R V R & J C COLLEGE OF ENGINEERING *(Autonomous)*, CHOWDAVARAM, GUNTUR-19

B.Tech., Computer Science & Engineering (AI & ML)

(w.e.f. the academic year 2021-2022)

Semester IV (Second Year)

S. No.	Course Code	Course Title	Hours Per Week	Scheme of Examination			Category Code
			L – T – P	INT	EXT	Credits	
1	CM 221	Computational Statistics	3 – 0 – 0	30	70	3	PC
2	CM 222	Artificial Intelligence	3 – 0 – 0	30	70	3	PC
3	CM 223	Operating Systems	3 – 0 – 0	30	70	3	PC
4	CM 224	Software Engineering	3 – 0 – 0	30	70	3	PC
5	CM 225	Design and Analysis of Algorithms	3 – 0 – 0	30	70	3	PC
6	CM 261	Computational Statistics Lab	0 – 0 – 3	30	70	1.5	PC
7	CM 262	Artificial Intelligence Lab	0 – 0 – 3	30	70	1.5	PC
8	CM 263	Design and Analysis of Algorithms Lab	0 – 0 – 3	30	70	1.5	PC
9	CM SL2	Skill Oriented Course - II	1 – 0 – 2	100	-	2	SC
10	CM MC4	Ethics & Human Values	2 – 0 – 0	100	-	-	MC
		Total	**18 – 0 – 11**	**440**	**560**	**21.5**	

Internship of Minimum 3 Weeks is mandatory during Summer Vacation (Will be evaluated in fifth Semester)
Registration for Honors/Minor degree permitted in this semester (Maximum Two additional courses per semester are permitted for Honors/Minor

CM 221	Computational Statistics	L	T	P	Int.	Ext.	C
		3	-	-	30	70	3

Course Objectives:

On completion of this course, students will have:

1. The knowledge to understand the concepts of linear statistical and ANOVA models and draw the conclusions.
2. The idea to develop a sound understanding of current, modern computational statistical approaches and their application to a variety of datasets.
3. To understand the key technologies in data science and business analytics such as data mining, machine learning, visualization techniques and predictive modelling.
4. The knowledge to apply principles of data science to analyze and to effectively visualize the data.

Course Outcomes:

On completion of this course, students will be able to:

CO1. Remember the basic concepts of linear statistical models

CO2. Interpret the results of Multivariate Regression models

CO3. Estimate the discriminate function to segregate and allot the item to the subgroup.

CO4. Data reduction and visualize the data for interpretation.

Course Content:

UNIT – I **CO1** **14 Periods**

Linear Statistical Models: Scatter diagram, linear regression and correlation, least squares methods, rank correlation, multiple correlation.

Analysis of Variance (ANOVA): Analysis of Variance (one-way classification), Analysis of Variance (two-way classification)

UNIT – II **CO2** **14 Periods**

Multivariate Normal Distribution: Multivariate Normal Distribution Functions, Conditional Distribution and its relation to regression model, Estimation of parameters.

Multiple Linear Regression Model: Standard multiple regression models with emphasis on collinearity, outliers, non-normality and auto correlation, validation of model assumptions.

UNIT – III **CO3** **14 Periods**

Multivariate Regression: Assumptions of multivariate regression models, Parameter estimation, multivariate analysis of variance and co-variance.

Discriminant Analysis: Statistical background, linear discriminant function analysis, Estimating linear discriminant functions and their properties.

UNIT – IV **CO4** **14 Periods**

Principal Component Analysis: Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, H-plot.

Factor Analysis: Factor analysis model, extracting common factors, determining number of factors, Transformation of factor analysis solutions, Factor scores.

Learning Resources:

Text Book:

1. Richard. A. Johnson and Dean. W. Wichern “Applied Multivariate Statistical Analysis” Pearson Prentice Hall, 6th Edition, 2007

Reference Books:

1. ALVIN C. RENCHER, “Methods of Multivariate Analysis”, John Wiley & Sons Publication,3rd Edition
2. T.W. Anderson, “An Introduction to Multivariate Statistical Analysis”, Wiley, 3rd Edition,2003.

CM 222	Artificial Intelligence	L	T	P	Int.	Ext.	C
		3	-	-	30	70	3

Course Objectives:

The main objectives of this course are

1. Introduce fundamental concepts of problem solving methodologies in artificial intelligence
2. Demonstrate various search and game playing strategies
3. Instruct logical representation of natural language sentences
4. Discuss knowledge representation strategies and planning algorithms

Course Outcomes:

At the end of the course the students will be able to

CO1. Use the fundamental concepts of artificial intelligence in problem solving

CO2. Apply search, game playing strategies for solving AI problems

CO3. Construct the given natural language sentences into appropriate predicate/proposition logic

CO4. Choose knowledge representation strategy for the real world problems

CO5. Summarize the algorithms for classical planning

Course Content:

UNIT – I **CO1** **14 Periods**

Introduction to AI: The Foundations of AI, The History of AI, The State of the Art. **Intelligent Agents:** Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Problem Solving by Search: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.

UNIT – II **CO2** **14 Periods**

Beyond Classical Search: Local Search Algorithms and Optimization Problems, Searching with Non-Deterministic Actions.

Adversarial Search: Games, Optimal Decisions in Games, Alpha–Beta Pruning,

Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.

UNIT – III **CO3** **14 Periods**

Logical Agents: Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic.

First-Order Logic: Representation Revisited, Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic.

UNIT – IV **CO4** **14 Periods**

Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

Knowledge Representation: Ontological Engineering, Categories and Objects, Events. Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information.

Automated Planning: Definition of Classical Planning, Algorithms for Classical Planning.

Learning Resources:

Text Book:

1. Artificial Intelligence - A Modern Approach, Stuart Russell and Peter Norvig, Fourth Edition, Pearson Education

Reference Books:

1. Artificial Intelligence, E. Rich and K. Knight,3rd Edn.,(TMH)
2. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, 3rd Edn., Pearson Education.
3. A First Course in Artificial Intelligence, **Deepak Khemani, Tata Mc-Grah Hill.**
4. Artificial Intelligence and Expert systems – Patterson, Pearson Education.
5. Artificial Intelligence, SarojKaushik, CENGAGE Learning

CM 223	Operating Systems	L	T	P	Int.	Ext.	C
		3	-	-	30	70	3

Course Objectives:

At the end of this course the students will understand

1. To introduce the structure and functions of the operating system.
2. To provide the knowledge of how the operating system manages the resources
3. To expose the students to the issues related to executing multiple process in the system.

Course Outcomes:

At the end of the course the students will be able to

CO1. Apply the concepts of multithreading and IPC mechanisms.

CO2. Analyze the performance of CPU scheduling algorithms, page replacement algorithms, and disk scheduling algorithms.

CO3. Demonstrate the methods to solve critical section problem and deadlock handling in a system.

CO4. Differentiate the effectiveness and the hardware support required for contiguous, non-contiguous, and virtual memory management schemes.

CO5. Differentiate the file systems for applying different allocation and access techniques.

Course Content:

UNIT – I **CO1** **14 Periods**

Introduction: What Operating Systems Do, Operating-System Operations, Resource Management, Security and Protection, Virtualization, Distributed Systems, Kernel Data Structures.

Operating System Structures: Operating-System Services, User and Operating-System Interface, System Calls, Operating-System Structure.

Processes: Process Concept, Process Scheduling, Operations on Processes, inter process Communication, IPC in shared-memory Systems, IPC in Message-passing Systems.

UNIT – II **CO2** **14 Periods**

Threads and Concurrency: Overview, Multicore Programming, Multithreading Models, Implicit Threading, Threading Issues.

CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling, Real-Time CPU Scheduling.

Synchronization: Background, The Critical-Section Problem, Peterson 'solution, Hardware support for Synchronization, Mutex Locks, Semaphores, Monitors. Classic Problems of Synchronization.

UNIT – III **CO3** **14 Periods**

Dead Locks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Main Memory: Background, Contiguous Memory Allocation, Paging, Structure of the Page Table, Swapping.

Virtual-Memory: Background, Demand Paging, Page Replacement, allocation of frames,

Thrashing - Memory Compression, Other considerations.

UNIT – IV **CO4, CO5** **10 Periods**

Mass-Storage Structure: Overview of Mass-Storage Structure, HDD Scheduling.

Files System Interface: File Concept, Access Methods, Directory Structure, Protection, Memory mapped files.

File-Systems Implementation: File-System Structure, File-System operations, Directory Implementation, Allocation Methods, and Free-Space Management.

Learning Resources:

Text Book:

1. Operating System Concepts-Abraham Silberchatz, Peter B Galvin, Greg Gange Tenth Edition, WILEY.

Reference Books:

1. Operating Systems, Internal and Design Principles, Stallings, 8th Edition-2015, Pearson education/PHI.
2. Operating system, A Design Approach-Crowley, TMH.
3. Modern Operating Systems, Andrew S Tenenbaum 4th Edition Pearson/PHI.
4. An Introduction to Operating Systems, Concepts and Practice, 4th Edition, PHI, 2013-Pramod Chandra P. Bhatt.
5. Operating Systems- A concept based approach –DM Dhamdhere -3rd Edition TMH.

CM 224	Software Engineering	L	T	P	Int.	Ext.	C
		3	-	-	30	70	3

Course Objectives:

At the end of the course, the student will understand and

1. Acquire knowledge on the principles and process models for software development.
2. Explain the specific requirements for a given software project
3. Acquire knowledge on design concepts and user interface principles for Software development
4. Examine various testing techniques and metrics applicable to a Software project

Course Outcomes:

After successful completion of the course, students will be able to:

CO1. Describe the software engineering process model required to create a software system.

CO2. Discuss the software requirements and analyze a model for a software project.

CO3. Design and specify software components for real-world problems.

CO4. Evaluate various software testing techniques and metrics.

Course Content:

UNIT – I **CO1** **14 Periods**

Software and Software engineering: The Nature of Software, Defining Software, Software Application Domains, Legacy Software, The software Process.

The Software Process: Process Models: A Generic Process Model, defining a Framework Activity, identifying a task set, Process Assessment and Improvement, Prescriptive Process Models: The waterfall model, Prototyping Process model, Evolutionary process model, The Unified Process.

Agile Development: What Is Agility? What Is an Agile Process? Scrum Other Agile Process Models, Scrum, Other Agile Frameworks- The XP Framework.

UNIT – II **CO2** **14 Periods**

Understanding Requirements: Requirements Engineering, Establishing the Groundwork, Requirements gathering, developing use cases, Building the Analysis Model, Negotiating Requirements, Requirements monitoring, Validating Requirements.

Requirements Modelling: Requirements Analysis, Scenario-Based Modeling, Class-Based Modeling, Functional Modelling, Behavioural Modelling.

Design Concepts: Design within the Context of Software Engineering, the Design Process, Design Concepts, the Design Model.

UNIT – III **CO3** **14 Periods**

Architectural Design: Software Architecture, Agility and Architecture, Architectural Styles, Architectural Design, Assessing Alternative Architectural Designs, Architectural Reviews.

Modeling Component-Level Design: What Is a Component? Designing Class-Based Components, Conducting Component Level Design.

User Experience Design: User Experience Design Elements, The Golden Rules, User Interface Analysis and Design, Interface Analysis and Design Models, The process.

UNIT – IV **CO4** **14 Periods**

Software Testing –Component Level: A Strategic Approach to Software Testing, Planning and Record keeping, Test case design, White box testing, Black-Box-Testing.

Software-Testing Integration level: Software Testing Fundamentals, Integration testing, Validation Testing, Testing Patterns.

Software Metrics and Analytics: Software Measurement, Software Analytics, Product Metrics, Metrics for Testing, Metrics for maintenance, Process and Project Metrics, Metrics for Quality.

Learning Resources:

Text Book:

1. Roger Pressman and Bruce Maxim "Software Engineering- A Practitioner's Approach", 9th edition, Tata McGraw-Hill International.

Reference Books:

1. Ian Somerville, Software Engineering. 6 ed, Pearson Education.
2. Carlo Ghezzi, Mehdi Jazayeri and Dino Mandrioli, Fundamentals of Software Engineering.2 ed, PHI.
3. RajibMall, Fundamentals of Software Engineering. 2 ed, PHI.

Web Resources:

1. http://nptel.ac.in/courses/106101061/2
2. http://nptel.ac.in/courses/106101061/5

CM 225	Design & Analysis of Algorithms	L	T	P	Int.	Ext.	C
		3	-	-	30	70	3

Course Objectives:

The main objectives of this course are

1. Instruct performance analysis of an algorithm.
2. Illustrate algorithm design Strategies.
3. Demonstrate pattern matching algorithms
4. Impart knowledge on P, NP and NP-complete and NP-hard class of problems.

Course Outcomes:

After completion of the course, the students will be able to

CO1. Analyze the performance of algorithms and solve problems using Divide and Conquer Technique.

CO2. Analyze and Solve problems by Greedy and Traversals and Search Techniques on Graphs.

CO3. Solve Problems by Dynamic programming and Back Tracking.

CO4. Solve problems by Branch and Bound and understand P class and NP class problems.

Course Content:

UNIT – I	CO1	14 Periods
Introduction - Algorithm Definition, Algorithm Specification – Pseudocode Conventions, Recursive Algorithms, Performance Analysis- space Complexity, Time Complexity, Asymptotic Notations, Practical Complexities and Performance Measurement. **Divide and Conquer:** General Method, Binary Search, Finding Maximum and Minimum, Merge Sort, Quick Sort, Strassens Matrix Multiplication.		
UNIT – II	**CO2**	**14 Periods**
Greedy Programming: General Method, Knapsack problem, Job Sequencing with Dead Lines, Minimum-cost Spanning Tree - Prim's and Kruskal's algorithms, Single-Source Shortest Paths- Dijkstra's Algorithm. **Basic Traversal & Search Techniques:** Techniques for Binary Trees, Techniques for Graphs, Connected Components and Spanning Trees, Bi-Connected Components and DFS.		
UNIT – III	**CO3**	**14 Periods**
Dynamic Programming: General Method, Multi Stage Graph, All Pairs Shortest Paths, Single Source Shortest Paths-general Weights, Optimal Binary Search Trees, String Editing, 0/1 Knapsack, Traveling Salesman Problem. **Back Tracking:** General Method, 8-queen problem, Sum of Subsets, Graph Coloring, Hamiltonian Cycles.		
UNIT – IV	**CO4**	**14 Periods**
Branch and Bound: Control Abstraction for LC Search, 15 Puzzle Problem, Bounding, FIFO branch and bound, LC branch and bound, 0/1 Knapsack problem, Travelling Salesman Problem. **NP-hard and NP-Complete Problems:** Basic Concepts, Non-Deterministic Algorithms, The classes NP-		

hard and NP-Complete, Cooks Theorem, NP-Hard Graph Problem, Click Decision Problem, Node Cover Decision Problem. (Theorem Proofs Excluded)

Learning Resources:

Text Book:

1. E.Horowitz, S. Sahni and S.Rajsekaran, "Fundamentals of Computer Algorithms", Galgotia Publication..

Reference Books:

1. T. H. Cormen, Leiserson, Rivest and Stein, "Introduction of Computer Algorithm", PHI.
2. Sara Basse, A.V. Gelder, "Computer Algorithms", Addison Wesley.

CM 261	Computational Statistics Lab	L	T	P	Int.	Ext.	C
		-	-	3	30	70	1.5

Course Objectives:

The student who successfully completes this course will have:

1. The knowledge to understand the concepts of linear statistical and ANOVA models and draw the conclusions.
2. The idea to develop a sound understanding of current, modern computational statistical approaches and their application to a variety of datasets.
3. To understand the key technologies in data science and business analytics such as data mining, machine learning, visualization techniques and predictive modelling.
4. The knowledge to apply principles of data science to analyse and to effectively visualize the data.

Course Outcomes:

On completion of this course, students will be able to:

CO1. Explain the basic concepts of linear statistical models

CO2. Interpret the results of Multivariate Regression models

CO3. Estimate the discriminate function to segregate and allot the item to the subgroup.

CO4. Implement Multi-Variate Statistical Analysis techniques using Python.

CO5. Apply data reduction and visualization techniques.

Lab Programs to implement:

Week 1	Simple Linear Regression
Week 2	Correlation methods
Week 3	Multiple Regression
Week 4	Multivariate Regression
Week 5	Multivariate analysis of variance and co-variance
Week 6	Analysis of Variance (one-way classification),
Week 7	Analysis of Variance (two-wayclassification)
Week 8	Multivariate Normal Distribution
Week 9	Linear discriminant analysis for multivariate data
Week 10	Principle component analysis for multivariate data
Week 11	Factor Analysis for multivariate data
Week 12	Cluster analysis for multivariate data

CM 262	Artificial Intelligence Lab	L	T	P	Int.	Ext.	C
		-	-	3	30	70	1.5

Course Objectives:

The main objectives of this course are:

1. Demonstrate various Python packages that are used for solving AI problems
2. Illustrate AI problems using informed and uninformed search techniques.
3. Discuss computational problems using AI techniques

Course Outcomes:

After the successful completion of the course students are able to

CO1. Solve the given problems using Python.

CO2. Apply heuristic search techniques for solving simple AI problems.

CO3. Implement solutions to problems using uninformed search techniques.

CO4. Develop solutions for the given real world problems.

List of Experiments to implement:

1. Informed Search Strategies
2. Uninformed Search Strategies
3. Game Playing Strategies
4. Constraint Satisfaction Problems
5. First-Order Logic-propositional and predicate logic
6. Classical Planning

CM 263	Design & Analysis of Algorithms Lab	L	T	P	Int.	Ext.	C
		-	-	3	30	70	1.5

Course Objectives:

The main objectives of this course are
1. Illustrate Algorithm Design Strategies.
2. Demonstrate complex problems using suitable Design Strategy.
3. Demonstrate String matching techniques.

Course Outcomes:

After completion of course, the student will be able to
CO1. Apply Algorithm Design Strategy to solve problem
CO2. Implement complex problems using the design strategy
CO3. Make use of string matching algorithms to solve complex problems

List of Experiments to implement:

1. Problems related to Divide and Conquer strategy
2. Problems related to Greedy Strategy
3. Graph Related Problems using Greedy Strategy
4. Problems related to Dynamic Programming
5. Graph Related Problems using Dynamic Programming
6. Problems related to Backtracking Strategy
7. Problems related to Branch and Bound
8. String Matching Problems

CM SL2 (c)	Skill Oriented Course 2D- Computer Animation	L	T	P	Int.	Ext.	C
		1	-	2	100	-	2

Course objectives:

At the end of the course the students will understand the

1. To familiarize the students with various approaches, methods and techniques of Animation Technology.
2. To develop competencies and skills needed for becoming an effective Animator.
3. Mastering traditional & digital tools to produce stills and moving images.
4. Exploring different approaches in computer animation.

Course Outcomes:

After completion of course, the student will be able to

CO1. Make use of software to develop storyboards and 2-dimensional animation Including creating, importing and sequencing media elements to create multi-media presentations.

CO2. Explain conceptualization, creativity, and visual aesthetics.

CO3. Organize various aspects of animation using a variety of 2 dimensional software.

CO4. Develop concepts, storyboarding and production of several 2 dimensional animations will be accomplished.

Course Content:

UNIT – I **CO1** **8 Periods**

Understanding the Interface, Editors and Workspaces, Navigate and Save, Objects in the 3D View Editor, Editing Objects, Editing Tools.

UNIT – II **CO2** **8 Periods**

Modifiers, Editing with Generate Modifiers, Editing with Deform Modifiers, Editing Using Curves, Editing Techniques and Examples.

UNIT – III **CO3** **8 Periods**

The Outliner and Collections, Text, Viewport Shading, Scene Lighting and Cameras.

UNIT – IV **CO4** **8 Periods**

Nodes – Materials and Textures, Rendering, Animation, Constraints, Shape Keys and Action Editors Particle Systems

Learning Resources:

Text Book:

1. The Complete Guide to Blender Graphics Computer Modeling &Animation By John M. Blain 6th Edition

CM SL2 (d)	Skill Oriented Course Serverside Scripting	L	T	P	Int.	Ext.	C
		1	-	2	100	-	2

Course objectives:

1. To design and develop dynamic, database-driven web applications using PHP.
2. Learn the basics and history of XML and how to write your own XML documents.
3. Java Servlet Technologies.
4. Java Server Page Technologies.

Course Outcomes:

After successful completion of the course, the students are able to

CO 1. Apply basic concepts of PHP programming.
CO 2. Design and Develop server side programs using PHP Technologies.
CO 3. Assess the principles of object oriented development using PHP.
CO 4. Develop Database Connectivity using MYSQL.

Course Content:

UNIT – I **CO1** **11 Periods**

Essential PHP:

Operators & Flow Control:

UNIT – II **CO2** **11 Periods**

Strings & Arrays:

Creating Functions:

UNIT – III **CO3** **10 Periods**

Reading Data in a webpage:

File Handling:

UNIT – IV **CO4** **10 Periods**

Working with Databases:

Sessions, Cookies & FTP:

Learning Resources:

Text Book:

1. PHP: Complete Reference, Steven Holzner, Tata Mcgraw Hill

Reference Books:

1. Harvey M. Deitel and Paul J.Deitel, "Internet & World Wide Web How to Program", 5/e, Pearson Education.

Web References:

1. www.w3schools.com
2. www.tutorialspot.com

CM MC4	Ethics & Human Values	L	T	P	Int.	Ext.	C
		2	-	-	100	-	-

Course objectives:

The objectives of the course are:

1. Create awareness to specific set of morals, values and ethics.
2. Introduce the importance of moral autonomy, professional ideals and Ethical theories.
3. Provide the safety/risk aspects, welfare of the public and about employee rights
4. Impart the global issues and code of ethics of professional bodies

Course Outcomes:

CO 1. Have basic understanding of how a prospective engineer should behave in his chosen field and society.
CO 2. Realize the importance of moral autonomy, professional ideals and Ethical theories.
CO 3. Identify the safety/ risk, welfare of the public and employee rights
CO 4. Expose to global issues and codes of some professional bodies

Course Content:

UNIT – I **CO1** **15 Periods**

Human Values: Morals, Values and Ethics - Integrity- Work Ethics- Service Learning – Civic Virtue Respect for Others - Living Peacefully - Caring - Sharing - Honesty - Courage – Valuing Time -Co-Operation - Commitment - Empathy - Self-Confidence – Stress Management-Character- Spirituality.

UNIT – II **CO2** **15 Periods**

Engineering Ethics: Senses of Engineering Ethics- Variety of Moral Issues - Types of Inquiry -Moral Dilemmas - Moral Autonomy - Kohlberg's Theory - Gillian-s Theory - Consensus and Controversy.

Professions and Professionalism: The nature and characteristics of Professions, Professionalism, the foundation and norms of Professional ethics, the need for separate code of conduct for Professionals, Professional Rights, Theories about Right Action, Uses of Ethical Theories. Case studies like The Space Shuttle Challenger, Bhopal gas tragedy, Chernobyl disaster etc.

UNIT – III **CO3** **15 Periods**

Engineering as Social Experimentation: Engineering as Experimentation - Engineers as Responsible Experimenters Safety.

Responsibilities and Rights: Safety and Risk - Assessment of Safety and Risk,Risk Benefit Analysis and Reducing Risk. Collegiality and Loyalty - Respect for Authority –Collective Bargaining - Confidentiality - Conflicts of Interest - Occupational Crime - Employee Rights – Intellectual Property Rights (IPR) - Discrimination.

UNIT – IV **CO4** **15 Periods**

Multinational Corporations - Environmental Ethics - Computer Ethics - Business ethics – Engineers As Managers - Consulting Engineers - Engineers As Expert Witnesses and Advisors - Codes Of Ethics -Sample Code Of Ethics Like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management Etc.,

Learning Resources:

Text Book:

1. Mike martin and Ronald Schinzinger, "Ethics in Engineering" McGraw-Hill, New York 1996
2. Govindarajan M, Natarajan S, Senthil Kumar V.S., "Engineering Ethics", PHI, New Delhi.
3. Bayles.M. D, Professional ethics, California, Wards worth publishing company,1981.
4. Koehn.D, The ground of Professional Ethics, Routledges, 1995

Reference Books:

1. Charles D,Fleddermann, "Engineering Ethics", Pearson / PHI, New Jersey 2004 (Indian Reprint)
2. Charles E Harris, Michael S.Protchard and Michael J Rabins, "Engineering Ethics -Concepts and Cases" Wadsworth Thompson Learning, United States, 2000 (IndianReprint now available)
3. John R Boatright, "Ethics and the conduct of business" Pearson, New Delhi, 2003.
4. Edmund G.Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers" Oxford University Press, Oxford, 2001.