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

| Course Code | Title of the Course | L | T | P/D | Contact Hours/ Week | Credits |
|---|---|---|---|---|---|---|
| 18PC1IT08 | Data Analytics | 2 | 1 | 0 | 3 | 3 |
| 18HS1MG02 | Principles of Management and Organizational Behavior | 3 | 0 | 0 | 3 | 3 |
| | **Professional Elective - III** | | | | | |
| 18PE1CS04 | Software Project Management | | | | | |
| 18PE1CS06 | Scripting Languages | | | | | |
| 18PE1IT07 | Semantic Web | 3 | 0 | 0 | 3 | 3 |
| 18PE1EC08 | Internet of Things | | | | | |
| 18PE1IT08 | Security in E-Commerce | | | | | |
| | **Professional Elective - IV** | | | | | |
| 18PE1IT09 | Design Patterns | | | | | |
| 18PE1CS02 | Augmented Reality and Virtual Reality | | | | | |
| 18PE1IT10 | Ad-hoc and Sensor Networks | 3 | 0 | 0 | 3 | 3 |
| 18PE1CS16 | Natural Language Processing | | | | | |
| 18PE1IT11 | Network Management System | | | | | |
| | **Open Elective - III** | 3 | 0 | 0 | 3 | 3 |
| 18PC2IT06 | Data Analytics Laboratory | 0 | 0 | 2 | 2 | 1 |
| 18PW4IT04 | Mini-Project | 0 | 0 | 4 | 4 | 2 |
| 18PW4IT05 | Major Project Phase - I | 0 | 0 | 8 | 8 | 4 |
| **Total** | | **14** | **1** | **14** | **29** | **22** |

| Course Category | Title of the Course | L | T | P/D | Contact Hours/ Week | Credits |
|---|---|---|---|---|---|---|
| | **Professional Elective – V** | | | | | |
| 18PE1IT12 | Distributed Systems | 3 | 0 | 0 | 3 | 3 |
| 18PE1CS10 | Neural Networks and Deep Learning | | | | | |
| 18PE1CS12 | Quantum Computing | | | | | |
| 18PE1IT13 | Network Security | | | | | |
| 18PE1IT14 | Advanced Databases | | | | | |
| | **Professional Elective – VI** | | | | | |
| 18PE1IT15 | Data Visualization | 3 | 0 | 0 | 3 | 3 |
| 18PE1CS14 | Information Retrieval Systems | | | | | |
| 18PE1IT16 | Software Defined Networks | | | | | |
| 18PE1CS17 | Distributed Trust and Blockchain Technologies | | | | | |
| 18PE1CS19 | Cognitive Engineering | | | | | |
| | **Open Elective – IV** | 3 | 0 | 0 | 3 | 3 |
| 18PW4IT06 | Major Project Phase - II | 0 | 0 | 12 | 12 | 6 |
| **Total** | | **9** | **0** | **12** | **21** | **15** |

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

**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 **(18OE1EC01)** | Introduction to Microcontrollers and Interfacing **(18OE1EC02)** | IoT Protocols and its Applications **(18OE1EC03)** | Wireless Sensor Networks **(18OE1EC08)** |
| **Augmented Reality (AR) / Virtual Reality (VR) (ECE)** | Introduction to C Sharp **(18OE1EC04)** | Introduction to Signal Processing **(180E1EC05)** | Introduction to Image and Video Processing **(18OE1EC06)** | 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:**

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

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| B.Tech. VII Semester | L | T/P/D | C |
|---|---|---|---|
| | 2 | 1 | 3 |

## (18PC1IT08) DATA ANALYTICS

**COURSE OBJECTIVES:**
- To explore basics of R
- To understand linear and logistic regression
- To explore decision tree and text mining

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Exploring R to load, explore data and to use in data analytics
**CO-2:** Analyzing linear and logistic regression techniques
**CO-3:** Exploring decision tree, clustering and text mining algorithms
**CO-4:** Analyze Time Series models

**UNIT – I:**
**Introduction to R:** Introduction, Downloading and Installing R, IDEs and Text Editors, Handling Packages in R.Getting Started with R: introduction, working with Directory, Data Types in R, Few Commands for Data Exploration,

**UNIT – II:**
**Loading and Handling Data in R:** Introduction, Challenges of Analytical Data Processing, Expression, Variables and Functions, Missing Values Treatment in R, Vectors, Matrices, Factors, List, Few common Analytical Tasks, Aggregating and Group Processing of a Variable, Simple Analysis Using R, Methods for Reading Data, Comparison of R GUIs for Data Input, Using R with Databases and Business Intelligence Systems.
**Exploring Data in R:** Introduction, Data Frames, R Functions for Understanding Data in Data Frames, Load Data Frames, Exploring Data, Data Summary, Finding the Missing Values, Invalid Values and Outliers, Descriptive Statistics, Spotting Problems in Data with Visualisation

**UNIT – III:**
**Linear Regression using R:** Introduction, Model Fitting, Linear Regression, Assumptions of Linear Regression, Validating Linear Assumption.
**Logistic Regression:** Introduction What is Regression, Introduction to Generalised Linear Models, Logistic Regression, Binary Logistic Regression, Diagnosing Logistic Regression, Multinomial Logistic Regression Models.

**UNIT – IV:**
**Decision Tree:** Introduction, What is a Decision Tree, Decision Tree Representation in R, Appropriate Problems for Decision Tree Learning, Basic Decision Tree Learning Algorithm, Measuring Features, Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Why Prefer Short Hypotheses, Issues in Decision Tree Learning.
**Association Rules:** Introduction, Frequent Itemset, Data Structure Overview, Mining Algorithm Interfaces, Auxiliary Functions, Sampling from Transaction, Generating Synthetic Transaction Data.

**UNIT – V:**

**Time Series in R:** Introduction, what is Time Series Data, Reading Time Series Data, Plotting Time series Data, Decomposing Time Series Data, Forecasts Using Exponential Smoothing, ARIMA Models, Case Study: Insurance Fraud Detection.

**Clustering:** introduction, what is clustering, basic concepts in clustering, Hierarchical Clustering, k-means Algorithm, CURE Algorithm, Clustering in Non-Euclidean Space, Clustering for Streams and Parallelism.

**UNIT – VI:**

**Text Mining:** Introduction, Definition of Text Mining, A Few Challenges in Text Mining, Text Mining vs. Data Mining, Text Mining in R, General Architecture of Text Mining Systems, Pre-processing of Documents in R, Core Text Mining Operations, Using Background Knowledge for Text Mining, Text Mining Query Languages, Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods, Frequent Itemsets, Closed Itemsets and Association Rules, Frequent Itemsets: Mining Methods, Pattern Evaluation Methods, Sentiment Analysis.

**TEXT BOOKS:**

1. Data Analytics using R, Seema Acharya, McGraw Hill Education, 2019
2. R for Data Science, Hadley Wickham, Garrett Grolemund, Import, Tidy, Transform, Visualize, and Model Data, 2016

**REFERENCES:**

1. Data Analytics with R, Bharti Motwani, 2019
2. Data Science-Theory, Analysis and Applications, Qurban A. Memon, Shakeel Ahmed Khoja, 2019

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. VII Semester**
            **L    T/P/D   C**
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## (18HS1MG02) PRINCIPLES OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR

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

**COURSE OBJECTIVES**:
- Understand the principles, functions and theories of management and expose with a systematic and critical understanding of organizational theory, structures and design
- Comprehend the conceptual knowledge relating to Organizational Behaviour.
- Provide a basic understanding of the behavior of individuals and groups in the organizations
- Develop theoretical and practical insights and problem-solving capabilities for effectively managing the organizational processes

**COURSE OUTCOMES**: After completion of the course, the student should be able to
**CO-1:** Apply theories to improve the practice of management and describe and assess the basic design elements of organizational structure and evaluate their impact on employees
**CO-2:** Analyse the behaviour of individuals and groups in organizations in terms of the key factors that influence organizational behaviour
**CO-3:** Appreciate the management challenges associated with high levels of change in the organizations
**CO-4:** Evaluate the appropriateness of various leadership styles, conflict management strategies and motivational strategies used in a variety of organizational settings

**UNIT – I:**
**Introduction to Management:**
**Concepts of Management -** Nature, Importance, and Functions of management; Taylor's Scientific Management Theory; Fayol's Principles of Management; Social Responsibilities of Management; Planning-definition and types of plans; decision making-definition and process
**Organizing –** Definition and Principles of Organization; Organization chart; Types of mechanistic and organic structures of organization - Line Organization, Line And Staff Organization, Functional Organization, Committee Organization, Matrix Organization, Virtual Organization, Cellular Organization, Team Structure, Boundaryless Organization, Inverted Pyramid Structure, And Lean And Flat Organization Structure; features and suitability.

**UNIT – II:**
**Motivation and Leadership:**
**Motivation-** Definition; Theories: Maslow's need of Hierarchy, Herzberg two Factor, Mc Gregor Theory X and theory Y and Alderfer's ERG.
**Leadership-** Definition; Styles and Theories: Trait, Behavioural and Contingency.

**UNIT – III:**
**Introduction to Organizational Behaviour:**
**Organizational Behaviour-** Definition; Historical Background; Nature, Scope and Importance; Linkages with other social Sciences; Approaches and Models.

**UNIT – IV:**
**Perception and Personality:**
**Perception-** Definition; Factors influencing; Perceptual Selectivity; Perceptual Organisation and Social Perception.
**Personality-** Definition; Determinants; Theories; Traits; Big Five Personality Model.

**UNIT – V:**
**Interpersonal Skills:**
**Communication-** Definition; Process; Direction; Interpersonal and Organizational and Barriers.
**Teams and Groups-** Definition; Types of teams and groups; Five-Stage Model; Characteristics of an effective teams; Johari Window & Transactional Analysis

**UNIT – VI:**
**Organizational – Conflict, Stress Management, Change and Development:**
**Organizational Conflict**- Definition; Reasons; Types and Levels; Handling Styles.
**Stress Management**-Definition; Types; Model; Consequences and Strategies to manage
**Organizational Change** - Definition; Types; Resistance; Overcoming and Approaches: Lewin's Three-Step Change Model, Kotter's Eight-Step Plan for Implementing Change.
**Organizational Development**- Definition; Nature and Interventions.

**TEXT BOOKS:**
1. Management, James Arthur, Finch Stoner, R. Edward Freeman, and Daniel R. Gilbert, 6th Edition, Pearson Education/Prentice Hall
2. Organizational Behaviour, Stephen P. Robbins, Prentice Hall, 2013
3. Organizational Behaviour, Fred Luthans, McGraw-Hill, 2013

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

## (18PE1CS04) SOFTWARE PROJECT MANAGEMENT

**COURSE OBJECTIVES:**
- To identify and discuss the conventional and contemporary software project management principles
- To assess and plan project schedule and assign resources
- To apply an appropriate project development methodology among various alternating processes
- To identify project risks, understand the responsibilities, monitor and track project deadlines and the capability to work in a team environment

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Describe the conventional s/w management and explain how to improve s/w economics
**CO-2:** Identify and discuss the key phases of project management and the key skills associated with each
**CO-3:** Relate an appropriate project management approach through an evaluation of context and project scope and knowledge of agile and traditional and Global project management approaches, risk and quality management
**CO-4:** Apply the knowledge of the key project management skills, such as product and work break-down structure, schedule; governance, progress reporting and People Focused Process Models

**UNIT – I:**
**Conventional Software Management:** The waterfall model, conventional software Management performance. Overview of Project Planning – Stepwise Project Planning.
**Improving Software Economics:** Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

**UNIT – II:**
**The Old Way and The New Way:** The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.
**Life Cycle Phases:** Engineering and production stages, Inception, Elaboration, Construction, Transition phases. Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

**UNIT – III:**
**Work Flows of the Process:** Software process workflows, Iteration workflows.
**Checkpoints of the Process:** Major mile stones, Minor Milestones, Periodic status assessments. Globalization Issues in Project management.

**UNIT – IV:**
**Iterative Process Planning:** Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning. Process Automation: Automation Building blocks.

**UNIT – V:**

**Project Control and Process Instrumentation:** The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation. Tailoring the Process: Process discriminants. Emerging Trends in Project Management.

**UNIT – VI:**

**Project Organizations and Responsibilities:** Line-of-Business Organizations, Understanding Behavior – Organizational Behavior

**Future Software Project Management:** Modern Project Profiles, Next generation Software economics, modern process transitions.

**TEXT BOOKS:**

1. Software Project Management, Walker Royce, Pearson Education, 2005
2. Managing and Global Software Project, Ramesh Gopalaswamy, Tata McGraw Hill, 2003

**REFERENCES:**

1. Software Project Management, Bob Hughes and Mike Cotterell, Tata McGraw-Hill Edition
2. Software Project Management, Joel Henry, Pearson Education
3. Software Project Management in practice, Pankaj Jalote, Pearson Education, 2005

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. VII Semester**

| L | T/P/D | C |
|---|-------|---|
| 3 | 0 | 3 |

## (18PE1CS06) SCRIPTING LANGUAGES

**COURSE OBJECTIVES:**
- To appreciate the nature of scripting and the role of scripting languages
- To effectively apply knowledge of scripting to new situations and learn from the experience
- To analyze requirements of software systems for the purpose of determining the suitability of implementation of PERL and Ruby
- To design and implement software solutions that accommodate specified requirements and constraints, based on analysis or modeling or requirements specification

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Distinguish between typical Scripting Languages & system and application programming languages
**CO-2:** Apply the syntax and semantics of languages such as PERL and Ruby for effective scripting
**CO-3:** Develop a Web applications to help in businesses and decision making
**CO-4:** Design and implement the appropriate software solutions using Scripting Languages such as e-commerce, content management, custom database solutions, and prototyping

**UNIT – I:**
**Introduction to Scripting Language:** Scripts and Programs, Origin of Scripting, Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages.

**UNIT – II:**
**Fundamentals of Perl:** PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

**UNIT – III:**
**Advanced Perl:** Finer points of looping, pack and unpack, filesystem, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues.

**UNIT – IV:**
**Facets of Ruby:** Ruby new, Classes, Objects and Variables, Containers, Blocks and Iterators, Standard Types, Methods, Expressions, Exceptions, Catch, And Through, Modules, Basic Input and Output.

**UNIT – V:**
**Ruby in its Setting:** The structure and Execution of Ruby Programs, Package Management with RUBYGEMS, Ruby and web: Writing CGI scripts, cookies, Choice of Webservers, SOAP and webservices

**UNIT – VI:**
**RubyTk** – Simple Tk Application, widgets, Binding events, Canvas, scrolling.
**Extending Ruby:** Ruby Objects in C, the Jukebox extension, Memory allocation, Ruby Type System, Embedding Ruby to Other Languages, Embedding a Ruby Interpreter

**TEXT BOOKS:**
1. The World of Scripting Languages, David Barren, Wiley Publications
2. Programming Ruby, The Pragmatic Programmers Guide, Dabve Thomas, Second Edition

**REFERENCES:**
1. Perl Example, E. Quigley, Pearson Education
2. Programming Perl, Larry Wall, T. Christiansen and J. Orwant, O'Reilly, SPD
3. Ruby Programming Language, David Flanagan and Yukihiro Matsumoto, O'Reilly

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. VII Semester**   **L**   **T/P/D**   **C**
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## (18PE1IT07) SEMANTIC WEB

**COURSE OBJECTIVES:**
- To learn Web Intelligence
- To learn Knowledge Representation for the Semantic Web
- To learn Ontology Engineering
- To learn Semantic Web Applications, Services and Technology

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Understand Semantic Web
**CO-2:** Learn SOAP, UDDI
**CO-3:** Handle multiple web services using Orchestration
**CO-4:** Experiment with XML Technologies
**CO-5:** Construct and use Ontologies

**UNIT – I:**
Introduction to Semantic Web, the Business Case for the Semantic Web, XML and Its Impact on the Enterprise.

**UNIT – II:**
**Web Services:** Uses, Basics of Web Services, SOAP, UDDI, Orchestrating Web Services, Securing Web Services, Grid Enabled and Semantic Web of Web Services.

**UNIT – III:**
**Resource Description Framework:** Features, Capturing Knowledge with RDF.
**XML Technologies:** XPath , The Style Sheet Family: XSL, XSLT, and XSLFO, XQuery, XLink, XPointer . XInclude, XMLBase, XHTML, XForms, SVG.

**UNIT – IV:**
**Taxonomies and Ontologies:** Overview of Taxonomies, Defining the Ontology Spectrum, Topic Maps, Overview of Ontologies, Syntax, Structure, Semantics, and Pragmatics, Expressing Ontologies Logically, Knowledge Representation.

**UNIT – V:**
**Semantic Web Application:** Semantic Web Services, e-Learning, Semantic Bioinformatics, Enterprise Application Integration, Knowledge Base.

**UNIT – VI:**
**Semantic Search Technology:** Search Engines, Semantic Search, Semantic Search Technology, Web Search Agents, Semantic Methods, Latent Semantic Index Search, TAP, Swoogle

**TEXT BOOKS:**
1. The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management, Michael C. Daconta, Leo J. Obrst, Kevin T. Smith, Wiley Publishing
2. Thinking on the Web, Berners Lee, Godel and Turing, Wiley Interscience

**REFERENCES:**

1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J. Davies, R. Studer, P. Warren, John Wiley & Sons
2. Semantic Web and Semantic Web Services, Li Yang Lu, Chapman and Hall/CRC, Taylor & Francis Group
3. Information Sharing on the Semantic Web, Heiner Stuckenschmidt; Frank Van Harmelen, Springer
4. Programming the Semantic Web, T. Segaran, C. Evans, J. Taylor, O'Reilly, SPD

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. VII Semester**

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## (18PE1EC08) INTERNET OF THINGS

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

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

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

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

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

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

**UNIT – V:**
**Cloud of Things:** Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture

**UNIT – VI:**
**Domain specific applications of IoT:** IoT Design Methodology, Applications of IoT– Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

**TEXT BOOKS:**
1. Internet of Things: A Hands-On Approach, Vijay Madisetti, Arshdeep Bahga

2. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi, Wiley, 2012
3. The Internet of Things in the Cloud: A Middleware Perspective, Honbo Zhou, CRC Press, 2012

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

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

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

**(18PE1IT08) SECURITY IN E – COMMERCE**

**COURSE OBJECTIVES:**
- To prepare student to understand current threats facing organizations that conduct business online
- To apply cryptography and related security techniques to e-commerce including secure electronic transactions
- To understand electronic payment systems, intellectual property protection
- To know and understand security development cycle and security services

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Understanding the various forms of electronic commerce and explain the range of threats to e-commerce security
**CO-2:** Remembering the different areas susceptible to malicious activity
**CO-3:** Analyzing different cryptographic techniques and their technical characteristics w.r.t E-commerce
**CO-4:** Evaluating how cryptography can be, and is, used to achieve security

**UNIT – I:**
Introduction to E-Commerce – Network and E-Commerce – Types of E-Commerce – E- Commerce Business Models: B2C, B2B, C2C, P2P and M-commerce business models – E- Commerce Payment systems: Types of payment system – Credit card E-Commerce transactions – B2C E-Commerce Digital payment systems – B2B payment system.

**UNIT – II:**
**Security and Encryption:** E-Commerce Security Environment – Security threats in E-Commerce environment – Policies, Procedures and Laws.

**UNIT – III:**
**Inter-organizational Trust in E-Commerce:** Need – Trading partner trust – Perceived benefits and risks of Ecommerce – Technology trust mechanism in E-Commerce – Perspectives of organizational, economic and political theories of inter-organizational trust – Conceptual model of inter-organizational trust in Ecommerce participation.

**UNIT – IV:**
**Introduction to Trusted Computing Platform:** Overview – Usage Scenarios – Key components of trusted Platform – Trust mechanisms in a trusted platform. Trusted platforms for organizations and individuals –Trust models and the E-Commerce domain.

**UNIT – V:**
**E-Commerce Security:** SET for E-Commerce Transactions, Business requirements for SET, SET System Participants, Dual Signature and Signature, Authentication and Message Integrity, Payment Processing.

**UNIT – VI:**

Secure Internet Programming, Security development life cycle, Internet Security Standards and Internet Security Products, Trusted Internet Security services

**TEXT BOOKS:**

1. E-Commerce Business Technology Society, Kenneth C. Laudon and Carol Guercio Trave, Pearson Education, 2005
2. Inter-Organizational Trust for Business-to-Business E-Commerce, Pauline Ratnasingam, IRM Press, 2005
3. Trusted Computing Platforms: TCPA Technology in Context, Siani Pearson, et al., Prentice Hall PTR, 2002

**REFERENCES:**

1. Frontiers Electronic Commerce, Ravi Kalakota and Andrew Whinston, 2nd Edition, Addison, Wesley, 1999
2. E-Commerce, P. T. Joseph, S. J., 2nd Edition, Prentice Hall, 2008
3. E-Commerce Security and Privacy, Anup Gosh, 2001

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

| B.Tech. VII Semester | L | T/P/D | C |
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## (18PE1IT09) DESIGN PATTERNS

**COURSE OBJECTIVES:**
- To understand design of patterns and solve design problems
- To study creational and structural patterns
- To understand behavioral patterns

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** To explore types of design patterns
**CO-2:** to examine the case study for designing a document editor
**CO-3:** to examine the importance of creational and structural patterns
**CO-4:** to explore the role of behavioral patterns in the given context

**UNIT – I:**
**Introduction:** Definition for Design Pattern. Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, Design of Patterns Solve Design Problems, Selection of a Design Pattern, Use of a Design Pattern.

**UNIT – II:**
**A Case Study:** Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation, Summary.

**UNIT – III:**
**Creational Patterns:** Abstract Factory, Builder, Factory Method, Prototype, Singleton,

**UNIT – IV:**
**Structural Patterns:** Adapter, Bridge, Composite, Decorator, façade, Flyweight, Proxy.

**UNIT – V:**
**Behavioral Patterns Part-I:** Chain of Responsibility, Command, Interpreter, Iterator, Mediator

**UNIT – VI:**
**Behavioral Patterns Part-II:** Memento, Observer, State, Strategy, Template Method, Visitor,

**TEXT BOOK:**
1. Design Patterns, Erich Gamma, Pearson Education

**REFERENCES:**
1. Pattern's in JAVA Vol-I, Mark Grand, Wiley DreamTech
2. Pattern's in JAVA Vol-II, Mark Grand, Wiley DreamTech
3. JAVA Enterprise Design Patterns Vol-III, Mark Grand, Wiley DreamTech
4. Head First Design Patterns, Eric Freeman, Oreilly, SPD

5. Design Patterns Explained, Alan Shalloway, Pearson Education.

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**B.Tech. VII Semester**             **L     T/P/D    C**
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**(18PE1CS02) AUGMENTED REALITY AND VIRTUAL REALITY**

**COURSE OBJECTIVES:**
- To provide a detailed understanding of the concepts of Virtual Reality and its applications

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Understand geometric modelling and Virtual environment
**CO-2:** Explain about Virtual Hardware and Software
**CO-3:** Develop Virtual Reality applications
**CO-4:** Explain about augmented reality concepts

**UNIT – I:**
**Introduction to Virtual Reality**
**Virtual Reality and Virtual Environment:** Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark
**3D Computer Graphics:** Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory, Simple 3D modelling, Illumination models, Reflection models, Shading algorithms, Radiosity, Hidden Surface Removal, Realism- Stereographic image.

**UNIT – II:**
**Geometric Modelling:** Introduction, From 2D to 3D, 3D space curves, 3D boundary representation Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection
**Generic VR system:** Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems.

**UNIT – III:**
**Introduction to AR,** Definition and Scope A brief history of AR, Examples, Related Fields, MR continuum, Virtual Reality, Ubiquitous Computing

**UNIT – IV:**
**Tracking:** Coordinate Systems, Characteristics of Tracking technology, Stationary Tracking systems, Mobile Sensors, Optical Tacking, Sensor Fusion

**UNIT – V:**
**Computer Vision for AR,** Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Incremental Tracking, Simultaneous Localization and Mapping, Outdoor Tracking.

**UNIT – VI:**
The future-What may drive Business Cases, AR developer's Wish List, Tracking AR Outdoors, Interface with Smart Objects

**TEXT BOOKS:**
1. Virtual Reality Systems, John Vince, Pearson Education, 2007
2. Augmented Reality, Principles and Practices, Dieter Schmalstieg, Tobias Hollerer Pearson, 2017
3. Augmented and Virtual Reality, Anand R., Khanna Publishing House, Delhi

**REFERENCES:**
1. Visualizations of Virtual Reality, Adams, Tata McGraw Hill, 2000
2. Virtual Reality Technology, Grigore C. Burdea, Philippe Coiffet, Wiley Inter Science, 2nd Edition, 2006
3. Understanding Virtual Reality: Interface, William R. Sherman, Alan B. Craig,
4. Application and Design, Morgan Kaufmann, 2008

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. VII Semester**

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## (18PE1IT10) ADHOC AND SENSOR NETWORKS

**COURSE OBJECTIVES:**
- To learn about the issues and challenges in the design of wireless ad hoc networks
- To understand the working of MAC and Routing Protocols for ad hoc and sensor networks
- To learn about the Transport Layer protocols and their QoS for ad hoc and sensor networks
- To understand various security issues in ad hoc and sensor networks and the corresponding solutions

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Identify different issues in wireless ad hoc and sensor networks
**CO-2:** Analyse protocols developed for ad hoc and sensor networks
**CO-3:** Identify and understand security issues in ad hoc and sensor networks
**CO-4:** Analyse the applications and challenges of Ad hoc sensor networks

**UNIT - I:**
**MAC & Routing In Ad Hoc Networks:** Introduction – Issues and challenges in ad hoc networks – MAC Layer Protocols for wireless ad hoc networks – Contention-Based MAC protocols – MAC Protocols Using Directional Antennas – Multiple-Channel MAC Protocols – Power-Aware MAC Protocols – Routing in Ad hoc Networks – Design Issues – Proactive, Reactive and Hybrid Routing Protocols

**UNIT – II:**
**Transport & Qos In Ad Hoc Networks:** TCP"s challenges and Design Issues in Ad Hoc Networks – Transport protocols for ad hoc networks – Issues and Challenges in providing QoS – MAC Layer QoS solutions – Network Layer QoS solutions – QoS Model

**UNIT – III:**
**MAC & Routing in Wireless Sensor Networks:** Introduction – Applications – Challenges – Sensor network architecture – MAC Protocols for wireless sensor networks – Low duty cycle protocols and wakeup concepts – Contention-Based protocols – Schedule-Based protocols – IEEE 802.15.4 Zigbee – Topology Control – Routing Protocols

**UNIT – IV:**
**Transport & Qos in Wireless Sensor Networks:** Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks – Congestion Control in network processing – Operating systems for wireless sensor networks – Examples.

**UNIT – V:**
**Security in Ad Hoc and Sensor Networks:** Security Attacks – Key Distribution and Management – Intrusion Detection – Software based Anti-tamper techniques – Water marking techniques – Defense against routing attacks – Secure Ad hoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS

**UNIT – VI:**

**Applications and Challenges of Ad Hoc and Sensor Networks:** Mobile ad hoc networks (MANETs), Vehicular ad hoc networks (VANETs), Smart phone ad hoc networks (SPANs),Wireless mesh networks Army tactical MANETs, Air Force UAV Ad hoc networks, Navy ad hoc networks, Ad hoc home smart lighting, Ad hoc street light networks, Ad hoc networked of robots, Disaster rescue ad hoc network, Hospital ad hoc network, Challenges.

**TEXT BOOKS:**

1. Ad Hoc Wireless Networks – Architectures and Protocols, C. Siva Ram Murthy and B. S. Manoj, Pearson Education, 2006
2. Protocols and Architectures for Wireless Sensor Networks, Holger Karl, Andreas Willing, John Wiley & Sons, Inc., 2005

**REFERENCES:**

1. Ad Hoc Mobile Wireless Networks, Subir Kumar Sarkar, T. G. Basavaraju, C Puttamadappa, Auerbach Publications, 2008
2. Ad Hoc and Sensor Networks: Theory and Applications, Carlos De Morais Cordeiro, Dharma Prakash Agrawal, 2nd Edition, World Scientific Publishing, 2011
3. Fundamentals of Wireless Sensor Networks Theory and Practice, Waltenegus Dargie, Christian Poellabauer, John Wiley and Sons, 2010
4. Wireless Ad Hoc and Sensor Networks: Theory and Applications, Xiang-Yang Li, 1227th Edition, Cambridge university Press, 2008

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. VII Semester**

| L | T/P/D | C |
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## (18PE1CS16) NATURAL LANGUAGE PROCESSING

**COURSE PRE-REQUISITES:** Data Structures, Finite Automata and Probability Theory

**COURSE OBJECTIVES:**
- To introduce the fundamental concepts and ideas in Natural Language Processing (NLP)
- To introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics
- To provide an understanding of the algorithms available for the processing of linguistic information and the underlying computational properties of natural languages
- To study and compare various NLP algorithms and design modelling techniques

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

**CO-1:** Show sensitivity to linguistic phenomena and an ability to model them with formal grammars

**CO-2:** Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems

**CO-3:** Manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods

**CO-4:** Design, implement, and analyze NLP algorithms and also design different language modeling Techniques

**UNIT – I:**
**Finding the Structure of Words:** Words and Their Components, Issues and Challenges, Morphological Models Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches.

**UNIT – II:**
**Syntax Analysis:** Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues.

**UNIT – III:**
**Semantic Parsing:** Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.

**UNIT – IV:**
Predicate-Argument Structure, Meaning Representation Systems, Software.

**UNIT – V:**
**Discourse Processing:** Cohension, Reference Resolution, Discourse Cohension and structure.

**UNIT – VI:**

**Language Modeling:** Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Cross lingual Language Modeling.

**TEXT BOOKS:**

1. Multilingual Natural Language Processing Applications: From Theory to Practice, Daniel M. Bikel and Imed Zitouni, Pearson Publication
2. Natural Language Processing and Information Retrieval, Tanvier Siddiqui, U. S. Tiwary

**REFERENCES:**

1. Speech and Natural Language Processing, Daniel Jurafsky & James H. Martin, Pearson Publications

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| B.Tech. VII Semester | L | T/P/D | C |
|---|---|---|---|
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**(18PE1IT11) NETWORK MANAGEMENT SYSTEM**

**COURSE OBJECTIVES:**
- To develop required skills in the students so that they are able to acquire following competency
- To plan, install, configure, administer and manage a network

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Explain Directory Services and Remote Access
**CO-2:** Set-up and use Virtual Private Network
**CO-3:** Explain Network protocols and services
**CO-4:** Install and configure Network server operating system
**CO-5:** Configure various services on Windows server platform and Troubleshoot Network

**UNIT – I:**
**Directory Services:** Define Directory Service, Definition of Novelle Directory, Windows Domain, MS Active Directory, X500 Directory Access Protocol, Lightweight Directory Access Proto col, Forests, Trees, Roots and Leaves.
**Active Directory Architecture:** Object Types, Object Naming, Canonical Names, LDAP Notation, Globally unique identifiers, User Principle Names, Domain, Trees & Forests.
**Remote Network Access:** Need of Remote Network Access, PSTN, ISDN, DSL, CATV
**Virtual Private Network:** VPN Protocols, Types of VPN, VPN Clients, SSL VPNs

**UNIT – II:**
**Dynamic Host Control Protocol (DHCP):** DHCP Origins, Reverse Address Resolution Protocol (RARP), The Bootstrap Protocol (BOOTP), DHCP Objectives, IP Address assignments, DHCP Architecture
**Introduction to Domain Name Systems (DNS):** DNS Objectives, Domain Naming, Top Level Domains, Second Level Domains, Sub-domains, DNS Functions, Resource Records, DNS Name Resolution, Resolves, DNS Requests, Root Name Servers, Resolving a Domain Name, DNS Name Registration

**UNIT – III:**
**Network Printing Concepts:** Locally Connected Print Devices, Setting up local Print Devices, Shared Print Devices, Sharing Locally Attached Print Devices, Describe Windows Network Printing and Add print Wizard
Designing Network – Accessing Network Needs, Applications, Users, Network Services, Security and Safety, Growth and Capacity Planning, Meeting Network Needs – Choosing Network Type, Choosing Network Structure, Choosing Servers

**UNIT – IV:**
Installing and Configuring Windows Server -Preparing for Installation, Creating windows server boot disk, Installing windows server, Configuring server/ client.
Setting windows server - Creating Domain controller, Adding the DHCP and WINS roles, Adding file server and print server, Adding Web based Administration

**UNIT – V:**
Working With User Accounts -Adding a User, Modifying User Account, Deleting or Disabling a User Account. Working with Windows Security Groups –Creating Group, Maintaining Group Membership. Working with Shares –Understanding Share Security, Cresting Shares, Mapping Drives Administering Printer Shares –Setting up Network Printer Working with Windows Backup – Using Windows Servers Backup Software

**UNIT – VI:**
Understanding the Problem –Troubleshooting, Segmenting the Problem, and Isolating the Problem, Setting Priorities. Troubleshooting Tools –Hardware Tools, Software Tools, Monitoring and Troubleshooting Tools Internal Security –Account Security, File and Directory permissions, Practices and user education

**TEXT BOOKS:**
1. The Complete Reference Networking, Craig Zacker, Tata McGraw-Hill
2. The Real-World Network Troubleshooting Manual, Alan Sugano, Firewall Media
3. Networking A Beginner's Guide, Bruce Hallberg, Tata McGraw-Hill

**REFERENCES:**
1. Introduction to Networking, Bruce Hallberg, Tata McGraw-Hill
2. Networking + Certification Training Kit, Richard A. McMahon, Microsoft Press
3. MCSE Training Kit Networking Essential Plus Microsoft Press

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| B.Tech. VII Semester | L | T/P/D | C |
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### (18PC2IT06) DATA ANALYTICS LABORATORY

**COURSE OBJECTIVES:**
- To explore basics of R tool
- To understand linear and logistic regression
- To explore decision tree and text mining

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Exploring R to load, explore data and to use in data analytics
**CO-2:** Analyzing linear and logistic regression techniques
**CO-3:** Exploring decision tree, clustering and text mining algorithms
**CO-4:** Analyze Time Series models

**LIST OF EXPERIMENTS:**

Experiments will be implemented using R/Python.

1. Practicing basic commands in R
2. Loading and handling data using R
3. Exploring datasets using R
4. Implementation of linear regression technique using R/Python
5. Implementation of logistic regression technique using R/Python
6. Implementation of decision tree algorithm/Python
7. Implementation of association rules
8. Exploring time-series models using R
9. Exploring ARIMA model
10. Analyze case studies on time-series models
11. Implementation of clustering algorithms using R/Python
12. Exploring text mining algorithms

**TEXT BOOKS:**
1. Data Analytics using R, Seema Acharya, McGraw-Hill Education,2019
2. R for Data Science, Import, Hadley Wickham, Garrett Grolemund, Tidy, Transform, Visualize, and Model Data, 2016

**REFERENCES:**
1. Data Analytics with R, Bharti Motwani, 2019
2. Data Science-Theory, Analysis and Applications, Qurban A. Memon, Shakeel Ahmed Khoja, 2019

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| B.Tech. VII Semester | L | T/P/D | C |
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## (18PW4IT04) 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.

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

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

## (18PE1IT12) DISTRIBUTED SYSTEMS

**COURSE OBJECTIVES:**
- To understand foundations of distributed systems
- To introduce the idea of peer-to-peer services and file system
- To understand in detail the system level and support required for distributed system
- To understand the issues involved in studying process and resource management

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Discuss trends in Distributed Systems
**CO-2:** Apply network virtualization
**CO-3:** Apply remote method invocation and objects
**CO-4:** Design process and resource management systems

**UNIT – I:**
**Introduction:** Introduction to Distributed Systems Architecture for Distributed System, Goals of Distributed system, Hardware and Software concepts, Distributed Computing Model, Advantages& Disadvantage distributed system, Examples of Distributed Systems, Trends in Distributed Systems, Challenges.

**UNIT – II:**
**Process & Resource Management:** Process Management: Process Migration: Features, Mechanism - Threads: Models, Issues, Implementation. Resource Management: Introduction- Features of Scheduling Algorithms –Task Assignment Approach – Load Balancing Approach – Load Sharing Approach.

**UNIT – III:**
**Memory Management in Distributed System:** Basic Concept of Distributed Share Memory (DSM), DSM Architecture & its Types, Design & Implementations issues In DSM System, Structure of Share Memory Space, Consistency Model, and Thrashing.

**UNIT – IV:**
**Inter Process Communication in Distributed System:** API for internet protocols – External data representation and Multicast communication, Network virtualization, overlay networks, Data Representation & Marshaling, Group Communication, Client Server Communication, RPC- Implementing RPC Mechanism, Stub Generation, RPC Messages, Synchronization: - Clock Synchronization, Mutual Exclusion, Election Algorithms, Bully & Ring Algorithms.

**UNIT – V:**
**Distributed Scheduling and Deadlock Distributed Scheduling-** Introduction - Clocks, events and process states, Logical time and logical clocks - Global states – Coordination and Agreement – Introduction - Distributed mutual exclusion, Issues in Load Distributing, Components for Load Distributing Algorithms, Load Distributing Algorithms, Task Migration and its issues. Deadlock-Issues in deadlock detection & Resolutions, Deadlock Handling Strategy, Distributed Deadlock Algorithms.

**UNIT – VI:**

**File Management in Distributed System:** Desirable features of good Distributed File System, Introduction File service architecture – Andrew File system, File Accessing Model, File Sharing semantics, File Catching Scheme, File Application    Naming: - Features, System Oriented Names, Object Locating Mechanism, Human Oriented Name.

**TEXT BOOKS:**

1.  Distributed Systems: Principles and Paradigms, Tanenbaum A. S., Van Steen M., Pearson Education, 2007
2.  Distributed Systems Concepts and Design, George Coulouris, Jean Dollimore and Tim Kindberg, 5th Edition, Pearson Education, 2012

**REFERENCES:**

1.  Distributed Operating Systems: Concepts and Design, Pradeep K. Sinha, Prentice Hall of India, 2007
2.  Distributed Computing, Principles and Applications, Liu M. L., Pearson Education, 2004
3.  Advance Concept in Operating System, Singhal & Shivratari, McGraw Hill
4.  Distributed Computing, Attiya & Welch, Wiley

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. VIII Semester**

| | L | T/P/D | C |
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## (18PE1CS10) NEURAL NETWORKS AND DEEP LEARNING

**COURSE OBJECTIVES**:
- To introduce to the basic concepts of neural networks
- To identify and analyze the various types of neural networks and models of neuron and apply accordingly
- To introduce the concept of deep learning and its types
- To explore the concepts of applications of deep learning

**COURSE OUTCOMES**: After completion of the course, the student should be able to
**CO-1:** Analyze and apply the basic the concepts of neural networks
**CO-2:** Analyze various types of neural networks and use various activation functions to solve complex problems
**CO-3:** Relate the concept of deep learning and its architecture
**CO-4:** Design and carry out empirical analysis for various types of applications of deep learning systems

**UNIT – I:**
**Introduction to Neural Networks:** Characteristics of Neural Networks, Historical Development of Neural Networks Principles, Artificial Neural Networks: Terminology, Models of Neuron, Topology, Basic Learning Laws, Pattern Recognition Problem, Basic Functional Units, Pattern Recognition Tasks by the Functional Units.

**UNIT – II:**
**Feed Forward Neural Networks:** Introduction, Analysis of pattern Association Networks, Analysis of Pattern Classification Networks, Analysis of pattern storage Networks. Analysis of Pattern Mapping Networks.

**UNIT – III:**
**Feedback Neural Networks:** Introduction, Analysis of Linear Auto associative FF Networks, Analysis of Pattern Storage Networks. Competitive Learning Neural Networks & Complex pattern Recognition- Introduction, Analysis of Pattern Clustering Networks, Analysis of Feature
Mapping Networks, Associative Memory.

**UNIT – IV:**
**Fundamentals of Deep Learning:** Defining Deep Learning, Common architectural principles of Deep Networks, Building Blocks of Deep Networks, and Major architectures of Deep Networks: Unsupervised Pretrained Networks, Convolution Neural Networks (CNNs), Recurrent Neural Networks.

**UNIT – V:**
**Convolution Neural Networks:** The convolution operation, motivation, pooling, Convolution and Pooling as an Infinitely Strong Prior, Applications of deep learning: Large scale deep learning, Computer vision, Speech Recognition, Natural Processing, other applications.

**UNIT – VI:**

**Sequential Modelling: Recurrent Neural Networks:** Recursive neural networks, The long short –term Memory, explicit memory, Auto encoders: Under complete, regularised, Stochastic Encoders and Decoders, Denoising Auto encoders

**TEXT BOOKS:**

1. Artificial Neural Networks, B. Yagna Narayana, PHI,
2. Deep Learning: A Practitioner's Approach, Josh Patterson, Adam Gibson
3. Deep Learning, Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville, An MIT Press Book in Preparation, 2015, http://www.deeplearningbook.org/

**REFERENCES:**

1. Neural Networks, Simon Haykin, PHI
2. Deep Learning (Adaptive Computation & Machine Learning), Ian Good Fellow, Yoshua Bengio, Aran Courville
3. Fundamentals of Neural Networks: Architectures, Algorithms and Applications, Fausett

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| **B.Tech. VIII Semester** | **L** | **T/P/D** | **C** |
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### (18PE1CS12) QUANTUM COMPUTING

**COURSE OBJECTIVES:**
- To provide the basics of quantum computation and its necessity
- To provide the background of mathematics for this kind of computation
- To provide Implication of quantum circuits
- To provide Explore various Quantum algorithms

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

**CO-1:** Explore the quantum computation environment

**CO-2:** Identify the implications of quantum computation in the field of mathematics and associated fields

**CO-3:** Explore building blocks and programming methodologies for quantum computing

**CO-4:** Apply quantum computation algorithms and use them

**UNIT – I:**
**Introduction to Quantum Computing:** Motivation for studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.), Origin of Quantum Computing, Overview of major concepts in Quantum Computing, Qubits, and multi-qubits states, Bra-ket notation Bloch Sphere representation,

**UNIT – II:**
**Math Foundation for Quantum Computing:** Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors.

**UNIT – III:**
**Building Blocks for Quantum Program:** Architecture of a Quantum Computing platform, Details of q-bit system of information representation: Block Sphere, Multi-qubits States Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from quantum algorithmic perceptive e.g. Bell State, Operation on qubits: Measuring and transforming using gates, Quantum Logic gates and Circuit: Pauli, Hadamard, phase shift.

**UNIT – IV:**
Programming model for a Quantum Computing Program, Steps performed on classical computer, Steps performed on Quantum Computer, Moving data between bits and qubits.

**UNIT – V:**
**Quantum Algorithms:** Basic techniques exploited by quantum algorithms, Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum Walks

**UNIT – VI:**
**Major Algorithms:** Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch

-Jozsa Algorithm.

**TEXT BOOKS:**
1. Quantum Computation and Quantum Information, Michael A. Nielsen, Cambridge University Press
2. Quantum Computing Explained, David McMahon, Wiley

**REFERENCES:**
1. IBM Experience: https://quantumexperience,ng,bluemix.net
2. Microsoft Quantum Development Kit https://www.microsoft.com/en-us/quantum/development-kit
3. Forest SDK PyQuil: https://pyquil.readthedocs.io/en/stable/

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. VIII Semester**

| | L | T/P/D | C |
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## (18PE1IT13) NETWORK SECURITY

**COURSE OBJECTIVES:**
- To understand security concepts, threats, attacks, services and mechanisms
- To describe various cryptosystems- symmetric key cryptography, public key cryptography
- To apply authentication services, mechanisms and Email security
- To be familiar with the concepts of IP Security, web security, SNMP, viruses and firewalls

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

**CO-1:** Analyze security issues, services, goals and mechanism of security

**CO-2:** Develop a security model to prevent, detect the attacks, using various mechanisms

**CO-3:** Examine the authenticity of the messages, communicate securely and investigate non-repudiation

**CO-4:** Apply concepts of IP Security, SET, firewalls and establish trusted system

**UNIT – I:**
**Introduction:** Security Attacks, Services Mechanisms, A model for Internetwork security, 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 – II:**
**Public Key Cryptography:** Confidentiality using Symmetric Encryption – Principles of Public key Cryptosystems, RSA algorithm, Key Management, Diffie-Hellman key Exchange, Elliptic Curve Cryptography. Buffer overflow, TCP session hijacking, ARP attacks, route table modification, UDP hijacking and man-in-the-middle attacks.

**UNIT – III:**
**Authentication and Hash Functions:** Authentication requirements, Authentication functions, Message Authentication Codes, Hash Functions, Security of Hash Functions and MACs, MD5 message Digest algorithm, Secure Hash Algorithm, HMAC.

**UNIT – IV:**
**Digital Signatures and SNMP:** Digital Signatures, Authentication Protocols, Digital Signature Standard, Authentication Applications: Kerberos, X.509 Authentication Service, Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3

**UNIT – V:**
**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 Practice, William Stallings, 4th Edition, Prentice Hall of India, 2005
2. Hack Proofing Your Network, Ryan Russell, Dan Kaminsky, Rain Forest, Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W. Manzuik and Ryan Permeh, Wiley Dreamtech

**REFERENCES:**

1. Network Security Essentials: Applications and Standards William Stallings, Prentice Hall, Hardcover, 1999, 366 pages, ISBN 0130160938
2. Security in Computing, Charles B. Pfleeger, Shari Lawrence Pfleeger, 3rd Edition, Pearson Education, 2003
3. Cryptography: Theory and Practice, Douglas R. Stinson, CRC Press, 1995, ISBN 0-8493-8521-0
4. Applied Cryptography, Bruce Schneier, John Wiley & Sons Inc, 2001

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| B.Tech. VIII Semester | **L** | **T/P/D** | **C** |
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### (18PE1IT14) ADVANCED DATABASES

**COURSE OBJECTIVES:**
- To introduce Distributed Database Management System and its Design issues
- To explore 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

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Analyze issues related to Distributed database Design
**CO-2:** Design and develop query processing strategies
**CO-3:** Apply distributed query optimization strategies
**CO-4:** Describe transaction processing, concurrency control and reliability in distributed databases

**UNIT – I:**
**Introduction:** Distributed Data Processing, Distributed Database System, Promises of DDBSs, Problem areas.

**UNIT – II:**
**Distributed DBMS Architecture:** Architectural Models for Distributed DBMS, DDMBS Architecture.
**Distributed Database Design:** Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation.

**UNIT – III:**
**Query Processing and Decomposition:** Query Processing Objectives, Characterization of query processors, layers of query processing, query decomposition, Localization of distributed data.

**UNIT – IV:**
**Distributed query Optimization:** Query optimization, centralized query optimization, Distributed query optimization algorithms.

**UNIT – V:**
**Transaction Management:** Definition, properties of transaction, types of transactions. Distributed concurrency control: Serializability, concurrency control Mechanisms & Algorithms, Time stamped & Optimistic concurrency control Algorithms, Deadlock Management.

**UNIT – VI:**
**Distributed DBMS Reliability:** Reliability concepts and measures, failures in Distributed DBMS, local & distributed reliability protocols, dealing with site failures, network partitioning.

**TEXT BOOKS:**
1. Principles of Distributed Database Systems, M. Tamer OZSU and Patuck Valduriez, Pearson Edn. Asia, 2001
2. Distributed Databases, Stefano Ceri and Willipse Pelagatti, McGraw Hill

**REFERENCES:**
1. Database System Concepts, Henry F. Korth, A. Silberchatz and Sudershan, MGH
2. Database Management Systems, Raghuramakrishnan and Johhanes Gehrke, MGH
3. Readings in Database Systems, M. Stonebraker, 2nd Edition, Morgan Kauffman, 1993

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| B.Tech. VIII Semester | L | T/P/D | C |
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## (18PE1IT15) DATA VISUALIZATION

**COURSE OBJECTIVES:**
- To identify the need of core skills for visual analysis
- To describe the techniques in time-series, ranking models
- To define the different types of analysis like deviation, distribution, correlation & multivariate
- To know how to design information dashboards

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Understand the principles of visual perception
**CO-2:** Apply core skills for visual analysis
**CO-3:** Analyze visualization techniques for various data analysis tasks
**CO-4:** Design information dashboard

**UNIT – I:**
**Core Skills for Visual Analysis:** Information visualization – effective data analysis – traits of meaningful data – visual perception – making abstract data visible – building blocks of information visualization – analytical interaction – analytical navigation – optimal quantitative scales – reference lines and regions – trellises and crosstabs – multiple concurrent views – focus and context – details on demand – over-plotting reduction – analytical patterns – pattern examples

**UNIT – II:**
**Time-Series, Ranking:** Time-series analysis – time-series patterns – time-series displays – time-series best practices – part-to-whole and ranking patterns – part-to-whole and ranking displays – best practices

**UNIT – III:**
**Deviation & Distribution Analysis:** deviation analysis – deviation analysis displays – deviation analysis best practices, Distribution analysis – describing distributions – distribution patterns – distribution displays – distribution analysis best practices

**UNIT – IV:**
**Correlation & Multivariate Analysis:** Correlation analysis – describing correlations – correlation patterns – correlation displays – correlation analysis techniques and best practices – multivariate analysis – multivariate patterns – multivariate displays – multivariate analysis techniques and best practices

**UNIT – V:**
**Information Dashboard Design I:** Information dashboard – categorizing dashboards – typical dashboard data – dashboard design issues and best practices – visual perception – limits of short-term memory – visually encoding data – Gestalt principles – principles of visual perception for dashboard design

**UNIT – VI:**
**Information Dashboard Design II:** Characteristics of dashboards – key goals in visual

design process – dashboard display media – designing dashboards for usability – meaningful organization – maintaining consistency – aesthetics of dashboards – testing for usability – case studies: sales dashboard, CIO dashboard, Telesales dashboard, marketing analysis dashboard

**TEXT BOOKS:**

1. Now You See It: Simple Visualization Techniques for Quantitative Analysis, Stephen Few, Analytics Press, 2009
2. Information Dashboard Design: The Effective Visual Communication of Data, Stephen Few, O'Reilly, 2006

**REFERENCES:**

1. The Visual Display of Quantitative Information, Edward R. Tufte, 2nd Edition, Graphics Press, 2001
2. Data Points: Visualization that Means Something, Nathan Yau, Wiley, 2013
3. Visualizing Data: Exploring and Explaining Data with the Processing Environment, Ben Fry, O'Reilly, 2008
4. Business Analytics for Managers: Taking Business Intelligence Beyond Reporting, Gert H. N. Laursen and Jesper Thorlund, Wiley, 2010
5. The Value of Business Analytics: Identifying the Path To Profitability, Evan Stubbs, Wiley, 2011

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**B.Tech. VIII Semester**

| | L | T/P/D | C |
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**(18PE1CS14) INFORMATION RETRIEVAL SYSTEMS**

**COURSE OBJECTIVES:**
- To describe the differences between repositories like Base Management Systems, Information retrieval systems and data warehouse
- To discover various pre-processing techniques which can apply on text documents to outline the structure of queries and documents
- To articulate fundamental functions used in information retrieval such as automatic indexing, abstracting, and clustering
- To learn the important concepts, algorithms, and data/file structures that are necessary to specify, design, and implement Information Retrieval (IR) systems

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Identify and understand the relationships between various Repository Systems
**CO-2:** Apply knowledge of data structures and indexing methods in information retrieval Systems
**CO-3:** Implement various clustering, searching techniques and algorithms on Information systems
**CO-4:** Analyze clustering techniques and algorithms using evaluation measures

**UNIT – I:**
**Introduction:** Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses, Information Retrieval System Capabilities – Search, Browse, Miscellaneous.

**UNIT – II:**
**Cataloging and Indexing:** Objectives, Indexing Process, Automatic Indexing, Information Extraction
**Data Structures:** Introduction, Stemming Algorithms, Inverted file structures, N – gram data structure, PAT data structure, Signature file structure, Hypertext data structure.

**UNIT – III:**
**Automatic Indexing:** Classes of automatic indexing, Statistical Indexing, Natural language, Concept indexing, Hypertext linkages.
**Document and Term Clustering:** Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters.

**UNIT – IV:**
**User Search Techniques:** Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, weighted searches of Boolean Systems, Searching the Internet and hypertext.

**UNIT – V:**
**Text Search Algorithms:** Introduction, Software text search algorithms, Hardware text search systems.

**UNIT – VI:**
**Information System Evaluation:** Introduction, Measures used in system evaluation, Measurement example – TREC results.

**TEXT BOOKS:**
1. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark T. Maybury, Springer
2. Modern Information Retrieval, Ricardo Baeza – Yates, Pearson Education, 2007


**REFERENCES:**
1. Information Retrieval: Algorithms and Heuristics, David A Grossman and Ophir Frieder, 2nd Edition, Springer
2. Information Retrieval Data Structures and Algorithms, Frakes, W.B., Ricardo Baeza-Yates: Prentice Hall, 1992

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**B.Tech. VIII Semester**

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**(18PE1IT16) SOFTWARE DEFINED NETWORKS**

**COURSE OBJECTIVES:**
- To provide a comprehensive introduction to Software Defined Networking (SDN) and presents SDN in context with more familiar network services and challenges
- Ito offer a unique perspective of the business case and technology motivations for considering SDN solutions
- To identify the impact of SDN on traffic management and the potential for network service growth
- To provide the basic concepts and explains the importance of virtualization, particularly the impact of virtualization on servers and networks, service providers, legacy networks, and network vendors

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Understand the concepts of Software Defined Networking (SDN) and its network services and challenges
**CO-2:** Understand the business case and technology motivations for considering SDN solutions
**CO-3:** Learn how to identify the impact of SDN on traffic management and the potential for network service growth
**CO-4:** Learn the concepts of visualization, particularly the impact of visualization on servers and networks, service providers, legacy networks, and network vendors

**UNIT – I:**
**Introduction to Software Defined Networking:** Virtualization, Virtual Memory, Virtual Memory Operation, Virtual and Physical Memory Mapping, Server Virtualization, Storage Virtualization, Software Defined Networking, Network Limitations, Network Control Plane.

**UNIT – II:**
**SDN Implementation:** Introduction, SDN Implementation, SDN Design, Separation of the Control and Data Planes, Edge-Oriented Networking, SDN Operation, Service Providers and SDN

**UNIT – III:**
**Open Flow:** Introduction, Overview of the OpenFlow Switch Specification, OpenFlow Ports, OpenFlow Packet-Processing Pipeline, OpenFlow Channel, Message Handling, OpenFlow Channel Connections, Controller Modes, Auxiliary Connection Use for Performance and Reliability, Flow Table Synchronization, Bundle Messages, OpenFlow Configuration-and- Management Protocol, Remote Configuration and The OpenFlow Conformance Testing Program

**UNIT – IV:**
SDN Controllers, Network Programmability, The Management Interface, The Application- Network Divide Modern Programmatic Interfaces, Virtualization and Data Plane I/O, Services Engineered Path, Service Locations and Chaining.

**UNIT – V:**
SDN Evolution Introduction, SDN and Enterprise Networks, SDN and Transport Networks, SDN and Optical Transport Networks, Increasing WAN Utilization with SDN, SDN Scalability Issues, Controller Designs for Scalability, Potential SDN Scalability Issues, Network Types.

**UNIT – VI:**
SDN Management, Load Adaptation, Google and SDN, Google's G-Scale Network, Google's G-Scale Network Hardware, Google SDN Deployment, Implementation Challenges.

**TEXT BOOKS:**
1. Software Defined Networking: Design and Deployment, Patricia A. Morreale and James M. Anderson, 1st Edition, CRC Press
2. SDN: Software Defined Networks, Thomas D. Nadeau and Ken Gray, Orielly

**REFERENCES:**
1. Software Defined Networking with OpenFlow, Siamak Azodolmolky Wiley
2. Software Defined Networks: A Comprehensive Approach, Paul Goransson, Chuck Black, Morgan Kaufmann

## VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

| **B.Tech. VIII Semester** | **L** | **T/P/D** | **C** |
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### (18PE1CS17) DISTRIBUTED TRUST AND BLOCKCHAIN TECHNOLOGIES

**COURSE OBJECTIVES:**
- To get the terminologies and overview of block chain technologies
- To study the concepts and foundation of blockchain Technology
- To understand Security Mechanism and Consensus in blockchain
- To design Use Cases and Architecture blockchain Technology

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Gain a clear understanding of the concepts that underlie digital distributed ledger
**CO-2:** Understand key mechanisms like Decentralization, Transparency and trust, Immutability, High availability, Highly secure and different types of Blockchain
**CO-3:** Understand the concept of Hash Function and Related Hash Algorithm
**CO-4:** Learn how to design and implement any application in Blockchain Technology

**UNIT – I:**
Need for Distributed Record Keeping, Byzantine Generals problem Consensus algorithms and their scalability problems, Technologies Borrowed in Blockchain – hash pointers, consensus, digital cash etc.

**UNIT – II:**
Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems

**UNIT – III:**
Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use

**UNIT – IV:**
Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts

**UNIT – V:**
Hyperledger fabric, Fabric Membership, Fabric Membership, plug and play platform and mechanisms in permissioned blockchain

**UNIT – VI:**
Pseudo-anonymity vs. anonymity, attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks.

**TEXT BOOKS:**
1. Blockchain Technology: Cryptocurrency and Applications, Oxford University Press, 2019

2. Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming, Josh Thompson, Create Space Independent Publishing Platform, 2017

**REFERENCES:**
1. Blockchain Quick Reference, Brenn Hill, Samanyu Chopra, Paul Valencourt, Packt Publishing, 2018
2. Blockchain: Blueprint for a New Economy, Melanie Swa, 2015
3. Mastering Bitcoin: Programming the Open Blockchain, Andreas M. Antonopoulos, 2017

| B.Tech. VIII Semester | L | T/P/D | C |
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## (18PE1CS19) COGNITIVE ENGINEERING

**COURSE OBJECTIVES:**
- To identify the basics of Artificial Intelligence and Cognitive science engineering with focus on knowledge representation, and its use by individual minds, brains, and machines
- To analyze the mind and intelligence, embracing psychology, artificial intelligence, neuroscience and linguistics
- To analyze the basics of language acquisition skills and language processing techniques
- To relate the role of Neuroscience in Cognitive field and robotics applications

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Analyze, relate the basic concepts of artificial intelligence and cognitive engineering
**CO-2:** Apply the base knowledge of cognitive science to create and evaluate computational network models
**CO-3:** Explore various knowledge representation and semantic methods for design, data collection, data analysis, and data interpretation
**CO-4:** Demonstrate the use of neuroscience in cognitive domain in present industry

**UNIT – I:**
**Introduction to Cognitive Science and Cognitive Psychology:** The Cognitive view – Some Fundamental Concepts – Computers in Cognitive Science – Applied Cognitive Science – The Interdisciplinary Nature of Cognitive Science
Cognitive Psychology – The Architecture of the Mind - The Nature of Cognitive Psychology- A Global View of The Cognitive Architecture.

**UNIT – II:**
**Cognitive Neuroscience:** Cognitive Processes, Working Memory, and Attention- The Acquisition of Skill- Brain and Cognition Introduction to the Study of the Nervous System – Neural Representation – Neuropsychology- Computational Neuroscience - The Organization of the mind.

**UNIT – III:**
**Language Acquisition, Semantics and Processing Models:**
**Language Acquisition:** Milestones in Acquisition – Theoretical Perspectives- Semantics and Cognitive Science – Meaning and Entailment, Computational Models of Semantic Processing.

**UNIT – IV:**
**Natural Language Processing and Cognitive Process:** Preliminaries, Role of Grammar in Language Processing. Connectionist Models, Information Processing Models of the Mind- Physical symbol systems and language of thought- Applying the Symbolic Paradigm.

**UNIT – V:**
**Higher-Level Cognition and Challenges:** Dynamical systems and situated cognition-Challenges – Emotions and Consciousness – Computation of Cognitive Functioning in machines: Robotics, Human-Robotics Interaction.

**UNIT – VI:**
**Cognitive science for vision/image processing:** Perception and sensing: visual cognition, cognitive mechanisms of vision, Feature Extraction from Images, Information Processing in Perception and Visual Behavior, Cognitive function measurement tools and software.

**TEXT BOOKS:**
1. Cognitive Science: An Introduction, Neil Stillings, Steven E. Weisler, Christopher H. Chase and Mark H. Feinstein, Second Edition,1995
2. Cognitive Science: An Introduction to the Science of the Mind, José Luis Bermúdez, Cambridge University Press, New York, 2010
3. Cognitive Science: An Introduction to the Study of Mind, J. Friedenberg and G. Silverman, A Bradford Book, 2006

**REFERENCES:**
1. Computational Vision: Information Processing in Perception and Visual Behavior, Hanspeter A. Mallot, Translated by John S. Allen
2. How the Mind Works, Steven Pinker, 2009
3. Cognitive Science: An Interdisciplinary Approach, Carolyn Panzer Sobel and Paul Li, 2013
4. Mind: Introduction to Cognitive Science, Paul Thagard, 2nd Edition, MIT Press, 2000
5. The MIT Encyclopedia of the Cognitive Sciences (MITECS), Wilson Robert A., & Keil, Frank C. (eds.), MIT Press, 2001

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| B.Tech. VII Semester | L | T/P/D | C |
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**(18PW4IT05) MAJOR PROJECT PHASE-I**

| B.Tech. VIII Semester | L | T/P/D | C |
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**(18PW4IT06) 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.

# 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.**
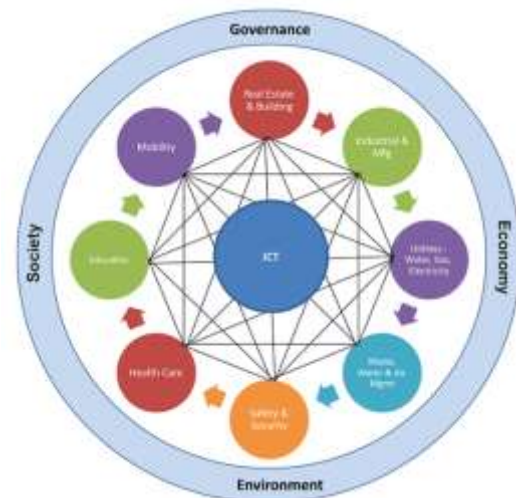


To develop new smart cities and to transform our cities into smart cities the engineers in particular are stepping up as leaders.

**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**

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## (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** |
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**(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 |
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## (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 acquire knowledge on different measuring techniques
- To learn about various smart sensors, actuators and their application in structural health monitoring
- To acquire knowledge on different smart composite materials and their modelling concepts
- To learn about the data acquisition and processing and their application in engineering domain

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

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

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

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

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

**UNIT-V:**

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

**UNIT –VI:**

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

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


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

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. VIII Semester**

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## (18OE1CE04) INTELLIGENT TRANSPORTATION SYSTEM

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

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

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

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

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

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

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

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

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

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

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

# WASTE MANAGEMENT

# WASTE MANAGEMENT

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

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

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

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

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

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

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. V Semester**

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## (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, Mc-Graw 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, Mc Graw 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

| B.Tech. VI Semester | L | T/P/D | C |
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## (18OE1CE06) HAZARDOUS WASTE MANAGEMENT

**COURSE PRE-REQUISITES:** Solid Waste Management

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

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

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

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

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

**UNIT – IV:**
**Management of Hazardous Wastes:** Identifying a hazardous waste – methods – Quantities of hazardous waste generated – Components of a hazardous waste

management plan – Hazardous waste minimization – Disposal practices in Indian Industries – Future challenges - Emergency Response - National Response Team and Regional Response Teams; National Contingency Plan and Regional Contingency Plans; National Response Center; State, Local and Industry Response Systems.

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

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

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

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

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| **B.Tech. VII Semester** | **L** | **T/P/D** | **C** |
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### (18OE1CE07) WASTE TO ENERGY

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

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

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

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

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

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

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

**UNIT – V:**

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

**UNIT – VI:**

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

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

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

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| B.Tech. VIII Semester | L | T/P/D | C |
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**(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 Foot Print (CFP) based SWM
- To understand the principles of Process Systems Engineering (PSE) and various laws and regulation of SWM

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

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

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

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

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

Based SWM - The Global-Warming Potential Impact - GHG Accounting - GWP Assessment for Solid Waste Management.

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

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

**TEXT BOOKS:**
1. Sustainable Solid Waste Management - A Systems Engineering Approach, Ni-Bin Chang and Ana Pires, IEEE & John Wiley & Sons, 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.

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

| B.Tech. V Semester | L | T/P/D | C |
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## (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**
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## (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 $CO_2$ 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 |
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**(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

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| **B.Tech. VIII Semester** | **L** | **T/P/D** | **C** |
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### (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

**UNIT – V:**
**Lighting Energy Audit and Energy Instruments:** Good lighting system design and practice, lighting control, lighting energy audit - Energy Instruments- watt meter, data loggers, thermocouples, pyrometers, flux meters, tongue testers, application of PLC's

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

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

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

**REFERENCES:**
1. Energy Efficient Electric Motors, John C. Andreas, 2nd Edition, Marcel Dekker Inc. Ltd., 1995
2. Energy Management Handbook, W. C. Turner, John Wiley and Sons
3. Energy Management and Good Lighting Practice: Fuel Efficiency Booklet, 12-EEO

# 3D PRINTING AND DESIGN

# 3D PRINTING AND DESIGN

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

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

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

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| **B.Tech. V Semester** | **L** | **T/P/D** | **C** |
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### (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

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. VI Semester**
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## (18OE1ME02) INTRODUCTION TO 3D PRINTING

**COURSE PRE-REQUISITES:** Elements of CAD

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

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

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

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

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

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

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

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

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

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

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

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

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

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**(18OE1ME03) 3D PRINTING-MACHINES, TOOLING AND SYSTEMS**

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

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

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

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

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

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

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

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

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

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

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

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

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| **B.Tech. VIII Semester** | **L** | **T/P/D** | **C** |
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### (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) and its methodologies
- To comprehend Data Acquisition Techniques for Reverse Engineering
- To understand Integration Between Reverse Engineering and Additive manufacturing
- To know the applications of reverse engineering

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

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

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

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

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

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

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

**TEXT BOOKS:**

1. Reverse Engineering: An Industrial Perspective, V. Raja and K. Fernandes, Springer-Verlag
2. Reverse Engineering, K. A. Ingle, McGraw-Hill
3. Rapid Prototyping, Ali Kamrani, Emad Nasr, Springer, 2006

**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…

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**B.Tech. V Semester**                                                         **L    T/P/D    C**
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**(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 & 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 & 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

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| B.Tech. VI Semester | L | T/P/D | C |
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**(18OE1EC02) INTRODUCTION TO MICROCONTROLLER AND INTERFACING**

**COURSE PRE-REQUISITES:** Sensors Transducers and Actuators

**COURSE OBJECTIVES:**
- To differentiate various number systems
- To understanding programming concepts
- To develop simple applications using 8051 microcontrollers

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Understand basic computing concepts
**CO-2:** Know architecture of 8051 microcontrollers
**CO-3:** Program internal resources of 8051 microcontroller
**CO-4:** Interface peripherals to 8051 microcontroller

**UNIT – I:**
**Introduction to Computing:** Numbering and Coding Systems: Binary, Decimal, Hexadecimal and conversions, Binary and Hexadecimal Arithmetic, Complements, Alphanumeric codes. Digital Premier, Inside the Computer

**UNIT – II:**
**Embedded System Design:** Embedded system - Definition, Characteristics of embedded computing applications, Design challenges, Requirements, Specification, Architecture design, Designing hardware and software components, system integration, Design example: Model train controller.

**UNIT – III:**
**8051 Microcontroller:** Microcontrollers and Embedded Processors, Architecture and Programming Model of 8051, Special Function Register formats, Memory Organization, Timers and Counters- Operating modes, Serial port, Interrupts

**UNIT – IV:**
**8051 Programming in C:** Data types, software delay generation, Logical operations, Accessing code and data space in 8051, I/O port programming, Timer/counter programming.

**UNIT – V:**
**8051 Programming:** Serial IO modes and their programming in C, interrupts programming in C: serial, timer and external interrupts.

**UNIT – VI:**
**Introduction to Arduino:** Features of Arduino, Arduino components and IDE, Interfacing: Seven Segment Display, Pulse Width Modulation, Analog Digital Converter, Wireless connectivity to Arduino. Case study: From BT To WiFi: Creating WiFi Controlled Arduino Robot Car.

**TEXT BOOKS:**
1. The 8051 Microcontroller: Programming, Architecture, Ayala & Gadre, Cengage Publications 3rd Edition, 2008
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, 2nd Edition, 2005

**REFERENCES:**
1. Digital Design, Morris Mano, PHI, 3rd Edition, 2006
2. Embedded Systems: Architecture, Programming and Design, 2nd Edition, TMH

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**B.Tech. VII Semester**

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## (18OE1EC03) IOT PROTOCOLS AND ITS APPLICATIONS

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

**COURSE OBJECTIVES:**
- To understand the basics of Internet of Things and Cloud of things
- To learn different protocols and connectivity technologies used in IOT
- To understand various IoT platforms
- To learn different applications with IoT

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Understand the concepts of Internet of Things and Cloud of things
**CO-2:** Analyze various protocols for IoT
**CO-3:** Apply IOT to different applications in the real world

**UNIT – I:**
**Introduction to Internet of Things:** Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Deployment Templates, M2M, IoT vs M2M.

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

**UNIT – III:**
**Connectivity Technologies:** IEEE802.15.4, ZIGBEE, 6LOWPAN, Wireless HART, Z-Wave, Bluetooth, NFC, RFID.
**Prototyping Embedded Device:** Sensors, Actuators, Embedded computing Basics, System on chips.

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

**UNIT – V:**
**Cloud of Things:** Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

**UNIT – VI:**
**Domain Specific Applications of IoT:** IoT Design Methodology, Applications of IoT– Home, Health, Environment, Energy, Agriculture, Industry and Smart City.

**TEXT BOOKS:**
1. Internet of Things: A Hands-On Approach, Vijay Madisetti, Arshdeep Bahga, Universities Press, 2015
2. The Internet of Things – Key Applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi, Wiley, 2012
3. The Internet of Things in the Cloud: A Middleware Perspective, Honbo Zhou, CRC Press, 2012

**REFERENCES:**
1. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers, 2013
2. Building the Internet of Things, Sara Cordoba, Wimer Hazenberg, Menno Huisman, BIS Publishers, 2011
3. Designing the Internet of Things, Adrian Mcewen, Hakin Cassimally, John Wiley and Sons, 2015

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

| B.Tech. VIII Semester | L | T/P/D | C |
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## (18OE1EC08) WIRELESS SENSOR NETWORKS

**COURSE PRE-REQUISITES:** Sensors Transducers and Actuators, Introduction to Microcontrollers and Interfacing, IoT Protocols and its applications

**COURSE OBJECTIVES:**
- To expose basic concepts of wireless sensor network technology
- To study medium access control protocols and various issues in a physical layer
- To understand the key routing protocols for sensor networks and their design issues
- To understand sensor management in networks and design requirements

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Appreciate various design issues of wireless sensor networks
**CO-2:** Understand the hardware details of different types of sensors and select the application specific sensor
**CO-3:** Understand radio standards and communication protocols to be used for wireless sensor networks

### UNIT – I:
**Introduction:** Overview of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.

### UNIT – II:
**Hardware:** Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (Operating Systems): TinyOS, MANTIS, Contiki, and RetOS.

### UNIT – III:
**Programming Tools:** C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet, NetSim)

### UNIT – IV:
**Overview of Sensor Network Protocols (Details of at least 2 important protocol per layer):** Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi- hop and cluster-based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

### UNIT – V:
**Data Dissemination and Processing:** Differences compared with other database management systems, Query models, In-network data aggregation, data storage; query processing.

### UNIT – VI:
**Specialized Features:** Energy preservation and efficiency; security challenges; Fault tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for

future research, and Enabling technologies in wireless sensor network.

**TEXT BOOKS:**
1. Wireless Sensor Networks Technology, Protocols, and Applications, Kazem Sohraby, Daniel Minoli, Taieb Znati, John Wiley & Sons, 2007
2. Protocols and Architectures for Wireless Sensor Networks, H. Karl and A. Willig, John Wiley & Sons, India, 2012
3. Wireless Sensor Networks, C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, 1st Indian Reprint, Springer Verlag, 2010

**REFERENCES:**
1. Wireless Sensor Networks: An Information Processing Approach, F. Zhao and L. Guibas, Morgan Kaufmann, 1st Indian Reprint, 2013
2. Wireless Sensor Network and Applications, Yingshu Li, My T. Thai, Weili Wu, Springer Series on Signals and Communication Technology, 2008
3. Principles of Mobile Communications, Gordon L. Stuber, 2nd Edition, Springer International, 2001

# AUGMENTED REALITY (AR) / VIRTUAL REALITY (VR)

# AUGMENTED REALITY (AR) / VIRTUAL REALITY (VR)

**Augmented reality and virtual reality (AR & VR):** Augmented reality (AR) and Virtual Reality (VR) bridge the digital and physical worlds. They allow you to take in information and content visually, in the same way you take in the world. AR dramatically expands the ways our devices can help with everyday activities like searching for information, shopping, and expressing yourself. VR lets you experience what it's like to go anywhere from the front row of a concert to distant planets in outer space.

**Job Roles in Augmented reality and virtual reality (AR & VR) Track**

- Design Architect. ...
- Software Designer. ...
- System Validation Engineers. ...
- Software Developer. ...
- 3D Artist…

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| B.Tech. V Semester | L | T/P/D | C |
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**(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** |
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**(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 Mc Graw Hill, 2004
4. Digital Signal Processing – A Practical Approach, Emmanuel C. Ifeacher, Barrie W. Jervis, 2nd Edition, Pearson Education

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**B.Tech. VII Semester**

| | L | T/P/D | C |
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| | 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, Joem Ostarmann and Ya – Quin Zhang, 1st Edition, PHI

**REFERENCES:**
1. Digital Video Processing, M. Tekalp, Prentice Hall International
2. Image Acquisition and Processing with LabVIEW, Relf, Christopher G., CRC Press
3. Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms, Aner Ozdemi R, John Wiley & Sons
4. Fundamentals of Digital Image Processing, A Practical Approach with Examples in Matlab, Chris Solomon, Toby Breckon, John Wiley & Sons

## VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. VIII Semester**

| | L | T/P/D | C |
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| | 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, students will be expected to develop AR VR applications by being able to do each of the following:
- Review of current Virtual Reality (VR) and Augmented Reality (AR) technologies
- Know the fundamentals of VR/AR modeling and programming
- Provide 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.

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| B.Tech. V Semester | L | T/P/D | C |
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### (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

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. VI Semester**

| L | T/P/D | C |
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## (18OE1CS01) FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

**COURSE PRE-REQUISITES:** Mathematics for Artificial Intelligence

**COURSE OBJECTIVES:**
- To understand and analyze the importance and basic concepts of artificial intelligence and the use of agents
- To identify, explore the complex problem-solving strategies and approaches
- To analyze the concepts of basic concepts of neural networks and learning process
- To explore and analyze the methodology used in machine learning

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Apply the basic concepts of artificial intelligence and the use of agents into the real-world scenario
**CO-2:** Design and formulate complex problem solutions with the use of various searching techniques
**CO-3:** Correlate the algorithmic approach of machine learning algorithms for a given case study
**CO-4:** Analyse the phenomenon of neural networks and apply basic learning laws

**UNIT – I:**
**Introduction to AI:** Foundations of AI – History of AI - Applications of AI, Intelligent Agents – Agents and Environments – Nature of Environments – Structure of Agents – Problem solving Agents – Problem formulation – Example Problems.

**UNIT – II:**
**Searching Techniques:** Uninformed Search Strategies – Breadth first search – Depth first search – Depth limited search - Bidirectional search – comparison – Search with partial information - Heuristic search – Greedy best first search – A* search – Memory bounded heuristic search - Heuristic functions - Local search- Hill climbing – Simulated annealing search - Local beam search, Genetic algorithms.

**UNIT – III:**
**Constraint Satisfaction Problems:** Backtracking search for CSP's - local search for constraint satisfaction problem. *Adversarial search* – Games - Minimax algorithm, Alpha beta pruning, cutting-off search.

**UNIT – IV:**
**Knowledge Representation and Reasoning:** Propositional Logic, Rules of Inference, First Order Logic (FOL) Syntax, Semantics, Entailment.

**UNIT – V:**
**Classical Planning:** Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches.

**UNIT – VI:**

**Planning and Acting in the Real World**: Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent Planning.

**TEXT BOOKS:**

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall, 2010
2. Machine Learning, Tom M. Mitchell, McGraw Hill Publications
3. Neural Networks: A Comprehensive Foundation, Simon Haykin, Pearson Education, 2nd Edition, 2004

**REFERENCES:**

1. Artificial Intelligence, Elaine Rich & Kevin Knight, 2nd Edition, TMH
2. Artificial Intelligence-A New Synthesis, Nils J. Nilsson, Elsevier
3. Artificial Neural Networks, Yegnanarayana B., PHI

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. VII Semester**  
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## (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:** Familiarize the basic concepts, notations, mathematical understanding required for machine learning applications

**CO-2:** Understand various kinds of models and algorithms used for machine learning

**CO-3:** Apply the suitable machine learning techniques to solve real world applications

**CO-4:** Demonstrate given technique for various data analysis applications

**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

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| B.Tech. VIII Semester | L | T/P/D | C |
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### (18OE1CS03) DEEP LEARNING

**COURSE PRE-REQUISITES:** Mathematics for Artificial Intelligence, Fundamentals of Artificial Intelligence, Machine Learning Techniques

**COURSE OBJECTIVES:**
- To introduce the foundations of deep learning
- To acquire the knowledge on Deep Learning Concepts

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Identify and select appropriate learning network models required for real world problems
**CO-2:** Design an efficient model with various deep learning techniques
**CO-3:** Implement deep learning algorithms and solve real-world problems
**CO-4:** Apply optimization strategies necessary for problem solving required for large scale applications

**UNIT – I:**
**Introduction to Deep Learning:** History of Deep Learning, Deep Learning Success Stories, Biological Neuron, Idea of computational units, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm and Convergence.

**UNIT – II:**
**Feedforward Networks:** Multilayer Perceptron, Gradient Descent, Back-propagation, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks.

**UNIT – III:**
**Regularization for Deep Learning:** Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, Multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier.

**UNIT – IV:**
**Optimization for Training Deep Models:** Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithm.

**UNIT – V:**
**Convolutional Neural Networks:** LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Markov Networks, Object Detection, RCNN, Fast RCNN, Faster RCNN, YOLO

**UNIT – VI:**

**Auto-Encoders:** Regularization in auto-encoders, De-noising auto-encoders, Sparse auto-encoders, Contractive auto-encoders, Structured probabilistic models of deep learning.

**TEXT BOOKS:**

1. Deep Learning: An MIT Press Book, Ian Goodfellow and Yoshua Bengio and Aaron Courville
2. Neural Networks and Learning Machines, Simon Haykin, 3rd Edition, Pearson Prentice Hall

**REFERENCES:**

1. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
2. Pattern Recognition and Machine Learning, Christopher Bishop, 2007

# BLOCKCHAIN TECHNOLOGIES

# BLOCKCHAIN TECHNOLOGIES

The blockchain is one of the fastest growing skills in the IT sector today. This track will help the students to gain knowledge in blockchain technology, it has taken quite a turn in the industry given its popularity in providing safe and secured online transactions. Most individuals and organizations have started adopting blockchain because of the many benefits it offers to the industry today. It is used in many industry applications such as banking sector, voting, health care, real estate, the legal industry and government.

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. V Semester**                                     **L       T/P/D    C**
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## (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:** Position to 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, W. A. Shay, 3rd Edition, Cengage Learning

| B.Tech. V Semester | L | T/P/D | C |
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## (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 be familiar with the basic issues of transaction processing and concurrency control
- To be 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. VI Semester**

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## (18OE1CS05) DISTRIBUTED DATA BASES

**COURSE PRE-REQUISITES:** Fundamentals of Computer Networks

**COURSE OBJECTIVES:**
- To introduce distributed databases and exploring several algorithms for processing queries and be able to use them
- To describe the methods to translate complex conceptual data models into logical and Physical database designs
- To demonstrate query optimization and its algorithms
- To enumerate the concepts behind distributed transaction processing

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Analyze issues related to distributed database design
**CO-2:** Apply Partitioning techniques to databases
**CO-3:** Design and develop query processing strategies
**CO-4:** Describe transaction processing and concurrency control in distributed databases

**UNIT – I:**
**Introduction:** Features of Distributed versus Centralized Databases,
**Levels of Distribution Transparency:** Reference Architecture for Distributed Databases, Types of Data Fragmentation, Distribution transparency for Read – only Applications, Distribution transparency for update Applications, Distributed database Access primitives, Integrity Constraints in Distributed Databases.

**UNIT – II:**
**Distributed Database Design:** A framework, the design of database fragmentation, the allocation of fragments.
**Translation of Global Queries to Fragment Queries:** Equivalence Transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries.

**UNIT – III:**
**Optimization of Access Strategies:** A Framework for Query Optimization, Join Queries, General Queries.

**UNIT – IV:**
**The Management of Distributed Transactions:** A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural aspects of Distributed Transactions.

**UNIT – V:**
**Concurrency Control:** Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.

**UNIT – VI:**

**Reliability:** Basic Concepts, Nonblocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart.

**TEXT BOOKS:**

1. Principles of Distributed Database Systems, M. Tamer OZSU and Patuck Valduriez, Pearson Education Asia, 2001
2. Distributed Databases, Stefano Ceri and Willipse Pelagatti, McGraw Hill

**REFERENCES:**

1. Database System Concepts, Henry F. Korth, A. Silberchatz and Sudershan, MGH
2. Database Management Systems, Raghuramakrishnan and Johhanes Gehrke, MGH

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**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 security attacks, services, goals and mechanism of security
**CO-2:** Develop a security model using conventional approach to prevent the attacks
**CO-3:** Apply public key cryptography principles, examine authenticity and integrity of the messages in the communication
**CO-4:** Build a model for IP security, firewall and test the security issues

**UNIT – I:**
**Security Attacks:** Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

**UNIT – II:**
**Conventional Encryption:** Classical Encryption techniques, Fiestel Cipher Structure, Data Encryption Standard, Block Cipher Design Principles and Modes of Operation, Triple DES, RC-4, Evaluation criteria for AES, AES Cipher, Placement of Encryption Function, Traffic Confidentiality.

**UNIT – III:**
**Public Key Cryptography and Authentication:** Confidentiality using Symmetric Encryption – Principles of Public key Cryptosystems, RSA algorithm, Key Management, Diffie-Hellman key Exchange, Elliptic Curve Cryptography.
Authentication requirements, Authentication functions, Message Authentication Codes

**UNIT – IV:**
**Hash Functions:** Hash Functions, Security of Hash Functions and MACs, MD5 message Digest algorithm, Secure Hash Algorithm, HMAC, Digital Signatures, Authentication Protocols, Digital Signature Standard, Authentication Applications: Kerberos, X.509 Authentication Service

**UNIT – V:**
**Network Security:** Email Security and Web Security
Electronic Mail Security – PGP/ SMIME, IP security- Architecture, Authentication Header, Encapsulating Security Payload, Key Management, Web Security- Secure Socket Layer, Transport Layer Security and Secure Electronic Transaction

**UNIT – VI:**
**System Level Security:** Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

**TEXT BOOKS:**
1. Cryptography and Network Security – Principles and Practices, William Stallings, 4th Edition, Prentice Hall of India, 2005
2. Hack Proofing Your Network, Ryan Russell, Dan Kaminsky, Rain Forest, Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W. Manzuik and Ryan Permeh, Wiley Dreamtech

**REFERENCES:**
1. Network Security Essentials: Applications and Standards, William Stallings, Prentice Hall,1999, ISBN 0130160938
2. Security in Computing, Charles B. Pfleeger, Shari Lawrence Pfleeger, 3rd Edition, Pearson Education, 2003

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| B.Tech. VIII Semester | L | T/P/D | C |
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**(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:** Gain a clear understanding of the concepts that underlie digital distributed ledger
**CO-2:** Understand key mechanisms like Decentralization, Transparency and trust, Immutability, High availability, Highly secure and different types of Blockchain
**CO-3:** Apply the concept of Hash Function and Related Hash Algorithm
**CO-4:** Design and implement applications using Blockchain Technology

**UNIT – I:**
**Introduction to Blockchain Part I:** Introduction to Centralized, Decentralized and Distributed system, History of Blockchain, Various technical definitions of Blockchain.
**Introduction to Blockchain Technology Part II:** Generic elements of a blockchain: Block, Transaction, Peer-to-peer network, Node, Smart contract, Why It's Called "Blockchain", Characteristics of Blockchain Technology, Advantages of blockchain technology.

**UNIT – II:**
**Concept of Blockchain Technology Part I:** Cryptography, Hashing, Nonce, Distributed database, Consensus, Smart Contract, Component of block, Structure of Block chain, Technical Characteristics of the Blockchain.
**Concept of Blockchain Technology Part II:** Applications of blockchain technology, Tiers of blockchain technology Bolckchain 0, Bolckchain 1, Blockchain 2, Blockchain 3, Generation of Blockchain X.

**UNIT – III:**
**Technical Foundations Part I:** Cryptography, Confidentiality, Integrity, Authentication, Cryptographic primitives, Public and private keys, RSA, Discrete logarithm problem, Hash Function: Message Digest (MD), Secure Hash Algorithms (SHAs), Design of Secure Hash Algorithms (SHA), SHA-256, Design of SHA3, Elliptic Curve Digital signature algorithm.
**Technical Foundations Part II:** Consensus algorithm: Proof of work (PoW), Proof-of-Stake (PoS), Byzantine Fault Tolerance (BFT)

## UNIT – IV:

**Types of Blockchain:** Public blockchains, Private blockchains, Semi-private blockchains, Side chains, Permissioned ledger, Distributed ledger, Shared ledger, Fully private and proprietary blockchains, Tokenized blockchains, Tokenless blockchains, CAP theorem and blockchain

## UNIT – V:

Financial markets and trading, Trading, Exchanges, Trade life cycle, Order anticipators, Market manipulation.

**Crypto Currency:** Bitcoin, Bitcoin definition, Keys and addresses, Public keys in Bitcoin, Private keys in Bitcoin, Bitcoin currency units

## UNIT – VI:

**Implementation Platforms:** Hyperledger as a protocol, Reference architecture, Hyperledger Fabric, Transaction Flow, Hyperledger Fabric Details, Fabric Membership, Fabric Membership

### TEXT BOOKS:

1. Mastering Blockchain, Imaran Bashir, Second Edition, Packt
2. Blockchain Basic, Daniel Drescher, A Press

### REFERENCES:

1. Blockchain For Dummies®, IBM Limited Edition, John Wiley & Sons Inc.

# ROBOTICS

# ROBOTICS

Robotics is a field of study that involves the design, construction and operation of robots. This field overlaps with electronics, computer science, mechatronics and artificial intelligence. Robotic companies are booming all over the world and are seeking engineers with skills for implementing **Next -Level Automation**. This Open Elective Track for Robotics consists of four courses and is intended for making students industry ready in the field of robotics.

The First course in this track" Fundamentals **of Robotics"** introduces various physical aspects of building a robot, exploring topics like how a robot perceives its environment using Sensors and how it interacts with its environment through various Actuators & Grippers. This course also inspects a variety of robot applications in different domains.

Second Course in this track" Kinematics **& Dynamics of robots"** delves a level deeper discussing analysis and control of robots. It establishes strong mathematical foundation for describing and controlling robot movement. In this course students will learn in detail about Forward Kinematics, Inverse Kinematics, Workspace Analysis and Trajectory planning for robots.

Third Course in the Robotics track **"Drives and Control System for Robots"** explores in detail various Drive Mechanisms used in robotics such as Hydraulic, Pneumatic & Electric drives. After completing this course students will be able to analyze operational aspects of a drive system for a given robotic application. Fourth Course in the track **"Robot Programming and Intelligent Control System"** expands on Robot Programming, discussing various aspects of Robot Programming Languages and their functions. This course also dives deep into advanced topics like Artificial Intelligence, Neural Networks and Fuzzy control for robots.

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. V Semester**

| L | T/P/D | C |
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## (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

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| **B.Tech. VI Semester** | **L** | **T/P/D** | **C** |
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**(18OE1EI02) KINEMATICS AND DYNAMICS OF ROBOTS**

**COURSE PRE-REQUISITES:** Fundamentals of Robotics

**COURSE OBJECTIVES:**
- To understand the basics of robot coordinate frames and their representation
- To obtain knowledge about direct kinematics and inverse kinematics for a robot manipulator
- To examine techniques for planning robot motion in a workspace
- To understand various methods for developing dynamic models for manipulator
- To learn control techniques applied to robot manipulators

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Mathematically represent a Robot system
**CO-2:** Calculate robot hand position and orientation for specific joint angles
**CO-3:** Calculate joint angles to achieve a particular hand position
**CO-4:** Plan trajectories for robot tool to do meaningful tasks
**CO-5:** Analyze different controlling techniques used for robot manipulators

**UNIT – I:**
**Introduction:** Introduction, position and orientation of objects, objects coordinate frame Rotation matrix, Euler angles Roll, pitch and yaw angles coordinate Transformations, Joint variables and position of end effector, Dot and cross products.

**UNIT – II:**
**Direct Kinematics:** Coordinate frames, Rotations, Homogeneous coordinates, Link coordinates D-H Representation, The ARM equation. Direct kinematic analysis for Four axis SCARA Robot and three, five and six axis Articulated Robots.

**UNIT – III:**
**Inverse Kinematics:** The inverse kinematics problem, General properties of solutions. Tool configuration, Inverse kinematics of four axis SCARA robot and three and five axis Articulated robot.

**UNIT – IV:**
**Workspace Analysis and Trajectory Planning:** Workspace Analysis, work envelope of a Four axis SCARA robot and five axis articulated robot workspace fixtures, the pick and place operations, Joint space technique - continuous path motion, Interpolated motion, straight line motion and Cartesian space technique in trajectory planning.

**UNIT – V:**
**Manipulator Dynamics:** Introduction, Lagrange's equation kinetic and potential energy. Link inertia Tensor, link Jacobian Manipulator inertia tensor. Gravity, Generalized forces, Lagrange-Euler Dynamic model, Dynamic model of a Two-axis planar robot, Newton Euler formulation, Lagrange - Euler formulation, problems.

**UNIT – VI:**

**Robot Control:** The Control Problem, State Equations: one axis robot; three axis SCARA robot, Constant solutions, Linear Feedback Systems, Single Axis PID Control, PD-Gravity Control.

**TEXT BOOKS:**

1. Fundamentals of Robotics: Analysis & Control, Robert J. Schilling, Prentice Hall of India
2. Robotics and Control, R. K. Mittal, I. J. Nagrath, McGraw Hill Education

**REFERENCES:**

1. Robotic Engineering–An Integrated Approach, Klafter R.D, Chimielewski T. A., Negin M., Prentice Hall of India, New Delhi, 2009
2. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover & Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, Tata McGraw-Hill Education, 2012
3. Robotics-Control, Sensing, Vision and Intelligence, K. S. Fu, R. C. Gonzalez, C. S. G. Lee, McGraw-Hill International Edition

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| B.Tech. VII Semester | L | T/P/D | C |
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## (18OE1EI03) DRIVES AND CONTROL SYSTEM FOR ROBOTICS

**COURSE PRE-REQUISITES:** Fundamentals of Robotics, Kinematics and Dynamics of Robotics

**COURSE OBJECTIVES:**
- To get acquainted with different robot drive mechanisms
- To understand in detail, working of hydraulic and pneumatic drives used in robotics
- To learn working principles of various electric drive systems for robotics
- To acquire basic Knowledge on servo systems for robot control

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Categorize various drive systems for robot movement
**CO-2:** Select appropriate drive system for a particular application
**CO-3:** Inspect different electric drives and their applications in robotics
**CO-4:** Analyze accurate positioning of robot end effector by servo control

**UNIT – I:**
**Introduction:** Objectives, motivation, open loop control, closed loop control with velocity and position feedback, Types of drive systems. Functions of drive system.

**UNIT – II:**
**Robot Drive Mechanism:** Lead Screws, Ball Screws, Chain & linkage drives, Belt drives, Gear drives, Precision gear boxes, Harmonic drives, Cyclo speed reducers.

**UNIT – III:**
**Hydraulic Drives:** Introduction, Requirements, Hydraulic piston and transfer valve, hydraulic circuit incorporating control amplifier, hydraulic fluid considerations, hydraulic actuators Rotary and linear actuators. Hydraulic components in robots.

**UNIT – IV:**
**Pneumatic Drives:** Introduction, Advantages, pistons-Linear Pistons, Rotary pistons, Motors-Flapper motor, Geared motor, Components used in pneumatic control. Pneumatic proportional controller, pneumatically controlled prismatic joint.

**UNIT – V:**
**Electric Drives:** Introduction, Types, DC electric motor, AC electric motor, stepper motors, half step mode operation, micro step mode. Types of stepper motors, Direct drive actuator.

**UNIT – VI:**
**Servo Mechanism for Robot:** Mathematical modeling of robot servos, error responses and steady state errors in robot servos, feedback and feed forward compensations, hydraulic position servo, computer-controlled servo system for robot applications, selection of robot drive systems.

**TEXT BOOKS:**
1. Engineering Foundation of Robotics, Francis N-Nagy Andras Siegler, Prentice Hall Inc.
2. Robotics Engineering - An Integrated Approach, Richard D. Klafter, Thomas A., Chri Elewski, Michael Negin, PHI Learning, 2009

**REFERENCES:**
1. Industrial Robotics, Technology Programming and Applications, Mikell P. Groover & Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel, Ashish Dutta, Tata McGraw-Hill Education, 2012
2. Industrial Robotics, Bernard Hodges, 2nd Edition, Jaico Publishing House, 1993
3. Fundamentals of Robotics Analysis and Control, Robert J. Schilling, PHI Learning, 2009
4. Foundations of Robotics Analysis and Control, Tsuneo Yohikwa, MIT Press, 2003
5. Introduction to Robotics Mechanics and Control, John J. Craig, 3rd Edition, Pearson, 2008

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

| B.Tech. VIII Semester | L | T/P/D | C |
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## (18OE1EI04) ROBOT PROGRAMMING AND INTELLIGENT CONTROL SYSTEM

**COURSE PRE-REQUISITES:** Fundamentals of Robotics, Kinematics and Dynamics of Robotics, Drives and Control Systems for Robotics

**COURSE OBJECTIVES:**
- To understand the fundamentals of robot programming
- To learn robot textual languages that are in common use
- To expose to artificial intelligence in robotics
- To acquire basic Knowledge on neural networks in robotics
- To acquire basic Knowledge on fuzzy logic in robotics

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Gain knowledge about different methods of robot programming
**CO-2:** Examine various robot language elements and their functions
**CO-3:** Analyze different AI techniques employed in robotics
**CO-4:** Design basic neuro-controller for robot motion control
**CO-5:** Apply fuzzy logic to robot control systems

**UNIT – I:**
**Robot Programming:** Methods of robot programming, leadthrough programming methods, robot program as a path in space - defining position in space, speed control, motion interpolation, WAIT, SIGNAL, DELAY commands, Branching.

**UNIT – II:**
**Robot Languages:** Textual robot language, generations of robot languages, robot language structure, operating systems, Robot language Elements and functions, constraints and variables, aggregates and location variables.

**UNIT – III:**
**Basic Commands and Operations:** Motion commands- move and related statements, speed control, points in workspace, paths and frames. End effector and sensor commands- end effector operation, sensor operation, REACT statement. Computations and operation. Program control and subroutines. Communications and data processing. Monitor mode commands.

**UNIT – IV:**
**AI for Robotics:** Introduction to Artificial Intelligence, goals of AI research, AI techniques- knowledge representation, problem representation, search techniques. LISP programming. AI and Robotics. LISP in the factory. Robotic Paradigms.

**UNIT – V:**
**Neural Network Approach in Robotics:** Introduction, Connectionist Models, Learning Principles and Learning Rules: Supervised, unsupervised, reinforcement learning. Sensor based robot learning, Neural Network in Robotics: Control of robot hands by neural network, neural set approach to robot motion coordination, robotic motor control using reinforcement learning optimization.

**UNIT – VI:**

**Fuzzy Logic Approach in Robotics:** Introduction, Fuzzy sets, Operation of Fuzzy sets, Fuzzy relations, Fuzzy rule formation, Control rules, Fuzzy algorithm in robotics, Robot obstacle avoidance using fuzzy logic, Fuzzy logic for robot path tracking and behavior coordination, fuzzy control system in mobile robots, fuzzy controller design for robot systems, Case study of fuzzy logic in robotics.

**TEXT BOOKS:**

1. Industrial Robotics Technology, Programming and Applications, Mikell P. Groover, McGraw Hill, 2012
2. Robotics Technology and Flexible Automation, Deb S. R., Tata McGraw Hill Publishing Company Limited

**REFERENCES:**

1. Design and Control of Intelligent Robotic Systems, (Studies in Computational Intelligence 177) M. Begum, F. Karray (auth.), Dikai Liu, Lingfeng Wang, Kay Chen Tan (eds.), Springer
2. Neural Networks in Robotics, Edited by George Bekey, Kenneth Y. Goldberg, Springer US, 2012
3. Neural Networks, Fuzzy Logic, Genetic Algorithm - Synthesis and Applications, Rajasekharan and Rai, PHI Publications
4. Introduction to Neural Networks using MATLAB 6.0, S. N. Sivanandam, S. Sumathi, S. N. Deepa, TMH, 2006

# CYBER SECURITY

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**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, W. A. Shay, 3rd Edition, Cengage Learning

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| **B.Tech. V Semester** | **L** | **T/P/D** | **C** |
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**(18OE1CS08) RELATIONAL DATABASE MANAGEMENT SYSTEMS**

**COURSE PRE-REQUISITES:** None

**COURSE OBJECTIVES:**
- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

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

**CO-1:** Demonstrate the basic elements of a relational database management system

**CO-2:** Ability to identify the data models for relevant problems

**CO-3:** Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data

**CO-4:** Apply normalization for the development of application software

**UNIT – I:**
**Introduction:** Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.
**Introduction to Database Design:** Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.
**Relational Model:** Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

**UNIT – II:**
**Relational Algebra and Calculus:** Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.
**SQL:** Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

**UNIT – III:**
**Schema Refinement and Normal Forms:** Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

**UNIT – IV:**
**Transaction Management:** Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels.

**UNIT – V:**
**Concurrency Control:** Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes.
Recovery System-Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

**UNIT – VI:**
**Storage and Indexing:** Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.
**Tree-Structured Indexing:** Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.
Hash- Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

**TEXT BOOKS:**
1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw Hill Education (India) Private Limited
2. Database System Concepts, A. Silberschatz, Henry F. Korth, S. Sudarshan, 6th Edition, McGraw Hill Education (India) Private Limited
3. Database Systems, R. Elmasri, Shamkant B. Navathe, 6th Edition, Pearson Education

**REFERENCES:**
1. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning
2. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition
3. Database Development and Management, Lee Chao, Auerbach Publications, Taylor & Francis Group
4. Introduction to Database Systems, C. J. Date, Pearson Education

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**B.Tech. VI Semester**                                      **L      T/P/D   C**
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**(18OE1CS06) CRYPTOGRAPHY AND NETWORK SECURITY**

**COURSE PRE-REQUISITES:** Fundamentals of Computer Networks, Distributed Data Bases

**COURSE OBJECTIVES:**
- To outline security concepts, threats, attacks, services and mechanisms
- To describe various cryptosystems- symmetric key cryptography, public key cryptography
- To apply authentication services and Secure hash functions
- To discuss the concepts of IP Security, web security, viruses and firewalls

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Analyze the security attacks, services, goals and mechanism of security
**CO-2:** Develop a security model using conventional approach to prevent the attacks
**CO-3:** Apply public key cryptography principles, examine authenticity and integrity of the messages in the communication
**CO-4:** Build a model for IP security, firewall and test the security issues

**UNIT – I:**
**Security Attacks:** Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

**UNIT – II:**
**Conventional Encryption:** Classical Encryption techniques, Fiestel Cipher Structure, Data Encryption Standard, Block Cipher Design Principles and Modes of Operation, Triple DES, RC-4, Evaluation criteria for AES, AES Cipher, Placement of Encryption Function, Traffic Confidentiality.

**UNIT – III:**
**Public Key Cryptography and Authentication:** Confidentiality using Symmetric Encryption – Principles of Public key Cryptosystems, RSA algorithm, Key Management, Diffie-Hellman key Exchange, Elliptic Curve Cryptography.
Authentication requirements, Authentication functions, Message Authentication Codes

**UNIT – IV:**
**Hash Functions:** Hash Functions, Security of Hash Functions and MACs, MD5 message Digest algorithm, Secure Hash Algorithm, HMAC, Digital Signatures, Authentication Protocols, Digital Signature Standard, Authentication Applications: Kerberos, X.509 Authentication Service

**UNIT – V:**

**Network Security:** Email Security and Web Security

Electronic Mail Security – PGP/ SMIME, IP security- Architecture, Authentication Header, Encapsulating Security Payload, Key Management, Web Security- Secure Socket Layer, Transport Layer Security and Secure Electronic Transaction

**UNIT – VI:**

**System Level Security:** Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

**TEXT BOOKS:**

1. Cryptography and Network Security – Principles and Practices, William Stallings, 4th Edition, Prentice Hall of India, 2005
2. Hack Proofing your Network, Ryan Russell, Dan Kaminsky, Rain Forest, Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W. Manzuik and Ryan Permeh, Wiley Dreamtech

**REFERENCES:**

1. Network Security Essentials: Applications and Standards, William Stallings Prentice Hall,1999, ISBN 0130160938
2. Security in Computing, Charles B. Pfleeger, Shari Lawrence Pfleeger, 3rd Edition, Pearson Education, 2003

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| B.Tech. VII Semester | L | T/P/D | C |
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**(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 |
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**(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.

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| **B.Tech. V Semester** | **L** | **T/P/D** | **C** |
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## (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 $\beta_0$ and $\beta_1$, Estimation of $\sigma^2$.

**UNIT – VI:**
**Non-Linear Regression:** Regression of second-degree polynomial (non-linear least square method for polynomial function), power function, exponential, estimation of coefficients, linear and polynomial regressions in R.

**TEXT BOOKS:**
1. Introductory Statistics, Thomas H. Wonnacott & Ronald J. Wonnacot, John Wiley & Sons Inc., 1969
2. Applied Statistics and Probability for Engineers, Douglas C. Montgomery, George C. Runger, 3rd Edition, John Wiley & Sons, Inc., 2003
3. R for Beginners, Sandip Rakshit, 1st Edition, McGraw-Hill Education, 2017

**REFERENCES:**
1. R-The Statistical Programming Language, Dr. Mark Gardner, Wiley India Pvt. Ltd, 2013
2. Introduction to the Theory of Statistics, A. M. Mood, F. A. Graybill and D. C. Boes, 3rd Edition, McGraw Hill Education, 2017
3. Introduction of Probability Models, S. M. Ross, 11th Edition, Academic Press, N.Y., 2014
4. Statistical Methods, S. P. Gupta, 42nd Revised Edition, Sultan Chand & Sons, 2012

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| B.Tech. VI Semester | L | T/P/D | C |
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**(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

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| B.Tech. VII Semester | L | T/P/D | C |
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**(18OE1IT04) FUNDAMENTALS OF DATA MINING**

**COURSE PRE-REQUISITES:** Statistical Methods for Data Science, Computational Thinking using Python

**COURSE OBJECTIVES:**
- To introduce the basic concepts and techniques in building a Data Warehouse
- To apply preprocessing methods for any given raw data
- To develop skills of using recent data mining software for solving practical problems
- To implement and apply basic algorithms for supervised and unsupervised learning

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Assess raw input data and process it to provide suitable input for a range of data mining algorithms.
**CO-2:** Discover and measure interesting patterns from different kinds of databases
**CO-3:** Evaluate and select appropriate data-mining algorithms and apply, interpret and report the output appropriately
**CO-4:** Design and implement data-mining applications using sample, realistic data sets and modern tools

**UNIT – I:**
**Data Warehousing & Modeling:** Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading.

**UNIT – II:**
**Data Cube:** A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.

**UNIT – III:**
**Data Warehouse Implementation & Data Mining:** Data Warehouse Architecture, What is data mining, Challenges, From Data Warehousing and Data Mining, Data Mining Tasks, Data Mining Functionalities, Major Issues in Data Mining. Data: Types of Data, Data Quality, Data Pre-processing, Measures of Similarity and Dissimilarity.

**UNIT – IV:**
**Association Analysis:** Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.

**UNIT – V:**
**Classification:** Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.

**UNIT – VI:**

**Clustering Analysis:** Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph- Based Clustering, Scalable Clustering Algorithms.

**TEXT BOOKS:**

1. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, First Impression, Pearson, 2014
2. Data Mining-Concepts and Techniques, Jiawei Han, Micheline Kamber, Jian Pei, 3rd Edition, Morgan Kaufmann, 2012

**REFERENCES:**

1. Data Warehousing in the Real World, Sam Anahory, Dennis Murray, Tenth Impression, Pearson, 2012
2. Mastering Data Mining, Michael J. Berry, Gordon S. Linoff, 2nd Edtion, Wiley, 2012

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. VIII Semester**

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## (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 17th and 18th centuries were mostly about steam-powered vehicles transporting people and goods. While electric cars enjoyed popularity in the 19th and early 20th centuries, the later period saw the accelerated adoption of the petrol car, due to its advantages of power, mass production, cost and advances in the internal combustion engine. It is only in the 21st century that interest in electric cars has come back, given the need for cleaner, greener modes of transport. The modern period is associated with several path breaking technologies. Over the last couple of decades, there has been an explosion of electronics in vehicles. Connected cars that include technology features are ever more popular. These smart cars come with internet access, GPS, wi-fi, superior infotainment, advanced telematics and navigation capabilities. More innovations in in-vehicle infotainment and electronics promise to give car users even more enhanced capabilities in the near future.

Today, safety has become a larger concern than ever before. While entertainment and infotainment have made car driving a pleasure, this has also given rise to a growing tribe of distracted drivers. Add to this, underdeveloped roads, which take a toll on drivers today. Increased distractions and fatigue can also contribute to human fatalities. The future certainly points in the direction of driverless cars, which promise to alleviate concerns of traffic congestion and road safety. Driverless cars, also known as autonomous cars, will usher in a paradigm shift in the evolution of the modern automobile. Self-driving cars can sense the environment and traffic with the help of RADAR, LIDAR, GPS and computer vision and navigate without human intervention. Autonomous cars are claimed to have greater accuracy, reliability and faster reaction time compared to human drivers. This would lead to fewer traffic collisions and less road congestion.

Autonomous driving is a popular subject of today's discussion and automakers are developing complex systems that allow cars to drive themselves. If technology continues on its current course, car will do the concentrating for you. Self-parking, automatic emergency braking, adaptive cruise control and lane keeping are just some of the technologies that have leapt into the market in the past few years. Put them all together, get a picture of driving to assisted driving to fully autonomous cars. The open elective track "Autonomous Vehicles" offered by the department of automobile engineering trains the students to meet the technological challenges and diverse needs of the industry and society in various areas of automobile engineering and equips them to excel in a truly competitive industry. With through knowledge in this filed, engineering graduates get opportunity to serve many top-notch automobile companies and IT companies as well.

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**B.Tech. V Semester**

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**(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**

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**(18OE1AE02) MODERN AUTOMOTIVE TECHNOLOGIES**

**COURSE PRE-REQUISITES:** Principles of Automobile Engineering

**COURSE OBJECTIVES:**
- To provide an overview on advanced engine control system concepts
- To know the interdisciplinary concepts and intelligent automotive systems
- To understand the interdisciplinary concepts and GPS-enabled applications in automobile
- To present intelligent vehicle technologies like comfort, safety and security systems

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Apply advanced engine control system concepts in engineering
**CO-2:** Discuss the need for implementation intelligent vehicle technologies
**CO-3:** Address the key technologies in automotive navigation
**CO-4:** Appreciate the technological advancements driver assistance systems

**UNIT – I:**
**Advanced Engine Controls:** Concept of an electronic engine control system, engine control module, powertrain control module, electronic fuel injection - throttle body fuel injection, multi-point fuel injection, gasoline direct injection, common rail direct injection, electronic ignition control, engine mapping, on-board diagnostics.

**UNIT – II:**
**Introduction to Intelligent Vehicles:** Driver information, driver perception, driver convenience, driver monitoring, general vehicle control, longitudinal and lateral control, collision avoidance, vehicle monitoring.

**UNIT – III:**
**Telematics:** Global positioning system, geographical information systems, navigation system, architecture, automotive vision system, road recognition.

**UNIT – IV:**
**Comfort Systems:** Adaptive cruise control system, active suspension system, power steering, collapsible and tiltable steering column, power windows.

**UNIT – V:**
**Safety Systems:** Active and passive safety, airbags, seat belt tightening system, forward collision warning systems, child lock, anti-lock braking systems, traction control system, lane departure warning system.

**UNIT – VI:**
**Security Systems:** Anti-theft technologies – mechanical, electromechanical and electronic immobilizers, alarm system, stolen vehicle tracking system, remote keyless entry, smart card system, number plate coding.

**TEXT BOOKS:**
1. Understanding Automotive Electronics, William B. Ribbens, 5th Edition, Butterworth Heinemann Woburn,1998
2. Intelligent Vehicle Technologies: Theory and Applications, Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann Publications, Oxford, 2001

**REFERENCES:**
1. Automotive Handbook, Robert Bosch, SAE, 5th Edition, 2000
2. Navigation and Intelligent Transportation Systems – Progress in Technology, Ronald K. Jurgen, Automotive Electronics Series, SAE, USA, 1998
3. Understanding Automotive Electronics, Bechhold, SAE, 1998

## VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.TECH. VII Semester**

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### (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** |
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**(18OE1AE04) CONNECTED AND AUTONOMOUS VEHICLES**

**COURSE PRE-REQUISITES:** Principles of Automobile Engineering, Modern Automotive Technologies, Electric, Hybrid and Fuel Cell Vehicles

**COURSE OBJECTIVES:**
- To understand the fundamentals of vehicle communication and networking
- To provide state-of-the-art in wireless communication technology within and between vehicles
- To know various levels of vehicle autonomy and intelligent automotive systems
- To provide an overview on driver-assist and self-driving processes

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Present the fundamentals of vehicle communication and networking

**CO-2:** Appreciate intra-vehicle and inter-vehicle communication technologies
**CO-3:** Describe various levels of vehicle autonomy
**CO-4:** Discuss the driver-assist and self-driving processes

**UNIT – I:**
**Introduction to Vehicle Communications:** Intra-vehicle communications - communications protocols, systems and sensors (Braking, steering, power train, chassis systems, body electronics, instrument clusters, infotainment systems), inter-vehicle communications - cooperative driving (accident warning, frontal/rear collision prevention, lane change, assistance). Consumer assistance – traffic information, multimedia support and smart parking

**UNIT – II:**
**Communication Fundamentals and Controller Area Network:** Communication fundamentals – Frequency, bandwidth, power measurement, signal to noise ratio, transmission rate constraints, radio frequency spectrum allocation, RADAR operation and types of RADAR. CAN evolution, versions, types of controllers, layered architecture. CAN bus, message frames and error handling.

**UNIT – III:**
**Intra-Vehicle Communications:** Wired communication – Network comparison, two tier approach, LIN applications - Localized vehicle area support, general support areas, CAN applications - In vehicle operation, infotainment, wireless communication – Bluetooth vehicle applications, satellite services – satellite radio, vehicle care and traffic status.

**UNIT – IV:**
**Inter-Vehicle Communication:** Adhoc Communications –Applications in Vehicle traffic Monitoring, Collision and congestion avoidance, Highway lane reservation, Emission Control, Vehicle Frequency Utilization – AM Radio, Bluetooth, FM Radio, GPS, Short range RADAR, Wireless LAN, Intelligent Roadway-Infrastructure to vehicle and vehicle to vehicle communications. Evolving smart vehicle – ECU, wireless networking,

forward RADAR, side RADAR, GPS, cellular transmission and event Recorder.

**UNIT – V:**

**Autonomous Vehicles:** Importance, levels of automation, policy making, social costs, safety and crashes, congestion, land use, energy and emissions, costs and disadvantages

**UNIT – VI:**

**Current State of Autonomous Vehicles:** Research, challenges, commercial development, sensor systems, sensor suits, environmental challenges, graceful degradation, V2V and V2I communication, sharing the drive, integrity, security, verification and policy implications.

**TEXT BOOKS:**
1. Inter and Intra Vehicle Communications, Gilbert Held Auerbach Publications, 2008
2. Autonomous Vehicle Technology-A Guide for Policymakers, James M. Anderson, Nidhi Kalra, Karlyn D. Stanley, Paul Sorensen, Constantine Samaras, Oluwatobi A. Oluwatola, RAND Corporation, Santa Monica, Calif., 2016
3. Autonomous Driving - Technical, Legal and Social Aspects, Markus Maurer, J. Christian Gerdes, Barbara Lenz, Hermann Winner, Editors, Springer, 2016

**REFERENCES:**
1. Intelligent Vehicle Technologies: Theory and Applications, Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann Publications, Oxford, 2001
2. Navigation and Intelligent Transportation Systems – Progress in Technology, Ronald K. Jurgen, Automotive Electronics Series, SAE, USA, 1998
3. Automotive In–vehicle Networks, J. Gabrielleen, Wiley-Blackwell, 2008
4. In-Vehicle Network Architecture for the Next-Generation Vehicles, Syed Masud Mahmud, IGI
5. Communication Technologies for Vehicles, Mohamed Kassab Springer, 2015

# GENERAL - COMPUTING

## 1. PROGRAMMING THROUGH JAVA

**Java** is an extensively **used** programming language specifically intended for use in the distributed environment of the internet. **Java** help students to create wide-ranging applications that possibly will run on a single workstation or be distributed among servers and clients in a network.

Java is an extremely fruitful language and an upper option for many developers for many years. The motive that it has remained so prevalent is since it still happens the needs of functioning across networks.

**Students will have different roles and responsibilities by learning Java Programming**

- Designing, implementing, and maintaining Java applications that are often high-volume and low-latency, required for mission-critical systems.
- Delivering high availability and performance.
- Contributing in all phases of the development lifecycle.
- Writing well-designed, efficient, and testable code.

## 2. RELATIONAL DATABASE MANAGEMENT SYSTEMS

A relational database permits you to effortlessly find precise information. It also consents you to sort based on any field and produce reports that comprise only definite fields from each record. With features like, Data Accuracy, Easy Access to Data, Data Integrity, Flexibility, Normalization, High Security, Feasible for Future Modifications

**By learning RDBMS Students will have different roles in Database environment**

- Data Administrator,
- Database Administrator
- Database Designer
- Application Programmer

## 3. COMPUTATIONAL THINKING USING PYTHON

The **python** language is one of the utmost accessible programming languages available because it has streamlined syntax and not complex, which gives more importance on natural language. Due to its comfort of learning and practice, **python** codes can be readily written and executed much quicker than former programming languages.

Data Science: The libraries and frameworks Python offers, e.g. PyBrain, PyMySQL, and

NumPy are one of the big reasons. Another reason is diversity. Python experience allows you to do a lot more than any other language, e.g. you can create scripts to automate stuff, go into web development, and so much more.

**Students will have various Job Profiles by learning Python**

- Software Engineer.
- Python Developer.
- Research Analyst.
- Data Analyst.
- Data Scientist.
- Software Developer.

## 4. INTRODUCTION TO DATA ANALYTICS

**Data** Scientists and Analysts **use data analytics** techniques in their research, and businesses also **use** it to inform their conclusions. **Data analysis** can assistance corporations healthier comprehend their customers, assess their ad-campaigns, personalize gratified, create content approaches and progress products.

**By learning Data Analytics students will get Jobs with different designations**

- IT Systems Analyst. Systems analysts use and design systems to solve problems in information technology. ...
- Healthcare Data Analyst. ...
- Operations Analyst. ...
- Data Scientist. ...
- Data Engineer. ...
- Quantitative Analyst. ...
- Data Analytics Consultant. ...
- Digital Marketing Manager.

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

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**(18OE1IT06) PROGRAMMING THROUGH JAVA**

**COURSE PRE-REQUISITES:** None

**COURSE OBJECTIVES:**
- To introduce object-oriented programming concepts using the Java language
- To introduce the principles of inheritance and polymorphism; and demonstrates how they relate to the design of abstract classes
- To introduce the implementation of packages and interfaces
- To introduce exception handling, event handling and multithreading

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Develop applications for range of problems using object-oriented programming techniques
**CO-2:** Design simple graphical user interface applications
**CO-3:** Explore the design of graphical user interface using applets and swings

**UNIT – I:**
**Object Oriented Thinking and Java Basics**: Need for OOP Paradigm, Summary of OOP Concepts, Coping with Complexity, Abstraction Mechanisms, A Way of Viewing World – Agents, Responsibility, Messages, Methods, History of Java, Java Buzzwords, Data Types, Variables, Scope and Life Time of Variables, Arrays, Operators, Expressions, Control Statements, Type Conversion and Casting, Simple Java Program, Concepts of Classes, Objects, Constructors, Methods, Access Control, This Keyword, Garbage Collection, Overloading Methods and Constructors, Method Binding, Inheritance, Overriding and Exceptions, Parameter Passing, Recursion, Nested and Inner Classes, Exploring String Class.

**UNIT – II:**
**Inheritance, Packages and Interfaces:** Hierarchical Abstractions, Base Class Object, Subclass, Subtype, Substitutability, Forms of Inheritance- Specialization, Specification, Construction, Extension, Limitation, Combination, Benefits of Inheritance, Costs of Inheritance. Member Access Rules, Super Uses, Using Final with Inheritance, Polymorphism- Method Overriding, Abstract Classes, The Object Class.
Defining, Creating and Accessing a Package, Understanding Classpath, Importing Packages, Differences between Classes and Interfaces, Defining an Interface, Implementing Interface, Applying Interfaces, Variables in Interface and Extending Interfaces, Exploring Java.IO.

**UNIT – III:**
**Exception Handling and Multi-threading:** Concepts of Exception Handling, Benefits of Exception Handling, Termination or Resumptive Models, Exception Hierarchy, Usage of Try, Catch, Throw, Throws and Finally, Built in Exceptions, Creating Own Exception Sub Classes.
String Handling, Exploring Java. Util, Differences between Multi-Threading and Multitasking, Thread Life Cycle, Creating Threads, Thread Priorities, Synchronizing Threads, Interthread Communication, Thread Groups, Daemon Threads.

Enumerations, Autoboxing, Annotations, Generics.

**UNIT – IV:**
**Event Handling:** Events, Event Sources, Event Classes, Event Listeners, Delegation Event Model, Handling Mouse and Keyboard Events, Adapter Classes.
The AWT Class Hierarchy, User Interface Components- Labels, Button, Canvas, Scrollbars, Text Components, Check Box, Check Box Groups, Choices, Lists Panels – Scrollpane, Dialogs, Menubar, Graphics, Layout Manager – Layout Manager Types – Border, Grid, Flow, Card and Grid Bag.

**UNIT – V:**
**Applets:** Concepts f Applets, Differences between Applets and Applications, Life Cycle of an Applet, Types of Applets, Creating Applets, Passing Parameters to Applets.

**UNIT – VI:**
**Swing:** Introduction, Limitations of AWT, MVC Architecture, Components, Containers, Exploring Swing- Japplet, Jframe and Jcomponent, Icons and Labels, Text Fields, Buttons – The Jbutton Class, Check Boxes, Radio Buttons, Combo Boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

**TEXT BOOKS:**
1. Java The Complete Reference, Herbert Schildt, 7th Edition, TMH
2. Understanding OOP with Java Updated Edition, T. Budd, Pearson Education
3. An Introduction to Programming and OO Design using Java, J. Nino and F.A. Hosch, John Wiley & Sons

**REFERENCES:**
1. Introduction to Java Programming, Y. Daniel Liang, Pearson Education
2. An Introduction to Java Programming and Object-Oriented Application Development, R.A. Johnson, Thomson
3. Core Java 2, Vol. 1 - Fundamentals, Cay. S. Horstmann and Gary Cornell, Eighth Edition, Pearson Education
4. Core Java 2, Vol. 2 - Advanced Features, Cay. S. Horstmann and Gary Cornell, 8th Edition, Pearson Education

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

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**(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 Data base 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**

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## (18OE1IT03) COMPUTATIONAL THINKING USING PYTHON

**COURSE PRE-REQUISITES:** None

**COURSE OBJECTIVES:**
- To understand why Python is a useful scripting language for developers
- To create and execute Python programs and to Learn how to use lists, tuples, and dictionaries in Python programs
- To learn how to build and package Python modules for reusability
- To learn how to design object-oriented programs with Python classes
- To learn how to use exception handling in Python applications for error handling

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms)
**CO-2:** Adequately use standard programming constructs: repetition, selection, functions, composition, modules, aggregated data (arrays, lists, etc.)
**CO-3:** Explain what a given program (in Python) does identify and repair coding errors in a program
**CO-4:** Understand and use object-based software concepts (constructing OO software will be dealt with in the course Software Engineering)
**CO-5:** Use library software for (e.g.) building a graphical user interface, web application, or mathematical software

**UNIT – I:**
**Introduction:** History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator, Conditional Statements-If
If- else Nested if-else Looping for While Nested loops Control Statements Break Continue Pass String Manipulation Accessing Strings Basic Operations String slices Function.

**UNIT – II:**
**Methods, Lists:** Introduction, Accessing list, Operations, Working with lists, Function and
**Methods, Tuple:** Introduction, Accessing tuples, Operations, Working, Functions and Methods
**Dictionaries:** Introduction, Accessing values in dictionaries, Working with dictionaries, Properties.

**UNIT – III:**
**Functions:** Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.
**Modules:** Creation, Importing module, Math module, Random module, Packages.

**UNIT – IV:**
**Composition:** Input-Output-Printing on screen, Reading data from keyboard, Opening and closing file Reading and writing files, Functions.
**Exception Handling:** Exception, Exception Handling, Except clause, Try? Finally clause,

User Defined Exceptions

**UNIT – V:**
**OOPs Concept:** Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding, Regular expressions- Match function, Search function, Matching VS Searching, Modifiers, Patterns.
**Multithreading:** Thread, Starting a thread, Threading module, Synchronizing threads.
**CGI:** Introduction, Architecture, CGI environment variable, GET and POST methods, Cookies, File upload.

**UNIT – VI:**
**Database:** Introduction, Connections, Executing queries, Transactions Handling error,
**Networking:** Socket, Socket Module, Methods, Client and server, Internet modules, Sending email.

**TEXT BOOKS:**
1.  Learning Python, David Ascher and Mark Lutz, 2nd Edition, O'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.**

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## (18OE1IT07) INTRODUCTION TO DATA ANALYTICS

**COURSE PRE-REQUISITES:** None

**COURSE OBJECTIVES:**
- To be exposed to conceptual framework of big data
- To understand different techniques of data analysis
- To be familiar with concepts of data streams
- To be exposed to item sets, clustering, frame works and Visualization

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Understand big data fundamentals
**CO-2:** Learn various data analysis techniques
**CO-3:** Implement various data streams
**CO-4:** Understand item sets, clustering, frame works & Visualizations

**UNIT – I:**
**Introduction to Big Data:** Introduction to Big Data Platform – Challenges of Conventional systems – Web data – Evolution of Analytic scalability, analytic process and tools, Analysis vs Reporting – Modern data analytic tools,
**Statistical Concepts:** Sampling distributions, resampling, statistical inference, prediction error.

**UNIT – II:**
**Data Analysis:** Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and Kernel methods
**Analysis of Time Series:** Linear systems analysis, nonlinear dynamics – Rule induction –
**Neural Networks:** Learning and and Generalisation, competitive learning, Principal component analysis and neural networks
**Fuzzy Logic:** extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.

**UNIT – III:**
**Mining Data Streams:** Introduction to Streams Concepts – Stream data model and architecture – Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a Window – Decaying window – Real time Analytics Platform (RTAP) applications – case studies – real time sentiment analysis, stock market predictions.

**UNIT – IV:**
**Frequent Itemsets and Clustering:** Mining Frequent itemsets – Market based Modeling – Apriori Algorithm – Handling large data sets in Main Memory – Limited Pass Algorithm – Counting frequent itemsets in a Stream – Clustering Techniques – Hierarchical – K-Means.

**UNIT – V:**
Clustering high dimensional data – CLIQUE and ProCLUS – Frequent pattern-based clustering methods – Clustering in non-Euclidean space – Clustering for streams and Parallelism.

**UNIT – VI:**
**Frameworks and Visualization:** MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – S3 – Hadoop Distributed file systems – Visualizations – Visual data analysis techniques,
**Interaction Techniques:** Systems and Applications

**TEXT BOOKS:**
1. Intelligent Data Analysis, Michael Berthold, David J. Hand, Springer, 2007
2. Mining of Massive Datasets, Anand Rajaraman and Jeffrey David Ullman, Cambridge University Press, 2012

**REFERENCES:**
1. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks, John Wiley & Sons, 2012
2. Big Data Glossary, Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, Pete Warden, O'Reilly, 2011
3. Data Mining Concepts and Techniques, Jiawei Han, Micheline Kamber, 2nd Edition, Elsevier, 2008

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech.**                                                          **L      T/P/D    C**
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## (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**

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### (18OE1HS01) PROFESSIONAL ETHICS AND HUMAN VALUES

**COURSE PRE-REQUISITES:** None

**COURSE OBJECTIVES:**
- To emphasize on the importance of ethics for engineers and computer scientists
- To provide a toolkit for ethical behaviour in personal and professional settings
- To relate the profession of engineering to sociocultural as well as ethical and moral contexts in India and globally
- To develop more socially conscious engineers who create and conceive a better society and a better world without sacrificing or ignoring public good

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Distinguish morals, values, and ethics in Indian and global contexts
**CO-2:** Resolve moral and ethical dilemmas through ethical inquiries and appropriate ethical theories
**CO-3:** Realize the professional role of engineers in society and the support available in creating safe solutions for the society focusing on public welfare
**CO-4:** Conduct themselves ethically in various roles that present themselves in professional and business environments

### UNIT – I:
**Motivation and Introduction to Human Values:** Motivation to study ethics in engineering with justifying case studies, historical events, and current affairs; Morals, Values, and Ethics – Definitions; Moral Judgement vs. Value Judgement; Moral Character and Moral Autonomy – Conscientiousness, Integrity, Empathy as basic building blocks; The Golden Rule; Maslow's Theory of Needs; Universal Human Values and Theories; Conventional and Constitutional Values in Indian Ethos; Anomie vs. Civic Virtue as a foundation for an ideal society; Ethics as a basis of legal framework; Privacy and Confidentiality – Increasing emphasis in personal and professional lives, technological considerations and examples; Profession, Professionalism – Definitions, Engineering as a Profession

### UNIT – II:
**Ethics, Ethical Theories, and Professionalism:** Ethics through Spirituality, Religion, and beyond; Indian Philosophy and Ethos, ancient to modern – Family System, Ethical Pluralism, Unity in Diversity; Ethics as application of values and as moral philosophy – Kohlberg's theory vs. Gilligan's theory of moral development leading to ethics, examples; Moral and Ethical Dilemmas – Definition, Causes, Case Studies and Examples; Resolution of Ethical Dilemmas through Ethical Inquiries – Normative, Conceptual, and Factual Inquiries, Classification of Ethics by Character and Conduct – Consequentialism/ Utilitarianism, Deontological Ethics, Virtue Ethics and Theories, Rights Theories; Ethical Frameworks and examples; Practical application of ethical theories for decision-making in personal life

## UNIT – III:

**Professionalism, Engineering in the Societal Context:** Professionalism – Professional Traits, Rights, Responsibilities, Roles, Virtues; Business Ethics; Engineering as Social Experimentation – Context with examples, Comparison with standard experiments, Application of Ethical Inquiries to gain knowledge and to gather relevant information, Responsibility of Experimenters, Accountability and Answerability, Consensus and Need for Informed Consent – how to address exceptions; Responsible Innovation – Social Context of Innovation, Responsible Research and Innovation, Data Privacy and Protection of Individual Rights, being Ethical by Design; Trust in the context of professionalism – confidentiality, non-disclosure agreements (NDA); Intellectual Property (IP) – IP Rights (IPR) as Professional Rights, Law, Moral Rights and Economic Rights, Patenting; Diverse roles of Engineers as Professionals – Manager, Leader, Consultant, and Expert Witness

## UNIT – IV:

**Professional Ethics, Ethics at Workplace and Roles of Engineers:** Overview of Organizational Behaviour; Collegiality, Loyalty, Trust in professional context; Respect for Authority vs. Moral Autonomy, Moral Responsibility; Organizational context of Ethics – Minor, interpersonal, severe, organizational workplace deviances; Occupational Crime, Culpable mistakes, Collateral damage; Gifts and bribes; Industrial Ethics for non-professionals; Code of ethics and Code of Conduct – Role of professional societies in guiding, promoting, and protecting professionals and professions, Examples of common professional societies in Engineering and Science; Decision-making in professional context – Choosing the right guidance, choosing the right ethical theory; Conflicts in profession and at workplace - Employee Relations and Discrimination, Conflict of Interest, Conflict Management and Resolution, Framework for Conflict Resolution; Multinational Companies and Corporates – Work Culture and Respect for Diversity and Pluralism; Employee Rights vs. Professional Rights; Whistleblowing – Social, Organizational, and Legal context with examples

## UNIT – V:

**Public Welfare, Safety & Risk:** Impact of engineering activities and technology on Public Welfare; Ethical Concerns of Public welfare in the context of Emerging Technologies – Artificial Intelligence, Machine Learning, Internet of Things, Cybersecurity and Cybercrime; Issues of Public Concern – Informed Consent, Health and environmental aspects, data security; Safety and Risk – Definitions; Risk Assessment – Known and Unintended consequences, Risk-Benefit Analysis, Reducing Risk, Optimum Level of Safety, Capability Curves, Safe Exit; Learning from the Past – Case Studies in Ethics Context: Titanic, Bhopal, Chernobyl; Environmental Ethics and Sustainable Development Goals; Computer Ethics and various Technology Ethics; Ethics in the context of War and Weapon Development; Ethics and Economics – Fair Trade, Capitalism vs. Communism, Developed vs. Developing vs. Underdeveloped economies

## UNIT – VI:

**Ethics for Lifelong Learning:** Ethics in the context of Globalization; Moral Character and Ethical Leadership – Case Studies and Examples of success and failure; Overview and comparison of different schools of thought, comparison of the works of pioneering philosophers and social scientists – Immanuel Kant, John Rawls, Martin Heidegger, Swami Vivekananda, Jiddu Krishnamurti, Dr. Abdul Kalam, *etc.*; Impact of Ethical and Unethical Behaviour in personal and professional lives, developing and maintaining

ethical behaviour, threats to moral autonomy and how to continue to be ethical in personal and professional lives

**TEXT BOOKS:**
1. Ethics in Engineering, Mike W. Martin, Roland Schinzinger, McGraw Hill Education, 2017 (ISBN: 978-9339204457)
2. Business Ethics: An Indian Perspective, A.C. Fernando, K.P. Muralidheeran, E.K. Satheesh, Pearson Education, 2019 (ISBN: 978-9353437442)
3. Professional Ethics, R. Subramanian, Oxford University Press, 2017 (ISBN: 978-0199475070)

**REFERENCES:**
1. Engineering Ethics: Concepts & Cases, Charles E. Harris, Jr., Michael S. Pritchard, Michael J. Rabins, Cengage Learning, 2012 (ISBN: 978-8131517291)
2. Classical Indian Ethical Thought: A Philosophical Study of Hindu, Jaina and Bauddha Morals, Kedar Nath Tiwari, Motilal Banarsidass Publishers, 2017 (ISBN: 978-8120816084)
3. The Manual for Indian Start-Ups, Dalai Lama, Ethics for the Whole World 978-9351360803 Vijay Kumar Ivaturi et al., Penguin Random House India, 2017 (ISBN: 978-0143428527)
4. To Be Human, Jiddu Krishnamurti, Shambhala, 2000 (ISBN: 978-1570625961)
5. On Ethics and Economics, Amartya Sen, Oxford India, 1999 (ISBN: 978-0195627619)

**VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

| **B.Tech. VI Semester** | **L** | **T/P/D** | **C** |
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**(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)

**REFERENCES:**
1. Measure What Matters: OKRs: The Simple Idea that Drives 10x Growth, John Doerr, Penguin Portfolio, 2018 (ISBN: 978-0241348482)
2. Entrepreneurship Development and Business Ethics, Abhik Kumar Mukherjee, Shaunae Roy, Oxford University Press, 2019 (ISBN: 978-0199494460)
3. The Manual for Indian Start-Ups, Vijay Kumar Ivaturi et al., Penguin Random House India, 2017 (ISBN: 978-0143428527)
4. Social Entrepreneurship in India: Quarter Idealism and a Pound of Pragmatism, Madhukar Shukla, SAGE Publications India Pvt Ltd, 2020 (ISBN: 978-9353882372)
5. Entrepreneurship: A South Asian Perspective. Donald F. Kuratko, T. V. Rao. Cengage Learning, 2012

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

**B.Tech. VII Semester**          **L     T/P/D     C**
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## (18OE1HS03) PERSONALITY DEVELOPMENT AND PUBLIC SPEAKING

**COURSE PRE-REQUISITES:** None

**COURSE OBJECTIVES:**
- To develop skills and techniques for Effective Communication and Public Speaking
- To develop Leadership qualities and increase Self – confidence
- To get along with people and Team-Building
- To enhance career opportunities by Goal setting
- To develop an acceptable personality

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Communicate better and speak with confidence
**CO-2:** Exhibit Leadership qualities and increased Self – confidence
**CO-3:** Work towards Team-Building
**CO-4:** Use career opportunities by Goal setting
**CO-5:** Acquire a forceful personality to maintain a pleasant relationship between the seniors and subordinates and other stakeholders

## UNIT – I:
## EFECTIVE COMMUNICATION
i.    Fundamentals of Effective Communication
ii.   How to sell your ideas
iii.  Communication within Industry (awareness of motivation, ego states, games, etc.)
iv.   Guidelines on: Listening, Reading and Writing
v.    Non-verbal Communication (Body Language)
vi.   Barriers of Communication

## UNIT – II:
## PUBLIC SPEAKING (SPEECH COMMUNICATION)
i.    How to develop courage and self-confidence
ii.   Speech purposes, preparation patterns and outlining of speech
iii.  Fundamentals and secrets of good delivery
iv.   How to make your meaning clear and convince an audience / client
v.    How to close effectively and get action?
vi.   How to participate in conferences, group discussions and office meetings

## UNIT – III:
## PERSONALITY DEVELOPMENT -1
i.    Leadership - qualities of a successful leader ; Leadership Styles; Leadership in Administration; Problem-solving & Decision-making
ii.   Group Dynamics and Team Building
iii.  Importance of groups in organization; Interactions in group, Group Decision Taking, Team Building, Interaction with the Team, Building a good team

**UNIT – IV:**
**PERSONALITY DEVELOPMENT -2**
i.   Interpersonal Relations- Introduction; Transactional Analysis in communication Awareness of Ego states and their application in communication
ii.  Conflict Management- Introduction & Causes of Conflict; Managing Conflict

**UNIT – V:**
**PERSONALITY DEVELOPMENT -3**
i.   Positive Attitude &Ways to develop positive attitude Self Esteem & Confidence Building
ii.  Motivation- Importance of self-motivation;
iii. Stress -Causes of Stress & Impact of Stress; Managing Stress

**UNIT – VI:**
**PERSONALITY DEVELOPMENT -4**
i.   Goal Setting-Meaning; Short, medium and Long Term Goals; Importance of Goal setting & Steps for Goal Setting
ii.  Creativity-Meaning; Barriers to Creativity & Steps to stimulate Creativity Understanding and Importance of Human Values; Ideals in Life; Becoming a Role Model
iii. Time Management - Time as a Resource; Techniques for better Time Management.

**TEXT BOOKS:**
1. Advance Speaking Skills, Jeremy Harmar & John Arnold, Essex, Longman Group Limited, 1978
2. Developing Soft Skills, Sherfield R. M., Montgomery R. J., Moody P. G., 4th Edition, Pearson, 2010
3. Personality Development and Soft Skills, Barun K. Mitra, Oxford University Press, 2016

**REFERENCES:**
1. Body Language: A Guide for Professionals, Hedwig Lewis, Response Books (a division of Sage Publications India, Pvt. Ltd.,) New Delhi, 1998
2. Emotional Intelligence, Daniel Goldman, Bantam Books, 1995
3. Personality Development, Rajiv Mishra, Rupa & Co., 2004

# VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

| B.Tech. VIII Semester | L | T/P/D | C |
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## (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)

**B.Tech.**                                                                    **L      T/P/D    C**
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(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

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| **B.Tech.** | **L** | **T/P/D** | **C** |
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**(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 |
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## (18OE1ME05) 3D PRINTING AND DESIGN

**COURSE PRE-REQUISITES:** None

**COURSE OBJECTIVES:**
- To understand the need and know about the applications of 3D Printing
- To understand the need of liquid and solid based 3D Printing systems
- To know about the laser-based 3D Printing systems and importance of CAD for 3D Printing
- To understand post-processing, inspection and testing involved in 3D Printing

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Summarize the importance of 3D Printing
**CO-2:** Explain the process involved in liquid and solid based 3D Printing Systems
**CO-3:** Explain about the laser-based 3D Printing systems and CAD for 3D Printing
**CO-4:** Plan post-processing techniques and perform inspection and testing in 3D Printing

**UNIT – I:**
**Introduction:** Introduction to 3D Printing, Classification, 3D Printing Process Chain, Materials for 3D Printing, Distinction between 3D Printing & Conventional Manufacturing.
**Applications:** Brief overview of applications in Aerospace, Automotive, Biomedical, Defense, Construction, Jewelry, Coin and Tableware Industry.

**UNIT – II:**
**Liquid Based 3D Printing Systems:** Introduction, Principle, Processes and Applications of Material Jetting and Binder Jetting.

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

**UNIT – IV:**
**Laser Based 3D Printing Systems:** Introduction, Principle, Processes and Applications of Selective Laser Sintering (SLS), Three-Dimensional Printing (3DP).

**UNIT – V:**
**CAD for 3D Printing:** CAD data formats, CAD model preparation, Part orientation and support generation, Overview of 3D Printing softwares like MAGICS and MIMICS only.

**UNIT – VI:**
**Post Processing:** Introduction, Post Processing Techniques like Support material removal, Cleaning, Sanding and Polishing.
**Inspection:** Introduction, Significance, Inspection techniques like Dimensional measurement along X, Y and Z axes, visual inspection of the surface finish (overall aesthetics and intact features), flatness or warp check, and FOD (foreign objects or

debris) check.

**TEXT BOOKS:**

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W Rosen, Brent Stucker, Springer, 2010
2. Rapid Prototyping: Principles and Applications, Chua C. K., Leong K. F., and Lim C. S., 3rd Edition, World Scientific, 2010

**REFERENCES:**

1. Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development, Liou L. W. and Liou F. W., CRC Press, 2007
2. Rapid Prototyping: Theory and Practice, Kamrani A. K. and Nasr E. A., Springer, 2006
3. Rapid Tooling: Technologies and Industrial Applications, Hilton P. D. and Jacobs P. F., CRC Press, 2000
4. Rapid Prototyping, Gebhardt A., Hanser, Gardener Publications, 2003

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**B.Tech.**

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## (18OE1EC09) EMBEDDED SYSTEMS FOR IOT

**COURSE PRE-REQUISITES:** Programming through C

**COURSE OBJECTIVES:**
- To understand the basics of computing with Embedded Systems
- To expose the students to various smart sensors
- To make the students familiar with the programming concepts of Embedded development board
- To understand the basics of Internet of Things and Cloud of things

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Familiar with architectural and programming issues of Embedded Systems
**CO-2:** Able to select proper smart Sensor for a specific measurement application
**CO-3:** Analyze various protocols for Internet of Things
**CO-4:** Apply Internet of Things to different applications in the real world

**UNIT – I:**
**Embedded System Design:** Numbering and Coding Systems, Digital Premier, Inside the Computer
Embedded system - Definition, Characteristics of embedded computing applications, Design challenges, Requirements, Specification, Architecture design, Designing hardware and software components, system integration.

**UNIT – II:**
**Smart Sensors & Applications:** Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation.

**UNIT – III:**
**Sensors Applications:** Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring.

**UNIT – IV:**
**Micro Controller Board:** Features of Arduino, Arduino components and IDE, Interfacing: Seven Segment Display, Pulse Width Modulation, Analog Digital Converter, Wireless connectivity to Arduino. Case study: From BT To WiFi: Creating WiFi Controlled Arduino Robot Car.

**UNIT – V:**
**Introduction to Internet of Things:** Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Deployment Templates, M2M, IoT vs M2M.

**UNIT – VI:**

**Domain Specific Applications of IoT:** IoT Design Methodology, Applications of IoT– Home, Health, Environment, Energy, Agriculture, Industry and Smart City.

**TEXT BOOKS:**

1. The 8051 Microcontroller: Programming, Architecture, Ayala & Gadre, 3rd Edition, Cengage Publications, 2008
2. Sensors and Transducers, D. Patranabis, 2nd Edition, PHI Learning Private Limited, 2013
3. Internet of Things: A Hands-On Approach, Vijay Madisetti, Arshdeep Bahga, Universities Press, 2015

**REFERENCES:**

1. Embedded Systems: Architecture, Programming and Design, 2nd Edition, TMH
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, 2nd Edition, 2005
3. Internet of Things with Raspberry Pi and Arduino, Singh, R., Gehlot, A., Gupta, L., Singh, B., Swain, M., Boca Raton, CRC Press, 2020

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| B.Tech. | L | T/P/D | C |
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## (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, M. C. Graw Hill Publications
3. Neural Networks-A Comprehensive Foundation, Simon Haykin, 2nd Edition, Pearson Education, 2004

**REFERENCES:**
1. Artificial Intelligence, Elaine Rich & Kevin Knight, 2nd Edition, TMH
2. Artificial Intelligence, A New Synthesis, Nils J. Nilsson, Elsevier
3. Artificial Neural Networks, Yegnanarayana B., PHI

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

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## (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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| **B.Tech.** | **L** | **T/P/D** | **C** |
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### (18OE1EI05) FUNDAMENTALS OF ROBOTICS AND DRONES

**COURSE PRE-REQUISITES:** None

**COURSE OBJECTIVES:**
- To classify based on coordinate system and control system
- To acquire knowledge on different types of 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 |
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## (18OE1IT08) FUNDAMENTALS OF CYBER SECURITY

**COURSE PRE-REQUISITES:** Basic Knowledge of Computers, Basic Knowledge of Networking and Internet

**COURSE OBJECTIVES:**
- To identify the key components of cyber security in network
- To describe the techniques in protecting Information security
- To define types of analyzing and monitoring potential threats and attacks
- To access additional external resources to supplement knowledge of cyber forensics and laws

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Understand, appreciate, employ, design and implement appropriate security technologies
**CO-2:** Demonstrate policies to protect computers and digital information
**CO-3:** Identify & Evaluate Information Security threats and vulnerabilities in Information Systems
**CO-4:** Understanding computer forensics and analyzing them

**UNIT – I:**
**Introduction to Cybersecurity**: Cybersecurity objectives, Cybersecurity roles, Differences between Information Security & Cybersecurity, Cybersecurity Principles - Confidentiality, integrity, & availability, Authentication & nonrepudiation, The Trinity of IT Security (CIA), Computer Protocols, Cookies, The TCP/IP

**UNIT – II:**
Who are the cyber criminals, Classification of cybercrimes, E-mail Spoofing, Spamming, Cyber defamation, Internet Time Theft, Salami Attack/ Salami Technique, Data Diddling, Forgery, Web Jacking, Newsgroup Spam/ Crimes Emanating from Usenet Newsgroup, Industrial Spying/Industrial Espionage, Hacking, Online Frauds, Pornographic Offenses, Software Piracy, Computer Sabotage, E-mail Bombing/Mail Bombs, UseNet Newsgroup as the Source of Cybercrimes, Computer Network Intrusions, Password Sniffing, Credit Card Frauds, Identity Theft.

**UNIT – III:**
**Cyber Offenses: How Criminals Plan Them:** Introduction, Categories of Cybercrime, How Criminals Plan the Attacks, Reconnaissance, Passive Attacks, Active Attacks, Scamming and Scrutinizing Gathered Information, Attack (Gaining and Maintaining the System Access), Social Engineering, Classification of Social Engineering, Cyber stalking, Types of Stalkers, Cases Reported on Cyber stalking, How Stalking Works?, Real-Life Incident of Cyber stalking, Cyber cafe and Cybercrimes,

**UNIT – IV:**
**Security Threats:** Introduction to security threats-Virus, Worms, Trojan horse, Bombs, Trap Door, E-Mail Virus, Virus Life cycle, How virus works?, Malware, Network and Services attack- Dos attacks, Types of Dos attacks, Methods of attacks, Examples of

attacks-SYN flooding, TCP flooding ,UDP flooding ,ICMP flooding ,Smurf, Ping of death, Tear drop, Security threats to E-commerce-Electronic payment system, Credit card/Debit cards, Smart cards, E- money, Electronic Fund Transfer, E-commerce security System, Electronic Cash, Digital Signatures

### UNIT – V:
**Introduction to Computer Forensics:** computer crimes, evidence, extraction, preservation, etc. Overview of hardware and operating systems: structure of storage media/devices; windows/Macintosh/ Linux -- registry, boot process, file systems, file metadata. Data recovery: identifying hidden data, Encryption/Decryption, Steganography, recovering deleted files. Digital evidence controls: uncovering attacks that evade detection by Event Viewer, Task Manager, and other Windows GUI tools, data acquisition, disk imaging, recovering swap files, temporary &cache files, Computer Forensic tools, Network Forensic. Computer crime and Legal issues: Intellectual property, privacy issues, Criminal Justice system for forensic, audit/investigative situations and digital crime scene, investigative procedure/standards for extraction, preservation, and deposition of legal evidence in a court of law.

### UNIT – VI:
**Fundamentals of Cyber Law:** Evolution of the IT Act, Genesis and Necessity , Salient features of the IT Act, 2000, various authorities under IT Act and their powers, Penalties & Offences, amendments, Impact on other related Acts Cyber Space Jurisdiction - Jurisdiction issues under IT Act, 2000- Traditional principals of Jurisdiction - Extra-terrestrial Jurisdiction- Case Laws on Cyber Space Jurisdiction Sensitive Personal Data or Information (SPDI) in Cyber Law (a) SPDI Definition and Reasonable Security Practices in India (b) Reasonable Security Practices – International perspective

### TEXT BOOKS:
1. Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunit Belpure, Wiley
2. Fundamentals of Cyber Security, Mayank Bhusan, Rajkumar Singh Rathore, Aatif Jamshed, BPB Publications
3. Cyber Law & Cyber Crimes, Advocat Prashant Mali, Snow White Publications, Mumbai

### REFERENCES:
1. Computer Forensics and Cyber Crime: An Introduction, Marjie T. Britz, 3rd Edition, 2013
2. Digital Forensics with Open-Source Tools. Cory Altheide and Harlan Carvey, Elsevier, 2011(ISBN: 978-1-59749- 586-8)
3. Network Forensics: Tracking Hackers Through Cyberspace, Sherri Davidoff, Jonathan Ham Prentice Hall, 2012
4. Cyber Law in India, Farooq Ahmad, Pioneer Books
5. Information Technology Law and Practice, Vakul Sharma, Universal Law Publishing Co. Pvt. Ltd

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| 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** |
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**(18OE1AE05) INTRODUCTION TO ADVANCED VEHICLE TECHNOLOGIES**

**COURSE PRE-REQUISITES:** None

**COURSE OBJECTIVES:**
- To understand the layout of an automobile and functionalities chassis elements
- To provide the concepts of automotive electrical systems and electric & hybrid vehicles
- To present various intelligent automotive systems and levels of vehicle autonomy

**COURSE OUTCOMES:** After completion of the course, the student should be able to
**CO-1:** Explain the functionalities of automotive systems and subsystems
**CO-2:** Discuss the concepts of automotive electrical systems and electric & hybrid vehicles
**CO-3:** Describe various intelligent automotive systems and levels of vehicle autonomy

**UNIT – I:**
**Introduction:** Classification of automobiles, layout of an automobile and types of bodies.
**Automotive Chassis:** Introduction to chassis systems - engine, cooling, lubrication, fuel feed, ignition, electrical, driveline - clutch, transmission, propeller shaft, differential, axles, wheels and tyres, steering, suspension and braking.

**UNIT – II:**
**Engine:** Working principle of four stoke and two stroke SI and CI engines, fuel system – layout of petrol and diesel fuel systems, electronic fuel injection - multi-point fuel injection, gasoline direct injection, common rail direct injection.

**UNIT – III:**
**Electrical System:** Simple automotive wiring diagram and components of electrical system, starting system – starter circuit, standard Bendix and over running clutch drive, charging system – alternator, cut-outs and regulators, ignition system - conventional and electronic ignition system.

**UNIT – IV:**
**Electric and Hybrid Vehicles:** Electric vehicle – Layout, components, configurations, advantages and limitations. Hybrid vehicle - Concepts of hybrid electric drivetrain based on hybridization and powertrain configuration, architecture of series, parallel and series-parallel hybrid electric drivetrains, modes of operation, merits and demerits.

**UNIT – V:**
**Intelligent Vehicle Systems:** Automotive navigation, night vision, head-up display, airbag, seat belt tightening system, immobilizers, adaptive cruise control, forward collision warning, lane departure warning and anti-lock braking system.

**UNIT – VI:**
**Autonomous Vehicles:** Levels of automation, research, challenges, commercial

development, sensor systems, sensor suits, environmental challenges, graceful degradation, V2V and V2I communication, sharing the drive, integrity, security, verification and policy implications.

**TEXT BOOKS:**
1. Advanced Vehicle Technology, Heinz Heisler, Butterworth Heinemann, 2002
2. Intelligent Vehicle Technologies: Theory and Applications, Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann, Oxford, 2001
3. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, CRS Press, 2004

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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