies used in Irrigation Engineering
- To identify and explain different Irrigation system components and their significance
- To understand the functions of main parts of canal headworks and canal structures
- To understand and design main components of canals, reservoirs and dams

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Enumerate the fundamental principles and concepts of Irrigation Engineering
CO-2: Identify and **explain** different components of an irrigation system
CO-3: Explain and **design** the main components of Diversion headworks and canal structure
CO-4: Explain and **design** main components of canals, reservoirs and dams

UNIT – I:
Introduction to Irrigation: Need for Irrigation in India, Advantages and Ill Effects of Irrigation, Soil-Water-Plant relationship, Water Requirement of Crops-Crops and Crop Seasons in India, Root Zone, Soil Water Infiltration, Consumptive Use, Cropping Pattern, Duty and Delta, Quality of Irrigation Water, Irrigation Requirement, Frequency of Irrigation, Efficiencies of Irrigation, Methods of Applying Water to the Fields-surface, subsurface, sprinkler and trickle/drip irrigation

UNIT – II:
Canal Irrigation: Canals, Command Areas, Planning of an Irrigation Canal System, Alignment of Irrigation Canals, Canal Losses, Estimation of Design Discharge of a Canal Design of Channel- Rigid Boundary Channel, Alluvial Channel, Kennedy and Lacey's Theory of Regime Channel, Tractive Force Concept in Canal Design, Borrow Pits and Spoil Banks Canal Outlets-Non-Modular, Semi-Modular and Modular Water Logging- Causes, Effects, and Remedial Measures Drainage of Irrigated Land- Necessity, Methods

UNIT – III:
Canal Structures: Regulation Structures: Canal Falls, Types of Canal Fall, Cistern Element, Hydraulic Design of Trapezoidal Notch Fall and Sarda Fall, Distributory Head Regulator, Cross Regulator, Canal Escapes, Cross Drainage Structures- Need, Types, Selection of Suitable Type

UNIT – IV:
Canal Headworks: Location of Headwork on Rivers, Weirs and Barrages, Layout of a Typical Diversion Headworks, Components, Causes and Failures of Hydraulic Structure on Permeable Foundation, Bligh's Creep Theory, Khosla's Theory, Exit Gradient, Design of Weirs on Permeable Foundation

UNIT – V:

Dams: Types of Dams, Factors Affecting Selection of Type of Dam, Embankment Dam-Classification, Design Considerations, Estimation and Control of Seepage, Slope Protection; Gravity Dams - Forces on Gravity Dams, Causes of Failure, Stress Analysis, Elementary and Practical Profile

UNIT – VI:

Reservoirs and Spillways: Reservoirs-Types, Selection of Suitable Sites, Capacity of Reservoirs, Yield of Reservoir, Reservoir Regulation, Sedimentation Spillways-Types of Spillways, Components of Spillways, Types of Gates for Spillway Crests

TEXT BOOKS:

1. Irrigation and Water Resources Engineering, G. L. Asawa, New Age International Publishers, 2008
2. Irrigation and Water Power Engineering, B.C. Punmia, Ashok Kumar Jain, et al.,Laxmi Publications, 2016

REFERENCES:

1. Irrigation Engineering & Hydraulic Structures, S. K. Garg, Khanna Publishers, 2017
2. Irrigation Engineering, R. K. Sharma and T. K. Sharma, S. Chand Publishers, 2008
3. Irrigation Engineering, N. N. Basak, McGraw-Hill Publications, 2017
4. A Textbook of Irrigation Engineering, S.R. Sahasrabudhe, S.K. Kataria& Sons, 2013

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

(18PC1CE17) ESTIMATION AND COSTING

COURSE OBJECTIVES:
- To understand the terms of estimation
- To calculate detailed estimate of buildings
- To perform rate analysis of quantities
- To list the methods of valuation of the property

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Estimate the detailed quantity of RC building
CO-2: Prepare the detailed estimation of roads, irrigation works
CO-3: Interpret the value of a property
CO-4: Implement the type of contract for a specific Work

UNIT-I:
Types of Estimate: Estimate - explanation of terms - contingencies - work charged establishments - provisional sum - lumpsum item - centage charge - types of estimate - revised estimate- supplementary estimate - maintenance estimate - approximate estimate - plinth area method - cubic rate method - unit rate method - bay method - approximate quantity from bill method - comparison method - cost from materials and labour. – detailed specifications for common building materials and items of work as per I.S specifications.

UNIT-II:
Method of Building Estimates and Analysis of Rates: Preparation of detailed estimate for R.C building - Centre line method and long wall - short wall method - methods of measurements of different items of work - calculation of quantities of materials for items of work. Analysis of rate for items of works required for civil engineering works

UNIT-III:
Water Supply and Sanitary Works, Roads and Irrigation Works: Preparation of detailed estimate for sanitary and water supply works - roads - irrigation works - doors and windows.

UNIT-IV:
Bar Bending Schedule for RCC Elements: Preparation of conveyance statement - preparation of abstract of estimate of civil engineering works. Preparation of bar bending schedule for RCC elements – beams, slabs, columns, footings.

UNIT-V:
Contracts and Tenders: Competitive bidding- Local competitive bidding, global bidding, item rate contract percentage rate contract and Lumpsum contract. Preparing tender papers- Invitation of tenders, tender notice, tender documents, (various terms and conditions to contracts) submission. Scrutiny and acceptance. Award of jobs. Rights and responsibilities of parties to contracts. Negotiated contracts.

Cost plus percentage. Cost plus fixed fees. Cost plus sliding scale of fees. Target cost as based on sharing risk and profits. Turnkey contracts. More than two party contracts.

UNIT-VI:

Valuation of Property and Rent Fixation: Explanation of items, types of values, sinking fund, years purchase, depreciation, straight line method, constant percentage method, S.F method, obsolescence, valuation tables, valuation of real property-rental method - profit based method - depreciation method. Valuation of land - belting method - development method - hypothecated building scheme method, Rent calculation - lease and lease hold property, Arbitration.

TEXT BOOKS:

1. Estimating and Costing, B.N. Dutta, 26th Edition, UBS Publishers, 2010
2. Estimating, Costing, Specification & Valuation, M. Chakraborti, 24th Edition, 2010

REFERENCES:

1. Estimating and Costing, G.S. Birdie, 5th Edition, Dhanpat Rai Publications, 2000
2. Standard Schedule of Rates and Standard Databook, Public Works Department
3. IS: 1200 (Parts I to XXV – 1974 / Method of Measurement of Building and Civil Engineering Works – B.I.S), National Building Code

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

(18PE1CE06) AIR POLLUTION CONTROL

COURSE OBJECTIVES:
- To understand the concepts of Air pollution
- To remember the plume behavior, Modelling Techniques, Air Pollution Climatology
- To acquire the concepts of Particulate and Gaseous Contaminants and its Control devices
- To remember and Understand Air quality monitoring and management

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the fundamental concepts of air pollution
CO-2: Execute the acquired knowledge of modelling techniques to resolve the practical problems
CO-3: Apply the fundamental knowledge on Particulate and Gaseous Contaminants and design control devices
CO-4: Implement the acquired knowledge of Air quality monitoring in indoor Air quality management.

UNIT – I:
Introduction: Air Pollution and its definition - Structure and composition of Atmosphere – Sources and classification of air pollutants - Effects of air pollutants on human health, vegetation & animals, Materials & Structures – Effects of air Pollutants on the atmosphere, Soil & Water bodies – Long- term effects on the planet – Global Climate Change, Ozone Holes – Ambient Air Quality and Emission Standards – Air Pollution Indices – Emission Inventories – Ambient and Stack Sampling
and Analysis of Particulate and Gaseous Pollutants - Factors influencing air pollution.

UNIT – II:
Air Pollution Modelling: Meteorology – Wind roses – lapses rates – mixing depth atmospheric dispersion – plume behaviour accumulation, estimation of pollutants – Effective stack height- Transport & Dispersion of Air Pollutants – Modelling Techniques – Air Pollution Climatology.

UNIT – III:
Control of Particulate Contaminants: Factors affecting Selection of Control Equipment – Gas Particle Interaction, – Working principle of Gravity Separators (cyclone), Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations - Process Control and Monitoring – Costing of APC equipment – Case studies for stationary and mobile sources.

UNIT – IV:
Control of Gaseous Contaminants: Factors affecting Selection of Control Equipment – Working principle of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations - Costing of APC Equipment – Case studies for stationary and mobile sources.

UNIT – V:
Air Pollution Monitoring and Management: Air pollution monitoring and management -Environmental guidelines for siting industries, Environmental Impact assessment, Environmental management plan, stack emission standards, stack emission monitoring, ambient air quality monitoring, ambient air quality survey.

UNIT – VI:
Indoor Air Quality Management: Source types and control of indoor air pollutants, sick building syndrome types – Radon Pollution and its control – Membrane process - UV photolysis – Internal Combustion Engines - Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures.

TEXT BOOKS:
1. Air Pollution Control Engineering, Nevers, McGraw-Hill Inc., 2000
2. Air Pollution & Control Technologies, Anjaneyulu Y., Allied Publishers (P) Ltd., India, 2002

REFERENCES:
1. Air Pollution Control, K.V.S.G. Murali Krishna, Kaushal & Co., 1995
2. Air Pollution and its Control, M.N. Rao & H.V.N. Rao, 15th Reprint, Tata McGraw-Hill, 2000
3. Air Pollution Engineering Manual, Wayne T. Davis, John Wiley & Sons, Inc., 2000
4. Fundamentals of Air Pollution, Daniel Vallero, Fourth Edition, 2008

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

(18PE1CE07) SOLID WASTE MANAGEMENT

COURSE OBJECTIVES:

- To define the terms and Understands the necessity of solid waste management
- To explain the strategies for the collection of solid waste
- To describe the solid waste disposal methods
- To categorize bio-medical waste and e-waste

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the basic concepts of solid waste management
CO-2: Analyze the characteristics and **design** solid waste processing facilities
CO-3: Choose different strategies and **design** solid waste disposal facilities
CO-4: Apply the acquired knowledge of e-waste, Biomedical waste and plastic waste in disposal practices

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

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 – landfill remediation

UNIT – VI:

Solid Waste Management of Biomedical Waste, plastic and E- Waste: Biomedical Waste – Sources and generation, biomedical waste management. Plastic– Dangers of plastic wastes, Recycling and disposal of plastic wastes. E-Wastes
– Definition, Health hazards, E-Waste management and conclusion.

TEXT BOOKS:

1. Handbook of Solid Waste Management, George Tchobanoglous and Frank Kreith, McGraw-Hill, 2002
2. Solid Waste Management, K. Sasi Kumar & S. Gopi Krishna, Prentice-Hall Publishers, 2009

REFERENCES:

1. Management of Municipal Solid Waste, T.V. Ramachandra, The Energy and Resources Institute, TERI, 2009
2. Municipal Solid Waste Management in India, Subhrabaran Das and KorobiGogoi, VDM Verlag, 2010
3. Solid Waste Engineering, William A. Worrell and P. AarneVesilind, 2nd Edition, Cengage Learning, 2000
4. Manual on Municipal Solid Waste Management, Central Public Health and Environmental Engineering Organization,Government of India, New Delhi, 2000

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

(18PE1CE08) ENVIRONMENTAL IMPACT ASSESSMENT

COURSE OBJECTIVES:

- To remember the fundamentals of Environmental Impacts assessment and the terminology
- To study and understand the impact identification and prediction methodologies
- To understand the concepts of EIA Guidelines and procedures and Impacts on Developmental Activities
- To understand the fundamental concepts of environmental audits and management plans

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the acquired knowledge of EIA and its Terminologies
CO-2: Integrate the fundamentals to carry out the impact identification and prediction methodologies
CO-3: Implement the procedure for obtaining Environmental clearance for various projects
CO-4: Apply the acquired knowledge of Environmental laws to carry out the Audits and management plans

UNIT – I:
Introduction: Introduction to Environmental Impact Assessment (EIA), Historical development of EIA, Definition of EIA and EIS, Types and limitations of EIA, Elements of EIA, Terms of reference in EIA, Classification of Environmental parameters, Initial Environmental Examination, Preparation of Environmental Base map, EIA procedure, Preparation of EIS, Public Participation in EIA.

UNIT – II:
Impact Identification and Prediction Methodologies: EIA methodology: Introduction, criteria for selection of EIA Methodology, EIA methods - Adhoc method, Check List Method, Matrix method, Network method, Environmental media quality Index method, Overlays method, Cost benefit analysis method, Expert systems in EIA. Prediction tools for EIA.

UNIT – III:
EIA Governmental Procedures: Environmental impacts - Identification & measurement, Aggregation, Secondary and Cumulative Impacts, Environmental Guidelines and procedures, Environmental clearance, Environmental Appraisal Procedure, Single window Clearance, Time frame, Post project monitoring, Procedure for obtaining Environmental clearance for industries, Forest clearance, Consent to operate Industrial unit, Consent to handle hazardous chemicals in the Industrial unit.

UNIT – IV:
Assessment of Impact on Developmental Activities: Assessment of Impact of developmental Activities on soil, ground water, surface water vegetation, air, wild life,

Noise & Socio Economic Environment, Environmental impacts of Deforestation-Causes and effects.

UNIT – V:

Environmental Audit: Environmental Audit, Types of environmental Audit, Audit protocol, Stages of Environmental Audit onsite activities, evaluation of audit data and preparation of Audit Report, Post Audit Activities, Case studies On EIA, Environmental laws and regulations-Air act, Water act, environmental protection act.

UNIT – VI:

Environmental Management Plan: Environmental Management Plan - preparation, implementation and review – Mitigation and Rehabilitation Plans – Policy and guidelines for planning and monitoring programmes – Post project audit – Ethical and Quality aspects of Environmental Impact Assessment- Case Studies.

TEXT BOOKS:

1. Environmental Impact Assessment, Canter L.W., McGraw-Hill, New York, 1996
2. Environment Impact Analysis, Jain R.K., Urban L.V. and Stacey G.S., Von Nostrand Reinhold Company

REFERENCES:

1. Handbook of Environmental Management and Technology, G. Burke, B. R. Singh and L. Theodore, 2nd Edition., John Wiley & Sons, 2000
2. Environment Impact Statements: A Comprehensive Guide to Project and Strategic Planning, C. H. Eccleston, John Wiley & Sons, 2000
3. Environmental Impact Assessment and Methodologies, Y. Anjaneyulu and Valli Manickam, 2nd Edition, BS Publications, 2011
4. World Bank – Source book on EIA

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

(18PE1CE09) RURAL WATER SUPPLY AND SANITATION

COURSE OBJECTIVES:
- To remember the system of rural and national water supply schemes
- To understand the concepts of sustainable water management
- To study and understand the concepts and importance of rural water supply and treatment
- To understand the fundamental ideas of rural sanitation, industrial hygiene and solidwaste management at rural

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify the problems pertaining to rural water supply and methods for low-cost water treatment
CO-2: Apply and carry out the Awareness and Development, program on comprehensive Water Management Plan (WMP)
CO-3: Apply the acquired fundamental concepts of low-cost water supply and treatment for rural areas
CO-4: Apply and carry out the fundamental concepts of rural sanitation, industrial hygiene and solid waste management at rural

UNIT – I:
Introduction: Rural Water Supply- Issues of rural water supply – Various techniques for rural water supply- merits - National rural drinking water program- rural water quality monitoring and surveillance- operation and maintenance of rural water supplies - Low-Cost Water Treatment – Epidemiological aspects of water quality- methods for low cost water treatment – Specific contaminant removal systems.

UNIT – II:
Awareness and Practices on Sustainable Water Management: Awareness, Development, implementation, management and monitoring of comprehensive Water Management Plan (WMP) – Prevention and reduce water losses - Water audit – optimize and optimization of water usage – Protection of water courses - Reuse of water for various purpose - Rainwater harvesting – Futuristic plan for expansion.

UNIT – III:
Rural Water Supply: Design population and demand loads - Various approaches of planning of water supply schemes in rural areas - Development of preferred sources of water such as springs, wells, infiltration wells, radial wells and infiltration galleries - collection of raw water from surface source - Specific practices and problems encountered in rural water supply.

UNIT – IV:
Rural Water Treatment: Improved methods and compact systems of treatment of surface and ground waters for rural water supply - Brief Details of multi-bottom settlers (MBS), diatomaceous earth filter, cloth filter, slow sand filter, chlorine diffusion

cartridges - Pumps, pipe materials, appurtenances and improved devices for use in rural water supply - Planning of distribution system in rural areas.

UNIT – V:

Rural Sanitation: Community and sanitary latrines - Various methods of collection and disposal of night soil - Planning of wastewater collection system in rural areas - Treatment and Disposal of wastewater - Compact and simple waste water treatment units and systems in rural areas such as stabilization ponds, septic tanks, Imhoff tank, soak pit etc. - Disposal of wastewater soakage pits and trenches.

UNIT – VI:

Industrial Hygiene and Solid Waste Management at Rural: Occupational Hazards - Schools - Public Buildings – Hospitals - Eating establishments - Swimming pools – Cleanliness and maintenance and comfort- Industrial plant sanitation. Disposal of Solid Wastes – Composting - land filling- incineration- Biogas plants - Rural health - Other specific issues and problems encountered in rural sanitation.

TEXT BOOKS:

1. Water Treatment and Sanitation – Simple Method for Rural Area, Mann H.T. and Williamson D.
2. Municipal and Rural Sanitation, Eulers V.M., and Steel E.W., 6th Edition, McGraw-Hill Book Company

REFERENCES:

1. Water Supply for Rural Areas & Small Communities, Wanger E.G. and Lanoix J.N., (World Health Organization)
2. Rural Water Supply and Sanitation, Wright F.B., E. Robert Krieger Publishing Company, Huntington, New York
3. Environmental History of Water: Global Views on Community Water Supply and Sanitation, Juuti P., Tapio S. K., and Vuorinen H., IWA Publishing (Intl. Water Assoc.), 2007
4. Manual on Water Supply and Treatment, CPHEEO, Mini. of Urban Development, Govt. of India

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PE1CE10) WATER SUPPLY ENGINEERING

COURSE OBJECTIVES:
- To understand the water supply system, storage capacity, Intakes, transport of water
- To define the basic and advanced water treatment system
- To recognize the principles of water distribution system
- To interpret the air and noise pollution and its control measures

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the acquired knowledge of water supply system, storage capacity, Intakes, transport of water to solve Engineering Problems
CO-2: Design basic and advanced water treatment systems
CO-3: Analyze and **Design** the water distribution system
CO-4: Apply the concepts of Air and Noise pollution to control pollution

UNIT – I:
Planning of Water Supply System: Importance - Necessity and Objectives of Protected Water Supply systems - Design Period - Water Demand - Sources of water – Hydrological Concepts – Surface Sources of Water – Sub surface or Underground sources - Water quality: Characterization and standards (Indian and WHO).

UNIT – II:
Conveyance System: Intake for collecting surface water: Functions and drawings – Types of Intakes - Pipes and conduits for transporting water - Pipe materials - Laying, jointing and testing of pipes - pipe appurtenances – Pumps for lifting water - Effects of corrosion and its prevention.

UNIT – III:
Water Treatment: Layout and general outline of water treatment units - unit operations and processes: Principles – functions - design and drawings of screening – plain sedimentation – sedimentation aided with coagulation –Filtration: working of gravity filters - pressure filters - roughening filters and double filtration – diatomaceous earth filters – Various disinfections methods.

UNIT – IV:
Advanced Water Treatment: Unit operations and processes: Principles – functions and drawings of Aeration - Water softening – removal of colour, odours and tastes - removal of Iron and manganese – addition and defluoridation - Desalination – Contamination of Arsenic and its removal - RO process and Membrane Systems – removal of radioactivity from water – domestic methods of treating water supplies.

UNIT – V:
Water Distribution and Supply: Introduction – requirements of a good distribution system – arrangements of distribution pipes and other accessories - Layout of distribution networks - Method of distribution – pressures in distribution system – system

of supply – Distribution reservoirs – Design of distribution networks – appurtenances in distribution system.

UNIT – VI:

Air and Noise Pollution and its Control Measures:

Air Pollution: sources – effects – predicting concentration of air pollutants - air pollution control - particulate control devices - gaseous emission control devices – controlling air pollution from automobiles – indoor air quality – pollution – control – **Noise Pollution:** introduction – sources of noise and their noise levels - effects – characteristics and measurements – ambient noise levels and standards – noise rating system - noise abatement and control.

TEXT BOOKS:

1. Environmental EngineeringVol.1, Garg S.K., Khanna Publishers, New Delhi, 2005
2. Water Supply Engineering, Punmia B.C., Ashok K. Jain and Arun K. Jain, Laxmi Publications Pvt. Ltd., New Delhi, 2005

REFERENCES:

1. Government of India, Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, New Delhi, 2003
2. Environmental Engineering, Peavy H., Rowe D., and Tchobanoglous G., Tata McGraw-Hill, 2013
3. Water Supply Engineering: Environmental Engineering-1, Modi P.N., Standard Publishers, 2011
4. Elements of Environmental Engineering, Duggal K.N., S. Chand & Company, New Delhi, 2013

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PC2CE07) SOIL MECHANICS LABORATORY

COURSE OBJECTIVES:
- To know the various properties of soils
- To apply the knowledge of science, mathematics and engineering with the context of applications in geotechnical engineering
- To describe various characteristics of soils to decide the problems related to foundation engineering
- To solve the problems encountered in real world situation

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify and **test** the soil types at the site.
CO-2: Determine the soil stabilization techniques for the foundation engineering project.
CO-3: Analyse the problems that may be encountered in any project.
CO-4: Apply remedial measures to **solve** the problems encountered in projects

LIST OF EXPERIMENTS:

1. Natural moisture content and field density using core cutter method
2. Field density using sand replacement method
3. Specific gravity of soils
4. Sieve analysis
5. Hydrometer analysis
6. Consistency limits
7. Permeability test
8. Standard proctor test
9. California bearing ratio test
10. Vane shear test
11. Direct shear test
12. Unconfined Compression strength test

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

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

COURSE OBJECTIVES:

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

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

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

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

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

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

UNIT – V:

Presentation Skills:

1. Oral Presentations
2. Powerpoint Presentations

UNIT – VI:

Report Writing:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18PW4CE03) 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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18MN6HS02) ENVIRONMENTAL SCIENCE

COURSE PRE-REQUISITES: Basic knowledge of environmental issues

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

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

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

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

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

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

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

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

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

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

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

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

OPEN ELECTIVE COURSES

SMART CITIES

SMART CITIES

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

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

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

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

What is the concept of a smart city?

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

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

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

Smart solutions

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

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

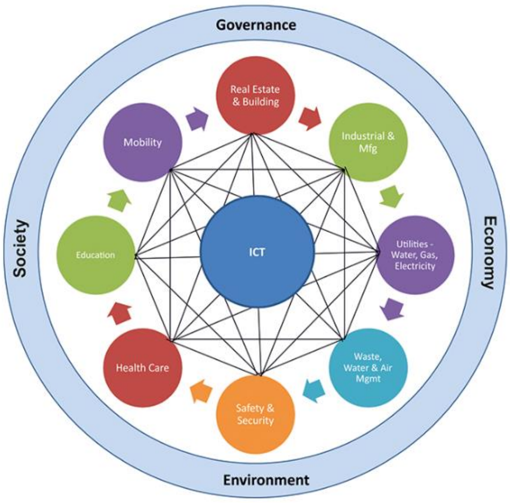
Advantages of a smart cities,

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

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

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

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



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

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

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

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

Conclusion

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1CE01) SMART CITIES PLANNING AND DEVELOPMENT

COURSE PRE-REQUISITES: None

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

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

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

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1CE02) GREEN BUILDING TECHNOLOGY

COURSE PRE-REQUISITES: Smart Cities Planning and Development

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

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

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

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

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

UNIT – IV:

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

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1CE03) SMART MATERIALS AND STRUCTURES

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

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

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

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

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

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

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

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

UNIT –VI:
Applications to Engineering Domains – Case studies

TEXT BOOKS:

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

REFERENCES:

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

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

(18OE1CE04) INTELLIGENT TRANSPORTATION SYSTEM

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

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

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

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

WASTE MANAGEMENT

WASTE MANAGEMENT

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

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

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

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

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

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

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

(18OE1CE05) SOLID WASTE MANAGEMENT

COURSE PRE-REQUISITES: None

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

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

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

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

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

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

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

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(18OE1CE06) HAZARDOUS WASTE MANAGEMENT

COURSE PRE-REQUISITES: Solid Waste Management

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

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

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

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

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

UNIT – IV:

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

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(18OE1CE07) WASTE TO ENERGY

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

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

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

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

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

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

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

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(18OE1CE08) INTELLIGENT WASTE MANAGEMENT SYSTEM AND RECYCLING SYSTEM

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

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

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

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

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

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

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

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

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

GREEN ENERGY

1. RENEWABLE ENERGY SOURCES

What we are studying?

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

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

Job opportunities:

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

Reference:

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

2. RENEWABLE ENERGY TECHNOLOGIES

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

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

Job Opportunities:

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

Reference:

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

3. ENERGY STORAGE TECHNOLOGIES

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

Job opportunities:

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

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

4. ENERGY MANAGEMENT AND CONSERVATION

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

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

(18OE1EE01) RENEWABLE ENERGY SOURCES

COURSE PRE-REQUISITES: None

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

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

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

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

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

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

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCE:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1EE02) RENEWABLE ENERGY TECHNOLOGIES

COURSE PRE-REQUISITES: Renewable Energy Sources

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

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

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

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

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

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

UNIT – V:

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

UNIT – VI:

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

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

TEXT BOOKS:

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

REFERENCE:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1EE03) ENERGY STORAGE TECHNOLOGIES

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

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

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

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

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

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

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

UNIT – V:

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

UNIT –VI:

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

TEXT BOOKS:

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

REFERENCES:

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

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

(18OE1EE04) ENERGY MANAGEMENT AND CONSERVATION

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

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

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

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

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

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

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

UNIT – V:

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

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

3D PRINTING AND DESIGN

3D PRINTING AND DESIGN

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

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

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

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

(18OE1ME01) ELEMENTS OF CAD

COURSE PRE-REQUISITES: None

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

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

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

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

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

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

UNIT – V:

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

Manipulations: Displaying, Segmentation, Trimming, Intersection, Projection

UNIT – VI:

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

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

TEXT BOOKS:

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

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

(18OE1ME02) INTRODUCTION TO 3D PRINTING

COURSE PRE-REQUISITES: Elements of CAD

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

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

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

(18OE1ME03) 3D PRINTING-MACHINES, TOOLING AND SYSTEMS

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

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

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

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

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

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

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

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

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

TEXT BOOKS:

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

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

REFERENCES:

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

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

(18OE1ME04) REVERSE ENGINEERING

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

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

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

UNIT-I:
Introduction to Reverse Engineering: Need, Definition, The Generic Process, History of Reverse Engineering, Scope and tasks of RE, Domain analysis, Overview of Applications

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

UNIT-III:
Data Acquisition Techniques : Contact Methods - Coordinate Measurement Machine and Robotic Arms; Noncontact Methods - Triangulation, and Structured Light, Destructive Method; Issues involved in data acquisition techniques

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

UNIT-V:
Segmentation: Definition and need, Methods for segmentation - Edge based and face based.
Integration Between Reverse Engineering and Additive manufacturing: Modeling Cloud Data, Integration of RE and AM for Layer-based Model Generation, Adaptive Slicing Approach for Cloud Data Modeling, Planar Polygon Curve Construction for a Layer, Determination of Adaptive Layer Thickness

UNIT-VI:
Applications: Automotive, Aerospace, Medical sectors
Legal Aspects: Copyright Law, Reverse Engineering, Recent Case Law Barriers in adopting RE

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

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

INTERNET OF THINGS

INTERNET OF THINGS

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

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

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

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

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

(18OE1EC01) SENSORS TRANSDUCERS AND ACTUATORS

COURSE PRE-REQUISITES: Engineering Physics, Electronic Measuring Instruments

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

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Familiar with classification and characteristics of various sensors and transducers
CO-2: Familiar with the principle and working of various sensors and transducers
CO-3: Familiar with the principle and working of various actuators
CO-4: Able to select proper Transducer / Sensor for a specific measurement application
CO-5: Able to select proper Actuator for a specific measurement application

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

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

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

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

UNIT – V:

Mechanical and Electrical Actuators: Mechanical Actuation Systems-Types of motion, Kinematic chains, Cams, Gears, Ratchet and pawl, Belt and chain drives, Bearings, Mechanical aspects of motor selection, Electrical Actuation Systems, Electrical systems, Mechanical switches, Solid-state switches, Solenoids, D.C. Motors, A.C. Motors, Stepper motors.

UNIT – VI:

Pneumatic and Hydraulic Actuators: Pneumatic and Hydraulic Actuation Systems-Actuation systems, Pneumatic and hydraulic systems, Directional Control valves, Pressure control valves, Cylinders, Servo and proportional control valves, Process control valves, Rotary actuators.

TEXT BOOKS:

1. A Course in Electrical and Electronic Measurements and Instrumentation, A. K. Sawhney, Puneet Sawhney,19th Edition, 2011
2. Sensors and Transducers, D. Patranabis, 2nd Edition, PHI Learning Private Limited, 2013
3. Mechatronics, W. Bolton, 7th Edition, Pearson Education Limited, 2018

REFERENCES:

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

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

(18OE1EC02) INTRODUCTION TO MICROCONTROLLER AND INTERFACING

COURSE PRE-REQUISITES: Sensors Transducers and Actuators

COURSE OBJECTIVES:
- To differentiate various number systems
- To understanding programming concepts
- To develop simple applications using 8051 microcontrollers

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand basic computing concepts
CO-2: Know architecture of 8051 microcontrollers
CO-3: Program internal resources of 8051 microcontroller
CO-4: Interface peripherals to 8051 microcontroller

UNIT – I:
Introduction to Computing: Numbering and Coding Systems: Binary, Decimal, Hexadecimal and conversions, Binary and Hexadecimal Arithmetic, Complements, Alphanumeric codes. Digital Premier, Inside the Computer

UNIT – II:
Embedded System Design: Embedded system - Definition, Characteristics of embedded computing applications, Design challenges, Requirements, Specification, Architecture design, Designing hardware and software components, system integration, Design example: Model train controller.

UNIT – III:
8051 Microcontroller: Microcontrollers and Embedded Processors, Architecture and Programming Model of 8051, Special Function Register formats, Memory Organization, Timers and Counters- Operating modes, Serial port, Interrupts

UNIT – IV:
8051 Programming in C: Data types, software delay generation, Logical operations, Accessing code and data space in 8051, I/O port programming, Timer/counter programming.

UNIT – V:
8051 Programming: Serial IO modes and their programming in C, interrupts programming in C: serial, timer and external interrupts.

UNIT – VI:
Introduction to Arduino: Features of Arduino, Arduino components and IDE, Interfacing: Seven Segment Display, Pulse Width Modulation, Analog Digital Converter, Wireless connectivity to Arduino. Case study: From BT To WiFi: Creating WiFi Controlled Arduino Robot Car.

TEXT BOOKS:

1. The 8051 Microcontroller: Programming, Architecture, Ayala &Gadre, Cengage Publications 3rd Edition, 2008
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. McKinlay, 2nd Edition, 2005

REFERENCES:

1. Digital Design, Morris Mano, PHI, 3rd Edition, 2006
2. Embedded Systems: Architecture, Programming and Design, 2nd Edition, TMH

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1EC03) IOT PROTOCOLS AND ITS APPLICATIONS

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

COURSE OBJECTIVES:
- To understand the basics of Internet of Things and Cloud of things
- To learn different protocols and connectivity technologies used in IOT
- To understand various IoT platforms
- To learn different applications with IoT

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the concepts of Internet of Things and Cloud of things
CO-2: Analyze various protocols for IoT
CO-3: Apply IOT to different applications in the real world

UNIT – I:
Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Deployment Templates, M2M, IoT vs M2M.

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

UNIT – III:
Connectivity Technologies: IEEE802.15.4, ZIGBEE, 6LOWPAN, Wireless HART, Z-Wave, Bluetooth, NFC, RFID.
Prototyping Embedded Device: Sensors, Actuators, Embedded computing Basics, System on chips.

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

UNIT – V:
Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

UNIT – VI:

Domain Specific Applications of IoT: IoT Design Methodology, Applications of IoT–Home, Health, Environment, Energy, Agriculture, Industry and Smart City.

TEXT BOOKS:

1. Internet of Things: A Hands-On Approach, Vijay Madisetti, ArshdeepBahga, Universities Press, 2015
2. The Internet of Things – Key Applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi, Wiley, 2012
3. The Internet of Things in the Cloud: A Middleware Perspective, Honbo Zhou, CRC Press, 2012

REFERENCES:

1. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers, 2013
2. Building the Internet of Things, Sara Cordoba, WimerHazenberg, Menno Huisman, BIS Publishers, 2011
3. Designing the Internet of Things, Adrian Mcewen, HakinCassimally, John Wiley and Sons, 2015

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1EC08) WIRELESS SENSOR NETWORKS

COURSE PRE-REQUISITES: Sensors Transducers and Actuators, Introduction to Microcontrollers and Interfacing, IoT Protocols and its applications

COURSE OBJECTIVES:
- To expose basic concepts of wireless sensor network technology
- To study medium access control protocols and various issues in a physical layer
- To understand the key routing protocols for sensor networks and their design issues
- To understand sensor management in networks and design requirements

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Appreciate various design issues of wireless sensor networks
CO-2: Understand the hardware details of different types of sensors and select the application specific sensor
CO-3: Understand radio standards and communication protocols to be used for wireless sensor networks

UNIT – I:
Introduction: Overview of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.

UNIT – II:
Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (Operating Systems): TinyOS, MANTIS, Contiki, and RetOS.

UNIT – III:
Programming Tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet, NetSim)

UNIT – IV:
Overview of Sensor Network Protocols (Details of at least 2 important protocol per layer): Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi- hop and cluster-based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

UNIT – V:
Data Dissemination and Processing: Differences compared with other database management systems, Query models, In-network data aggregation, data storage; query processing.

UNIT – VI:

Specialized Features: Energy preservation and efficiency; security challenges; Fault tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

TEXT BOOKS:

1. Wireless Sensor Networks Technology, Protocols, and Applications, Kazem Sohraby, Daniel Minoli, TaiebZnati, John Wiley & Sons, 2007
2. Protocols and Architectures for Wireless Sensor Networks, H. Karl and A. Willig, John Wiley & Sons, India, 2012
3. Wireless Sensor Networks, C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, 1st Indian Reprint, Springer Verlag, 2010

REFERENCES:

1. Wireless Sensor Networks: An Information Processing Approach, F. Zhao and L. Guibas, Morgan Kaufmann, 1st Indian Reprint, 2013
2. Wireless Sensor Network and Applications, Yingshu Li, My T. Thai, Weili Wu, Springer Series on Signals and Communication Technology, 2008
3. Principles of Mobile Communications, Gordon L. Stuber, 2nd Edition, Springer International, 2001

AUGMENTED REALITY (AR) / VIRTUAL REALITY (VR)

AUGMENTED REALITY (AR) / VIRTUAL REALITY (VR)

Augmented reality and virtual reality (AR & VR): Augmented reality (AR) and Virtual Reality (VR) bridge the digital and physical worlds. They allow you to take in information and content visually, in the same way you take in the world. AR dramatically expands the ways our devices can help with everyday activities like searching for information, shopping, and expressing yourself. VR lets you experience what it's like to go anywhere from the front row of a concert to distant planets in outer space.

Job Roles in Augmented reality and virtual reality (AR & VR) Track

- Design Architect. ...
- Software Designer. ...
- System Validation Engineers. ...
- Software Developer. ...
- 3D Artist…

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

(18OE1EC04) INTRODUCTION TO C-SHARP

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand the foundations of CLR execution
- To learn the technologies of the .NET framework and object-oriented aspects of C#
- To be aware of application development in .NET
- To learn web-based applications on .NET (ASP.NET)

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain how C# fits into the .NET platform
CO-2: Analyze the basic structure of a C# application
CO-3: Develop programs using C# on .NET
CO-4: Design and develop Web based applications on .NET

UNIT – I:
Introduction to C#: Introducing C#, Understanding .NET, overview of C#, Literals, Variables, Data Types, Operators, checked and unchecked operators, Expressions, Branching, Looping, Methods, implicit and explicit casting, Constant, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing.

UNIT – II:
Object Oriented Aspects of C#: Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism, sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, events, errors and exception, Threading.

UNIT – III:
Application Development on .NET: Building windows application, Creating our own window forms with events and controls, menu creation, inheriting window forms, SDI and MDI application, Dialog Box (Modal and Modeless), accessing data with ADO.NET, DataSet, typed dataset, Data Adapter, updating database using stored procedures

UNIT – IV:
SQL Server with ADO.NET, handling exceptions, validating controls, windows application configuration.

UNIT – V:
Web Based Application Development on .NET: Programming web application with web forms, ASP.NET introduction, working with XML and .NET, Creating Virtual Directory and Web Application, session management techniques, web.config, web services, passing datasets, returning datasets from web services, handling transaction, handling exceptions, returning exceptions from SQL Server.

UNIT – VI:

CLR and .NET Framework: Assemblies, Versoning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, remoting, security in .NET

TEXT BOOKS:

1. The Complete Reference: C# 4.0, Herbert Schildt, Tata McGraw-Hill, 2012
2. Professional C# 2012 with .NET 4.5, Christian Nagel et al. Wiley India, 2012

REFERENCES:

1. Pro C# 2010 and the .NET 4 Platform, Andrew Troelsen, 5th Edition, A Press, 2010
2. Programming C# 4.0, Ian Griffiths, Matthew Adams, Jesse Liberty, 6th Edition, O"Reilly, 2010

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1EC05) INTRODUCTION TO SIGNAL PROCESSING

COURSE PRE-REQUISITES: Introduction to C Sharp

COURSE OBJECTIVES:
- To understand various fundamental characteristics of signals and systems
- To analyze signals in frequency domain
- To know principles of signal transmission through systems
- To understand fundamentals of digital signal

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Classify signals and implement various operations on signals
CO-2: Analyze the characteristics of signals and systems
CO-3: Understand the basics of filter design
CO-4: Appreciate the processes of Multirate systems

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

UNIT – II:
Representation of Systems: Classification of discrete time Systems, impulse response, Concept of convolution in time domain and frequency domain, response of a linear system, System function, Signal bandwidth, system bandwidth. Ideal filter characteristics.

UNIT – III:
Sampling Theorem: Representation of continuous time signals by its samples - Sampling theorem – Reconstruction of a Signal from its samples, aliasing
Z –Transform: Basic principles of z-transform, region of convergence, properties of ROC, Inverse z-transform using Partial fraction.

UNIT – IV:
Introduction to Digital Signal Processing: Applications of Z-Transforms- Solution of Linear Constant Coefficient Difference equations (LCCD), System function, Frequency Response of the system.

UNIT – V:
Discrete Fourier Transforms: Circular convolution, Comparison between linear and circular convolution, Computation of DFT.
IIR Digital Filters: Design of IIR Digital filters (H(s) to be given) - Impulse invariance transformation techniques, Bilinear transformation method.

UNIT – VI:
FIR Digital Filters: Characteristics of linear phase FIR filters and its frequency response, Comparison of IIR and FIR filters. Design of FIR filters using Fourier Method and Windowing Technique (only Hanning).
Realization of IIR and FIR Filters: Direct and Cascade forms.

TEXT BOOKS:

1. Signals, Systems and Communications, B. P. Lathi, BS Publications, 2009
2. Signals and Systems, Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, 2nd Edition, PHI
3. Digital Signal Processing: Principles, Algorithms and Applications, John G. Proakis, D.G. Manolakis, 4th Edition, 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**

(18OE1EC06) INTRODUCTION TO IMAGE AND VIDEO PROCESSING

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

COURSE OBJECTIVES:
- To introduce fundamentals of digital image and video processing
- To demonstrate digital signal processing techniques in spatial and frequency domains
- To study and compare various image and video compression algorithms
- To study applications of motion estimation in video processing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire, represent the digital image and transforms
CO-2: Apply various pixel position and intensity-based image processing techniques
CO-3: Understand and analyze the performance of block matching algorithms in MPEG video coding standards

UNIT – I:
Fundamentals of Image Processing and Image Transforms: Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels, 2 – D Discrete Fourier Transform, Discrete Cosine Transform, Introduction to Wavelet transforms.

UNIT – II:
Image Enhancement-Spatial Domain Methods: Point Processing, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters.

UNIT – III:
Image Enhancement-Frequency Domain Methods: Basics of filtering in frequency domain, Image Smoothing, Image Sharpening, Selective Filtering.
Image Segmentation: Segmentation Concepts, Point, Line and Edge Detection, Thresholding, Region Based Segmentation.

UNIT – IV:
Image Compression: Image compression fundamentals – coding Redundancy, spatial and temporal redundancy.
Compression Models: Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding.

UNIT – V:
Basic Steps of Video Processing: Analog video, Digital Video, Time varying Image Formation models: 3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals.

UNIT – VI:

2-D Motion Estimation: Optical flow, pixel-based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Application of motion estimation in video coding.

TEXT BOOKS:

1. Digital Image Processing, Gonzaleze and Woods, 3rd Edition, Pearson
2. Video Processing and Communication, Yao Wang, JoemOstarmann and Ya – Quin Zhang, 1st Edition, PHI

REFERENCES:

1. Digital Video Processing, M. Tekalp, Prentice Hall International
2. Image Acquisition and Processing with LabVIEW, Relf, Christopher G., CRC Press
3. Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms, Aner Ozdemi R, John Wiley & Sons
4. Fundamentals of Digital Image Processing, A Practical Approach with Examples in Matlab, Chris Solomon, Toby Breckon, John Wiley & Sons

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

(18OE1EC07) APPLICATIONS OF AR AND VR

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

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

- A review of current Virtual Reality (VR) and Augmented Reality (AR) technologies
- The fundamentals of VR/AR modeling and programming
- Provides a detailed analysis of engineering scientific and functional aspects of VR/AR

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire knowledge in main applications VR / AR technologies
CO-2: Analyze different tools for VR/AR applications
CO-3: Developing VR/AR applications

UNIT – I:
Augmented Reality and Virtual Reality:
Augmented Reality: Introduction to Augmented Reality (AR), Fundamentals, Chronicle order of AR, features
Virtual Reality: Introduction to Virtual Reality (VR), Features of VR and Chronicle order of VR; Difference between AR and VR.

UNIT – II:
Types of Augmented Reality: Marker based AR, Marker less AR, Projection based AR, Super Imposition based AR, Applications of AR.

UNIT – III:
Types of Virtual Reality: Non- immersive simulation, Semi-immersive simulations, Fully immersive simulations; Applications VR.

UNIT – IV:
Making an AR App with Simple CUBE: Introduction to Unity, Installation steps, Fundamentals while implementing Project, importing a cube, Create an account in Vuforia, license manager, target manager, downloading database and uploading target database in unity.

UNIT – V:
AR App with Interaction: Introduction to C#, Scripting interactive objects, implementation C# Script using unity, uploading target object, deploying application into ANDROID Device.

UNIT – VI:

Creating an Virtual Reality: Creating an Virtual Reality Scene in unity, adding colliders, Settings of Unity to make the application compatible with Google cardboard.

TEXT BOOKS:

1. Virtual Reality & Augmented Reality in Industry, Ma D., Gausemeier, J., Fan, X., Grafe, M. (Eds.) Springer, 2011

REFERENCES:

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

ADDITIONAL RESOURCES:

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

ARTIFICIAL INTELLIGENCE

ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) is a cognitive science with highly research activities in the major areas like Machine Learning, Robotics, Natural Language Processing and image processing. This track will cover basic foundations of artificial intelligence it will make the students industry-ready for artificial intelligence and data science job roles. Artificial intelligence is used in wide range of industrial applications such as healthcare, transportation, entertainment, insurance, transport and logistics, and customer service.

Future applications of AI would be utilized in automated transportation, cyborg technology, solving problems associated with climate change, deep-sea and space exploration.

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

(18OE1MT02) MATHEMATICS FOR ARTIFICIAL INTELLIGENCE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce the basic concepts of probability and matrices in the field of Artificial Intelligence
- To identify, explore the complex problem-solving strategies
- To develop problem solving skills related to algorithmic analysis required for AI
- To apply and build mathematical model to solve real-world problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explore and demonstrate practical approaches related to implementation of the AI algorithms using probability concepts
CO-2: Formulate and solve the Artificial intelligence related problems by using the knowledge of matrices and vectors
CO-3: Demonstrate the understanding of mathematical ideas from artificial intelligence perspective and machine learning
CO-4: Analyze and solve the complexity of a given problem with suitable optimization techniques

UNIT – I:
Probability: Basic rules and axioms, events, sample space, frequentist approach, dependent and independent events, conditional probability, Random variables, continuous and discrete, expectation, variance, distributions - joint and conditional, Bayes' theorem, Popular distributions - Bernoulli, Binomial, Poisson, Normal.

UNIT – II:
Descriptive Statistics & Linear Regression: Classification and tabulation of univariate data, graphical representation, Frequency curves. Descriptive measures - Central tendency and Dispersion. Simple Linear Regression Models.

UNIT – III:
Vector Space: Vectors, definition, scalars, addition, scalar multiplication, inner product (dot product), vector projection, cosine similarity, orthogonal vectors, normal and orthonormal vectors, vector norm, vector space, linear combination, linear span, linear independence, basis vectors.
UNIT – IV:
Matrices: Matrices definition, rank, System of equations: Direct methods - LU decomposition method, Tri-diagonal system; Applications of linear systems - Network flows and Mechanical systems.

UNIT – V:
Eigen Values & Eigen Vectors: Eigen values & eigen vectors, concept, intuition, significance, how to find principle component analysis, concept, properties, applications, Singular value decomposition, concept, properties, applications.

UNIT – VI:

Multivariate Calculus: Functions, Scalar derivative, partial derivatives, Gradient, chain rule, properties, method for derivative of vector-valued function with respect to scalar, vector four combinations - Jacobian, Hessian, Gradient of vector valued function, Gradient of matrices. Local/global maxima and minima, saddle point, convex functions, gradient descent algorithms - Learning rate, momentum, stochastic, Constrained optimization (Lagrange Multiplier method), convex optimization.

TEXT BOOKS:

1. Mathematics for Machine Learning, Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Cambridge University Press, 2020
2. Linear Algebra and it's Applications, David C. Lay, 3rd Edition, Pearson Publications
3. Probability and Statistics for Engineers, Richard A. Johanson, 5th Edition, Prentice-Hall, 1995

REFERENCES:

1. Math for Machine Learning: Open Doors to Data Science and Artificial Intelligence, Richard Han, Paperback, 2018
2. Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning, James V Stone
3. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006

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

(18OE1CS01) FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence

COURSE OBJECTIVES:
- To understand and analyze the importance and basic concepts of artificial intelligence and the use of agents
- To identify, explore the complex problem-solving strategies and approaches
- To analyze the concepts of basic concepts of neural networks and learning process
- To explore and analyze the methodology used in machine learning

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the basic concepts of artificial intelligence and the use of agents into the real-world scenario
CO-2: Design and formulate complex problem solutions with the use of various searching techniques
CO-3: Estimate the skill for representing knowledge using the appropriate technique for a given problem
CO-4: Apply AI techniques to solve problems of game playing, and machine learning

UNIT – I:
Introduction to AI: Foundations of AI – History of AI - Applications of AI, Intelligent Agents – Agents and Environments – Nature of Environments – Structure of Agents – Problem solving Agents – Problem formulation – Example Problems.

UNIT – II:
Searching Techniques: Uninformed Search Strategies – Breadth first search – Depth first search – Depth limited search - Bidirectional search – comparison – Search with partial information - Heuristic search – Greedy best first search – A* search – Memory bounded heuristic search - Heuristic functions - Local search- Hill climbing – Simulated annealing search - Local beam search, Genetic algorithms.

UNIT – III:
Constraint Satisfaction Problems: Backtracking search for CSP's - local search for constraint satisfaction problem. *Adversarial search* – Games - Minimax algorithm, Alpha beta pruning, cutting-off search.

UNIT – IV:
Knowledge Representation and Reasoning: Propositional Logic, Rules of Inference, First Order Logic (FOL) Syntax, Semantics, Entailment.

UNIT – V:

Classical Planning: Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches.

UNIT – VI:

Planning and Acting in the Real World: Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent Planning.

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall, 2010
2. Machine Learning, Tom M. Mitchell, McGraw-Hill
3. Neural Networks A Comprehensive Foundation, Simon Haykin, Pearson Education, 2nd Edition, 2004

REFERENCES:

1. Artificial Intelligence, Elaine Rich & Kevin Knight, 2nd Edition, TMH
2. Artificial Intelligence-A New Synthesis, Nils J. Nilsson, Elsevier
3. Artificial Neural Networks, Yegnanarayana B., PHI

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

(18OE1CS02) MACHINE LEARNING TECHNIQUES

COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence, Fundamentals of Artificial Intelligence

COURSE OBJECTIVES:
- To understand applications in computational learning theory
- To analyse the pattern comparison techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and Familiarize the basics concept, notations used in machine learning and mathematics behind machine learning algorithms
CO-2: Demonstrate different types of machine learning algorithms
CO-3: Apply the suitable machine learning techniques and construct a machine learning model to solve real world applications.
CO-4: Evaluate model accuracy and familiarize with advanced learning algorithms.

UNIT – I:
Introduction to Machine Learning: Perspectives and issues in machine learning, Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation.

UNIT – II:
Supervised Learning: Classification, decision boundaries; nearest neighbor methods, Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, Linear classifiers Bayes' Rule and Naive Baye's classification
Regression: Regression types, gradient descent; features of Over fitting and complexity; training, validation, test data, Logistic regression and applications.

UNIT -III:
Unsupervised Learning: Clustering, k-means, hierarchical, partition-based clustering, overlapping clustering, Support vector machines, Support vector regression.

UNIT -IV:
Reinforcement Learning: Introduction to Reinforcement learning, the learning task, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

UNIT- V:
Instance-Based Learning: Introduction, k-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT – VI:

Neural Networks: Introduction to neural networks, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and Convolution neural networks.

TEXT BOOKS:

1. Machine Learning, Tom M. Mitchell, McGraw-Hill
2. Neural Networks and Learning Machines, S. Haykin, Pearson, 2008

REFERENCES:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis
2. Machine Learning: The Art and Science of Algorithms that make Sense of Data, Peter Flash, Cambridge, University Press
3. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, MIT Press, 2012

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

(18OE1CS03) DEEP LEARNING

COURSE PRE-REQUISITES: Mathematics for Artificial Intelligence, Fundamentals of Artificial Intelligence, Machine Learning Techniques

COURSE OBJECTIVES:
- To introduce the foundations of deep learning
- To acquire the knowledge on Deep Learning Concepts

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify and select appropriate learning network models required for real world problems
CO-2: Design an efficient model with various deep learning techniques
CO-3: Implement deep learning algorithms and solve real-world problems
CO-4: Apply optimization strategies necessary for problem solving required for large scale applications

UNIT – I:
Introduction to Deep Learning: History of Deep Learning, Deep Learning Success Stories, Biological Neuron, Idea of computational units, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm and Convergence.

UNIT – II:
Feedforward Networks: Multilayer Perceptron, Gradient Descent, Back-propagation, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks.

UNIT – III:
Regularization for Deep Learning: Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, Multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier.

UNIT – IV:
Optimization for Training Deep Models: Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithm.

UNIT – V:
Convolutional Neural Networks: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Markov Networks, Object Detection, RCNN, Fast RCNN, Faster RCNN, YOLO

UNIT – VI:

Auto-Encoders: Regularization in auto-encoders, De-noising auto-encoders, Sparse auto-encoders, Contractive auto-encoders, Structured probabilistic models of deep learning.

TEXT BOOKS:

1. Deep Learning: An MIT Press Book, Ian Goodfellow and YoshuaBengio and Aaron Courville
2. Neural Networks and Learning Machines, Simon Haykin, 3rd Edition, Pearson Prentice Hall

REFERENCES:

1. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
2. Pattern Recognition and Machine Learning, Christopher Bishop, 2007

BLOCKCHAIN TECHNOLOGIES

BLOCKCHAIN TECHNOLOGIES

The blockchain is one of the fastest growing skills in the IT sector today. This track will help the students to gain knowledge in blockchain technology, it has taken quite a turn in the industry given its popularity in providing safe and secured online transactions. Most individuals and organizations have started adopting blockchain because of the many benefits it offers to the industry today. It is used in many industry applications such as banking sector, voting, health care, real estate, the legal industry and government.

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

(18OE1CS04) FUNDAMENTALS OF COMPUTER NETWORKS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce the fundamental various types of computer networks
- To demonstrate the TCP/IP and OSI models with merits and demerits
- To explore the various layers of OSI model
- To introduce UDP and TCP models
- To have the concept of different routing techniques for data communications

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

CO-1: Understand and explore the basics of Computer Networks reference models and the functionalities of physical layer.

CO-2: Learn major concepts, principles involved in Data Link Layer and Network Layer

CO-3: Analyze how to maintain QoS in Network and maintaining of Congestion Control

CO-4: Demonstrate the Application Layer functionalities and importance of Security in the Network

UNIT – I:
Introduction to Networks: Internet, Protocols and Standards, The OSI Model, Layers in OSI Model, TCP/IP Suite, Addressing.
Physical Layer: Multiplexing, Transmission Media, Circuit Switched Networks, Datagram Networks, and Virtual Circuit Networks.

UNIT – II:
Data Link Layer: Introduction, Checksum, Framing, Flow and Error Control, Noiseless Channels, Noisy Channels, Random Access Controlled Access, Channelization, IEEE Standards, Ethernet, Giga-Bit Ethernet, Wireless LANs, SONET-SDH, Frame Relay and ATM.

UNIT – III:
Network Layer: Logical Addressing, Internetworking, Tunneling, Address Mapping, ICMP, IGMP, Forwarding, Routing-Flooding, Bellman& Ford, Disjkstra's routing protocols, RIP, OSPF, BGP and Multicast Routing Protocols. Connecting Devices-Passive Hubs, Repeaters, Active Hubs, Bridges, Routers.

UNIT – IV:
Transport Layer: Process to Process Delivery, UDP, TCP and SCTP Protocols, Congestion, Congestion Control, Quality of Service.

UNIT – V:
Application Layer: Domain Name Space, DNS in Internet, Electronic Mail, File Transfer Protocol, WWW, HTTP, SNMP, Multi-Media.

UNIT – VI:

Network Security: Security services, mechanisms and attacks, IPSec, SSL, VPN, Firewall. Bluetooth, Zigbee, IPv4, IPv6.

TEXT BOOKS:

1. Data Communications and Networking, Behrouz A. Forouzan, 4th Edition, McGraw-Hill Education, 2006
2. Computer Networks, Andrew S. Tanenbaum, 4th Edition, Pearson Education
3. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education

REFERENCES:

1. Data Communications and Networks, William Stallings
2. Data Communication and Networks, Bhusan Trivedi, Oxford University Press, 2016
3. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education
4. Understanding Communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1CS08) RELATIONAL DATABASE MANAGEMENT SYSTEMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the basic elements of a relational database management system
CO-2: Identify the data models for relevant problems
CO-3: Design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data
CO-4: Apply normalization for the development of application software

UNIT – I:
Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.
Introduction to Database Design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.
Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT – II:
Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.
SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

UNIT – III:
Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of

Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

UNIT – IV:

Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

UNIT – V:

Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.

Recovery System-Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

UNIT – VI:

Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.

Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.

Hash- Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw-Hill Education (India) Private Limited
2. Database System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, 6th Edition, McGraw-Hill Education (India) Private Limited,
3. Database Systems, R. Elmasri, Shamkant B. Navathe, 6th Edition, Pearson Education

REFERENCES:

1. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning
2. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Introduction to Database Systems, C. J. Date, Pearson Education

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

(18OE1CS05) DISTRIBUTED DATA BASES

COURSE PRE-REQUISITES: Fundamentals of Computer Networks

COURSE OBJECTIVES:
- To introduce distributed databases and exploring several algorithms for processing queries and be able to use them
- To describe the methods to translate complex conceptual data models into logical and Physical database designs
- To demonstrate query optimization and its algorithms
- To enumerate the concepts behind distributed transaction processing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze issues related to distributed database design
CO-2: Apply Partitioning techniques to databases
CO-3: Design and develop query processing strategies
CO-4: Describe transaction processing and concurrency control in distributed databases

UNIT – I:
Introduction: Features of Distributed versus Centralized Databases,
Levels of Distribution Transparency: Reference Architecture for Distributed Databases, Types of Data Fragmentation, Distribution transparency for Read – only Applications, Distribution transparency for update Applications, Distributed database Access primitives, Integrity Constraints in Distributed Databases.

UNIT – II:
Distributed Database Design: A framework, the design of database fragmentation, the allocation of fragments.
Translation of Global Queries to Fragment Queries: Equivalence Transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries.

UNIT – III:
Optimization of Access Strategies: A Framework for Query Optimization, Join Queries, General Queries.

UNIT – IV:
The Management of Distributed Transactions: A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural aspects of Distributed Transactions.

UNIT – V:
Concurrency Control: Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.

UNIT – VI:

Reliability: Basic Concepts, Nonblocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart.

TEXT BOOKS:

1. Principles of Distributed Database Systems, M. Tamer OZSU and PatuckValduriez, Pearson Education Asia, 2001
2. Distributed Databases, Stefano Ceri and WillipsePelagatti, McGraw-Hill

REFERENCES:

1. Database System Concepts, Henry F. Korth, A. Silberchatz and Sudershan, MGH
2. Database Management Systems, Raghuramakrishnan and JohhanesGehrke, MGH

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

(18OE1CS06) CRYPTOGRAPHY AND NETWORK SECURITY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases

COURSE OBJECTIVES:
- To outline security concepts, threats, attacks, services and mechanisms
- To describe various cryptosystems- symmetric key cryptography, public key cryptography
- To apply authentication services and Secure hash functions
- To discuss the concepts of IP Security, web security, viruses and firewalls

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the basics of security attacks, services, goals and mechanism of security
CO-2: Apply variety of cryptographic algorithms, Hash Functions and protocols underlying network security applications and authentication applications
CO-3: Examine and analyze various email security and web security mechanisms **CO-4:** Understand the system level security issues

UNIT – I:
Security Attacks: Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

UNIT – II:
Conventional Encryption: Classical Encryption techniques, Fiestel Cipher Structure, Data Encryption Standard, Block Cipher Design Principles and Modes of Operation, Triple DES, RC-4, Evaluation criteria for AES, AES Cipher, Placement of Encryption Function, Traffic Confidentiality.

UNIT – III:
Public Key Cryptography and Authentication: Confidentiality using Symmetric Encryption – Principles of Public key Cryptosystems, RSA algorithm, Key Management, Diffie-Hellman key Exchange, Elliptic Curve Cryptography.
Authentication requirements, Authentication functions, Message Authentication Codes

UNIT – IV:
Hash Functions: Hash Functions, Security of Hash Functions and MACs, MD5 message Digest algorithm, Secure Hash Algorithm, HMAC, Digital Signatures, Authentication Protocols, Digital Signature Standard, Authentication Applications: Kerberos, X.509 Authentication Service

UNIT – V:

Network Security: Email Security and Web Security

Electronic Mail Security – PGP/ SMIME, IP security- Architecture, Authentication Header, Encapsulating Security Payload, Key Management, Web Security- Secure Socket Layer, Transport Layer Security and Secure Electronic Transaction

UNIT – VI:

System Level Security: Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

TEXT BOOKS:

1. Cryptography and Network Security – Principles and Practices, William Stallings, 4th Edition, Prentice Hall of India, 2005
2. Hack Proofing Your Network, Ryan Russell, Dan Kaminsky, Rain Forest, Puppy, Joe Grand, David Ahmad, Hal Flynn IdoDubrawsky, Steve W. Manzuik and Ryan Permeh, Wiley Dreamtech

REFERENCES:

1. Network Security Essentials: Applications and Standards, William Stallings Prentice Hall,1999, ISBN 0130160938
2. Security in Computing, Charles B. Pfleeger, Shari Lawrence Pfleeger, 3rd Edition, Pearson Education, 2003

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1CS07) BLOCKCHAIN TECHNOLOGY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases, Cryptography and Network Security

COURSE OBJECTIVES:
- To get the terminologies and overview of blockchain technologies
- To study the concepts and foundation of blockchain technology
- To understand security mechanism and consensus in blockchain
- To design use cases and architecture blockchain technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the basic concepts and characteristics of Blockchain technology
CO-2: Demonstrate key mechanisms like Decentralization, Transparency and trust, Immutability, High availability, highly secure and different types of Blockchain
CO-3: Apply the concept of Hash Function and Related Hash Algorithm to provide the security and analyze the various types of blockchains
CO-4: Understand the Crypto Currency and implement, the applications using Blockchain Technology

UNIT – I:
Introduction to Blockchain Part I: Introduction to Centralized, Decentralized and Distributed system, History of Blockchain, Various technical definitions of Blockchain.
Introduction to Blockchain Technology Part II: Generic elements of a blockchain: Block, Transaction, Peer-to-peer network, Node, Smart contract, Why It's Called "Blockchain", Characteristics of Blockchain Technology, Advantages of blockchain technology.

UNIT – II:
Concept of Blockchain Technology Part I: Cryptography, Hashing, Nonce, Distributed database, Consensus, Smart Contract, Component of block, Structure of Block chain, Technical Characteristics of the Blockchain.
Concept of Blockchain Technology Part II: Applications of blockchain technology, Tiers of blockchain technology Bolckchain 0, Bolckchain 1, Blockchain 2, Blockchain 3, Generation of Blockchain X.

UNIT – III:
Technical Foundations Part I: Cryptography, Confidentiality, Integrity, Authentication, Cryptographic primitives, Public and private keys, RSA, Discrete logarithm problem, Hash Function: Message Digest (MD), Secure Hash Algorithms (SHAs), Design of Secure Hash Algorithms (SHA), SHA-256, Design of SHA3, Elliptic Curve Digital signature algorithm.
Technical Foundations Part II: Consensus algorithm: Proof of work (PoW), Proof-of-Stake (PoS), Byzantine Fault Tolerance (BFT)

UNIT – IV:

Types of Blockchain: Public blockchains, Private blockchains, Semi-private blockchains, Side chains, Permissioned ledger, Distributed ledger, Shared ledger, Fully private and proprietary blockchains, Tokenized blockchains, Tokenless blockchains, CAP theorem and blockchain

UNIT – V:

Financial markets and trading, Trading, Exchanges, Trade life cycle, Order anticipators, Market manipulation.

Crypto Currency: Bitcoin, Bitcoin definition, Keys and addresses, Public keys in Bitcoin, Private keys in Bitcoin, Bitcoin currency units

UNIT – VI:

Implementation Platforms: Hyperledger as a protocol, Reference architecture, Hyperledger Fabric, Transaction Flow, Hyperledger Fabric Details, Fabric Membership, Fabric Membership

TEXT BOOKS:

1. Mastering Blockchain, Imaran Bashir, Second Edition, Packt
2. Blockchain Basic, Daniel Drescher, A Press

REFERENCES:

1. Blockchain For Dummies®, IBM Limited Edition, John Wiley & Sons Inc.

ROBOTICS

ROBOTICS

Robotics is a field of study that involves the design, construction and operation of robots. This field overlaps with electronics, computer science, mechatronics and artificial intelligence. Robotic companies are booming all over the world and are seeking engineers with skills for implementing **Next -LevelAutomation**. This Open Elective Track for Robotics consists of four courses and is intended for making students industry ready in the field of robotics.

The First course in this track" Fundamentals **of Robotics"** introduces various physical aspects of building a robot, exploring topics like how a robot perceives its environment using Sensors and how it interacts with its environment through various Actuators & Grippers. This course also inspects a variety of robot applications in different domains. Second Course in this track" Kinematics**& Dynamics of robots"** delves a level deeper discussing analysis and control of robots. It establishes strong mathematical foundation for describing and controlling robot movement. In this course students will learn in detail about Forward Kinematics, Inverse Kinematics, Workspace Analysis and Trajectory planning for robots.

Third Course in the Robotics track **"Drives and Control System for Robots"** explores in detail various Drive Mechanisms used in robotics such as Hydraulic, Pneumatic & Electric drives. After completing this course students will be able to analyze operational aspects of a drive system for a given robotic application. Fourth Course in the track **"Robot Programming and Intelligent Control System"** expands on Robot Programming, discussing various aspects of Robot Programming Languages and their functions. This course also dives deep into advanced topics like Artificial Intelligence, Neural Networks and Fuzzy control for robots.

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

(18OE1EI01) FUNDAMENTALS OF ROBOTICS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the basic components of a Robot
- To learn different types of Robot sensors and actuators used in Robotics
- To identify different types of Robot grippers and their applications
- To acquire basic Knowledge on Robot kinematics
- To expose to various application fields of Robotics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain knowledge about basic concepts of robots
CO-2: Appreciate the usage of different sensors and actuators in Robotics
CO-3: Select appropriate Gripping mechanism for a particular application
CO-4: Analyze the direct and the inverse kinematic problems
CO-5: Appreciate robot design deference's for various applications

UNIT – I:
Basic Concepts: An overview of Robotics, classification of Robots, Robot Components, Robot degrees of freedom, Robot Joints, Robot Coordinates, Robot reference frames, Programming modes, Robot Characteristics.

UNIT – II:
Sensors: Sensor characteristics, Position sensors, Velocity sensors, Acceleration sensors, Force and Pressure sensors, Torque sensors, Microswitches, Light and infrared sensors, Touch and tactile sensors, Proximity sensors, Range finders.

UNIT – III:
Actuators: Characteristics of actuating system, Comparison of actuating systems, Hydraulic actuators, Pneumatic devices, Electric motors, Magneto-strictive actuators, Shape-Memory Metals, Electro-active Polymer Actuators.

UNIT – IV:
Grippers: Classification of Grippers, Drive system for Grippers, Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Adhesive Grippers, Hooks and Scoops, Gripper Force analysis and design, Active and Passive Grippers.

UNIT – V:
Kinematics: Robots as Mechanisms, Matrix Representation, Homogeneous Transformation Matrices, Representation of Transformations, Inverse of Transformation Matrices, Forward and Inverse Kinematics with Equations.

UNIT – VI:

Applications: Industrial applications, material handling, processing, assembly application, inspection application, application planning, justification of robots, non-industrial applications, Robot safety.

TEXT BOOKS:

1. Introduction to Robotics: Analysis, Control, Applications, Saeed B. Niku, Wiley, 2nd Edition
2. Robotics Technology and Flexible Automation, Deb S. R., John Wiley
3. Robotics and Control, R. K. Mittal, I. J. Nagrath, McGraw-Hill Education

REFERENCES:

1. Industrial Robotics, Technology programming and Applications, Mikell P. Groover, Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, McGraw-Hill, 2012
2. Robotics-Control, Sensing, Vision and Intelligence, K. S. Fu, R. C. Gonzalez, C. S. G Lee, McGraw-Hill International Edition
3. Robotic Engineering–An Integrated Approach, Klafter R. D., Chimielewski T. A., Negin M., Prentice Hall of India, New Delhi, 2009

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

(18OE1EI02) KINEMATICS AND DYNAMICS OF ROBOTS

COURSE PRE-REQUISITES: Fundamentals of Robotics

COURSE OBJECTIVES:
- To understand the basics of robot coordinate frames and their representation
- To obtain knowledge about direct kinematics and inverse kinematics for a robot manipulator
- To examine techniques for planning robot motion in a workspace
- To understand various methods for developing dynamic models for manipulator
- To learn control techniques applied to robot manipulators

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Mathematically represent a Robot system
CO-2: Calculate robot hand position and orientation for specific joint angles
CO-3: Calculate joint angles to achieve a particular hand position
CO-4: Plan trajectories for robot tool to do meaningful tasks
CO-5: Analyze different controlling techniques used for robot manipulators

UNIT – I:
Introduction: Introduction, position and orientation of objects, objects coordinate frame Rotation matrix, Euler angles Roll, pitch and yaw angles coordinate Transformations, Joint variables and position of end effector, Dot and cross products.

UNIT – II:
Direct Kinematics: Coordinate frames, Rotations, Homogeneous coordinates, Link coordinates D-H Representation, The ARM equation. Direct kinematic analysis for Four axis SCARA Robot and three, five and six axis Articulated Robots.

UNIT – III:
Inverse Kinematics: The inverse kinematics problem, General properties of solutions. Tool configuration, Inverse kinematics of four axis SCARA robot and three and five axis Articulated robot.

UNIT – IV:
Workspace Analysis and Trajectory Planning: Workspace Analysis, work envelope of a Four axis SCARA robot and five axis articulated robot workspace fixtures, the pick and place operations, Joint space technique - continuous path motion, Interpolated motion, straight line motion and Cartesian space technique in trajectory planning.

UNIT – V:
Manipulator Dynamics: Introduction, Lagrange's equation kinetic and potential energy. Link inertia Tensor, link Jacobian Manipulator inertia tensor. Gravity, Generalized forces, Lagrange-Euler Dynamic model, Dynamic model of a Two-axis planar robot, Newton Euler formulation, Lagrange - Euler formulation, problems.

UNIT – VI:

Robot Control: The Control Problem, State Equations: one axis robot; three axis SCARA robot, Constant solutions, Linear Feedback Systems, Single Axis PID Control, PD-Gravity Control.

TEXT BOOKS:

1. Fundamentals of Robotics: Analysis & Control, Robert J. Schilling, Prentice Hall of India
2. Robotics and Control, R. K. Mittal, I. J. Nagrath, McGraw-Hill Education

REFERENCES:

1. Robotic Engineering–An Integrated Approach, Klafter R. D., Chimielewski T. A., Negin M, Prentice Hall of India, New Delhi, 2009
2. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover & Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, Tata McGraw-Hill Education, 2012
3. Robotics-Control, Sensing, Vision and Intelligence, K.S. Fu, R.C. Gonzalez, C.S.G Lee, McGraw-Hill International Edition

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

(18OE1EI03) DRIVES AND CONTROL SYSTEM FOR ROBOTICS

COURSE PRE-REQUISITES: Fundamentals of Robotics, Kinematics and Dynamics of Robotics

COURSE OBJECTIVES:
- To get acquainted with different robot drive mechanisms
- To understand in detail, working of hydraulic and pneumatic drives used in robotics
- To learn working principles of various electric drive systems for robotics
- To acquire basic Knowledge on servo systems for robot control

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Categorize various drive systems for robot movement
CO-2: Select appropriate drive system for a particular application
CO-3: Inspect different electric drives and their applications in robotics
CO-4: Analyze accurate positioning of robot end effector by servo control

UNIT – I:
Introduction: Objectives, motivation, open loop control, closed loop control with velocity and position feedback, Types of drive systems. Functions of drive system.

UNIT – II:
Robot Drive Mechanism: Lead Screws, Ball Screws, Chain & linkage drives, Belt drives, Gear drives, Precision gear boxes, Harmonic drives, Cyclo speed reducers.

UNIT – III:
Hydraulic Drives: Introduction, Requirements, Hydraulic piston and transfer valve, hydraulic circuit incorporating control amplifier, hydraulic fluid considerations, hydraulic actuators Rotary and linear actuators. Hydraulic components in robots.

UNIT – IV:
Pneumatic Drives: Introduction, Advantages, pistons-Linear Pistons, Rotary pistons, Motors-Flapper motor, Geared motor, Components used in pneumatic control. Pneumatic proportional controller, pneumatically controlled prismatic joint.

UNIT – V:
Electric Drives: Introduction, Types, DC electric motor, AC electric motor, stepper motors, half step mode operation, micro step mode. Types of stepper motors, Direct drive actuator.

UNIT – VI:
Servo Mechanism for Robot: Mathematical modeling of robot servos, error responses and steady state errors in robot servos, feedback and feed forward compensations, hydraulic position servo, computer-controlled servo system for robot applications, selection of robot drive systems.

TEXT BOOKS:

1. Engineering Foundation of Robotics, Francis N-Nagy Andras Siegler, Prentice Hall Inc.
2. Robotics Engineering - An Integrated Approach, Richard D. Klafter, Thomas. A, ChriElewski, Michael Negin, PHI Learning, 2009

REFERENCES:

1. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover & Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, Tata McGraw-Hill Education, 2012
2. Industrial Robotics, Bernard Hodges, 2nd Edition, Jaico Publishing House, 1993
3. Fundamentals of Robotics Analysis and Control, Robert J. Schilling, PHI Learning, 2009
4. Foundations of Robotics Analysis and Control, Tsuneo Yohikwa, MIT Press, 2003
5. Introduction to Robotics Mechanics and Control, John J. Craig, 3rd Edition, Pearson, 2008

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

(18OE1EI04) ROBOT PROGRAMMING AND INTELLIGENT CONTROL SYSTEM

COURSE PRE-REQUISITES: Fundamentals of Robotics, Kinematics and Dynamics of Robotics, Drives and Control Systems for Robotics

COURSE OBJECTIVES:
- Understand the fundamentals of robot programming
- Learn robot textual languages that are in common use
- Expose to artificial intelligence in robotics
- Acquire basic Knowledge on neural networks in robotics
- Acquire basic Knowledge on fuzzy logic in robotics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain knowledge about different methods of robot programming
CO-2: Examine various robot language elements and their functions
CO-3: Analyze different AI techniques employed in robotics
CO-4: Design basic neuro-controller for robot motion control
CO-5: Apply fuzzy logic to robot control systems

UNIT – I:
Robot Programming: Methods of robot programming, leadthrough programming methods, robot program as a path in space - defining position in space, speed control, motion interpolation, WAIT, SIGNAL, DELAY commands, Branching.

UNIT – II:
Robot Languages: Textual robot language, generations of robot languages, robot language structure, operating systems, Robot language Elements and functions, constraints and variables, aggregates and location variables.

UNIT – III:
Basic Commands and Operations: Motion commands- move and related statements, speed control, points in workspace, paths and frames. End effector and sensor commands- end effector operation, sensor operation, REACT statement. Computations and operation. Program control and subroutines. Communications and data processing. Monitor mode commands.

UNIT – IV:
AI for Robotics: Introduction to Artificial Intelligence, goals of AI research, AI techniques- knowledge representation, problem representation, search techniques. LISP programming. AI and Robotics. LISP in the factory. Robotic Paradigms.

UNIT – V:
Neural Network Approach in Robotics: Introduction, Connectionist Models, Learning Principles and Learning Rules: Supervised, unsupervised, reinforcement learning. Sensor based robot learning, Neural Network in Robotics: Control of robot hands by

neural network, neural set approach to robot motion coordination, robotic motor control using reinforcement learning optimization.

UNIT – VI:

Fuzzy Logic Approach in Robotics: Introduction, Fuzzy sets, Operation of Fuzzy sets, Fuzzy relations, Fuzzy rule formation, Control rules, Fuzzy algorithm in robotics, Robot obstacle avoidance using fuzzy logic, Fuzzy logic for robot path tracking and behavior coordination, fuzzy control system in mobile robots, fuzzy controller design for robot systems, Case study of fuzzy logic in robotics.

TEXT BOOKS:

1. Industrial Robotics Technology, Programming and Applications, Mikell. P. Groover, McGraw-Hill, 2012
2. Robotics Technology and Flexible Automation, Deb S. R., Tata McGraw-Hill Publishing Company Limited

REFERENCES:

1. Design and Control of Intelligent Robotic Systems, (Studies in Computational Intelligence 177) M. Begum, F. Karray (auth.), Dikai Liu, Lingfeng Wang, Kay Chen Tan (eds.), Springer
2. Neural Networks in Robotics, Edited by George Bekey, Kenneth Y. Goldberg, Springer US, 2012
3. Neural Networks, Fuzzy Logic, Genetic Algorithm - Synthesis and Applications, Rajasekharan and Rai, PHI Publications
4. Introduction to Neural Networks using MATLAB 6.0, S. N. Sivanandam, S. Sumathi, S. N. Deepa, TMH, 2006

CYBER SECURITY

CYBER SECURITY

Cybersecurity is **important** because it incorporates everything that relates to protecting our sensitive data, personally identifiable information (PII), protected health information (PHI), personal information, intellectual property, data, and governmental and **industry** information systems from stealing and destruction endeavoured. The cyber security track helps students to learn about how to
Defend networks and data from unapproved access.
Enhanced information security and business endurance supervision.
Upgraded stakeholder confidence in your information security preparations.
Developed company authorizations with the correct security controls in place.

Some of the more common career paths in the cyber security path are

- Chief Information Security Officer. ...
- Forensic Computer Analyst. ...
- Information Security Analyst. ...
- Penetration Tester. ...
- Security Architect. ...
- IT Security Engineer. ...
- Security Systems Administrator. ...
- IT Security Consultant.

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

(18OE1CS04) FUNDAMENTALS OF COMPUTER NETWORKS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce the fundamental various types of computer networks
- To demonstrate the TCP/IP and OSI models with merits and demerits
- To explore the various layers of OSI model
- To introduce UDP and TCP models
- To have the concept of different routing techniques for data communications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and explore the basics of Computer Networks and Various Protocols and in a position to understand the World Wide Web concepts
CO-2: Administrate a network and flow of information
CO-3: Understand easily the concepts of network security, Mobile and ad-hoc networks

UNIT – I:
Introduction to Networks: Internet, Protocols and Standards, The OSI Model, Layers in OSI Model, TCP/IP Suite, Addressing.
Physical Layer: Multiplexing, Transmission Media, Circuit Switched Networks, Datagram Networks, and Virtual Circuit Networks.

UNIT – II:
Data Link Layer: Introduction, Checksum, Framing, Flow and Error Control, Noiseless Channels, Noisy Channels, Random Access Controlled Access, Channelization, IEEE Standards, Ethernet, Giga-Bit Ethernet, Wireless LANs, SONET-SDH, Frame Relay and ATM.

UNIT – III:
Network Layer: Logical Addressing, Internetworking, Tunneling, Address Mapping, ICMP, IGMP, Forwarding, Routing-Flooding, Bellman& Ford, Disjkstra's routing protocols, RIP, OSPF, BGP,- and Multicast Routing Protocols. Connecting Devices-Passive Hubs, Repeaters, Active Hubs, Bridges, Routers.

UNIT – IV:
Transport Layer: Process to Process Delivery, UDP, TCP and SCTP Protocols, Congestion, Congestion Control, Quality of Service.

UNIT – V:
Application Layer: Domain Name Space, DNS in Internet, Electronic Mail, File Transfer Protocol, WWW, HTTP, SNMP, Multi-Media.

UNIT – VI:

Network Security: Security services, mechanisms and attacks, IPSec, SSL, VPN, Firewall, Bluetooth, Zigbee, IPv4, IPv6.

TEXT BOOKS:

1. Data Communications and Networking, Behrouz A. Forouzan, 4th Edition, McGraw-Hill Education, 2006
2. Computer Networks, Andrew S. Tanenbaum, 4th Edition, Pearson Education
3. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education

REFERENCES:

1. Data Communications and Networks, William Stallings
2. Data Communication and Networks, Bhusan Trivedi, Oxford University Press, 2016
3. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education
4. Understanding Communications and Networks, 3rd Edition, W.A. Shay, Cengage Learning

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1CS08) RELATIONAL DATABASE MANAGEMENT SYSTEMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the basic elements of a relational database management system
CO-2: Ability to identify the data models for relevant problems
CO-3: Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data
CO-4: Apply normalization for the development of application software

UNIT – I:
Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.
Introduction to Database Design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.
Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT – II:
Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.
SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

UNIT – III:
Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

UNIT – IV:

Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

UNIT – V:

Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.
Recovery System-Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

UNIT – VI:

Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.
Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.
Hash- Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw-Hill Education (India) Private Limited
2. Database System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, 6thEditio,n McGraw-Hill Education (India) Private Limited
3. Database Systems, R. Elmasri, Shamkant B. Navathe, 6th Edition, Pearson Education

REFERENCES:

1. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning
2. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Introduction to Database Systems, C. J. Date, Pearson Education

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

(18OE1CS06) CRYPTOGRAPHY AND NETWORK SECURITY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Distributed Data Bases

COURSE OBJECTIVES:
- To outline security concepts, threats, attacks, services and mechanisms
- To describe various cryptosystems- symmetric key cryptography, public key cryptography
- To apply authentication services and Secure hash functions
- To discuss the concepts of IP Security, web security, viruses and firewalls

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the security attacks, services, goals and mechanism of security
CO-2: Develop a security model using conventional approach to prevent the attacks
CO-3: Apply public key cryptography principles, examine authenticity and integrity of the messages in the communication
CO-4: Build a model for IP security, firewall and test the security issues

UNIT – I:
Security Attacks: Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

UNIT – II:
Conventional Encryption: Classical Encryption techniques, Fiestel Cipher Structure, Data Encryption Standard, Block Cipher Design Principles and Modes of Operation, Triple DES, RC-4, Evaluation criteria for AES, AES Cipher, Placement of Encryption Function, Traffic Confidentiality.

UNIT – III:
Public Key Cryptography and Authentication: Confidentiality using Symmetric Encryption – Principles of Public key Cryptosystems, RSA algorithm, Key Management, Diffie-Hellman key Exchange, Elliptic Curve Cryptography.
Authentication requirements, Authentication functions, Message Authentication Codes

UNIT – IV:
Hash Functions: Hash Functions, Security of Hash Functions and MACs, MD5 message Digest algorithm, Secure Hash Algorithm, HMAC, Digital Signatures, Authentication Protocols, Digital Signature Standard, Authentication Applications: Kerberos, X.509 Authentication Service

UNIT – V:

Network Security: Email Security and Web Security

Electronic Mail Security – PGP/ SMIME, IP security- Architecture, Authentication Header, Encapsulating Security Payload, Key Management, Web Security- Secure Socket Layer, Transport Layer Security and Secure Electronic Transaction

UNIT – VI:

System Level Security: Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

TEXT BOOKS:

1. Cryptography and Network Security – Principles and Practices, William Stallings, 4th Edition, Prentice Hall of India, 2005
2. Hack Proofing your Network, Ryan Russell, Dan Kaminsky, Rain Forest, Puppy, Joe Grand, David Ahmad, Hal Flynn IdoDubrawsky, Steve W. Manzuik and Ryan Permeh, Wiley Dreamtech

REFERENCES:

1. Network Security Essentials: Applications and Standards, William Stallings, Prentice Hall,1999, ISBN 0130160938
2. Security in Computing, Charles B. Pfleeger, Shari Lawrence Pfleeger, 3rd Edition, Pearson Education, 2003

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

(18OE1IT01) ESSENTIALS OF CYBER SECURITY

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Cryptography and Network Security

COURSE OBJECTIVES:
- To identify the key components of cyber security in network
- To describe various security levels and categories, operating system security
- To define authentication issues and network security
- To describe memory management and protection measures

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Categorize cyber-crime and an understand social, political, ethical and psychological dimensions cyber security
CO-2: Demonstrate security levels and models with objects and access control
CO-3: Analyse tools and methods used in cybercrime
CO-4: Understand Organizational Implications and security risks

UNIT – I:
Introduction to Cybercrime: Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT – II:
Cyber Offenses:How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT – III:
Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies an Measures in Mobile Computing Era, Laptops.

UNIT – IV:
Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT – V:
Cyber Security: Organizational Implications

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications.

UNIT – VI:

Social Media Marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

TEXT BOOKS:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley India

REFERENCES:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press
2. Introduction to Cyber Security, Chwan-Hwa (John) Wu, J. David Irwin, CRC Press T&F Group

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

(18OE1IT02) COMPUTER FORENSICS

COURSE PRE-REQUISITES: Fundamentals of Computer Networks, Cryptography and Network Security, Essentials of Cyber Security

COURSE OBJECTIVES:
- To provide an understanding of computer forensics fundamentals
- To analyze various computer forensics technologies and to provide computer forensics systems
- To identify methods for data recovery
- To apply the methods for preservation of digital evidence

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Define and discuss the concepts of computer forensics
CO-2: Explain and apply the concepts of computer investigations
CO-3: Select and apply current computer forensics tools
CO-4: Identify and apply current practices for processing crime and incident scenes

UNIT – I:
Computer Forensics Fundamentals: What is Computer Forensics? Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists.

UNIT – II:
Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement — Computer Forensic Technology — Types of Business Computer Forensic Technology Computer Forensics Evidence and Capture: Data Recovery Defined — Data Back-up and Recovery — The Role of Back-up in Data Recovery — The Data-Recovery Solution.

UNIT – III:
Evidence Collection and Data Seizure: Why Collect Evidence? Collection Options — Obstacles — Types of Evidence — The Rules of Evidence — Volatile Evidence — General Procedure — Collection and Archiving — Methods of Collection — Artifacts — Collection Steps — Controlling Contamination: The Chain of Custody Duplication and Preservation of Digital Evidence: Preserving the Digital Crime Scene — Computer Evidence Processing Steps — Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer Image Verification and Authentication: Special Needs of Evidential Authentication — Practical Consideration —Practical Implementation.

UNIT – IV:
Computer Forensics Analysis and Validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network

tools, examining the honeynet project. Processing Crime and Incident Scenes: Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case.

UNIT – V:

Current Computer Forensic Tools: Evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.

Cell Phone and Mobile Device Forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

UNIT – VI:

Working with Windows and DOS Systems: understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

TEXT BOOKS:

1. Computer Forensics, Computer Crime Investigation, John R. Vacca, Firewall Media, New Delhi
2. Computer Forensics and Investigations, Nelson, Phillips Enfinger, Steuart, CENGAGE Learning
3. Real Digital Forensics, Keith J. Jones, Richard Bejtiich, Curtis W. Rose, Addison Wesley, Pearson Education

REFERENCES:

1. Forensic Compiling, A Practitioners Guide, Tony Sammes and Brian Jenkinson, Springer International Edition
2. Computer Evidence Collection & Presentation, Christopher L.T. Brown, Firewall Media
3. Homeland Security, Techniques & Technologies, Jesus Mena, Firewall Media
4. Software Forensics Collecting Evidence from the Scene of a Digital Crime, Robert M. Slade, TMH 2005
5. Windows Forensics, Chad Steel, Wiley India Edition

DATA SCIENCES / BIG DATA AND ANALYTICS

DATA SCIENCES / BIG DATA AND ANALYTICS

Data science helps in risk evaluation and observing, possible deceitful comportment, payments, customer analysis, and experience, among much other exploitation. The capability to make **data**-driven choices generates a steadier financial situation and **data scientists** make the strength of the **industry.**

As such, **data science** track helps students to apply business concepts in banking, finance, manufacturing, transport, e-commerce, education, etc. that use **data science**. As a consequence, there are numerous **Data Science** Applications associated to it

Job Roles in Data Science Track

- Data Analyst
- Data Engineers
- Database Administrator
- Machine Learning Engineer
- Data Scientist
- Data Architect
- Statistician
- Business Analyst
- Data and Analytics Manager

Big Data analytics track helps the students to learn the process of gathering, establishing and examining large sets of **data** (called **Big Data**) to determine patterns and other beneficial information. Analysts occupied with **Big Data** characteristically want the acquaintance that comes from investigating the **data**.

Big data analytics is the practice of mining useful information by examining different **types** of big data sets. Big data analytics is utilized to determine concealed patterns, market developments and consumer favorites, for the advantage of organizational decision making.

Job responsibilities in a Big Data Analytics Track are

- To gather and accumulate data from disparate sources, clean it, organize it, process it, and analyse it to extract valuable insights and information.
- To identify new sources of data and develop methods to improve data mining, analysis, and reporting.
- To create data definitions for new database files or alterations made to the already existing ones for analysis purposes.
- To present the findings in reports (in table, chart, or graph format) to help the management team in the decision-making process.
- To apply statistical analysis methods for consumer data research and analysis purposes.
- To keep track of the trends and correlational patterns among complex data sets.
- To perform routine analysis tasks to support day-to-day business functioning and decision making.
- To collaborate with Data Scientists to develop innovative analytical tools.
- To work in close collaboration with both the IT team and the business management team to accomplish company goals.

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

(18OE1MT03) STATISTICAL METHODS FOR DATA SCIENCE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To provide insights about the basic roles of various statistical methods in building computer applications
- To develop a greater understanding of the importance of Data Visualization techniques
- To develop problem-solving skills
- To make inferences about the population parameters using sample data
- To provide an understanding on the importance and techniques of predicting a relationship between the two sets of data and determine the goodness of fitted model

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze an extremely large data set and perform exploratory data analysis to extract meaningful insights
CO-2: Develop various visualizations of the data in hand and communicate results of analysis effectively (visually and verbally)
CO-3: Examine a real-world problem and solve the same with the knowledge gained from various distributions study
CO-4: Use and fit a linear regression model to data and use it for prediction
CO-5: Fit a polynomial regression model to data and use it for prediction

UNIT – I:
Introduction to Statistics: Definition of statistics, basic objectives, applications in various branches of science with examples, collection of data: internal and external data, primary and secondary data, population and sample, representative sample.

UNIT – II:
Descriptive Statistics: Classification and tabulation of univariate data, graphical representation, frequency curves, descriptive measures - central tendency and dispersion, bivariate data, summarization, marginal and conditional frequency distribution.

UNIT – III:
Introduction to R: Introduction, Installing R and data types in R, programming using R: operators, conditional statements, looping, scripts, function creation, creating list, list operations, recursive list, creating a data frame, operations on data frames.

UNIT – IV:
Data Visualization using R: Import - export of data, measures of central tendency and measures of dispersion, data visualization – scatter plot, pie chart, histogram, bar chart, box plot, absolute and relative frequencies, frequency distribution.

UNIT – V:

Correlation & Linear Regression:

Correlation: Correlation, types of correlation, coefficient of correlation, rank correlation coefficient.

Linear Regression: Introduction, regression model, interval estimation, estimation of parameters of β_0 and β_1, Estimation of σ^{2}.

UNIT – VI:

Non-Linear Regression: Regression of second-degree polynomial (non-linear least square method for polynomial function), power function, exponential, estimation of coefficients, linear and polynomial regressions in R.

TEXT BOOKS:

1. Introductory Statistics, Thomas H. Wonnacott& Ronald J. Wonnacot, John Wiley & Sons Inc., 1969
2. Applied Statistics and Probability for Engineers, Douglas C. Montgomery, George C. Runger, 3rd Edition, John Wiley & Sons, Inc., 2003
3. R for Beginners, Sandip Rakshit, 1st Edition, McGraw-Hill Education, 2017

REFERENCES:

1. R-The Statistical Programming Language, Dr. Mark Gardner, Wiley India Pvt. Ltd, 2013
2. Introduction to the Theory of Statistics, A. M. Mood, F. A. Graybill and D. C. Boes, 3rd Edition, McGraw-Hill Education, 2017
3. Introduction of Probability Models, S. M. Ross, 11th Edition, Academic Press, N.Y., 2014
4. Statistical Methods, S. P. Gupta, 42nd Revised Edition, Sultan Chand & Sons, 2012

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

(18OE1IT03) COMPUTATIONAL THINKING USING PYTHON

COURSE PRE-REQUISITES: Statistical Methods for Data Science

COURSE OBJECTIVES:
- To understand why Python is a useful scripting language for developers
- To create and execute Python programs and to Learn how to use lists, tuples, and dictionaries in Python programs
- To learn how to build and package Python modules for reusability
- To learn how to design object-oriented programs with Python classes
- To learn how to use exception handling in Python applications for error handling

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms)
CO-2: Adequately use standard programming constructs: repetition, selection, functions, composition, modules, aggregated data (arrays, lists, etc.)
CO-3: Explain what a given program (in Python) does identify and repair coding errors in a program
CO-4: Understand and use object-based software concepts (constructing OO software will be dealt with in the course Software Engineering)
CO-5: Use library software for (e.g.) building a graphical user interface, web application, or mathematical software

UNIT – I:
Introduction: History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator, Conditional Statements-If
If- else Nested if-else Looping for While Nested loops Control Statements Break
Continue Pass String Manipulation Accessing Strings Basic Operations String slices Function.

UNIT – II:
Methods, Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods, Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods
Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties.

UNIT – III:
Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.
Modules: Creation, Importing module, Math module, Random module, Packages.

UNIT – IV:
Composition: Input-Output-Printing on screen, Reading data from keyboard, Opening and closing file Reading and writing files, Functions.

Exception Handling: Exception, Exception Handling, Except clause, Try? Finally clause, User Defined Exceptions

UNIT – V:

OOPs Concept: Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding, Regular expressions- Match function, Search function, Matching VS Searching, Modifiers, Patterns.

Multithreading: Thread, Starting a thread, Threading module, Synchronizing threads.

CGI: Introduction, Architecture, CGI environment variable, GET and POST methods, Cookies, File upload.

UNIT – VI:

Database: Introduction, Connections, Executing queries, Transactions Handling error,

Networking: Socket, Socket Module, Methods, Client and server, Internet modules, Sending email.

TEXT BOOKS:

1. Learning Python, David Ascher and Mark Lutz, O'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**

(18OE1IT04) FUNDAMENTALS OF DATA MINING

COURSE PRE-REQUISITES: Statistical Methods for Data Science, Computational Thinking using Python

COURSE OBJECTIVES:
- To introduce the basic concepts and techniques in building a Data Warehouse
- To apply preprocessing methods for any given raw data
- To develop skills of using recent data mining software for solving practical problems
- To implement and apply basic algorithms for supervised and unsupervised learning

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Assess raw input data and process it to provide suitable input for a range of data mining algorithms.
CO-2: Discover and measure interesting patterns from different kinds of databases
CO-3: Evaluate and select appropriate data-mining algorithms and apply, interpret and report the output appropriately
CO-4: Design and implement data-mining applications using sample, realistic data sets and modern tools

UNIT – I:
Data Warehousing & Modeling: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading.

UNIT – II:
Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.

UNIT – III:
Data Warehouse Implementation & Data Mining: Data Warehouse Architecture, What is data mining, Challenges, From Data Warehousing and Data Mining, Data Mining Tasks, Data Mining Functionalities, Major Issues in Data Mining. Data: Types of Data, Data Quality, Data Pre-processing, Measures of Similarity and Dissimilarity.

UNIT – IV:
Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.

UNIT – V:
Classification: Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.

UNIT – VI:

Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph- Based Clustering, Scalable Clustering Algorithms.

TEXT BOOKS:

1. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, First Impression, Pearson, 2014
2. Data Mining-Concepts and Techniques, Jiawei Han, Micheline Kamber, Jian Pei, 3rd Edition, Morgan Kaufmann, 2012

REFERENCES:

1. Data Warehousing in the Real World, Sam Anahory, Dennis Murray, Tenth Impression, Pearson, 2012
2. Mastering Data Mining, Michael J. Berry, Gordon S. Linoff, 2ndEdtion, Wiley, 2012

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

(18OE1IT05) DATA ANALYSIS AND VISUALIZATION

COURSE PRE-REQUISITES: Statistical Methods for Data Science, Computational Thinking using Python, Fundamentals of Data Mining

COURSE OBJECTIVES:
- To introduce concept and characteristics of probability distribution
- To introduce underlying design principles, properties and assumptions of linear and non-linear regression modelling
- To introduce design principles involved in identifying interesting classification and prediction of data patterns
- To introduce properties of time series data and perform time series analysis

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply probability distribution concepts to identify univariate data patterns
CO-2: Apply regression modelling to build efficient mathematical models for prediction and classification
CO-3: Apply decision and regression trees for supervised learning
CO-4: Visualize time series data by applying time series techniques

UNIT – I:
Data Definitions and Analysis Techniques: Elements, Variables, and Data categorization, Introduction to statistical learning, Descriptive Statistics: Measures of central tendency, Measures of location of dispersions.

UNIT – II:
Basic Analysis Techniques: Basic analysis techniques, Statistical hypothesis generation and testing, Chi-Square test, t-Test Analysis of variance, Correlation analysis, Maximum likelihood test.

UNIT – III:
Data Analysis Techniques: Regression analysis and visualization, Classification techniques and visualization, Clustering and visualization, Association rules analysis and visualization

UNIT – IV:
Time-Series Analysis and Forecasting – Time-series components, Variation in Time Series, Cyclic Variation, Seasonal Variation, Irregular Variation.

UNIT – V:
Smoothing Techniques: A problem involving all four components of time series, Introduction to forecasting, forecasting models, Trend and Seasonal effects, Trend Analysis

UNIT – VI:

Case-studies and Projects: Understanding business scenarios, Feature engineering and visualization, Sensitivity Analysis.

TEXT BOOKS:

1. Data Mining and Analysis, Mohammed J. Zaki, Wagner Meira, Cambridge, 2012
2. Data Mining: Theories, Algorithms, and Examples, Nong Ye, CRC Press Taylor & Francis Group, 2014
3. Statistics for Management, David S. Rubin, Sanjay Rastogi, Masood Husain Siddiqui Richard I. Levin, 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**

(18OE1AE01) PRINCIPLES OF AUTOMOBILE ENGINEERING

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the layout of an automobile and functionalities subsystems
- To provide overview on concepts of engine, cooling, lubrication and fuel systems
- To present constructional features and working of automotive driveline and running systems
- To study the fundamentals and principles of automotive electrical systems

COURSE OUTCOMES After completion of the course, the student should be able to
CO-1: Explain the functionalities of automotive systems and subsystems
CO-2: Give an overview on engine and engine subsystems.
CO-3: Describe working of automotive driveline and running systems
CO-4: Discuss the concepts of automotive starting, ignition and charging systems

UNIT – I:
Introduction: Classification of automobiles, layout of an automobile, automobile sub systems and their role. Types of chassis, role and requirement of a chassis frame, types of frames, materials, loading points and types of bodies.

UNIT – II:
Engine: Classification and components of an engine, principle and working of four stoke and two stroke SI and CI engines, petrol fuel system - carburetor, diesel fuel system - diesel fuel pump, injectors, introduction to electronic fuel injection system – MPFI and CRDI.

UNIT – III:
Cooling and Lubrication: Necessity of cooling, air-cooling, water cooling - thermosyphon and pump cooling, radiator, pump, thermostat, antifreeze solution and radiator fan. Mist, splash and forced lubrication, oil filters and oil pumps.

UNIT – IV:
Drive Line: Clutches, principle, single plate clutch, multi plate clutch and centrifugal clutch. Gear box - Need, sliding mesh, constant mesh and synchromesh gear box. Propeller shaft, universal joint, differential, wheels and tyres.

UNIT – V:
Running Systems: Suspension systems – Objective, rigid axle and independent suspension system and torsion bar. Steering system – Layout, steering mechanism, steering geometry and steering gear boxes. Brake system –Principle, stopping distance, types of brakes and actuation.

UNIT – VI:

Electrical Systems: Starting system - Principle, working of different starter drive units and solenoid switches. Ignition system **-** Conventional ignition system types, ignition advance and retarding mechanisms. Charging system – Alternator principle, construction and working, cut-outs and regulators.

TEXT BOOKS:

1. Advanced Vehicle Technology, Heinz Heisler, Butterworth Heinemann Publishers, 2002
2. Automobile Electrical Equipment, Crouse W. H., 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**

(18OE1AE02) MODERN AUTOMOTIVE TECHNOLOGIES

COURSE PRE-REQUISITES: Principles of Automobile Engineering

COURSE OBJECTIVES:

- To provide an overview on advanced engine control system concepts
- To know the interdisciplinary concepts and intelligent automotive systems
- To understand the interdisciplinary concepts and GPS-enabled applications in automobile
- To present intelligent vehicle technologies like comfort, safety and security systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply advanced engine control system concepts in engineering
CO-2: Discuss the need for implementation intelligent vehicle technologies
CO-3: Address the key technologies in automotive navigation
CO-4: Appreciate the technological advancements driver assistance systems

UNIT – I:
Advanced Engine Controls: Concept of an electronic engine control system, engine control module, powertrain control module, electronic fuel injection - throttle body fuel injection, multi-point fuel injection, gasoline direct injection, common rail direct injection, electronic ignition control, engine mapping, on-board diagnostics.

UNIT – II:
Introduction to Intelligent Vehicles: Driver information, driver perception, driver convenience, driver monitoring, general vehicle control, longitudinal and lateral control, collision avoidance, vehicle monitoring.

UNIT – III:
Telematics: Global positioning system, geographical information systems, navigation system, architecture, automotive vision system, road recognition.

UNIT – IV:
Comfort Systems: Adaptive cruise control system, active suspension system, power steering, collapsible and tiltable steering column, power windows.

UNIT – V:
Safety Systems: Active and passive safety, airbags, seat belt tightening system, forward collision warning systems, child lock, anti-lock braking systems, traction control system, lane departure warning system.

UNIT – VI:
Security Systems: Anti-theft technologies – mechanical, electromechanical and electronic immobilizers, alarm system, stolen vehicle tracking system, remote keyless entry, smart card system, number plate coding.

TEXT BOOKS:

1. Understanding Automotive Electronics, William B. Ribbens, 5th Edition, Butterworth Heinemann Woburn,1998
2. Intelligent Vehicle Technologies: Theory and Applications, LjuboVlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann Publications, Oxford, 2001

REFERENCES:

1. Automotive Handbook, Robert Bosch, 5th Edition, SAE, 2000
2. Navigation and Intelligent Transportation Systems – Progress in Technology, Ronald K. Jurgen, Automotive Electronics Series, SAE, USA, 1998
3. Understanding Automotive Electronics, Bechhold, SAE, 1998

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1AE03) ELECTRIC, HYBRID AND FUEL CELL VEHICLES

COURSE PRE-REQUISITES: Principles of Automobile Engineering, Modern Automotive Technologies

COURSE OBJECTIVES:
- To study the concepts and drivetrain configurations of electric and hybrid vehicles
- To understand about electric propulsion system
- To provide various energy storage devices
- To present principle, working and automotive applications of fuel cell and solar technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the concepts and drivetrain configurations of electric and hybrid vehicles
CO-2: Discuss various electric motors and controls
CO-3: Present various energy storage devices
CO-4: Describe automotive applications of fuel cell and solar technology

UNIT – I:
Electric Vehicles: Layout of an electric vehicle, system components, traction motor characteristics, transmission, electronic control system, advantage and limitations, performance and energy consumption of electric vehicles.

UNIT – II:
Hybrid Vehicles: Concepts of hybrid electric drivetrain based on hybridization and powertrain configuration, architecture of series, parallel and series-parallel hybrid electric drivetrains, modes of operation, merits and demerits, plug-in hybrid architecture, speed and torque coupling of hybrid electric drivetrains.

UNIT – III:
Electric Motors: Review of technology suited to automotive propulsion, requirements, DC motors, Induction motors, permanent magnet brushless DC motors and switched reluctance motors.

UNIT – IV:
Motor Drives: Speed and torque control, DC motor - Chopper based four quadrant operations, induction motor, permanent magnet motor and switched reluctance motor.

UNIT – V:
Energy Storages: Electromechanical batteries - Types, parameters, lead acid batteries, nickel-based batteries, lithium-based batteries, battery management system and ultracapacitors.

UNIT – VI:

Fuel Cell and Solar Vehicles: Fuel cell vehicle – Operating principle, types of fuel cells, fuel cell options for fuel cell vehicle and fuel cell hybrid vehicle. Solar vehicle - Solar photovoltaic cell, solar array, solar car electrical system and drive train.

TEXT BOOKS:

1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, CRC Press, 2004
2. Electric Vehicle Technology-Explained, James Larminie and John Loury, John Wiley & Sons Ltd., 2003

REFERENCES:

1. Electric and Hybrid Vehicles – Design Fundamentals, Iqbal Husain, CRC Press, 2010
2. Electric Vehicle Battery Systems, Sandeep Dhameja, Butterworth–Heinemann, 2002
3. Electric and Hybrid – Electric Vehicles, Ronald K. Jurgen, SAE, 2002
4. Light Weight Electric/Hybrid Vehicle Design, Ron Hodkinson and John Fenton, Butterworth–Heinemann

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1AE04) CONNECTED AND AUTONOMOUS VEHICLES

COURSE PRE-REQUISITES: Principles of Automobile Engineering, Modern Automotive Technologies, Electric, Hybrid and Fuel Cell Vehicles

COURSE OBJECTIVES:
- To understand the fundamentals of vehicle communication and networking
- To provide state-of-the-art in wireless communication technology within and between vehicles
- To know various levels of vehicle autonomy and intelligent automotive systems
- To provide an overview on driver-assist and self-driving processes

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Present the fundamentals of vehicle communication and networking
CO-2: Appreciate intra-vehicle and inter-vehicle communication technologies
CO-3: Describe various levels of vehicle autonomy
CO-4: Discuss the driver-assist and self-driving processes

UNIT – I:
Introduction to Vehicle Communications: Intra-vehicle communications - communications protocols, systems and sensors (Braking, steering, power train, chassis systems, body electronics, instrument clusters, infotainment systems), inter-vehicle communications - cooperative driving (accident warning, frontal/rear collision prevention, lane change, assistance). Consumer assistance – traffic information, multimedia support and smart parking

UNIT – II:
Communication Fundamentals and Controller Area Network: Communication fundamentals – Frequency, bandwidth, power measurement, signal to noise ratio, transmission rate constraints, radio frequency spectrum allocation, RADAR operation and types of RADAR. CAN evolution, versions, types of controllers, layered architecture. CAN bus, message frames and error handling.

UNIT – III:
Intra-Vehicle Communications: Wired communication – Network comparison, two tier approach, LIN applications - Localized vehicle area support, general support areas, CAN applications - In vehicle operation, infotainment, wireless communication – Bluetooth vehicle applications, satellite services – satellite radio, vehicle care and traffic status.

UNIT – IV:
Inter-Vehicle Communication: Adhoc Communications –Applications in Vehicle traffic Monitoring, Collision and congestion avoidance, Highway lane reservation, Emission Control, Vehicle Frequency Utilization – AM Radio, Bluetooth, FM Radio, GPS, Short range RADAR, Wireless LAN, Intelligent Roadway-Infrastructure to vehicle and

vehicle to vehicle communications. Evolving smart vehicle – ECU, wireless networking, forward RADAR, side RADAR, GPS, cellular transmission and event Recorder.

UNIT – V:

Autonomous Vehicles: Importance, levels of automation, policy making, social costs, safety and crashes, congestion, land use, energy and emissions, costs and disadvantages

UNIT – VI:

Current State of Autonomous Vehicles: Research, challenges, commercial development, sensor systems, sensor suits, environmental challenges, graceful degradation, V2V and V2I communication, sharing the drive, integrity, security, verification and policy implications.

TEXT BOOKS:

1. Inter and Intra Vehicle Communications, Gilbert Held Auerbach Publications, 2008
2. Autonomous Vehicle Technology-A Guide for Policymakers, James M. Anderson, Nidhi Kalra, Karlyn D. Stanley, Paul Sorensen, Constantine Samaras, Oluwatobi A. Oluwatola, RAND Corporation, Santa Monica, Calif., 2016
3. Autonomous Driving - Technical, Legal and Social Aspects, Markus Maurer, J. Christian Gerdes, Barbara Lenz, Hermann Winner, Editors, Springer, 2016

REFERENCES:

1. Intelligent Vehicle Technologies: Theory and Applications, LjuboVlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann Publications, Oxford, 2001
2. Navigation and Intelligent Transportation Systems – Progress in Technology, Ronald K. Jurgen, Automotive Electronics Series, SAE, USA, 1998
3. Automotive In–vehicle Networks, J. Gabrielleen, Wiley-Blackwell, 2008
4. In-Vehicle Network Architecture for the Next-Generation Vehicles, Syed Masud Mahmud, IGI
5. Communication Technologies for Vehicles, Mohamed Kassab Springer, 2015

GENERAL - COMPUTING

1. PROGRAMMING THROUGH JAVA

Java is an extensively **used** programming language specifically intended for use in the distributed environment of the internet. **Java** help students to create wide-ranging applications that possibly will run on a single workstation or be distributed among servers and clients in a network.

Java is an extremely fruitful language and an upper option for many developers for many years. The motive that it has remained so prevalent is since it still happens the needs of functioning across networks.

Students will have different roles and responsibilities by learning Java Programming

- Designing, implementing, and maintaining Java applications that are often high-volume and low-latency, required for mission-critical systems.
- Delivering high availability and performance.
- Contributing in all phases of the development lifecycle.
- Writing well-designed, efficient, and testable code.

2. RELATIONAL DATABASE MANAGEMENT SYSTEMS

A relational database permits you to effortlessly find precise information. It also consents you to sort based on any field and produce reports that comprise only definite fields from each record. With features like, Data Accuracy, Easy Access to Data, Data Integrity, Flexibility, Normalization, High Security, Feasible for Future Modifications

By learning RDBMS Students will have different roles in Database environment

- Data Administrator,
- Database Administrator
- Database Designer
- Application Programmer

3. COMPUTATIONAL THINKING USING PYTHON

The **python** language is one of the utmost accessible programming languages available because it has streamlined syntax and not complex, which gives more importance on natural language. Due to its comfort of learning and practice, **python** codes can be readily written and executed much quicker than former programming languages.

Data Science: The libraries and frameworks Python offers, e.g.PyBrain, PyMySQL, and NumPy are one of the big reasons. Another reason is diversity. Python experience allows you to do a lot more than any other language, e.g. you can create scripts to automate stuff, go into web development, and so much more.

Students will have various Job Profiles by learning Python

- Software Engineer.
- Python Developer.
- Research Analyst.
- Data Analyst.
- Data Scientist.
- Software Developer.

4. INTRODUCTION TO DATA ANALYTICS

Data Scientists and Analysts **use data analytics** techniques in their research, and businessesalso **use** it to inform their conclusions. **Data analysis** can assistance corporations healthier comprehend theircustomers, assess their ad-campaigns, personalize gratified, create content approaches and progress products.

By learning Data Analytics students will get Jobs with different designations

- IT Systems Analyst. Systems analysts use and design systems to solve problems in information technology. ...
- Healthcare Data Analyst. ...
- Operations Analyst. ...
- Data Scientist. ...
- Data Engineer. ...
- Quantitative Analyst. ...
- Data Analytics Consultant. ...
- Digital Marketing Manager.

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

(18OE1IT06) PROGRAMMING THROUGH JAVA

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To introduce object-oriented programming concepts using the Java language
- To introduce the principles of inheritance and polymorphism; and demonstrates how they relate to the design of abstract classes
- To introduce the implementation of packages and interfaces
- To introduce exception handling, event handling and multithreading

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Develop applications for range of problems using object-oriented programming techniques
CO-2: Design simple graphical user interface applications
CO-3: Explore the design of graphical user interface using applets and swings

UNIT – I:
Object Oriented Thinking and Java Basics: Need for OOP Paradigm, Summary of OOP Concepts, Coping with Complexity, Abstraction Mechanisms, A Way of Viewing World – Agents, Responsibility, Messages, Methods, History of Java, Java Buzzwords, Data Types, Variables, Scope and Life Time of Variables, Arrays, Operators, Expressions, Control Statements, Type Conversion and Casting, Simple Java Program, Concepts of Classes, Objects, Constructors, Methods, Access Control, This Keyword, Garbage Collection, Overloading Methods and Constructors, Method Binding, Inheritance, Overriding and Exceptions, Parameter Passing, Recursion, Nested and Inner Classes, Exploring String Class.

UNIT – II:
Inheritance, Packages and Interfaces: Hierarchical Abstractions, Base Class Object, Subclass, Subtype, Substitutability, Forms of Inheritance- Specialization, Specification, Construction, Extension, Limitation, Combination, Benefits of Inheritance, Costs of Inheritance. Member Access Rules, Super Uses, Using Final with Inheritance, Polymorphism- Method Overriding, Abstract Classes, The Object Class.
Defining, Creating and Accessing a Package, Understanding Classpath, Importing Packages, Differences between Classes and Interfaces, Defining an Interface, Implementing Interface, Applying Interfaces, Variables in Interface and Extending Interfaces, Exploring Java.IO.

UNIT – III:
Exception Handling and Multi-threading: Concepts of Exception Handling, Benefits of Exception Handling, Termination or Resumptive Models, Exception Hierarchy, Usage of Try, Catch, Throw, Throws and Finally, Built in Exceptions, Creating Own Exception Sub Classes.
String Handling, Exploring Java. Util, Differences between Multi-Threading and Multitasking, Thread Life Cycle, Creating Threads, Thread Priorities, Synchronizing

Threads, Interthread Communication, Thread Groups, Daemon Threads. Enumerations, Autoboxing, Annotations, Generics.

UNIT – IV:
Event Handling: Events, Event Sources, Event Classes, Event Listeners, Delegation Event Model, Handling Mouse and Keyboard Events, Adapter Classes.
The AWT Class Hierarchy, User Interface Components- Labels, Button, Canvas, Scrollbars, Text Components, Check Box, Check Box Groups, Choices, Lists Panels – Scrollpane, Dialogs, Menubar, Graphics, Layout Manager – Layout Manager Types – Border, Grid, Flow, Card and Grid Bag.

UNIT – V:
Applets: Concepts f Applets, Differences between Applets and Applications, Life Cycle of an Applet, Types of Applets, Creating Applets, Passing Parameters to Applets.

UNIT – VI:
Swing: Introduction, Limitations of AWT, MVC Architecture, Components, Containers, Exploring Swing- Japplet, Jframe and Jcomponent, Icons and Labels, Text Fields, Buttons – The Jbutton Class, Check Boxes, Radio Buttons, Combo Boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

TEXT BOOKS:
1. Java The Complete Reference, Herbert Schildt, 7^{th} 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, 8^{th} Edition, Pearson Education
4. Core Java 2, Vol. 2 - Advanced Features, Cay. S. Horstmann and Gary Cornell, 8^{th} Edition, Pearson Education

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

(18OE1CS08) RELATIONAL DATABASE MANAGEMENT SYSTEMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate the basic elements of a relational database management system
CO-2: Ability to identify the data models for relevant problems
CO-3: Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data
CO-4: Apply normalization for the development of application software

UNIT – I:
Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.
Introduction to Database Design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.
Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

UNIT – II:
Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.
SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

UNIT – III:
Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

UNIT – IV:
Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

UNIT – V:
Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.
Recovery System-Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

UNIT – VI:
Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.
Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.
Hash- Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

TEXT BOOKS:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw-Hill Education (India) Private Limited
2. Database System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, 6th Edition, McGraw-Hill Education (India) Private Limited
3. Database Systems, R. Elmasri, Shamkant B. Navathe, 6th Edition, Pearson Education

REFERENCES:

1. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning
2. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Introduction to Database Systems, C. J. Date, Pearson Education

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1IT03) COMPUTATIONAL THINKING USING PYTHON

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- Understand why Python is a useful scripting language for developers
- Create and execute Python programs and to Learn how to use lists, tuples, and dictionaries in Python programs
- To learn how to build and package Python modules for reusability
- To learn how to design object-oriented programs with Python classes
- To learn how to use exception handling in Python applications for error handling

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms)
CO-2: Adequately use standard programming constructs: repetition, selection, functions, composition, modules, aggregated data (arrays, lists, etc.)
CO-3: Explain what a given program (in Python) does identify and repair coding errors in a program
CO-4: Understand and use object-based software concepts (constructing OO software will be dealt with in the course Software Engineering)
CO-5: Use library software for (e.g.) building a graphical user interface, web application, or mathematical software

UNIT – I:
Introduction, History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator, Conditional Statements-If
If- else Nested if-else Looping for While Nested loops Control Statements Break
Continue Pass String Manipulation Accessing Strings Basic Operations String slices Function.

UNIT – II:
Methods, Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods, Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods
Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties.

UNIT – III:
Functions: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.
Modules: Creation, Importing module, Math module, Random module, Packages.

UNIT – IV:
Composition: Input-Output-Printing on screen, Reading data from keyboard, Opening and closing file Reading and writing files, Functions.

Exception Handling: Exception, Exception Handling, Except clause, Try? Finally clause, User Defined Exceptions

UNIT – V:

OOPs concept: Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding, Regular expressions- Match function, Search function, Matching VS Searching, Modifiers, Patterns.

Multithreading: Thread, Starting a thread, Threading module, Synchronizing threads.

CGI: Introduction, Architecture, CGI environment variable, GET and POST methods, Cookies, File upload.

UNIT – VI:

Database: Introduction, Connections, Executing queries, Transactions Handling error, Networking: Socket, Socket Module, Methods, Client and server, Internet modules, Sending email.

TEXT BOOKS:

1. Learning Python, David Ascher and Mark Lutz, 2nd Edition, O'Relly, 2003

REFERENCES:

1. Python Programming: An Introduction to Computer Science, John M. Zelle, 2nd Edition, Kindle Edition
2. Python Essential Reference, David M. Beazley, 4th Edition, Developer's Library

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1IT07) INTRODUCTION TO DATA ANALYTICS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To be exposed to conceptual framework of big data
- To understand different techniques of data analysis
- To be familiar with concepts of data streams
- To be exposed to item sets, clustering, frame works and Visualization

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand big data fundamentals
CO-2: Learn various data analysis techniques
CO-3: Implement various data streams
CO-4: Understand item sets, clustering, frame works & Visualizations

UNIT – I:
Introduction to Big Data: Introduction to Big Data Platform – Challenges of Conventional systems – Web data – Evolution of Analytic scalability, analytic process and tools, Analysis vs Reporting – Modern data analytic tools,
Statistical Concepts: Sampling distributions, resampling, statistical inference, prediction error.

UNIT – II:
Data Analysis: Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and Kernel methods
Analysis of Time Series: Linear systems analysis, nonlinear dynamics – Rule induction –
Neural Networks: Learning and andGeneralisation, 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

(18OE1CS11) FUNDAMENTALS OF COMPUTER ALGORITHMS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To reinforce algorithms analysis methods
- To analyse running time of an algorithm
- To understand different algorithm design strategies
- To familiarize with an assortment of important algorithms

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply algorithm design techniques and concepts to solve given engineering problem
CO-2: Analyze running times of algorithms using asymptotic analysis
CO-3: Develop efficient algorithms for computational tasks
CO-4: Computing complexity measures of algorithms

UNIT – I:
Introduction: Characteristics of algorithm. Analysis of algorithms: Asymptotic analysis of complexity bounds – best, average and worst-case behaviour; Performance measurements of Algorithm, Time and space trade-offs.

UNIT – II:
Divide and Conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication. Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

UNIT – III:
Greedy Method: General method, applications-Job sequencing with deadlines, 0/1 knapsack problem, Minimum cost spanning trees, Single source shortest path problem, Huffman Codes.

UNIT – IV:
Dynamic Programming-I: General method, Principle of optimality, applications-Multistage graphs, Matrix chain multiplication, Optimal binary search trees.

UNIT – V:
Dynamic Programming-II: 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem, Reliability design.

UNIT – VI:
Backtracking: General method, applications- N-Queen problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles.

TEXT BOOKS:

1. Fundamentals of Computer Algorithms, E. Horowitz et al., Galgotia Publications
2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Lieserson, Ronald L. Rivest and Clifford Stein, 4th Edition, MIT Press/McGraw-Hill

REFERENCES:

1. Algorithm Design, Jon Kleinberg and EvaTardos, 1st Edition, Pearson
2. Algorithm Design: Foundations, Analysis and Internet Examples, Michael T. Goodrich and Roberto Tamassia, Second Edition, Wiley
3. Algorithms – A Creative Approach, Udi Manber, 3rd Edition, Addison-Wesley, Reading, MA
4. Introduction to the Design and Analysis of Algorithms, Anany Levitin, 3rd Edition, Pearson Publications

GENERAL

PROFESSIONAL ETHICS AND HUMAN VALUES

Ethics is a necessary and listed Graduate Attribute for all engineers according to the Washington Accord. As engineers deal with the society and provide for the society, it is important that the ethical concerns pertaining to technology are well-understood and addressed. Human Values form the basis for all Ethics and ethical theories help resolve professional dilemmas too. This course aims to create an appreciation for normative and applied ethics with special focus on professionalism and technology education and practice. Given the diverse set of roles an engineer or computer scientist may play in the society, there is an inherent societal need for engineers, technologists, and computer scientists to be ethical. The formative years of students of engineering are the best time to impress upon them the practical importance and application aspects of ethics. The curriculum is designed to include an inherent appreciation for the Indian Ethos and cover a wide variety of topics with suitable case studies and examples all through, so as to enable the learners to find practical contexts in global and contemporary careers of their future. The course also leads to attaining two other Graduate Attributes majorly, along with Ethics, *viz.* Engineer and Society, and Lifelong Learning.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1HS01) PROFESSIONAL ETHICS AND HUMAN VALUES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To emphasize on the importance of ethics for engineers and computer scientists
- To provide a toolkit for ethical behaviour in personal and professional settings
- To relate the profession of engineering to sociocultural as well as ethical and moral contexts in India and globally
- To develop more socially conscious engineers who create and conceive a better society and a better world without sacrificing or ignoring public good

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Distinguish morals, values, and ethics in Indian and global contexts
CO-2: Resolve moral and ethical dilemmas through ethical inquiries and appropriate ethical theories
CO-3: Realize the professional role of engineers in society and the support available in creating safe solutions for the society focusing on public welfare
CO-4: Conduct themselves ethically in various roles that present themselves in professional and business environments

UNIT – I:
Motivation and Introduction to Human Values: Motivation to study ethics in engineering with justifying case studies, historical events, and current affairs; Morals, Values, and Ethics – Definitions; Moral Judgement vs. Value Judgement; Moral Character and Moral Autonomy – Conscientiousness, Integrity, Empathy as basic building blocks; The Golden Rule; Maslow's Theory of Needs; Universal Human Values and Theories; Conventional and Constitutional Values in Indian Ethos; Anomie vs. Civic Virtue as a foundation for an ideal society; Ethics as a basis of legal framework; Privacy and Confidentiality – Increasing emphasis in personal and professional lives, technological considerations and examples; Profession, Professionalism – Definitions, Engineering as a Profession

UNIT – II:
Ethics, Ethical Theories, and Professionalism: Ethics through Spirituality, Religion, and beyond; Indian Philosophy and Ethos, ancient to modern – Family System, Ethical Pluralism, Unity in Diversity; Ethics as application of values and as moral philosophy – Kohlberg's theory vs. Gilligan's theory of moral development leading to ethics, examples; Moral and Ethical Dilemmas – Definition, Causes, Case Studies and Examples; Resolution of Ethical Dilemmas through Ethical Inquiries – Normative, Conceptual, and Factual Inquiries, Classification of Ethics by Character and Conduct – Consequentialism/ Utilitarianism, Deontological Ethics, Virtue Ethics and Theories, Rights Theories; Ethical Frameworks and examples; Practical application of ethical theories for decision-making in personal life

UNIT – III:

Professionalism, Engineering in the Societal Context: Professionalism – Professional Traits, Rights, Responsibilities, Roles, Virtues; Business Ethics; Engineering as Social Experimentation – Context with examples, Comparison with standard experiments, Application of Ethical Inquiries to gain knowledge and to gather relevant information, Responsibility of Experimenters, Accountability and Answerability, Consensus and Need for Informed Consent – how to address exceptions; Responsible Innovation – Social Context of Innovation, Responsible Research and Innovation, Data Privacy and Protection of Individual Rights, being Ethical by Design; Trust in the context of professionalism – confidentiality, non-disclosure agreements (NDA); Intellectual Property (IP) – IP Rights (IPR) as Professional Rights, Law, Moral Rights and Economic Rights, Patenting; Diverse roles of Engineers as Professionals – Manager, Leader, Consultant, and Expert Witness

UNIT – IV:

Professional Ethics, Ethics at Workplace and Roles of Engineers: Overview ofOrganizational Behaviour; Collegiality, Loyalty, Trust in professional context; Respect for Authority vs. Moral Autonomy, Moral Responsibility; Organizational context of Ethics – Minor, interpersonal, severe, organizational workplace deviances; Occupational Crime, Culpable mistakes, Collateral damage; Gifts and bribes; Industrial Ethics for non-professionals; Code of ethics and Code of Conduct – Role of professional societies in guiding, promoting, and protecting professionals and professions, Examples of common professional societies in Engineering and Science; Decision-making in professional context – Choosing the right guidance, choosing the right ethical theory; Conflicts in profession and at workplace - Employee Relations and Discrimination, Conflict of Interest, Conflict Management and Resolution, Framework for Conflict Resolution; Multinational Companies and Corporates – Work Culture and Respect for Diversity and Pluralism; Employee Rights vs. Professional Rights; Whistleblowing – Social, Organizational, and Legal context with examples

UNIT – V:

Public Welfare, Safety & Risk: Impact of engineering activities and technology on Public Welfare; Ethical Concerns of Public welfare in the context of Emerging Technologies – Artificial Intelligence, Machine Learning, Internet of Things, Cybersecurity and Cybercrime; Issues of Public Concern – Informed Consent, Health and environmental aspects, data security; Safety and Risk – Definitions; Risk Assessment – Known and Unintended consequences, Risk-Benefit Analysis, Reducing Risk, Optimum Level of Safety, Capability Curves, Safe Exit; Learning from the Past – Case Studies in Ethics Context: Titanic, Bhopal, Chernobyl; Environmental Ethics and Sustainable Development Goals; Computer Ethics and various Technology Ethics; Ethics in the context of War and Weapon Development; Ethics and Economics – Fair Trade, Capitalism vs. Communism, Developed vs. Developing vs. Underdeveloped economies

UNIT – VI:

Ethics for Lifelong Learning: Ethics in the context of Globalization; Moral Character and Ethical Leadership – Case Studies and Examples of success and failure; Overview and comparison of different schools of thought, comparison of the works of pioneering philosophers and social scientists – Immanuel Kant, John Rawls, Martin Heidegger, Swami Vivekananda, JidduKrishnamurti, Dr. Abdul Kalam, *etc.*; Impact of Ethical and Unethical Behaviour in personal and professional lives, developing and maintaining ethical behaviour, threats to moral autonomy and how to continue to be ethical in personal and professional lives

TEXT BOOKS:

1. Ethics in Engineering, Mike W. Martin, Roland Schinzinger, McGraw-Hill Education, 2017 (ISBN: 978-9339204457)
2. Business Ethics: An Indian Perspective, A. C. Fernando, K. P. Muralidheeran, E. K. Satheesh, Pearson Education, 2019 (ISBN: 978-9353437442)
3. Professional Ethics, R. Subramanian, Oxford University Press, 2017 (ISBN: 978-0199475070)

REFERENCES:

1. Engineering Ethics: Concepts & Cases, Charles E. Harris, Jr., Michael S. Pritchard, Michael J. Rabins, Cengage Learning, 2012 (ISBN: 978-8131517291)
2. Classical Indian Ethical Thought: A Philosophical Study of Hindu, Jaina and Bauddha Morals, Kedar Nath Tiwari, Motilal Banarsidass Publishers, 2017 (ISBN: 978-8120816084)
3. The Manual for Indian Start-Ups, Dalai Lama, Ethics for the Whole World 978-9351360803 Vijay Kumar Ivaturi et al., Penguin Random House India, 2017 (ISBN: 978-0143428527)
4. To Be Human, JidduKrishnamurti, Shambhala, 2000 (ISBN: 978-1570625961)
5. On Ethics and Economics, Amartya Sen, Oxford India, 1999 (ISBN: 978-0195627619)

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

(18OE1HS02) ENTREPRENEURSHIP

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To motivate the engineers to inculcate the skills thereof in any professional role and to consider intrapreneurship or entrepreneurship as career choices for personal and societal growth
- To impart lean management principles and practices to plan, execute, and convert one's own idea into a sustainable business model
- To gain practical knowledge to design one's own lean startup
- To identify and avoid the potential pitfalls in validation, design, production, and marketing phases of an innovative product or service

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Discover societal problems as entrepreneurial opportunities and ideate to develop solutions through systematic and creative approaches to innovation and business strategy
CO-2: Apply lean methodology to startup ideas using Business Model Canvas and Lean Canvas and be able to create Business Plan
CO-3: Validate ideas, design, production, and marketing systematically using techniques such as 5 Whys, Innovation Accounting, Value and Growth Propositions
CO-4: To strategize during ideation, production, market research, marketing and facing competition

UNIT – I:
Entrepreneurial Skills and Opportunities : Role of Entrepreneurs in Indian and World Economy; Entrepreneurship as a career for engineers, scientists, and technologists; Personality and Skill Set of an Entrepreneur; Need for Ethics and Empathy for Entrepreneurs; Stories of Successful and Failed Enterprises; Current Business Trends; Entrepreneurial Management vs. Corporate Management – Roles and Scope; Concepts of Intrapreneurship, Social Entrepreneurship, Technopreneurship, Studentpreneurship; Opportunities in Telangana State and India – incubators, schemes, accelerators

UNIT – II:
Introduction to Lean Startup Methodology: Overview, Principles of Lean Startup, Lean vs. Traditional Startup; Vision-to-Steering, Start-Define-Learn-Experiment, Leap-Test-Measure-Pivot, Build-Measure-Learn

UNIT – III:
Business Model Concepts: Components of Business Plan; Business Model Canvas (BMC); Lean Canvas (LC); Pitch Deck; Elevator Pitch; Financial Aspects – Financing, Funding Stages, Inflows, Outflows; Market Research and Marketing

UNIT – IV:

Building Your Business Model: Desirability, Feasibility, and Viability; Minimum Viable Product (MVP), Proof of Concept (PoC), Prototype; Early Adopters; Value Proposition; Overview of opportunities in India – Financing and Support Schemes, Online and Offline Resources, Entrepreneurial Networks

UNIT – V:

Evaluating Your Business Model: Three Learning Milestones of Innovation; Root Cause Analysis (RCA) through 5 Whys; Pivot or Persevere; The Engines of Growth: Sticky, Viral, and Paid; Kan-ban Diagram for Project Planning and Resource Allocation

UNIT – VI:

Strengthen Your Business Model: Why startups fail? Value and Waste; Design Thinking for Business; Analogs and Antilogs; Paralysis by Analysis and Extinct by Instinct; The three A's: Actionable, Accessible, and Auditable Metrics and Vanity Metrics

TEXT BOOKS:

1. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Eric Ries, Penguin Portfolio, 2015 (ISBN: 978-0670921607)
2. Entrepreneurship, Robert D. Hisrich, Michael P. Peters and Dean A. Shepherd, Tata McGraw-Hill, 11th Ed., 2020 (ISBN: 978-9390113316)
3. Entrepreneurship Simplified: From Idea to IPO, Ashok Soota, S R Gopalan, Penguin Random House India, 2016 (ISBN: 978-0670088959)
4. Startup Easy - Part 1: The Essentials, Shishir Gupta, StartupLanes.Com, 2017 (ISBN: 978-9386503886)

REFERENCES:

1. Measure What Matters: OKRs: The Simple Idea that Drives 10x Growth, John Doerr, Penguin Portfolio, 2018 (ISBN: 978-0241348482)
2. Entrepreneurship Development and Business Ethics, Abhik Kumar Mukherjee, Shaunae Roy, Oxford University Press, 2019 (ISBN: 978-0199494460)
3. The Manual for Indian Start-Ups, Vijay Kumar Ivaturi et al., Penguin Random House India, 2017 (ISBN: 978-0143428527)
4. Social Entrepreneurship in India: Quarter Idealism and a Pound of Pragmatism, Madhukar Shukla, SAGE Publications India Pvt Ltd, 2020 (ISBN: 978-9353882372)
5. Entrepreneurship: A South Asian perspective. Donald F Kuratko, T.V Rao. Cengage Learning, 2012

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

(18OE1HS03) PERSONALITY DEVELOPMENT AND PUBLIC SPEAKING

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES: To enable the students to

- Develop skills and techniques for Effective Communication and Public Speaking
- Develop Leadership qualities and increase Self – confidence
- Get along with people and Team-Building
- Enhance career opportunities by Goal setting
- Develop an acceptable PERSONALITY

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Communicate better and speak with confidence
CO-2: Exhibit Leadership qualities and increased Self – confidence
CO-3: Work towards Team-Building
CO-4: Use career opportunities by Goal setting
CO-5: Acquire a forceful personality to maintain a pleasant relationship between the seniors and subordinates and other stakeholders

UNIT – I:
EFECTIVE COMMUNICATION

i. Fundamentals of Effective Communication
ii. How to sell your ideas
iii. Communication within Industry (awareness of motivation, ego states, games, etc.)
iv. Guidelines on: Listening, Reading and Writing
v. Non-verbal Communication (Body Language)
vi. Barriers of Communication

UNIT – II:
PUBLIC SPEAKING (SPEECH COMMUNICATION)

i. How to develop courage and self-confidence
ii. Speech purposes, preparation patterns and outlining of speech
iii. Fundamentals and secrets of good delivery
iv. How to make your meaning clear and convince an audience / client
v. How to close effectively and get action?
vi. How to participate in conferences, group discussions and office meetings

UNIT – III:
PERSONALITY DEVELOPMENT -1

i. Leadership - qualities of a successful leader; Leadership Styles; Leadership in Administration; Problem-solving & Decision-making
ii. Group Dynamics and Team Building
iii. Importance of groups in organization; Interactions in group, Group Decision Taking, Team Building, Interaction with the Team, Building a good team

UNIT – IV:
PERSONALITY DEVELOPMENT -2

i. Interpersonal Relations- Introduction; Transactional Analysis in communication Awareness of Ego states and their application in communication
ii. Conflict Management- Introduction & Causes of Conflict; Managing Conflict

UNIT – V:
PERSONALITY DEVELOPMENT -3

i. Positive Attitude &Ways to develop positive attitude
Self Esteem & Confidence Building
ii. Motivation- Importance of self-motivation;
iii. Stress -Causes of Stress & Impact of Stress; Managing Stress

UNIT – VI:
PERSONALITY DEVELOPMENT -4

i. Goal Setting-Meaning; Short, medium and Long Term Goals;
Importance of Goal setting & Steps for Goal Setting
ii. Creativity-Meaning; Barriers to Creativity & Steps to stimulate Creativity
Understanding and Importance of Human Values; Ideals in Life; Becoming a Role Model
iii. Time Management - Time as a Resource; Techniques for better Time Management.

TEXT BOOKS:

1. Advance Speaking Skills, Jeremy Harmar& John Arnold, Essex, Longman Group Limited, 1978
2. Developing Soft Skills, Sherfield, R. M., Montgomery, R. J., Moody, P. G. 4th Edition, Pearson, 2010
3. Personality Development and Soft Skills, Barun K. Mitra, Oxford University Press, 2016

REFERENCES:

1. Body Language: A Guide for Professionals, Hedwig Lewis, Response Books (A division of Sage Publications India, Pvt. Ltd.,) New Delhi, 1998
2. Emotional Intelligence, Daniel Goldman, Bantam Books, 1995
3. Personality Development, Rajiv Mishra, Rupa & Co., 2004

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1HS04) FOREIGN LANGUAGE – FRENCH

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To communicate verbally in a simple way by asking and responding to simple questions related to everyday language needs
- To read and comprehend different kinds of texts (notices, informal letters, catalogues, menus etc.)
- To write clear, concise, and correct sentences and paragraphs on familiar topics.
- To recognize and use basic syntax and structures in French including articles, prepositions and connecting words as well as master basic vocabulary

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Use vocabulary contextually and effectively
CO-2: Use reading skills to comprehend different kinds of texts
CO-3: Understand everyday expressions dealing with simple and concrete everyday needs, in clear, slow and well-articulated speech and manage very short mini dialogues /conversations
CO-4: Demonstrate basic competence in Written French including grammar, sentence and paragraph structure, coherence

UNIT – I: Introduce oneself and introduce someone:
Reading: Read and understand an introduction about someone
Grammar: Question words, Subject verb agreement, Mas/fem and prepositions with cities and countries
Vocabulary: professions, nationalities, countries numbers, days of the week and verbs
Writing: Build basic sentences and Write about oneself
Life Skills: Greetings, Formal and Informal way of asking questions

UNIT – II: Express likes and dislikes and Talk about your locality:
Reading: Read and understand description of a place
Grammar: Articles, prepositions, possessive adjectives, basic connecting words such as **"like, and, but",** and Negation
Vocabulary: Adjectives, verbs of preference, different places, and basic vocabulary on leisure and sports activities.
Writing: Write about hobbies and pastimes
Life Skills: Conversation fillers

UNIT – III: Take / Fix an appointment with someone:
Reading: Understand propositions and counters
Grammar: How to say time, Interrogative adjectives
Vocabulary: Irregular verbs, days of the week, Fixed expressions with Etre and Avoir and expressions to ask for appointment or refuse/accept a proposed time
Life Skills: Telephone etiquette and colloquial expressions in French

UNIT – IV: Talk about your routine / Invite someone and Accept or refuse an invitation
Reading: Read and understand an invitation on basic info: date and time, venue, occasion, type of invitation etc.
Grammar: Question word Why, Connecting word "because", partitive and contracted articles, reflexive verbs
Vocabulary: Expressions to propose, thank / apologize and accept or refuse an invitation,
Writing: Respond to an invitation (Accept or refuse)
Life Skills: At the table

UNIT – V: Ask for information (timings, price, etc) and Ask for/ Give Directions
Reading: Understand signboards and instructions
Grammar: Imperative mode and prepositions.
Vocabulary: Directions, Expressions to ask information or seek precision
Writing: Give instructions and fill a form

UNIT – VI: Vacation (plan vacation, choose destination, visit, and appreciate)
Reading: Read and understand travel brochures for basic info on offers, locations, touristic attractions hotels and so on
Grammar: demonstrative adjectives and near future tense
Vocabulary: Weather forecast, modes of transport, and vacation activities
Writing: Write a post card
Life Skills: Types of vacation in France

TEXT BOOKS:

1. Painless French, Carol Chitin, M.S., Lynn Gore, Barrons Educational Series, 2016 (ISBN: 978-1438007700)
2. Language Learning University, French: Learn French for Beginners Including French Grammar, French Short Stories and 1000+ French Phrases, Createspace Independent Publications, 2018 (ISBN: 978-1726415002)
3. Language School, French Language for Beginners, 2019 (ISBN: 978-1700175700)

REFERENCES:

1. Practice Makes Perfect: Complete French All-in-One, Annie Heminway, McGraw-Hill Education, 2018 (ISBN: 978-1260121032)
2. Easy French Step-by-Step, Myrna Bell Rochester, McGraw-Hill Education, 2008 (ISBN: 978-0071453875)
3. Contacts: Langue et culture françaises, Jean-Paul Valette, Rebecca Valette, Wadsworth Publishing Co. Inc., 2012 (ISBN: 978-1133309581)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1CE09) SMART CITIES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

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

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

UNIT – I:
Introduction to Smart Cities: Introduction to Smart Cities - Understanding Smart Cities - Dimensions of Smart Cities – World urbanization, Global Experience of Smart Cities, Smart City case studies-Indian scenario - India "100 Smart Cities" Policy and Mission.

UNIT – II:
City as a System of Systems: Systems thinking – Developing a smart city approach – Core elements of a smart city – Relevant open data for a smart city – Sustainability – Privacy and Ethics – Energy systems for smarter cities.

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

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

UNIT – V:

Smart Transportation Systems: Smart Transportation Technologies - Driverless and connected vehicles - ride sharing solutions - The "improve" pathway - The "shift" pathway – Smart Roads and Pavement systems – Relevant case studies

UNIT – VI:

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

TEXT BOOKS:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1EE05) TRENDS IN ENERGY SOURCES FOR SUSTAINABLE DEVLOPMENT

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the role of sustainable energy
- To know components of solar PV and wind energy conversion systems
- To understand the principles of Biomass, geo-thermal and wave energy systems
- To learn various energy storage methods

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand various sources for sustainable energy
CO-2: Understand Solar Photo voltaic and wind energy systems
CO-3: Learnt the harnessing techniques of Biomass, geothermal and ocean energy
CO-4: Familiarize with energy storage methods

UNIT – I:
Introduction: Trends in energy consumption - Conventional and renewable sources, Energy sources and their availability, Energy Conservation status in India -need of new energies for sustainable development.

UNIT – II:
Fundamentals of Solar Radiation: Introduction-The Sun as Source of Energy, Extraterrestrial and Terrestrial Radiations, Spectral Power Distribution of Solar Radiation, instruments for measuring solar radiation and sunshine recorder.
Solar PV Conversion: The PV Cell-Crystalline Solar cells -Thin film and amorphous solar cells, Module, Array, Equivalent Electrical circuit- Open circuit voltage and Short circuit current, I-V, P-V Curves. Developments in efficient non silicon solar cells

UNIT – III:
Wind Energy: origin of winds-Global (or Planetary) Winds- Local Winds-Factors Affecting the Distribution of Wind Energy on the Surface of Earth, Wind Turbine – Types, construction of HAWT, VAWT, performance characteristics, Betz criteria.

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

UNIT – V:
Geothermal Energy: Resources, types of wells, methods of harnessing the energy
Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles.
Tidal and Wave Energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT – VI:

Energy Storage:

Electro Chemical Storage: lead-acid- nickel cadmium-nickel-metal-hydride and lithium type batteries-Principle of operation, Types, Advantages and disadvantages.

Non-Electric Storage: Methods of Energy storage –Pumped Energy Storage – Compressed air Energy Storage, Superconducting Magnet Energy Storage.

TEXT BOOKS:

1. Non-Conventional Energy Sources, G. D. Rai, 6th Edition, Khanna Publishers, 2004
2. Non-Convention Energy Resources, B.H. Khan, 3rd Edition, McGraw-Hill, 2017

REFERENCES:

1. Renewable Energy Sources, Twidell& Weir, 3rd Edition, CRC Press, 2015
2. Solar Energy, Sukhatme, 3rd Edition, McGraw-Hill, 2008
3. Non-Conventional Energy, Ashok V. Desai, Wiley Eastern, 1990

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

(18OE1ME05) 3D PRINTING AND DESIGN

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the need and know about the applications of 3D Printing
- To understand the need of liquid and solid based 3D Printing systems
- To know about the laser-based 3D Printing systems and importance of CAD for 3D Printing
- To understand post-processing, inspection and testing involved in 3D Printing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Summarize the importance of 3D Printing
CO-2: Explain the process involved in liquid and solid based 3D Printing Systems
CO-3: Explain about the laser-based 3D Printing systems and CAD for 3D Printing
CO-4: Plan post-processing techniques and perform inspection and testing in 3D Printing

UNIT – I:
Introduction: Introduction to 3D Printing, Classification, 3D Printing Process Chain, Materials for 3D Printing, Distinction between 3D Printing & Conventional Manufacturing.
Applications: Brief overview of applications in Aerospace, Automotive, Biomedical, Defense, Construction, Jewelry, Coin and Tableware Industry.

UNIT – II:
Liquid Based 3D Printing Systems: Introduction, Principle, Processes and Applications of Material Jetting and Binder Jetting.

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

UNIT – IV:
Laser Based 3D Printing Systems: Introduction, Principle, Processes and Applications of Selective Laser Sintering (SLS), Three-Dimensional Printing (3DP).

UNIT – V:
CAD for 3D Printing: CAD data formats, CAD model preparation, Part orientation and support generation, Overview of 3D Printing softwares like MAGICS and MIMICS only.

UNIT – VI:
Post Processing: Introduction, Post Processing Techniques like Support material removal, Cleaning, Sanding and Polishing.
Inspection: Introduction, Significance, Inspection techniques like Dimensional measurement along X, Y and Z axes, visual inspection of the surface finish (overall

aesthetics and intact features), flatness or warp check, and FOD (foreign objects or debris) check.

TEXT BOOKS:

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W. Rosen, Brent Stucker., Springer, 2010
2. Rapid Prototyping: Principles and Applications, Chua C. K., Leong K. F., and Lim C. S., 3rd Edition, World Scientific, 2010

REFERENCES:

1. Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development, Liou L. W. and Liou F. W., CRC Press, 2007
2. Rapid Prototyping: Theory and Practice, Kamrani A. K. and Nasr E. A., Springer, 2006
3. Rapid Tooling: Technologies and Industrial Applications, Hilton P. D. and Jacobs P. F., CRC Press, 2000
4. Rapid Prototyping, Gebhardt A., Hanser Gardener Publications, 2003

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(18OE1EC09) EMBEDDED SYSTEMS FOR IOT

COURSE PRE-REQUISITES: Programming through C

COURSE OBJECTIVES:
- To understand the basics of computing with Embedded Systems
- To expose the students to various smart sensors
- To make the students familiar with the programming concepts of Embedded development board
- To understand the basics of Internet of Things and Cloud of things

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Familiar with architectural and programming issues of Embedded Systems
CO-2: Able to select proper smart Sensor for a specific measurement application
CO-3: Analyze various protocols for Internet of Things
CO-4: Apply Internet of Things to different applications in the real world

UNIT – I:
Embedded System Design: Numbering and Coding Systems, Digital Premier, Inside the Computer
Embedded system - Definition, Characteristics of embedded computing applications, Design challenges, Requirements, Specification, Architecture design, Designing hardware and software components, system integration.

UNIT – II:
Smart Sensors & Applications: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation.

UNIT – III:
Sensors Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring.

UNIT – IV:
Micro Controller Board: Features of Arduino, Arduino components and IDE, Interfacing: Seven Segment Display, Pulse Width Modulation, Analog Digital Converter, Wireless connectivity to Arduino. Case study: From BT To WiFi: Creating WiFi Controlled Arduino Robot Car.

UNIT – V:
Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Deployment Templates, M2M, IoT vs M2M.

UNIT – VI:

Domain Specific Applications of IoT: IoT Design Methodology, Applications of IoT– Home, Health, Environment, Energy, Agriculture, Industry and Smart City.

TEXT BOOKS:

1. The 8051 Microcontroller: Programming, Architecture, Ayala &Gadre, 3rd Edition, Cengage Publications, 2008
2. Sensors and Transducers, D. Patranabis, 2nd Edition, PHI Learning Private Limited, 2013
3. Internet of Things: A Hands-On Approach, Vijay Madisetti, ArshdeepBahga, Universities Press, 2015

REFERENCES:

1. Embedded Systems: Architecture, Programming and Design, 2nd Edition, TMH
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. McKinlay, 2nd Edition, 2005
3. Internet of Things with Raspberry Pi and Arduino, Singh R., Gehlot A., Gupta L., Singh B., Swain M., Boca Raton, CRC Press, 2020

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

(18OE1CS09) ARTIFICIAL INTELLIGENCE – A BEGINNER'S GUIDE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand and analyze the basic concepts of artificial intelligence
- To identify, explore the complex problem-solving strategies and approaches
- To analyze the concepts of basic concepts of neural networks and learning process
- To explore and analyze the methodology used in machine learning and computer vision

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and apply the basic concepts of artificial intelligence and its use cases. lives
CO-2: Explore the various search strategies and approaches for problem solving
CO-3: Correlate the fields related to AI, and articulate various learning paradigms
CO-4: Describe several issues and ethical concerns surrounding AI

UNIT – I:
Introduction to AI: What is AI-On Overview, History of AI, Applications and Examples of AI, AI Concepts, Terminology, Key fields of AI. AI Issues, Concerns, and Ethical Considerations.

UNIT – II:
AI as Search Process: On overview of Search Strategy. Types of Searches- Uninformed, Informed, Bidirectional search, Heuristic search. Local search, Local beam search, Adversarial Search.

UNIT – III:
AI as Knowledge Exploration: Introduction to Propositional Logic, Rules of Inference, First Order Logic (FOL) Syntax, Semantics, Entailment, Tools to represent knowledge.

UNIT – IV:
AI as a Learning Task: Introduction to Learning, Learning types -Supervised, Unsupervised, Reinforcement Learning, Machine learning, Deep Learning, The link between AI, ML, DL.

UNIT – V:
AI as Neural Networks: Introduction to biological neural networks. Link between biological neuron and artificial neuron. Architecture of artificial neural network, Types of Neural networks-single layer, multilayer, Back propagation networks.

UNIT – VI:
The future of AI: Computer Vision - Seeing the World Through AI, Bots - Conversation as a Platform, AI and the society, AI in action-the Use Cases, Building AI Projects.

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall, 2010
2. Machine Learning, Tom M. Mitchell, McGraw-Hill Publications
3. Neural Networks-A Comprehensive Foundation, Simon Haykin, 2nd Edition, Pearson Education, 2004

REFERENCES:

1. Artificial Intelligence, Elaine Rich & Kevin Knight, 2nd Edition, TMH
2. Artificial Intelligence, A New Synthesis, Nils J. Nilsson, Elsevier
3. Artificial Neural Networks, Yegnanarayana B., PHI

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

(18OE1CS10) BLOCKCHAIN TECHNOLOGY ESSENTIALS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce and get the technological overview of blockchain technologies
- To Study the foundation of Blockchain Technology and demonstrate the various types of Blockchain
- To explore the application area of Blockchain Technology
- To introduce smart contract, consensus algorithm and Security Mechanism
- Introduction to available platforms to implement Blockchain Technology

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and explore the Blockchain Technology
CO-2: Describe smart contract concepts
CO-3: Explore different types of Blockchain
CO-4: Develop the platforms to implement Blockchain Technology

UNIT – I:
Fundamental of Blockchain Part I: Introduction to Centralized, Decentralized and Distributed system, computer network peer to peer connection
Fundamental of Blockchain Part II: History of Blockchain, Various technical definitions of Blockchain. Generic elements of a blockchain: Block, Transaction, Node, Why It's Called "Blockchain", Characteristics of Blockchain Technology, Advantages of blockchain technology, Limitations of blockchain as a technology

UNIT – II:
Concept of Blockchain Technology Part I: Applications of blockchain technology, Tiers of blockchain technology Blockchain 0, Blockchain 1, Blockchain 2, Blockchain 3, Generation of Blockchain X, smart contract
Concept of Blockchain Technology Part II: Types of blockchain: Public blockchain, private blockchain, hybrid blockchain, examples of Public, private, hybrid blockchain and it merit and demerit.

UNIT – III:
Technical Foundations Part I: Component of block, Structure of Block chain, Technical Characteristics of the Blockchain, genesis block, Nonce
Technical Foundations Part II: Cryptography, Hashing, Distributed database, Consensus mechanisms, and basic of Cryptographic primitives, Technical Characteristics of Secure Hash Algorithms (SHA), Digital signature.

UNIT – IV:
Consensus Algorithm: Proof of work (PoW), Proof-of-Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of authority (PoA), Confidentiality, Integrity, Authentication, Permissioned ledger, Distributed ledger, Shared ledger, Fully private and proprietary

blockchains, Tokenized blockchains, Tokenless blockchains, CAP theorem and blockchain

UNIT – V:

E-Governance and other contract enforcement mechanisms, Financial markets and trading, Trading, Exchanges, Trade life cycle, Order anticipators, Market manipulation. **Crypto Currency:** Bitcoin, Bitcoin definition, Keys and addresses, Public keys in Bitcoin, Private keys in Bitcoin, Bitcoin currency units

UNIT – VI:

Implementation Platforms: Hyperledger as a protocol, Reference architecture, Hyperledger Fabric, Transaction Flow, Hyperledger Fabric Details, Fabric Membership, Fabric Membership

TEXT BOOKS:

1. Mastering Blockchain, Imaran Bashir, 2nd Edition, Packt
2. Blockchain Basic, Daniel Drescher, A Press

REFERENCES:

1. Blockchain For Dummies®, IBM Limited Edition, John Wiley & Sons, Inc

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(18OE1EI05) FUNDAMENTALS OF ROBOTICS AND DRONES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To classify by coordinate system and control system
- To acquire Knowledge on different types Power Sources and Sensors
- To classify different types of Manipulators, Actuators and Grippers
- To acquire Knowledge on kinematics and Vision systems used for different Robots
- To acquire Knowledge on the basics of Drones

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire knowledge on different types of Power Sources (actuators) and Sensors, Manipulators, Actuators and Grippers
CO-2: Acquire knowledge on different applications of various types of robots
CO-3: Analyze the direct and the inverse kinematic problems and calculate the manipulator dynamics
CO-4: Acquire knowledge on the applications of Machine Vision in Robotics
CO-5: Acquire Knowledge on the basics of Drones

UNIT – I:
Basic Concepts & Fundamentals: An overview of Robotics, classification of Robots, Robot Components, Robot degrees of freedom, Robot Joints, Robot Coordinates, Robot reference frames, Programming modes, Robot Characteristics.

UNIT – II:
Sensors and Actuators:
Sensors: Sensors characteristics, Position sensors, velocity sensors, acceleration sensors, torque sensors, micro switches, lighten infrared sensors, touch and tactile sensors, proximity sensors, range finders.
Actuators: Characteristics of activating system, comparison of activating system Hydraulic devices, Pneumatic devices, electric motors, magneto-strictive actuators.

UNIT – III:
Manipulators and Grippers:
Grippers: Robot end effectors, Classification, drive system for Gripper, Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Adhesive Grippers, Hooks, Scoops and other Miscellaneous Devices, Gripper force Analysis and Gripper Design, Active and passive Grippers.

UNIT – IV:
Kinematics: Matrix representation of translational and Rotational motion – Homogeneous Transformation-DH representation of standard configuration Robots-Inverse Kinematics. Joint space vs. Cartesian space-Basics of Trajectory planning in joint and Cartesian space.

UNIT – V:

Robot Vision: Low level and High-level vision

Image acquisition, Illumination Techniques, Imaging Geometry, Some Basic Relationships between Pixels, Segmentation, Description, Segmentation and Description of 3-D Structures, Recognition, Interpretation.

UNIT – VI:

Basics of Drones: Theory behind how drones work, individual components that makeup a drone, basic concepts involved radio-controlled model flying, building a complete quad copter drone from scratch

TEXT BOOKS:

1. Introduction To Robotics: Analysis, Control, Applications, Wiley, Saeed B. Niku, 2nd Edition
2. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover, Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, McGraw-Hill, 2012

REFERENCES:

1. Robotics Technology and Flexible Automation, Deb S. R., John Wiley
2. Robots and Manufacturing Automation, Asfahl C. R., John Wiley
3. Robotic Engineering–An Integrated Approach, Klafter R. D., Chimielewski T. A., Negin. M, Prentice Hall of India, New Delhi
4. Drones for Beginners, Udemy

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

(18OE1IT08) FUNDAMENTALS OF CYBER SECURITY

COURSE PRE-REQUISITES: Basic Knowledge of Computers, Basic Knowledge of Networking and Internet

COURSE OBJECTIVES:
- To identify the key components of cyber security in network
- To describe the techniques in protecting Information security
- To define types of analyzing and monitoring potential threats and attacks
- To access additional external resources to supplement knowledge of cyber forensics and laws

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand, appreciate, employ, design and implement appropriate security technologies
CO-2: Demonstrate policies to protect computers and digital information
CO-3: Identify& Evaluate Information Security threats and vulnerabilities in Information Systems
CO-4: Understanding computer forensics and analyzing them

UNIT – I:
Introduction to Cybersecurity, Cybersecurity objectives, Cybersecurity roles, Differences between Information Security & Cybersecurity, Cybersecurity Principles - Confidentiality, integrity, & availability, Authentication & nonrepudiation, The Trinity of IT Security (CIA), Computer Protocols, Cookies, The TCP/IP

UNIT – II:
Who are the cyber criminals, Classification of cybercrimes, E-mail Spoofing, Spamming, Cyber defamation, Internet Time Theft, Salami Attack/ Salami Technique, Data Diddling, Forgery, Web Jacking, Newsgroup Spam/ Crimes Emanating from Usenet Newsgroup, Industrial Spying/Industrial Espionage, Hacking, Online Frauds, Pornographic Offenses, Software Piracy, Computer Sabotage, E-mail Bombing/Mail Bombs, UseNet Newsgroup as the Source of Cybercrimes, Computer Network Intrusions, Password Sniffing, Credit Card Frauds, Identity Theft.

UNIT – III:
Cyber Offenses: How Criminals Plan Them: Introduction, Categories of Cybercrime, How Criminals Plan the Attacks, Reconnaissance, Passive Attacks, Active Attacks, Scamming and Scrutinizing Gathered Information, Attack (Gaining and Maintaining the System Access), Social Engineering, Classification of Social Engineering, Cyber stalking, Types of Stalkers, Cases Reported on Cyber stalking, How Stalking Works?, Real-Life Incident of Cyber stalking, Cyber cafe and Cybercrimes,

UNIT – IV:
Security Threats: Introduction to security threats-Virus, Worms, Trojan horse, Bombs, Trap Door, E-Mail Virus, Virus Life cycle, How virus works?, Malware, Network and

Services attack- Dos attacks, Types of Dos attacks, Methods of attacks, Examples of attacks-SYN flooding, TCP flooding ,UDP flooding ,ICMP flooding ,Smurf, Ping of death, Tear drop, Security threats to E-commerce-Electronic payment system, Credit card/Debit cards, Smart cards, E- money, Electronic Fund Transfer, E-commerce security System, Electronic Cash, Digital Signatures

UNIT – V:

Introduction to Computer Forensics: computer crimes, evidence, extraction, preservation, etc. Overview of hardware and operating systems: structure of storage media/devices; windows/Macintosh/ Linux -- registry, boot process, file systems, file metadata. Data recovery: identifying hidden data, Encryption/Decryption, Steganography, recovering deleted files. Digital evidence controls: uncovering attacks that evade detection by Event Viewer, Task Manager, and other Windows GUI tools, data acquisition, disk imaging, recovering swap files, temporary &cache files, Computer Forensic tools, Network Forensic. Computer crime and Legal issues: Intellectual property, privacy issues, Criminal Justice system for forensic, audit/investigative situations and digital crime scene, investigative procedure/standards for extraction, preservation, and deposition of legal evidence in a court of law.

UNIT – VI:

Fundamentals of Cyber law: Evolution of the IT Act, Genesis and Necessity , Salient features of the IT Act, 2000, various authorities under IT Act and their powers, Penalties & Offences, amendments, Impact on other related Acts Cyber Space Jurisdiction -Jurisdiction issues under IT Act, 2000- Traditional principals of Jurisdiction - Extra-terrestrial Jurisdiction- Case Laws on Cyber Space Jurisdiction Sensitive Personal Data or Information (SPDI) in Cyber Law (a) SPDI Definition and Reasonable Security Practices in India (b) Reasonable Security Practices – International perspective

TEXT BOOKS:

1. Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and SunitBelpure, Wiley
2. Fundamentals of Cyber Security, Mayank Bhusan, Rajkumar Singh Rathore, Aatif Jamshed, BPB Publications
3. Cyber Law & Cyber Crimes, Advocat Prashant Mali, Snow White Publications, Mumbai

REFERENCES:

1. Computer Forensics and Cyber Crime: An Introduction, Marjie T. Britz, 3rd Edition, 2013
2. Digital Forensics with Open-Source Tools. Cory Altheide and Harlan Carvey, Elsevier, 2011(ISBN: 978-1-59749- 586-8)
3. Network Forensics: Tracking Hackers Through Cyberspace, Sherri Davidoff, Jonathan Ham Prentice Hall, 2012
4. Cyber Law in India, Farooq Ahmad, Pioneer Books
5. Information Technology Law and Practice, Vakul Sharma, Universal Law Publishing Co. Pvt. Ltd

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B.Tech.	L	T/P/D	C
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(18OE1IT09) FUNDAMENTALS OF DATA SCIENCE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration
- To explore data analysis, predictive modeling, descriptive modeling, data product creation, evaluation, and effective communication
- To understand the basic knowledge of algorithms and reasonable programming experience and some familiarity with basic linear algebra and basic probability and statistics
- To identify the importance of recommendation systems and data visualization techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data
CO-2: Discuss the significance of exploratory data analysis (EDA) in data science and to apply basic tools (plots, graphs, summary statistics) to carry out EDA
CO-3: Apply basic machine learning algorithms and to identify common approaches used for Feature Generation
CO-4: Analyze fundamental mathematical and algorithmic ingredients that constitute a Recommendation Engine and to Build their own recommendation system using existing components

UNIT – I:
Introduction: What is Data Science? - Big Data and Data Science hype – and getting past the hype - Why now? – Datafication - Current landscape of perspectives - Skill sets needed - Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model - Intro to R

UNIT – II:
Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Case Study: Real Direct (online real estate firm) - Three Basic Machine Learning Algorithms- Linear Regression - k-Nearest Neighbors (k-NN) - k-means

UNIT – III:
One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam

UNIT – IV:
Data Wrangling: APIs and other tools for scrapping the Web - Feature Generation and

Feature Selection (Extracting Meaning From Data) - Motivating application: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests

UNIT – V:

Recommendation Systems: Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis - Exercise: build your own recommendation system - Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighbourhood properties in graphs

UNIT – VI:

Data Visualization - Basic principles, ideas and tools for data visualization 3 - Examples of inspiring (industry) projects - Exercise: create your own visualization of a complex dataset - Data Science and Ethical Issues - Discussions on privacy, security, ethics - A look back at Data Science - Next-generation data scientists

TEXT BOOKS:

1. Doing Data Science, Straight Talk From The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014
2. Mining of Massive Datasets v2.1, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, Cambridge University Press, 2014
3. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, 2013 (ISBN 0262018020)

REFERENCES:

1. Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani and Jerome Friedman, 2nd Edition, 2009 (ISBN 0387952845)
2. Foundations of Data Science, Avrim Blum, John Hopcroft and Ravindran Kannan
3. Data Mining and Analysis: Fundamental Concepts and Algorithms, Mohammed J. Zaki and Wagner Miera Jr. Cambridge University Press, 2014
4. Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, 3rd Edition, 2011 (ISBN 0123814790)

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

(18OE1AE05) INTRODUCTION TO ADVANCED VEHICLE TECHNOLOGIES

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To understand the layout of an automobile and functionalities chassis elements
- To provide the concepts of automotive electrical systems and electric & hybrid vehicles
- To present various intelligent automotive systems and levels of vehicle autonomy

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Explain the functionalities of automotive systems and subsystems
CO-2: Discuss the concepts of automotive electrical systems and electric & hybrid vehicles
CO-3: Describe various intelligent automotive systems and levels of vehicle autonomy

UNIT – I:
Introduction: Classification of automobiles, layout of an automobile and types of bodies.
Automotive Chassis: Introduction to chassis systems - engine, cooling, lubrication, fuel feed, ignition, electrical, driveline - clutch, transmission, propeller shaft, differential, axles, wheels and tyres, steering, suspension and braking.

UNIT – II:
Engine: Working principle of four stoke and two stroke SI and CI engines, fuel system – layout of petrol and diesel fuel systems, electronic fuel injection - multi-point fuel injection, gasoline direct injection, common rail direct injection.

UNIT – III:
Electrical System: Simple automotive wiring diagram and components of electrical system, starting system – starter circuit, standard Bendix and over running clutch drive, charging system – alternator, cut-outs and regulators, ignition system - conventional and electronic ignition system.

UNIT – IV:
Electric and Hybrid Vehicles: Electric vehicle – Layout, components, configurations, advantages and limitations. Hybrid vehicle - Concepts of hybrid electric drivetrain based on hybridization and powertrain configuration, architecture of series, parallel and series-parallel hybrid electric drivetrains, modes of operation, merits and demerits.

UNIT – V:
Intelligent Vehicle Systems: Automotive navigation, night vision, head-up display, airbag, seat belt tightening system, immobilizers, adaptive cruise control, forward collision warning, lane departure warning and anti-lock braking system.

UNIT – VI:

Autonomous Vehicles: Levels of automation, research, challenges, commercial development, sensor systems, sensor suits, environmental challenges, graceful degradation, V2V and V2I communication, sharing the drive, integrity, security, verification and policy implications.

TEXT BOOKS:

1. Advanced Vehicle Technology, Heinz Heisler, Butterworth Heinemann, 2002
2. Intelligent Vehicle Technologies: Theory and Applications, LjuboVlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann, Oxford, 2001
3. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, CRS Press, 2004

REFERENCES:

1. Automotive Mechanics, Giri N. K., Khanna Publications, 2006
2. Automotive Electrical Equipment, Kohli P. L., Tata McGraw-Hill Co., Ltd., New Delhi, 1975
3. Electric and Hybrid Vehicles – Design Fundamentals, Iqbal Husain, CRC Press, 2010
4. Autonomous Vehicle Technology-A Guide for Policymakers, James M. Anderson, Nidhi Kalra, Karlyn D. Stanley, Paul Sorensen, Constantine Samaras, Oluwatobi A. Oluwatola, RAND Corporation, Santa Monica, Calif., 2016

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

(18PC1CE18) WASTEWATER ENGINEERING

COURSE OBJECTIVES:
- To understand the knowledge on estimation, characteristics, standards and design of sewer and storm drain
- To define the principles and design of primary and secondary treatment of sewage
- To recognize the various processes on sewage disposal and sludge management
- To interpret the principles and functions of industrial wastewater treatment

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the knowledge on estimation, characteristics, standards to design sewer and storm drain
CO-2: Design the primary and secondary treatment units of sewage
CO-3: Execute the gained knowledge in sewage disposal and sludge management
CO-4: Implement the acquired knowledge of principles and functions of industrial wastewater treatment

UNIT – I:
Planning for Sewerage Systems: Introduction - Sources of wastewater generation – Effects – Estimation of sewage discharge – design period and future forecasts - Estimation of peak drainage discharge – quality and characteristics of sewage: decomposition of sewage – physical – chemical – bacteriological characteristics – population equivalent – relative stability - collection of sewage samples – Effluent standards – Legislation requirements.

UNIT – II:
Sewer Design: Hydraulics of flow in sewers – Design of sewers and storm water drains – Sewers: Sewer shapes – forces acting - materials Laying & testing of sewers – sewers appurtenances – maintenance – cleaning – ventilation of sewers - Pumps – pumps for lifting sewages - Plumbing System for Buildings – One pipe and two pipe system.

UNIT – III:
Primary Treatment of Sewage: Introduction – Selection of treatment processes – Onsite sanitation - Primary treatment: Principles, functions, design and drawing of screen - grit chambers - oil and grease removal - sedimentation tanks – sedimentation aided with coagulations - construction, operation and maintenance aspects.

UNIT – IV:
Secondary Treatment of Sewage: Introduction – Selection of Treatment Methods – Principles, Functions, Design and Drawing of Units – Contact beds – Intermittent sand filters - Trickling filter – High rate trickling filters – other filters – secondary sedimentation - Activated Sludge Process – Rotating biological contractors - Oxidation and Stabilization ponds - aeration lagoons - UASB – septic tank and soak pit – imhoff tank – chlorination of sewage.

UNIT – V:

Disposal of Sewage and Sludge Management: Disposing of the sewage effluents – disposal by dilution: favouring conditions – Standards for Disposal – disposal in rivers and self-purification of surface water bodies – Oxygen sag curve – disposal in lakes and sea – disposal on land - Principle of Sludge digestion – moisture content – sludge digestion process (SDP) – various stages in SDP - factors affecting sludge digestion and their control - sludge digestion tanks – disposal of digested sludge – use of lagoons for disposal – Biogas recovery – 4Rs - odour prevention - water footprints.

UNIT – VI:

Industrial Wastewater Treatment: Introduction to industrial wastewater treatment - volume reduction - strength reduction - equalization - neutralization – Physical treatment: sedimentation – flotation – Chemical treatment: reverse osmosis - electrodialysis – chemical oxidation and precipitation – adsorption – deionization – thermal reduction – air stripping – Biological treatment.

TEXT BOOKS:

1. Environmental EngineeringVol. II, Garg S. K.,Khanna Publishers, New Delhi, 2003
2. Environmental Engineering, Punmia B. C., Jain A. K., and Jain A., Vol-II, Lakshmi Publications, 2005

REFERENCES:

1. Manual on Sewerage and Sewage Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1997
2. Metcalf & Eddy, Wastewater Engineering – Treatment and Reuse, Tata McGraw-Hill Company, New Delhi, 2003
3. Wastewater Treatment, Karia G. L. & Christian R. A., Prentice Hall of India, New Delhi, 2013
4. Water Supply and Sanitary Engineering, G. S. Birdi, Dhanpat Rai & Sons Publishers

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

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

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

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

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

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

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(18PE1CE11) FOUNDATION ENGINEERING

COURSE OBJECTIVES:
- To understand the impact of engineering solutions related to the ground stability
- To develop an understanding of sampling techniques in soils
- To create ability to solve foundation engineering design and problems associated
- To determine the bearing capacity for the design of shallow and deep foundations

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand and **solve** various problems related to foundations
CO-2: Correlate the mechanics of soil conditions and **apply** them to foundations
CO-3: Analyse different theories and use them for foundations
CO-4: Determine the stability of the soil-structures

UNIT – I:
Subsoil Exploration: Methods of subsoil exploration - Direct, semi direct and indirect methods, Soundings by Standard, Dynamic and Static Cone Penetration tests. Types of Boring, Types of soil sampler and sampling, Criteria for undisturbed sampling, Planning of exploration programmes, Bore logs, Transport and preservation of samples, report writing.

UNIT – II:
Earth Slope Stability: Infinite and finite earth slopes – types of failures – factor of safety of infinite slopes – stability analysis by standard method of slices, Bishop's Simplified method– Taylor's Stability Number- Stability of slopes of earth dams under steady seepage, sudden drawdown, during and at the end of construction.

UNIT – III:
Earth Pressure: Types of Earth pressure. Rankine's Active and passive earth pressure, Smooth Vertical wall with horizontal backfill. Extension to Soil Coloumb's wedge theory, Culmann's and Rehbann's graphical method for active earth pressure.

UNIT – IV:
Retaining Walls: Types of retaining walls – Principles of the design and proportioning of retaining walls, Shallow and deep shear failure, Drainage of the backfill, Stability of retaining walls.

UNIT – V:
Bearing Capacity: Safe and allowable bearing capacity, Terzaghi's, IS bearing capacity equations and its modifications for square, rectangular and circular footings. General and local shear failure conditions. Factors affecting bearing capacity of Soil. Allowable bearing pressure based on N-values and Plate load tests.
Shallow Foundations: Factors effecting locations of foundation and design considerations of shallow foundations, choice of type of foundations. Settlement

analysis, Causes of settlement, Computation of settlement, allowable settlement. Measures to reduce settlement.

UNIT – VI:

Deep Foundations: Types, Construction, load carrying capacity of single pile – Static and Dynamic formulae, Pile load tests, Load carrying capacity of pile groups, settlement of pile groups, Negative skin friction. Problems with foundations on expansive soils.

TEXT BOOKS:

1. Principles of Foundation Engineering, Braja M. Das, 8th Edition, Global Engineering: Timothy L. Anderson
2. Soil Mechanics, Foundation Engineering, V. N. S. Murthy, CBS Publishers
3. Soil Mechanics and Foundation Engineering, K. R. Arora, Standard Publishers

REFERENCES:

1. Soil Mechanics and Foundations, Muni Budhu, John Wiley & Sons
2. Foundation Analysis and Design, J. E. Bowles, Tata McGraw-Hill
3. Geotechnical Engineering, S. K. Gulhati& Manoj Datta, Tata McGraw-Hill Education

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(18PE1CE12) ADVANCED STRUCTURAL DESIGN

COURSE OBJECTIVES:
- To understand the Working stress / Limit state design principles and design the RC structures based on appropriate IS codes
- To identify the relevant IS codes and necessary codal provisions for the design of RC structural components / structures
- To determine the design shear forces and bending moments from the critical sections
- To sketch the reinforcement details in RC structures

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the basic concepts of RCC for the design of complex RC structures
CO-2: Determine the various types of loads acting on RC structures
CO-3: Understand the various codal provisions required for the design of structural components / structures
CO-4: Design the RC structures for various loads / load combinations

UNIT – I:
Combined Footings: Design of Rectangular Combined Footing with and without beam, Design of Trapezoidal Combined Footing with and without beam.

UNIT – II:
Retaining Walls: Design of Cantilever Retaining Wall, Design of Counterfort Retaining Wall.

UNIT – III:
Concrete Bridges: IRC Class AA Tracked & Wheeled Vehicle loading, Design of deck slab bridge.

UNIT – IV:
Water Tanks: Design of RCC Water tanks resting on ground, Intze type tanks

UNIT – V:
Flat Slabs: Introduction, Proportioning of Flat slabs, Direct design method, Distribution of moments in column strips and middle strip, Moment and shear transfer from slabs to columns, Shear in Flat slabs, Check for One way and Two way shear.

UNIT – VI:
Staircases: Design of Dog legged Staircase, Stringer Beam, Waist Slab.

TEXT BOOKS:

1. Advanced Reinforced Concrete Structures, Varghese, PHI, New Delhi
2. Reinforced Concrete Structures Vol – II, B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications Pvt. Ltd., New Delhi
3. Advanced Reinforced Concrete Design, N. Krishna Raju, CBS Publishers

REFERENCES:

1. Essentials of Bridge Engineering, D. Johnson Victor, Oxford and IBM Publication Co., Pvt. Ltd.
2. Reinforced Concrete Design, S. U. Pillai and D. Menon, TMH, New Delhi
3. Structural Design and Drawing: Reinforced Concrete and Steel, N. Krishna Raju, Universities Press

CODE BOOKS:

1. IS 456 : 2000 - Plain and Reinforced Concrete - Code of Practice
2. IRC 112 : 2011 - Code of Practice for Concrete Road Bridges
3. IS 3370 (Part 2) : 2009 – Concrete Structures for Storage of Liquids - Code of Practice

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(18PE1CE13) URBAN TRANSPORTATION PLANNING

COURSE OBJECTIVES:

- To introduce students on basic concepts and methods of urban transportation planning in the India
- To design, conduct and administer surveys to provide the data required for transportation planning
- To understand and apply travel demand modeling, mode choice modeling and traffic Assignment Modeling
- To identify importance of transportation planning in cities

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

CO-1: Plan and conduct surveys to provide the data required for transportation planning

CO-2: Recognize zonal demand generation and attraction regression models.

CO-3: Develop and calibrate trip generation rates for specific types of land use developments

CO-4: Predict the final decisions among planning alternatives that best integrate multiple objectives such as technical feasibility and cost minimization

UNIT – I;

Basic Concepts of Transportation Planning: Goals and objectives - Hierarchical levels of Transportation planning - Forecast - Implementation - Constraints. UTP survey – Inventory of land use- Introduction of classical four stage modeling. Zonal Classifications.

UNIT – II:

Trip Generation and Distribution Analysis: Trip generation and Trip Distribution Trip classification - productions and attractions - Multiple regression models - Category analysis - Trip production models - Trip distribution models – Linear programming approach.

UNIT – III:

Traffic Assignment: Assignment methods – Route choice behavior, The Minimum Path, All-or-Nothing Assignment, Multipath Traffic Assignment, Capacity-Restrained Traffic Assignment - Network analysis.

UNIT – IV:

Mode Choice Modeling: Behavioral models - Probabilistic models – Utility functions – logit models - Two stage model. Influencing Factors, Earlier Modal Split Models, Trip-End Type Modal Split Model, Trip-Interchange Modal Split Model, Disaggregate Mode-Choice Model, Logit Model of Mode Choice, Binary Choice Situations, Multinomial Logit Model, Model calibration, Case studies.

UNIT – V

Land-Use and its Interaction: Lowry derivative models - Non- Transport solutions for transport problems. Characteristics of urban structure; Urban Activity Systems, Urban Movement Hierarchies, Types of Urban Structure, Centripetal-Type Urban Structure, Grid Type Urban Structure, Linear-Type Urban Structure, Directional Grid Urban Structure Town planning concepts.

UNIT – VI:

Applications of UTP: Preparation of alternative plans - Evaluation techniques – Plan implementation – Monitoring.

TEXT BOOKS:

1. Principles of Urban Transportation System Planning, Hutchinson B. G., McGraw-Hill, 1974
2. An Introduction to Transportation Planning (The Living Environment), Bruton M. J., UCL Press, London, UK, 2000
3. Transportation Engineering, C. J. Khisty and B. Kent Lall, Prentice Hall of India Pvt. Ltd., 2002

REFERENCES:

1. Transportation Engineering and Planning, C. S. Papacostas and P. D. Prevedouros, Prentice Hall of India Pvt. Ltd., 2001
2. UTP Lecture Notes, Chari S. R., Regional Engg. College, Warangal 1978
3. Metropolitan Transportation Planning, Dicky J. W., Script Book Co., Washington, D.C., 1975
4. Modelling Transport, Ortuzar J. and Willumsen L.G., Wiley, Chinchestor, 1994

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(18PE1CE14) FINITE ELEMENT METHODS

COURSE OBJECTIVES:
- To understand the general steps of finite element methods
- To know the basic finite element formulation techniques
- To equip with the Finite Element Analysis fundamentals
- To perform engineering simulations using Finite Element Analysis software

COURSE OUTCOMES: After the completion of the course student should be able to
CO-1: Solve multi-disciplinary problems
CO-2: Derive equations in finite element methods for 1-D and 2-D problems
CO-3: Formulate and **solve** basic problems in structural mechanics using different elements
CO-4: Apply knowledge of mathematics and solve engineering problems

UNIT – I:
Introduction: Basic concepts of FEM – Steps in the FEA – Advantages and Disadvantages -Applications – Discretization - A general procedure for finite element analysis.

UNIT – II:
Principles of Elasticity: Equilibrium equations – Strain displacement relationships - Stress-Strain Relations - Plane stress, Plane strain problems - Axi-symmetric bodies of revolution with Axi-symmetric loading.

UNIT – III:
One Dimensional FEM: Linear spring as a Finite element - Local and Global coordinate systems - Finite element modeling - Stiffness matrix for Bar element, Flexure element - Element load vector - Equivalent nodal loads -Analysis of plane truss - Shape functions for one dimensional elements – One dimensional problems - Comparison of the finite element solution with the exact solution.

UNIT – IV:
Two Dimensional FEM: Different types of elements for plane stress and plane strain analysis - CST element - LST element - Rectangular elements - Displacement models – generalized coordinates – shape functions – convergence and compatibility requirements – Geometric invariance – Natural coordinate system – Area coordinates - Volume coordinates.

UNIT – V:
Iso-Parametric Formulation: Concepts of Iso-parametric elements for 2D analysis - Formulation of CST element, 4–noded and 8-noded iso-parametric quadrilateral elements – Shape functions - Strain displacement matrices - Lagrangian and Serendipity elements – Iso-parametric, Super parametric and Sub parametric elements.

UNIT – VI:

Solution Techniques: Numerical Integration - Guassian Quadrature - One point, Two Point and Three point formula - Static condensation, Assembly of elements and solution techniques for static loads.

TEXT BOOKS:

1. A First Course in The Finite Element Method, Daryl L. Logon
2. Finite Elements Methods in Engineering, Tirupati R. Chandrupatla and Ashok D. Belegundu, Pearson Education
3. Finite Element Analysis – Theory & Programming, C. S. Krishna Murthy, Tata McGraw-Hill

REFERENCES:

1. Concepts and Applications of Finite Element Analysis, Robert D. Cook, David S. Malkus and Michael E. Plesha, John Wiley & Sons
2. Textbook of Finite Element Analysis, P. Seshu, Prentice Hall of India
3. Finite Element Analysis, S. S. Bhavikatti, New Age International Publishers
4. Finite Element Analysis, David V. Hutton, Tata McGraw-Hill

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(18PE1CE15) GEO-ENVIRONMENTAL ENGINEERING

COURSE OBJECTIVES:
- To understand various sources of contamination of ground and to characterize contaminated ground
- To describe the knowledge on the Geotechnical engineering problems associated with soil contamination
- To explain extent of contamination and arrive at safe disposal of waste
- To identify and remediate the contaminated soils by different techniques thereby protecting environment

COURSE OUTCOMES: After the completion of the course student should be able to
CO-1: Analyse soil environment interaction, and Mechanisms of soil water interaction.
CO-2: Examine groundwater flow and predict contaminant transport Phenomenon.
CO-3: Design and **develop** various landfill techniques.
CO-4: Apply remediation techniques for contaminated site.

UNIT – I:
Generation of Wastes and Consequences of Soil Pollution: Introduction to Geo environmental engineering; Environmental cycle; Sources, production, and classification of waste; Causes of soil pollution, Effect of contaminant on subsoil.

UNIT – II:
Soil Mineralogy: Significance of mineralogy in determining soil behavior; Mineralogical characterization, Factors governing soil pollution and interaction with clay minerals.

UNIT – III:
Site Selection and Safe Disposal of Waste: Safe disposal of waste; Site selection for landfills; Characterization of land fill sites and waste; Risk assessment; Stability of landfills, Current practice of waste disposal, Monitoring facilities, Passive containment system; Application of geosynthetics in solid waste management in landfills, Rigid or flexible liners.

UNIT – IV:
Contaminant Transport
Contaminant transport in sub surface: Advection, Diffusion, Dispersion; Governing equations; Contaminant transformation: Sorption, Biodegradation, Ion exchange, Precipitation; Hydrological consideration in landfill design; Ground water pollution.

UNIT – V:
Waste Stabilization: Stabilization & Solidification of wastes, Micro and macro encapsulation; Absorption, Adsorption, Precipitation; Detoxification, Mechanism of stabilization, Organic and inorganic stabilization; Utilization of solid waste for soil improvement, case studies.

UNIT – VI:

Remediation of Contaminated Soils: Ex-situ and In situ remediation, Solidification, bioremediation, incineration, soil washing, phytoremediation, soil heating, vitrification, bioventing.

TEXT BOOKS:

1. Geo-Environmental Engineering, Hari D. Sharma and Krishna R. Reddy, John Wiley and Sons, INC, USA, 2004
2. Geotechnical Practice for Waste Disposal, Daniel B. E., Chapman & Hall, London 1993
3. Waste Disposal in Engineered Landfills, Manoj Datta, Narosa Publishing House, 1997

REFERENCES:

1. Industrial Solid Waste Management and Landfilling Practice, Manoj Datta, B. P. Parida, B. K. Guha, Narosa Publishing House, 1999
2. Landfill Waste Pollution and Control, Westlake K., Albion Publishing Ltd., England, 1995
3. Hazardous Waste Management, Wentz C. A., McGraw-Hill, Singapore, 1989
4. Proceedings of the International Symposium on Environmental Geotechnology (Vol. I and II) Environmental Publishing Company, 1986 and 1989
5. Environmental Indices, Theory and Practice, Ott W. R., Ann Arbor, 1978

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(18PE1CE16) GEO-SYNTHETICS AND SOIL REINFORCEMENT

COURSE OBJECTIVES:

- To create awareness of the latest trends, modern standards and state of the art techniques for solving geotechnical engineering problems
- To develop an ability to design a Geo-synthetic system to meet desired needs such as economic, environmental and sustainability related
- To identify latest trends in practice in numerous special aspects of civil engineering
- To apply the basic knowledge and to solve critical civil engineering problems in the field

COURSE OUTCOMES: After the completion of the course student should be able to
CO-1: Analyze different functions and applications of geosynthetics in Civil Engineering
CO-2: Examine the properties of geosynthetic materials
CO-3: Interpret the stability of reinforced structures using modern tools
CO-4: Design the structures using geosynthetic materials

UNIT – I:
An Overview of Geo-synthetics: Classification of Geo-synthetics, Functions and applications, Raw materials used, Manufacturing, Sustainability.

UNIT – II:
Geosynthetic Properties and Testing: Physical properties - Specific Gravity, Mass per unit area, Thickness, Stiffness, POA, AOS. Mechanical properties – Tests on tensile strength, Burst strength, Tear, Impact, Puncture, Friction behavior, Pullout, Seam strength, Compressibility. Hydraulic properties - In plane & Cross plane permeability, Long term flow test. Endurance properties - Abrasion , UV-Degradation, Gradient ratio (clogging) test.

UNIT – III:
Soil Reinforcement: Mechanism, Reinforced slopes, Embankments on soft ground, Reinforced Embankments and Reinforced soil walls, Gabion walls, Internal and External Stability, Slope stabilization.

UNIT – IV:
Geosynthetics for Highways: Roadway Reinforcement, Separation-Filtration-Drainage in highways: Mechanism, Applications, Functions, Reflection cracking, Pavement rehabilitation and repair, Widening of existing road embankments.

UNIT – V:
Ground Improvement
Dewatering Systems: Prefabricated Vertical drains (PVD) designs, Sand Drains and French Drains, Bearing capacity: Geocell reinforced sand overlaying soft clay.

UNIT – VI:

Geo-environmental Applications: Geomembranes for landfills and ponds, Geosynthetic clay liners (GCLs), Filtration, drainage and erosion control, Slope protection, Encapsulation. Moisture barriers.

TEXT BOOKS:

1. Designing with Geo-synthetics, Koerner R. M., 6th Edition, Xlibris Corporation, 2012
2. Engineering with Geo-synthetics, Venkatappa R. G. and Suryanarayana R. G. V. S Tata McGraw-Hill, New Delhi, 1990
3. An Introduction to Soil Reinforcement and Geosynthetics, Sivakumar Babu G. L., University Press, 2005

REFERENCES:

1. Ground Improvement, Mosley, 2nd Edition, CRC Press, 2004
2. Earth Reinforcement and Soil Structures, Jones C. J. F. P., Elsevier, 2013
3. Engineering Principles of Ground Modifications Hausmann M. R., McGraw-Hill Publishing Company, New York, 1990
4. Ground control and Improvement, XianthakosAbremson and Bruce, John Wiley & Sons, 1994
5. A Guide to Geotextiles Testing, Mandal J. N. and Divshikar D. G., New Age International Pvt. Ltd. Publisher, New Delhi, 2002

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(18PE1CE17) EARTHQUAKE RESISTANCE DESIGN OF BUILDINGS

COURSE OBJECTIVES:
- To understand Engineering Seismology
- To explain and discuss single degree of freedom systems subjected to free and forced vibrations
- To acquire the knowledge of the conceptual design and principles of earthquake resistant designs as per IS codes
- To understand the importance of ductile detailing of RC structures

COURSE OUTCOMES: After the completion of the course student should be able to
CO-1: Explain and **derive** equations of motion for single degree of freedom systems
CO-2: Understand Engineering Seismology
CO-3: Explain the importance of conceptual design and **evaluate** the base shear using IS methods
CO-4: Design and **Detail** structural members for ductile requirement as per IS codal provisions

UNIT – I:
Introduction to Structural Dynamics: Elements of vibrating system – Degrees of freedom – Continuous system – Lumped mass idealization – Oscillatory motion – Free vibrations of single degree of freedom system – undamped, damped and critical damping – Logarithmic decrement – Forced vibrations of SDOF – Harmonic loading

UNIT – II:
Earthquakes and Ground Motion: The interior of the earth – Causes of earthquakes – Nature and occurrence of earthquakes – Seismic waves – Effects of earthquake – Consequences of earthquake damage – Measurement of earthquakes - intensity and magnitude – Seismograph – Classification of Earthquakes – Seismic zoning

UNIT – III:
Conceptual Design: Introduction to functional planning – Continuous load path – Overall form – Simplicity, Uniformity and Symmetry – Elongated shapes – Stiffness and strength – Horizontal and vertical members – Twisting of buildings – Ductility - Flexible buildings

UNIT – IV:
Framing systems – Effect of Non-structural elements - Unconfined concrete and confined concrete – Reinforcing steel – Lateral load resisting systems – Irregularities in buildings

UNIT – V:
Code-based Analysis Method and Design Approaches: Basic assumptions – Principles in earthquake resistant designs – Seismic design requirements – Design earthquake loads – Permissible stresses – Seismic methods of analysis – Equivalent lateral force method – Dynamic analysis – Response spectrum method – Time history method

UNIT – VI:

Reinforced Concrete Buildings: Damage to RC buildings – Principles of earthquake resistant design of RC members – Interaction between concrete and steel – Ductility considerations in earthquake resistant design of RC buildings – Impact of ductility – Requirements for ductility –Assessment of ductility – Factors affecting ductility – Ductile detailing considerations as per IS:13920 – Behaviour of beams, columns and joints in RC buildings during earthquake

TEXT BOOKS:

1. Earthquake Resistant Design of Structures, S. K. Duggal, Oxford University Press, 2013
2. Earthquake Resistant Design of Structures, Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd., 2011

REFERENCES:

1. Structural Dynamics – Theory and Computation, Mario Paz, CBS Publisher, 2004
2. Earthquake Resistant Design of Masonry Building, Miha Tomazevic, Imperial College Press, 2006
3. Earthquake Tips-Learning Earthquake Design and Construction, C. V. R. Murthy, IIT Kanpur and BMTPC, New Delhi

REFERENCE CODES:

1. IS: 1893(Part-1)-2016, Criteria for Earthquake Resistant Design of Structures, Part-1: General Provisions and Buildings (Sixth Revision), B.I.S., New Delhi
2. IS: 13920-2016, Ductile Detailing of Concrete Structures Subjected to Seismic Force Code of Practice (First Revision) Guidelines, B.I.S. New Delhi

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(18PE1CE18) TRAFFIC ENGINEERING

COURSE OBJECTIVES:

- To understand the basic concepts of traffic engineering
- To analyze capacity and level of service of highways
- To identify the importance and types of parking and traffic safety in day-to-day life
- To design signals at the intersection

COURSE OUTCOMES: After the completion of the course student should be able to
CO-1: Develop relationship between basic traffic characteristics like speed, flow and density
CO-2: Analyze and **estimate** the capacity and level of service of any given highway
CO-3: Perform parking inventory surveys and predict parking demand for designing parking facility
CO-4: Design the intersections and assess the impact of traffic on environment

UNIT – I:
Basic Traffic Characteristics: Speed, volume and concentration. Relationship between Flow, Speed and Concentration Volume Studies - Objectives, Methods; Speed studies - Objectives: Definition of Spot Speed, time mean speed and space mean speed

UNIT – II:
Speed Studies: Methods of conducting speed studies; Presentation of speed study data; Head ways and Gaps; Critical Gap; Gap acceptance studies.

UNIT – III:
Highway Capacity and Level of Service: Basic definitions related to capacity; Level of service concept; Factors affecting capacity and level of service; Computation of capacity and level of service for two lane highways Multilane highways and freeways.

UNIT – IV:
Parking Studies and Analysis: Types of parking facilities - on street parking and off street Parking facilities; Parking studies and analysis.
Traffic Safety: Accident studies and analysis; Causes of accidents - The Road, The vehicle, The road user and the Environment; Engineering, Enforcement and Education measures for the prevention of accidents, Road User cost study, Road safety audit.

UNIT – V:
Traffic Control and Regulation: Traffic Signals - Design of Isolated Traffic Signal by Webster method, Warrants for signalization, Signal Co-ordination methods, Simultaneous, Alternate, Simple progression and Flexible progression Systems.

UNIT – VI:

Traffic and Environment: Detrimental effects of Traffic on Environment; Air pollution; Noise Pollution; Measures to curtail environmental degradation due to traffic.

TEXT BOOKS:

1. Traffic Engineering and Transportation Planning, Kadiyali L. R., Khanna Publication, New Delhi, 2011
2. Traffic Engineering, Roger P. Roess, Elena S. Prassas and William R. McShane, 4^{th} Edition, Prentice Hall, 2010

REFERENCES:

1. Traffic Engineering Design: Principles and Practice, Mike Slinn, Paul Matthews, Peter Guest, 2^{nd} Edition, Butterworth-Heinemann, 2005
2. Traffic & Highway Engineering, Nicholas J. Garber, Lester A. Hoel, 3^{rd} Edition, Bill, 2011
3. Design Codes IRC: SP: 41-1994, IRC SP: 31-1992, IRC 43-1994, Indian Roads Congress, New Delhi, Highway Capacity Manual 2010, Transportation Research Board
4. Traffic Engineering, Matson T. M., Smith W. S., Hurd F. W., McGraw-Hill Book Co., NY USA

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(18PE1CE19) REMOTE SENSING AND GIS

COURSE OBJECTIVES:

- To describe and define various concepts of Remote Sensing and GIS
- To analyze Remote sensing and GIS data
- To appraise the importance of accuracy of remote sensing and GIS data
- To apply Remote Sensing and GIS knowledge in solving various Civil Engineering related problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Describe different concepts and terms used in Remote Sensing and GIS
CO-2: Compare and process different data sets
CO-3: Evaluate the accuracy and decide whether a data set can be used or not
CO-4: Demonstrate various applications in RS and GIS

UNIT – I:
Introduction to Photogrammetry: Introduction to aerial photography and photogrammetry. Principle and types of aerial photographs, Parallax measurements for height, determinations.
Concepts of Remote Sensing: Basics of remote sensing- elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology & units, energy resources, energy interactions with earth surface features & atmosphere, atmospheric effects,

UNIT – II:
Remote Sensing Platforms and Sensors: Remote Sensing Platforms and Sensors, Satellite orbits, Sensor Resolution, types of sensors., IRS satellites. spectral properties of soil, water, and vegetation.

UNIT – III:
Remote Sensing Data Interpretation: Visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation. Concepts of Digital image processing, image enhancements, qualitative & quantitative analysis and pattern recognition, classification techniques and accuracy estimation.

UNIT – IV:
Introduction to GIS: Introduction, History of GIS, GIS Components, GIS Applications in Real life, The Nature of geographic data, Maps, Types of maps, Map scale, Types of scale, Map and Globe, Co-ordinate systems, Map projections, Map transformation, Georeferencing. Over view of GPS

UNIT – V:
Spatial Data input and Editing: Data input methods – keyboard entry, digitization, scanning, conversion of existing data, remotely sensed data, errors in data input, Data accuracy, Micro and Macro components of accuracy, sources of error in GIS. Spatial

Analysis: Introduction, topology, spatial analysis, vector data analysis, Network analysis, raster data analysis, Spatial data interpolation techniques

UNIT – VI:
Applications of Remote Sensing and GIS Land Use Land Cover mapping, agricultural applications, oceanographic applications, urban and regional planning applications, water resources applications, environmental studies, and disaster management applications

TEXT BOOKS:

1. Remote Sensing and Image Interpretation, Lillesand T. M. & Kiefer R. W., John Wiley and Sons, 2008
2. Introduction to Geographic Information Systems, Kang-Tsung Chang, 7th Edition, McGraw-Hill Education (Indian Edition), 2015

REFERENCES:

1. Geographical Information System, Thanappan Subash, Lambert Academic Publishing, 2011
2. Textbook of Remote Sensing and Geographical Information Systems, M. Anji Reddy, 4th Edition, B.S. Publications, 2012
3. Remote Sensing and GIS, Basudeb Bhatta, 2nd Revised Edition, Oxford University Press, 2011
4. Textbook of Remote Sensing and Geographical Information Systems, Kali CharanSahu, 1st Edition, Atlantic Publishers and Distributors, 2007

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

(18PE1CE20) SUBSURFACE INVESTIGATION AND INSTRUMENTATION

COURSE OBJECTIVES:

- To apply the various methods of geotechnical investigation and the field tests based on field conditions
- To develop clear idea about planning and execution of geotechnical investigation programme
- To analyze and take proper engineering decisions in practical situations
- To gain the knowledge about the instrumentation for critical sites

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Examine subsurface investigation based on the requirement of civil engineering project and site condition
CO-2: Execute different subsurface exploration tests, collect disturbed/undisturbed samples for laboratory tests and can suggest design parameters
CO-3: Understand various methods for estimation of dynamic soil properties required for design purpose
CO-4: Develop instrumentation scheme for monitoring of critical sites

UNIT – I:
Planning an Investigation Programmes: Factors to be considered; Exploration for preliminary and detailed design; Guidelines for location, depth and spacing of drilling bore holes

UNIT – II:
Exploration Techniques: Methods of Boring, Accessible exploration and Semi-direct methods, Machinery used for drilling and applicable soil types; Stabilization of boreholes.

UNIT – III:
Sampling: Disturbed and undisturbed soil sampling, representative samples; Methods to minimize sample disturbance; Types of samplers; Preservation and handling of samples, Ground water observations, Borehole logging.

UNIT – IV:
Field Tests: Standard Penetration Test; Dynamic and static cone penetration tests; Pressure meter test; Field vane shear; Field permeability test; Soil Investigation report

UNIT – V:
Instrumentation: Settlement gauges, Inclinometers, Stress measurements, Seismic measurements and Pore pressure measurements.

UNIT – VI:
Geophysical Methods: Geophysical methods-types-Seismic Methods – Electrical Resistivity Methods – Electrical Profiling Method – Seismic refraction method – Sub-soil Investigation Report

TEXT BOOKS:

1. Foundation Analysis and Design, Bowles J. E., McGraw-Hill International Edition, 1997
2. Advanced Soil Mechanics, Das B. M., 2nd Edition, Taylor and Francis, Washington, DC, 1997
3. Soil Mechanics & Foundation Engineering, Purushothama Raj P., Pearson Education India, 2008

REFERENCES:

1. Principles of Geotechnical Engineering, Braja M. Das, 7th Edition, Cengage Learning Inc, Stamford, USA, 2010
2. Ground Property Characterization from In-Situ Testing, M. D. Desai, IGS-Surat Chapter, 2005
3. Geotechnical Engineering Investigation Manual, Hunt R. E., 2nd Edition, McGraw-Hill, New York, 2005
4. American Society of Civil Engineers: Soil sampling, 1999
5. Engineering Properties of Soil and Their Measurements, Bowles B., McGraw-Hill Companies, 1992

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

(18PC2CE08) CAD AND GIS LABORATORY

CAD LABORATORY

COURSE OBJECTIVES:
- To understand the GUI of the analysis package
- To create geometries using preprocessor
- To analyze and Interpret the results using post processor
- To design the structural elements

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Model the geometry of real world structures
CO-2: Analyze the structure for various loads
CO-3: Interpret the results using Post processing
CO-4: Design the Concrete & Steel structural elements as per IS Codes
1. Analysis of determinate beams
2. Analysis of indeterminate beams
3. Analysis of portal frames
4. Analysis and Design of steel angular truss
5. Analysis of multistory RC building for gravity loads
6. Design of beams and columns of a multistory RC Building

Software: Staad Pro or Equivalent software for structural analysis and design

GIS LABORATORY

COURSE OBJECTIVES:
- To explain the process of visual image interpretation
- To explore various tools available in GIS software
- To acquire knowledge on creating maps with GIS software, data entry and editing it
- To perform overlay analysis, buffering and DEM analysis.

COURSE OUTCOMES: After the completion of the course, student should be able to
CO-1: Identify different objects and components present in an image using visual image interpretation technique
CO-2: Create a new digitized map for a given toposheet, entry of relevant data and editing it
CO-3: Do the **Analysis** of attribute and spatial query for a given set of vector data
CO-4: Apply the concepts of overlay analysis, buffering and DEM analysis for a real world problem

REMOTE SENSING:
1. Arial photograph interpretation
2. Visual interpretation of multispectral and panchromatic image
3. Image classification, supervised and unsupervised classifications
4. Change detection from multi-date imagery

GIS:

1. Analog to Digital Conversion – Scanning methods
2. Introduction to software
3. Digital database creation – Point features, Line features, Polygon features
4. Data Editing-Removal of errors – Overshoot and Undershoot, Snapping
5. Data Collection and Integration, Non-spatial data attachment working with tables
6. Dissolving and Merging
7. Clipping, Intersection and Union
8. Buffering techniques
9. Spatial and Attribute query and Analysis
10. DEM

Software: Remote Sensing and GIS Software

REFERENCES:

1. Remote Sensing and Image Interpretation, Lillesand T. M. and Kiefer R. W., John Wiley and Sons
2. ArcGIS 10.1 User Manuals, 2013
3. ERDAS Imagine 2013 User Manual
4. QGIS User Manual

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

(18PC2CE09) ENVIRONMENTAL ENGINEERING LABORATORY

COURSE OBJECTIVES:

- To understand the concepts of water testing
- To acquire the principles of wastewater testing
- To apply the concepts of experimentation on biological parameters
- To conduct the experimentation on air pollution parameters

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the water quality parameters from different sources
CO-2: Detect the waste water quality parameters from different sources
CO-3: Analyze the biological parameters of water/waste water from different sources
CO-4: Detect the air quality parameters at various places

LIST OF EXPERIMENTS:

Experiments on Water Testing:

1. Examine the pH for the given water and soil samples.
2. Determination of conductivity.
3. Examine the turbidity for the given water and soil samples.
4. Investigate the hardness for the given water samples.
5. Test the Acidity for the given water samples.
6. Determination of Alkalinity for the given water samples.
7. Perform the Residual Chlorine test for the given water samples.
8. Determination of Iron and Manganese
9. Test the Sulphate for the given water samples.
10. Examine the Chloride, Nitrates, Fluorides and Ammonia for the given water samples.
11. Determination of optimum dosage of coagulant using Jar test (flocculation test).

Experiments on Wastewater Testing:

12. Examination of Solids: Total Solids, Settleable Solids, Suspended solids, Dissolved solids.
13. Investigation of Dissolved Oxygen.
14. Estimation of Biochemical Oxygen Demand.
15. Determination of Chemical Oxygen Demand.

Experiments on Air Pollution Parameters:

16. Determination of PM10 in air by using respirable dust sampler.
17. Conduction of experiment to find the concentration of CO and CO2 by using indoor air quality monitor.

TEXT BOOKS:

1. Environmental Engineering Laboratory Manual, Dr. B. Kotaiah and Dr. N. Kumara Swamy, Charotar Publishing House Pvt. Ltd.

2. Standards Methods for the Examination of Water and Wastewater, 23rd Edition, APHA, AWWA and WEF, USA, 2017
3. Chemistry for Environmental Engineering and Science, Clair Sawyer and Perry McCarty and Gene Parkin, McGraw-Hill Series in Civil and Environmental Engineering

REFERNECES:

1. Guide Manual: Water & Wastewater Analysis, Central Pollution Control Board, Govt. of India
2. Environmental Engineering, Garg S. K., Vol. I Khanna Publishers, New Delhi, 2005
3. Environmental Engineering, Garg S. K., Vol. II, Khanna Publishers, New Delhi, 2003

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

(18PW4CE04) 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**

(18PE1CE21) ROCK MECHANICS

COURSE OBJECTIVES:
- To understand the concepts of Rock Mechanics and various terminology involved
- To conduct experiments as well as to analyze and interpret data related to the rock mechanics
- To impart the understanding of the basic principles, latest developments on real world problems
- To connect the theoretical knowledge to real life problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: understand the formation of rocks and its properties
CO-2: Determine different engineering properties of rock
CO-3: Relate to the latest trends, modern standards and state-of-the-art techniques for understanding rock mechanics and engineering
CO-4: Predict the mode of failure of Rock Structures and to implement appropriate preventive measures

UNIT – I:
Introduction to Rock Mechanics: Development of rock mechanics - problems of rock mechanics - applications and scope of rock mechanics - Classification by Rock Quality Designation - Rock structure Rating - Geomechanics and NGI classification systems.

UNIT – II:
Laboratory Testing: Rock sampling - Determination of density - Porosity and Water absorption - Uniaxial Compressive strength - Determination of elastic parameters - Tensile strength - Shear Strength - Flexural strength - Strength criterion in rocks - Swelling and slake durability - Permeability - Point load strength - Dynamic methods of testing - Factors affecting strength of rocks.

UNIT – III:
In – situ Testing: Necessity and Requirements of in - situ tests - Types of in - situ tests - Flat jack Technique - Hydraulic Fracturing Technique - Plate Load Test - Shear Strength Test - Radial Jack Test - Goodman Jack Test and Dilatometer Test.

UNIT – IV:
Methods of Improving Rock Mass Properties: Rock Reinforcement - Rock bolting - Mechanism of Rock bolting - Principles of design - Types of rock bolts. Pressure grouting - grout curtains and consolidation grouting.

UNIT – V:
Stability of Rock Slopes: Causes of landslides - Modes of failure - Methods of analysis - Prevention and control of rock slope failure - Instrumentation for Monitoring and Maintenance of Landslides.

UNIT – VI:

Foundations on Rock: Shallow foundations - Pile and well foundations - Basement excavation - Foundation construction - Allowable bearing pressure.

Tunnels: Rock stresses and deformation around tunnels - Rock support interaction - Tunnel driving methods - Design of tunnel lining.

TEXT BOOKS:

1. Introduction to Rock Mechanics, Goodman, 2nd Edition, Wiley, 1989
2. Engineering in Rocks for Slopes, Foundations and Tunnels, Ramamurthy T., 3rd Edition, Prentice Hall of India, PHI Learning Pvt. Ltd., 2014
3. Fundamentals of Rock Mechanics, Jaeger J. C. and Cook N. G. W., 3rd Edition,Chapman and Hall, London, 1979

REFERENCES:

1. Underground Excavation in Rock, Hoek E. and Brown E. T., 1982
2. Rock Mechanics for Underground Mining, Brady B. H. G. and Brown E. T., 3rd Edition, Chapman & Hall, Springer Science & Business Media, 2007
3. Engineering Rock Mass Classification, Singh Bhawani, Goel R. K., Elsevier, 2011

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

(18PE1CE22) PRE-ENGINEERED BUILDINGS

COURSE OBJECTIVES:

- To distinguish between conventional steel buildings and PEB's
- To identify the Pre-Engineered Building components
- To estimate the loads on Pre-Engineered Buildings
- To identify the various design parameters of PEB frames

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the functions of Primary system, Secondary system and Bracing system of PEB components
CO-2: Calculate the Dead, Live, Wind and Seismic loads acting on PEB's
CO-3: Check the structural stability of PEB's
CO-4: Analyze and Design the PEB's

UNIT – I:
Introduction to Pre-Engineered Buildings: Introduction – History - Advantages of PEB - Applications of PEB – Materials used for manufacturing of PEB - Differences between Conventional Steel Buildings and Pre-Engineered Buildings.

UNIT – II:
Pre-Engineered Building Components:
Primary System: Main frames, Gable End frame - Secondary system: Sizes and Properties of Purlins & Girts – Bracing System: Rod, angle, Portal, Pipe bracing – Sheeting and Cladding: Roof Sheeting and Wall sheeting – Accessories: Turbo Ventilators, Ridge vents, Sky Lights, Louvers, Insulation, Stair cases.

UNIT – III:
Design Loads on Pre-Engineered Buildings: Design of PEB frame under the influence of Dead, Live, Collateral, Wind, Seismic and other applicable Loads - Serviceability limits as per code.

UNIT – IV:
PEB Design Methodology: Design parameters of PEB frames - Depth of the section, Depth to Flange width ratios, Thickness of Flange to Thickness of Web ratios of sections as per IS code - Section sizes as per manufacturing limitations.

UNIT – V:
Structural Stability System of PEB: Shear buckling effect (d/t ratio exceeding 67ε) - Effective cross-sectional area concept for compression members (d/t ratio exceeding 42ε) - Effect of d/t ratio for flexural members according to section classifications - Bracing system: Flange Bracing, Rod Bracing, Angle Bracing, Portal Bracing.

UNIT – VI:
Analysis and Design of Pre-Engineered Buildings: Analysis and Design of Rigid Frames - Rigid Frame Moment Connection, Shear Connection - Anchor bolt and base plate design (Pinned and Fixed)

TEXT BOOKS:

1. Pre-Engineered Steel Building, K. S. Vivek und P. Vyshnavi, LAP Lambert Academic Publishing
2. Metal Building Systems: Design and Specifications, Alexander Newman, McGraw-Hill Publications

REFERENCES:

1. Pre-Engineered Metal Building Iron Worker, Red-Hot Careers, Create Space Independent Publishing Platform
2. Pre-Engineered Metal Building Systems, Labsori

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

(18PE1CE23) PAVEMENT ANALYSIS DESIGN AND EVALUATION

COURSE OBJECTIVES:

- To understand the characterization of materials and factors affecting pavement design
- To estimate the stresses and strains in flexible and rigid pavement
- To carry out the design of flexible and rigid pavements
- To identify the overlay thickness for strengthening of pavement

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify the pavement components with respect to their material composition
CO-2: Analyze the stresses and strains in a flexible pavement using multi-layered elastic theory
CO-3: Design a flexible and rigid pavement using MEPDG and IRC guidelines
CO-4: Estimate overlay thickness for strengthening the existing pavement

UNIT – I:
Pavement Types, Materials and Factors Affecting Pavement Design: Types and component of pavements; basic characteristics of materials used in pavements.
Variables considered in pavement design; classification of axle types, standard and legal axle loads, tyre pressure, contact pressure, ESWL, EWLF and EAL concepts; traffic analysis: ADT, AADT, truck factor, growth factor, lane distribution factor, directional distribution factor and vehicle damage factor.

UNIT – II:
Stresses in Flexible Pavements: Layered system concepts; stress solution for one, two- and three-layered systems; fundamental design concepts; stress analysis in flexible pavements; Viscoelastic theories.

UNIT – III:
Stresses in Rigid Pavements: Westergaard's theory and assumptions; Stresses due to curling, stresses and deflections due to loading, frictional stresses; Stresses in dowel bars and tie bars; Stress analysis in rigid pavements.

UNIT – IV:
Design of Flexible Pavements: IRC method of flexible pavement design – IRC 37 2018; method of flexible pavement design.
Introduction to Mechanistic-Empirical Pavement Design Guide - MEPDG

UNIT – V:
Design of Rigid Pavements: Calibrated Mechanistic Design Process, IRC method of plain jointed rigid pavement design; AASHTO method of rigid pavement design; Design of dowel bar and design of tie bars.

UNIT – VI:

Pavement Overlays & Design: Pavement Overlays, Design of Flexible Overlay over Flexible Pavement by Benkelman Beam Deflection and other Methods, Flexible Overlays and Rigid Overlays over Rigid Pavements. Concept of White topping, Design of overlay using White topping

TEXT BOOKS:

1. Pavement Analysis and Design, Huang Y. H., 2nd Edition, Dorling Kindersley (India) Pvt. Ltd., New Delhi, India, 2008
2. Pavement Design and Materials, Papagiannakis A. T. and E. A. Masad, John Wiley and Sons, New Jersey, USA, 2008
3. Principles of Transportation Engineering, ParthaChakroborty and Animesh Das, Prentice Hall of India Pvt. Ltd., New Delhi, India, 2017

REFERENCES:

1. Asphalt Institute Thickness Design – Asphalt Pavements for Highways and Streets Manual Series No. 1 (MS-1), Asphalt Institute, Kentucky, USA, 1999
2. Principles of Pavement Design, Yoder E. J. and Witczak M. W., 2nd Edition, Wiley, NY, USA, 1975
3. IRC: 37-2018, Guidelines for the Design of Flexible Pavements, The Indian Roads Congress, New Delhi, India, 2018
4. IRC: 58-2015, Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, The Indian Roads Congress, New Delhi, India, 2015

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

(18PE1CE24) INDUSTRIAL WASTEWATER TREATMENT

COURSE OBJECTIVES:

- To understand the Industrial wastewater sources, regulations, toxicity and pollution prevention
- To define the treatment process and reuse of industrial wastewater
- To recognize the principles of sludge treatment process and management
- To interpret the various industrial manufacturing process, wastewater characteristics and source reduction options

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the knowledge of Industrial wastewater sources, regulations, and pollution prevention
CO-2: Impart the knowledge of treatment process and reuse of industrial wastewater
CO-3: Apply the gained knowledge of principles of sludge treatment process and management
CO-4: Carryout the concept of various industrial manufacturing process description, wastewater characteristics and source reduction options

UNIT – I
Introduction: Industrial scenario in India– Industrial activity and Environment - Uses of Water by industry – Sources and types of industrial wastewater – Nature and Origin of Pollutants - Industrial wastewater and environmental impacts – Regulatory requirements for treatment of industrial wastewater – Industrial waste survey – Industrial wastewater monitoring and sampling - generation rates, characterization and variables –Toxicity of industrial effluents and Bioassay tests – Major issues on water quality management.

UNIT – II:
Industrial Pollution Prevention: Prevention and Control of Industrial Pollution – Benefits and Barriers – Waste management Hierarchy - Source reduction techniques – Pollution Prevention of Assessment - Material balance - Evaluation of Pollution prevention options – Cost benefit analysis – payback period - Waste minimization Circles.

UNIT – III:
Industrial Wastewater Treatment: Equalization - Neutralization – Oil separation – Flotation – Precipitation – Heavy metal Removal– Aerobic and anaerobic biological treatment – Sequencing batch reactors – High Rate reactors - Chemical oxidation – Ozonation – carbon adsorption - Photocatalysis – Wet Air Oxidation – Evaporation – Ion Exchange – Membrane Technologies – Nutrient removal - Treatability studies.

UNIT – IV:
Wastewater Reuse: Individual and Common Effluent Treatment Plants – Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse – Industrial reuse and its Present status and

issues - Disposal on water and land – Residuals of industrial wastewater treatment – Management of RO rejects.

UNIT – V:

Sludge Management and Treatment: Sludge quantity and characteristics - stabilization and dewatering - sludge freezing - reed beds - vermi stabilization - comparison of bed type operations - composting land application and surface disposal of bio solids onsite wastewater systems - effluent disposal and reuse.

UNIT – VI:

Case Studies: Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing – Oil Refining – Pharmaceuticals – Sugar and Distilleries.

TEXT BOOKS:

1. Industrial Water Pollution Control, Eckenfelder W. W., McGraw-Hill, 2000
2. Industrial waste treatment Handbook, Frank Woodard, Butterworth Heinemann, New Delhi, 2001

REFERENCES:

1. Industrial Waste Treatment – Contemporary Practice and Vision For The Future, Nelson Leonard Nemerow, Elsevier, Singapore, 2007
2. Pollution Prevention and Abatement Handbook – Towards Cleaner Production, World Bank and UNEP, Washington DC., 1998
3. Pollution Prevention: Fundamentals and Practice, Paul L. Bishop, McGraw-Hill International, Boston, 2000
4. Wastewater Treatment for Pollution Control and Reuse, Soli J. Arceivala, Shyam R. Asolekar, Tata McGraw-Hill, 2007

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

(18PE1CE25) STRUCTURAL HEALTH MONITORING

COURSE OBJECTIVES:
- To understand the concepts of health monitoring
- To assess the structural health of the structures using static and dynamic field methods
- To suggest the possible repair and rehabilitation methods
- To perform the Structural Auditing after the investigation

COURSE OUTCOMES: After the completion of the course student should be able to
CO-1: Diagnosis the distress in the structure understanding the causes and factors
CO-2: Assess the health of structure using static field methods
CO-3: Assess the health of structure using dynamic field tests
CO-4: Suggest repairs and rehabilitation measures of the structure

UNIT – I:
Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance

UNIT – II:
Structural Health Monitoring: Concepts, Various Measures, Structural Safety in Alteration.

UNIT – III:
Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

UNIT – IV:
Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.

UNIT – V:
Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response
Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health monitoring.

UNIT – VI:
Introduction to Repairs and Rehabilitations of Structures: Case Studies, piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

TEXT BOOKS:
1. Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, John Wiley and Sons

2. Health Monitoring of Structural Materials and Components - Methods with Applications, Douglas E. Adams, John Wiley and Sons

REFERENCES:

1. Structural Health Monitoring and Intelligent Infrastructure, Vol.1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis
2. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press

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

(18PE1CE26) GROUND IMPROVEMENT TECHNIQUES

COURSE OBJECTIVES:
- To learn various ground improvement techniques
- To understand methods of compaction for ground improvement
- To explain various physical and chemical modification for ground improvement
- To choose the foundation and/or treatment method based on the site condition

COURSE OUTCOMES: After the completion of the course student should be able to
CO-1: Understand different techniques of ground improvement techniques based on the various types of in-situ soils
CO-2: Select the suitable and economical ground improvement technique which is for soil strengthening
CO-3: Design and construction of reinforced earth structures
CO-4: Apply knowledge of ground improvement techniques to various types of in-situ soils

UNIT – I:
Introduction to Ground Modification: In-situ densification methods- Granular soils - Vibration and Impact at the Ground surface and depth. Cohesive soils-Preloading, Dewatering, Drain wells, Sand drains, Sandwich geo-drains, Prefabricated Vertical drains (PVD), Vacuum consolidation, Stone columns, Lime columns, Thermal methods.

UNIT – II:
Expansive Soils: Problems in Expansive soils, Mechanism of swelling, swell pressure, swell potential, Heave, Tests for identification, I. S. Test Methods of determination of swell pressure, Foundation techniques in Expansive soils.

UNIT – III:
Mechanical Stabilization: Soil aggregate mixtures, Properties and proportioning techniques, soft aggregate stabilization, compaction, Field compaction control.

UNIT – IV:
Chemical Stabilization: Cement and lime–Mechanism, Factors affecting and properties, Construction techniques. Uses of modern additives.

UNIT – V:
Reinforced Earth: Principles, Components of reinforced earth walls, Factors governing design of reinforced earth walls, Design principles of reinforced earth walls. Introduction to geotextiles and geomembranes, Functions and applications of geotextiles.

UNIT – VI:
Grouting and Nailing: Mechanism, Factors affecting, Construction methods. Grouting materials, Soil nailing.

TEXT BOOKS:

1. Ground Improvement Techniques, Dr. G. V. R. Purshotham Raj, Laxmi Publications
2. Ground Improvement Techniques, Bikash Chandra Chattopadhyay, JoyantaMaity, PHI Learning Pvt. Ltd
3. Designing with Geosynthetics, Robert M. Koerner, Vol. 1, 6th Edition, Kindle Edition

REFERENCES:

1. Ground Improvement, Moseley M. P., Blackie Academic and Professional, Boca Taton, Florida, USA
2. Ground Control and Improvement, Xanthakos P. P., Abramson L. W. and Brucwe D. A., John Wiley and Sons
3. Principles and Practice of Ground Improvement, Jie Han, Wiley India

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

(18PE1CE27) PRE-STRESSED CONCRETE

COURSE OBJECTIVES:

- To describe the necessity of pre-stressed concrete structures and various techniques of pre-stressing
- To develop an understanding of various losses & Deflections in pre-stress members
- To develop an understanding of the analysis of pre-stressed concrete members
- To develop an understanding of the analysis of Composite members

COURSE OUTCOMES: After the completion of the course student should be able to
CO-1: Acquire the knowledge of evolution of process of pre-stressing
CO-2: Acquire the knowledge of various pre-stressing techniques
CO-3: Develop skills in analysis of pre-stressed concrete beams, and slabs
CO-4: Develop skills to satisfy the serviceability and strength provisions of the Indian Standards (IS: 1343-2012

UNIT – I:
Introduction: Historic development – General principles of pre-stressing pretensioning and post tensioning, Advantages and limitations of pre-stressed concrete, Materials – High strength concrete and high tensile steel, their characteristics. I.S.Code provisions,

UNIT – II:
Pre-Stressing Techniques: Methods and Systems of Pre-stressing; Pre-tensioning and post tensioning methods, Analysis of post tensioning, Different systems of pre-stressing like Hoyer System, Magnel System Freyssinet system and Gifford, Udall System.

UNIT – III:
Losses of Pre-Stress: Loss of pre-stress in pre-tensioned and post-tensioned members due to various causes like elastic shortening of concrete, shrinkage of concrete, creep of concrete, Relaxation of steel, slip in anchorage bending of member and frictional losses.

UNIT – IV:
Analysis of Sections for Flexure: Elastic analysis of concrete beams pre-stressed with straight, concentric, eccentric, bent and parabolic tendons.

UNIT – V:
Deflections of Pre-Stressed Concrete Beams: Importance of control of deflections – factors influencing deflections – short term deflections of uncracked members prediction of long term deflections.

UNIT – VI:
Composite Section: Introduction – Analysis of stress – Differential shrinkage – General designs considerations.

TEXT BOOKS:

1. Prestressed Concrete, Krishna Raju, 4th Edition, Tata McGraw-Hill Publications, 2006
2. Pre-stressed Concrete, N. Rajagopalan, 2nd Edition, Narosa Publications, 2014

REFERENCES:

1. Pre-stressed Concrete Structures, P. Dayaratnam, 4th Edition, Oxford & IBH Publishers
2. Design of Pre-stressed Concrete Structures, T. Y. Lin & N. H. Burns, 3rd Edition, John Wiley & Sons, 2005
3. Pre-stressed Concrete Structures, M. K. Hurst, 2rnd Edition, Tata McGraw-Hill Publications, 2009
4. Pre-stressed Concrete, Ramamrutham, 2nd Edition, Dhanpat Rai & Sons Publications, 2005
5. Pre-stressed Concrete, K. U. Muthu, Agmil Ibrahim, MagantiJanardhana, M. Vijayanand, PHI Publishers, 2016

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

(18PE1CE28) INTELLIGENT TRANSPORTATION SYSTEMS

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 – Road side 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:
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:
Automated Highway System: 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 Hand Book 2000: Recommendations for World Road Association (PIARC), Kan Paul Chen, John Miles

2. Intelligent Transport Systems – Cases and Policies, Roger R. Stough, Edward Elgar, 2001
3. Intermodal Freight Transport, David Lowe, Elsevier Butterworth-Heinemann, 2005

REFERENCES:

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

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B.Tech. VIII Semester

L	T/P/D	C
3	0	3

(18PE1CE29) CONSTRUCTION TECHNOLOGY AND PROJECT MANAGEMENT

COURSE OBJECTIVES:

- To learn the fundamentals of construction laws
- To know the fundamentals of construction safety
- To understand various equipment's used in construction
- To practice project planning

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Differentiate between different construction equipment
CO-2: Prepare Plan and control resources of projects
CO-3: Prepare Construction Schedule by using different methods
CO-4: Understand and apply ISO 9000 standards to projects

UNIT – I:
Fundamentals of Construction Technology: Introduction to construction Project, Construction activities, phases and processes, Construction schedule, construction records, documents, Quality, Safety, codes and regulations.

UNIT – II:
Construction Equipment: Earthwork, piling, concrete and concreting, formwork, fabrication and erection, Mechanized construction and productivity, equipment economics, excavators, Rollers, Dozers, Scrapers, Handling equipment, concrete equipment, cranes, draglines and clamshells.

UNIT – III:
Quality and Safety: Quality control, Assurance and safety, ISO 9000, quality systems, principles on safety, personnel, fire and electrical safety, environment protection, Concept of green building.

UNIT – IV:
Construction Management: Types of contracts, contract document, Estimating, Tendering, Bidding, and Procurement process, Construction planning, Project planning techniques, Planning of manpower, material, equipment and finance.

UNIT – V:
Networking Methods: Project scheduling, Fundamentals of network, Program Evaluation and Review Technique, Critical Path Method, Resource leveling and smoothing

UNIT – VI:
Claim Management: Construction claims, Dispute and project closure, Source of claim, Claim management, Dispute Resolution, Arbitration, Construction Closure, Contract Closure, Documentation.

TEXT BOOKS:

1. Construction Technology, Subir K. Sarkar, SubhajitSaraswati, Oxford University Press, 2008
2. Construction Project Management Theory and Practice, Neeraj Jha, Pearson Education, 2011

REFERENCES:

1. Project Planning and Control with PERT and CPM, B. C. Punmia, K. K. Khandelwala, Laxmi Publication, 2011
2. Construction Project Management, K. K. Chitkara, Tata McGraw-Hill Education Private Limited, 2010
3. Construction Planning & Management, U. K. Srivastava, Galgotia Publications, 2013
4. Construction Planning Equipment and Methods, Peurifacy, Schexnayder, Sharpira TMH, 2010

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

(18PE1CE30) RAILWAY, AIRPORT AND HARBOUR ENGINEERING

COURSE OBJECTIVES:
- To impart knowledge on the components related to railway track along with the conceptual design
- To introduce the fundamental concepts on track signaling, metro rail and high-speed tracks
- To explain the characteristics of aircrafts related to airport design
- To understand the concepts related to water transportation and discuss the importance of docks and harbors in development

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify the functions and requirements related to railway track
CO-2: Describe the concepts of track signaling and modern railway system
CO-3: Elaborate the factors influencing the aircraft characteristics and its design process
CO-4: Assess the importance of water transportation and discuss the developments of dock and harbor

UNIT – I:
Railway Planning: Introduction to Railways- Role of Indian Railways in national development, Railways in Urban Transportation – Concepts of LRT, Mono Rail, Metro Rail and MMTS.
Permanent Way: Rail components and their Functions - Types of Rails, Joints, Rail Fastenings, Gauges, Coning of Wheels, Creep theory- Sleepers functions, requirements, types – Ballast, depth of ballast

UNIT – II:
Railway Track Design: Route alignment, Engineering Surveys, Gradients- Cant and Negative cant-Degree of Curve, Safe speed- Curve design on track – extra clearance on curves – widening of gauge on curves – vertical curves – cheek rails importance.

UNIT – III:
Track Operation and Maintenance: Track layouts – Points and Crossings, crossing types Turnouts – Layout of Turnout- Signal Objectives – Classification, signaling systems – System for Controlling Train Movement –Interlocking concepts–Modern signaling installations- Track Circuiting - Track Maintenance

UNIT – IV:
Airport Planning: Air transport characteristics – airport classifications objectives, layout characteristics, criteria for airport site selection – Taxiway – Hanger – Parking and circulation area, airport zones and laws-terminal area and Airport layout.

UNIT – V:
Runway Design: Orientation of Runway, Wind Rose Diagram- runway length design and corrections, Pavement design principles, Elements of Taxiway Design, Runway and Taxiway Markings and lighting

UNIT – VI:

Dock and Harbour Engineering: Water Transportation: Types of water transportation – Ports and harbours: requirements, classification – Harbour components - breakwaters, jetties, fenders, piers, wharves, dolphins- Navigational aids, types, requirements- Docks– dry docks, wet docks, slipways, lock gates, Dredging – classification, dredgers - Port facilities – general layout, development, planning, facilities, terminals.

TEXT BOOKS:

1. Railway Engineering, S. C. Saxena and S. Arora, Dhanpat Rai and Sons, 2007
2. Railway Engineering, Satish Chandra and M. M. Agarwal, 2nd Edition, Oxford, 2013
3. Airport Planning and Design, S. K. Khanna & M. G. Arora, Nem Chand & Bros, 2012

REFERENCES:

1. Docks and Harbor Engineering, Bindra S. P., Dhanpat Rai Publications, 2012
2. Railway Engineering, Rangwala, Charotar Publishing House Pvt. Ltd., 2017
3. Air Transportation Planning and Design, Virendhra Kumar & Satish Chandra, Gal Gotia Publications Pvt. Ltd., 1999
4. Harbour, Dock and Tunnel Engineering, R. Srinivasan, Charotar Publishing House Pvt. Ltd., 2016
5. Dock and Harbour Engineering, Seetharaman S., Umesh Publications, New Delhi, India, 1999

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

(18PW4CE05) MAJOR PROJECT PHASE-I

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

(18PW4CE06) 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.