



ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)



B. Tech. Scheme of Examination & Syllabus 2023-24

COMPUTER SCIENCE AND BUSINESS SYSTEMS

FIFTH SEMESTER

Sr No	Course Category	Course Code	Course Title	Hours per Week			Credits	Maximum Marks		
				L	T	P		Continual Assessment	End Sem Examination	Total
1	PCC	23CB501T	Design and Analysis of Algorithms	3	-	-	3	30	70	100
2	PCC	23CB501P	Design and Analysis of Algorithms Lab	-	-	2	1	25	25	50
3	PEC	23CB502T	Artificial Intelligence	3	-	-	3	30	70	100
4	PEC	23CB502T	Artificial Intelligence Lab	-	-	2	1	25	25	50
5	PEC	23CB503T	Fundamentals of Management	2	-	-	2	15	35	50
6	VSEC	23CB504T	Cloud, Microservices & Application	3	-	-	3	30	70	100
7	VSEC	23CB504P	Cloud, Microservices & Application Lab	-	-	2	1	25	25	50
8	PEC	23CB505T	Design Thinking	2	-	-	2	15	35	50
9	PEC	23CB506T	Professional Elective I*	2	-	-	2	15	35	50
10	PEC	23CB507T	Professional Elective II*	2	-	-	2	15	35	50
11	ELC	23CB508P	Project I	-	-	2	1	25	25	50
12	MDM	23CB531M	Multidisciplinary Minor III	3	-	-	3	30	70	100
Total				20	8	24	24	280	520	800

23CB506T	Professional Elective I
23CB506T(i)	PE-I Conversational Systems
23CB506T(ii)	PE-I Business Strategy
23CB506T(iii)	PE-I Compiler Design
23CB507T	Professional Elective II
23CB507T(i)	PE-II Behavioral Economics
23CB507T(ii)	PE-II Computational Finance & Modelling
23CB507T(iii)	PE-II Psychology

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COMPUTER SCIENCE AND BUSINESS SYSTEMS

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						MST	ESE	Total
						23CB501T	Design and Analysis of Algorithm	3

Course Objectives	Course Outcomes
<ol style="list-style-type: none"> 1. Analysis of asymptotic performance of algorithms. 2. Analysis of asymptotic runtime complexity of algorithms including formulating recurrence relations. 3. Understanding and way of designing of algorithms using greedy strategy, divide and conquer approach, dynamic programming. 	<ol style="list-style-type: none"> 1. Analyze different types of asymptotic notations and find the time complexity in terms of asymptotic notations 2. Apply various techniques such as recursion tree, characteristic equations, and master theorem to solve recurrence relations. 3. Implement greedy, divide & conquer algorithms and solve recurrences describing the performance of each. 4. Understand dynamic-programming paradigm, analyze and implement dynamic programming algorithms 5. Describe the major graph algorithms and employ graphs to model engineering problems using backtracking strategy and Identify and differentiate between various types of complexity classes

Unit I	[9Hrs]
Mathematical foundations, summation of arithmetic and geometric series, analyzing control structures, , algorithmic design principles, Review of asymptotic notations & growth of functions, Asymptotic Notations and its properties –for analysis of algorithms, best, worst case and average case analysis, amortized analysis and it's applications, analysis of sorting algorithms such as selection sort, insertion sort, bubble sort, heap sort, lower bound proof, elementary and advanced data structures with operations on them and their time complexity.	
Unit II	[9Hrs]
Recursive functions and recurrence relations, solutions of recurrence relations using technique of recursion tree method, characteristic equation, master method ,mathematical analysis for recursive and non-recursive algorithms	
Unit III	[9Hrs]
Divide and conquer basic strategy, binary search, quick sort, merge sort Greedy method - basic strategy, 0/1 knapsack problem, application to job sequencing with deadlines problem, Strassen's Matrix Multiplication, minimum cost spanning trees -Prim's algorithm and kruskal's algorithm , single source shortest path - Dijkstra's and Bellman Ford algorithm etc.	
Unit IV	[9Hrs]
Dynamic Programming basic strategy, multistage graphs, all pairs shortest path Floyd Warshall algorithm, single source shortest paths, optimal binary search trees, travelling salesman problem, matrix chain multiplication, longest common sub sequence problem, Optimal Merge pattern – Huffman Trees.	
Unit V	[9Hrs]
Basic Traversal and Search Techniques, breadth first search and depth first search, connected components. Backtracking basic strategy, 8-Queen's problem, graph coloring, Hamiltonian Circuit Problem – Subset Sum Problem , randomized and approximate algorithms, NP-hard and NP-complete problems, basic concepts, non-deterministic algorithms, NP-hard and NP-complete, Cook's Theorem, decision and optimization problems, polynomial reduction.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Introduction to Algorithms	Cormen T.H		Prentice Hall of India
2	Algorithms Design and Analysis	Udit Agarwal		Dhanpat Rai & Co. (P) Limited

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Fundamentals of Computer Algorithms	Horowitz, Sahani, Rajsekharan		Galgotia Publications Pvt. Ltd
2	Fundamentals of Algorithms	Brassard, Bratley		Prentice Hall
3	Data Structures and Algorithms	Alfred V. Aho, John E. Hopcroft , Jeffrey D. Ullman	Reprint 2006	

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23CB501P	Design and Analysis of Algorithm Lab	-	-	2	1	25	25	50
Course Objectives		Course Outcomes						
1. To introduce different asymptotic notations. 2. To understand mathematical principles of algorithm analysis 3. To understand various algorithm design strategies like divide and conquer strategy, greedy strategy, dynamic programming strategy and backtracking strategy. 4. To comprehend various complexity classes like P, NP, NP-complete and NP-Hard.		1. Analyze different types of asymptotic notations and find the time complexity in terms of asymptotic notations 2. Solve recurrences using various techniques. 3. Implement divide and conquer strategy, greedy strategy, dynamic programming algorithms and backtracking strategy 4. Identify and differentiate between various types of complexity classes.						

Practical No.	Title of the experiment
1	Analyze the time complexity of the given algorithm and determine its Big O notation. The algorithm is: Given an unsorted array of integers, find the maximum and minimum elements.
2	Analyze the time complexity of the given algorithm and determine its Big O notation. The algorithm is: Given an unsorted array of integers, count how many times a specific number occurs in the array.
3	Simulate both the insertion sort and selection sort algorithms on the following three arrays $U = [1, 2, 3, 4, 5, 6]$, $V = [6, 5, 4, 3, 2, 1]$ and $W = [1, 3, 4, 5, 2, 6]$ Does insertion sorting run faster on the array U or the array V? Justify your answer. Does selection sorting run faster on the array U or the array V? Justify your answer. Does insertion/selection sorting run faster on the array W? Justify your answer. Derive the time complexity of Insertion Sort and Selection Sort algorithms. b) Consider the following array X, whose all elements are equal. $X = [1, 1, 1, 1, 1, 1]$ Simulate both the insertion sort and selection sort algorithms on the array X. How does this compare to sorting the arrays U and V in previous practical number 1.
4	Implement the Merge Sort algorithm and analyze its time complexity for best, average, and worst-case scenarios.
5	0/1 Knapsack Problem Problem Description: You are given items each with a weight and a value, and a knapsack with a maximum capacity. The goal is to select items that maximize the total value in the knapsack without exceeding its capacity. Each item can either be taken or not taken (0/1 property).
6	Implement the Huffman coding algorithm to compress a given string of text. Your program should output the Huffman tree and the encoded binary string.
7	Implement Dijkstra's algorithm to find the shortest paths from a source vertex to all other vertices in a weighted graph. Test your implementation on a given graph and output the shortest paths and their distances.
8	Traveling Salesman Problem (TSP) Problem Description: Given a set of cities and the distances between every pair of cities, find the shortest possible route that visits each city exactly once and returns to the origin city (assuming a complete graph).
9	Solve the N-Queens problem for a given value of N. Your program should output all possible solutions where N queens can be placed on an NxN chessboard such that no two queens attack each other.
10	NP-Completeness and Approximation Algorithms

Text Books

S.N	Title	Authors	Edition	Publisher
1	Cloud computing bible	Barrie sosinsky	2010	Wiley publishing
2	Cloud computing	Michael Miller		Pearson Publication
3	Cloud Computing (Principles and Paradigms)	Rajkumar Buyya, James Broberg, Andrzej Goscinski		A John Wiley & Sons, Inc. Publication

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Cloud computing	Arshdeep Bahga & Vijay Madiseti		Universities Press
2	Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online	Michael Miller		Springer

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FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23CB502T	Artificial Intelligence	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
<ul style="list-style-type: none"> Understand the fundamental concepts, terminology, and history of artificial intelligence. Understand the concept of state space representation and how it applies to problem-solving in AI. Understand different methods for representing knowledge, including logic, semantic networks, frames, and ontologies. 	CO1. Understanding of the concepts and principles of artificial intelligence, including problem-solving, and intelligent agents. CO2. Understand the concept of state space representation and how it applies to problem-solving in AI. CO3. Analyze and apply different search techniques to solve problems, including uninformed search. CO4. Understand the various methods of representing knowledge in AI systems, including propositional and predicate logic, semantic networks, and frames. CO5. Understand the process of acquiring knowledge from domain experts and structuring it effectively in a knowledge base.

Unit I	[10Hrs]
Introduction, Overview of Artificial intelligence: Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.	

Unit II	[10Hrs]
Problem Solving, Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, and issues in the design of search programs.	

Unit III	[10Hrs]
Search techniques: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best-first search, A* search, AO* search, optimization problems: Hill climbing search	

Unit IV	[10Hrs]
Knowledge & reasoning: Knowledge representation issues, representation & mapping, approaches to knowledge representation. Using predicate logic, representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Representing knowledge using rules, Procedural verses declarative knowledge, logic programming, forward verses backward reasoning.	

Unit V	[5Hrs]
Expert Systems: Representing and using domain knowledge, expert system shells, and knowledge acquisition.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Artificial Intelligence: A Modern Approach	Stuart Russell and Peter Norvig,	First	Pearson education.
2	Artificial Intelligence	Elaine Rich, Kevin Knight, Shivashankar B. Nair,	Second	Tata McGraw Hill.
3	Introduction to Artificial Intelligence and Expert Systems	Dan W. Patterson	First	Prentice India.

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Principles of Artificial Intelligence"	Nils J. Nilson	---	Narosa Publishing House
2	"Programming in PROLOG",	William F. Clocksin, Christopher S. Mellish,	----	Narosa Publishing House.

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23CB502P	Artificial Intelligence Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
<ul style="list-style-type: none">Learn algorithms for problem-solving, such as search algorithms (e.g., breadth-first, depth-first, A* search).Analyze and apply different search techniques to solve problems, including uninformed search (breadth-first, depth-first) and informed search (A* search, greedy search).	<p>CO1: Implement different search techniques to solve problems, including uninformed search (breadth-first, depth-first) and informed search (A* search, greedy search).</p> <p>CO2: Implement the problem-solving strategies used in AI, including constraint satisfaction problems, planning algorithms, and decision-making processes.</p> <p>CO3: Implement machine learning algorithms such as neural networks, clustering, and support vector machines</p>

Expt. No.	Title of the experiment
1	Implementation of Tic-Tac-Toe game.
2	Implementation of Water-Jug problem.
3	Implementation of Depth First Search
4	Implementation of Breadth First Search
5	Implementation of 8-Puzzle problem.
6	Implementation of A* algorithm
7	Implementation of AO* algorithm
8	Implementation of Backward Chaining

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Programming in PROLOG	William F. Clocksin, Christopher S. Mellish,	----	Narosa Publishing House.

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FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23CB503T	FUNDAMENTALS OF MANAGEMENT	2	-	-	2	15	35	50

Course Objectives	Course Outcomes
<p>This course ensures that the students understand how:</p> <ul style="list-style-type: none"> Managers manage business organizations in the dynamic global environment Organizations develop and maintain competitive advantage Business decisions are made using various tools and techniques to remain competitive Managers use problem-solving strategies and critical thinking skills in real-life situations 	<p>CO1. What are the circumstances that lead to management evolution and how it will affect future managers</p> <p>CO2. Analyze and evaluate the influence of historical forces on the current practice of management</p> <p>CO3. Identify and evaluate social responsibility and ethical issues involved in business situations and logically articulate own position on such issues and Develop the process of management's four functions: planning, organizing, leading and controlling</p>

Unit I: Management Theories	[10Hrs]
<p>Concept and Foundations of Management, Evolution of Management Thoughts [Pre-Scientific Management Era (before 1880), Classical management Era (1880-1930), Neo-classical Management Era (1930-1950), Modern Management era (1950-on word), Contribution of Management Thinkers: Taylor, Fayol, Elton Mayo etc.</p>	

Unit II: Functions of Management & Organization Behavior	[10Hrs]
<p>Planning, Organizing, Staffing, Directing, Controlling</p> <p>Organization Behavior Introduction, Personality, Perception, Learning and Reinforcement, Motivation, Group Dynamics, Power & Influence, Work Stress and Stress Management, Decision Making, Problems in Decision Making, Decision Making, Organizational Culture, Managing Cultural Diversity</p> <p>Leadership: Concept, Nature, Importance, Attributes of a leader, developing leaders across the organization, Leadership Grid</p>	

Unit III: Organizational Design	[10Hrs]
<p>Classical, Neoclassical and Contingency approaches to organizational design; Organizational theory and design, Organizational structure (Simple Structure, Functional Structure, Divisional Structure, Matrix Structure)</p> <p>Managerial Ethics & Leadership: Ethics and Business, Ethics of Marketing & advertising, Ethics of Finance & Accounting, Decision-making frameworks, Business and Social Responsibility, International Standards, Corporate Governance, Corporate Citizenship, Corporate Social Responsibility</p>	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Understanding the Theory and Design of Organizations	Richard L. Daft	11 TH	Cengage India Private Limited

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	<i>Organizational Behavior</i>	Stephen P. Robbins, Timothy A. Judge, Neharika Vohra,	2010	Financial Times Prentice Hall

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23CB504T	Cloud, Micro services & Applications	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
<ul style="list-style-type: none"> To introduce the fundamental concepts of cloud computing. To provide an understanding of core cloud technologies and to explore tools and models that enhance cloud performance and efficiency. To equip students with knowledge of cloud security principles. To delve into modern application architectures, emphasizing the design and deployment of microservices and cloud-native applications for improved scalability and agility. To introduce DevOps practices and tools, such as Docker, to streamline the development, deployment, and management of cloud-based applications. 	<ul style="list-style-type: none"> Understand Cloud, various cloud service and deployment models, enabling students to choose appropriate cloud solutions based on organizational needs. Explain the role and significance of virtualization technologies and how they integrate with cloud computing to enhance resource management and scalability. Identify and assess cloud security risks, and implement fundamental security measures to protect cloud environments. Design and develop microservices-based architectures that adhere to cloud-native principles, improving application scalability and maintainability. Apply DevOps tools and practices to streamline cloud application development and deployment processes.

Unit I-Introduction to Cloud Computing	[10Hrs]
Cloud Fundamentals; Cloud Service Components, Cloud service/Deployment Models, Cloud Architecture, Cloud components Guiding Principle with respect to utilization/Security/Pricing and the applications of Cloud. Characteristics of Cloud Computing; Benefits of cloud computing; Disadvantages of cloud computing Service oriented Architecture, Public Cloud Platforms overview and their usage.	
Unit II- Cloud Concepts & Technologies	[10Hrs]
Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hypervisors, Billing and Pricing model, Scalability and Elasticity, Service Level Agreements and its elements, Disaster recovery, Apache Hadoop, HDFS, Mapreduce.	
Unit III- Cloud Security	[8Hrs]
Introduction to Cloud Security, benefits of Cloud Security, Cloud security risks and challenges, Identity and Access Management, CSA Cloud Security Architecture, Authentication, Single Sign On (SSO), Authorization. Cloud Security and Monitoring Tools.	
Unit IV	[10Hrs]
Application architectures-Monolithic & Distributed, Microservice fundamental and design approach, Cloud Native applications-12 Factors App. Application integration process/Apification Process, API Fundamental. Microservice /API management, Spring boot Fundamental and design of microservice, API tools. Developer Portal. Applications of Microservice and APIFICATION.	
Unit V:	[7Hrs]
Devops fundamentals, Tools and their usage in cloud application development. Docker and Containerization Process. Python Use cases for cloud application development.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Cloud computing bible	Barrie sosinsky	2010	Wiley publishing
2	Cloud computing	Michael Miller		Pearson Publication
3	Cloud Computing (Principles and Paradigms)	Rajkumar Buyya, James Broberg, Andrzej Goscinski		A John Wiley & Sons, Inc. Publication

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Cloud computing	Arshdeep Bahga & Vijay Madiseti		Universities Press
2	Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online	Michael Miller		Springer

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						CA	ESE	Total	
23CB504P	Cloud, Microservices & Applications	-	-	2	1	25	25	50	
Course Objectives					Course Outcomes				
<ul style="list-style-type: none"> To introduce the fundamental concepts of cloud computing. To provide an understanding of core cloud technologies and to explore tools and models that enhances cloud performance and efficiency. To equip students with knowledge of cloud security principles. To delve into modern application architectures, emphasizing the design and deployment of microservices and cloud-native applications for improved scalability and agility. To introduce DevOps practices and tools, such as Docker, to streamline the development, deployment, and management of cloud-based applications. 					<ul style="list-style-type: none"> Understand Cloud, various cloud service and deployment models, enabling students to choose appropriate cloud solutions based on organizational needs. Explain the role and significance of virtualization technologies and how they integrate with cloud computing to enhance resource management and scalability. Identify and assess cloud security risks, and implement fundamental security measures to protect cloud environments. Design and develop microservices-based architectures that adhere to cloud-native principles, improving application scalability and maintainability. Apply DevOps tools and practices to streamline cloud application development and deployment processes. 				

Practical No.	Title of the experiment
1	Introduction to Cloud Computing. Overview of Public Cloud Platforms- AWS, Google Cloud and Azure.
2	Creation AWS EC2 Windows Instance and access it from Desktop windows machine.
3	Creation of Simple Storage Service (S3) buckets in AWS. Add file to the folder inside bucket created and update it.
4	Create Ubuntu- AWS EC2 instance. Install Nginx in EC2 instance and Deploy Sample application.
5	Create AWS IAM User, Group, Security Group, and Policy.
6	Create Elastic Block Storage, attach it to EC2 Instance and detach it from EC2 instance.
7	Create Elastic/ Static IP, attach it to EC2 instance and detach it from EC2 instance.
8	Create Elastic Load Balancer - Classic Load balancer in AWS.
9	Implementing MapReduce word count problem using Hadoop.
10	Create Docker Container. Use Elastic Beanstalk to deploy web applications from Docker containers.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Cloud computing bible	Barrie sosinsky	2010	Wiley publishing
2	Cloud computing	Michael Miller		Pearson Publication
3	Cloud Computing (Principles and Paradigms)	Rajkumar Buyya, James Broberg, Andrzej Goscinski		A John Wiley & Sons, Inc. Publication

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Cloud computing	Arshdeep Bahga & Vijay Madiseti		Universities Press
2	Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online	Michael Miller		Springer

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COMPUTER SCIENCE AND BUSINESS STUDIES

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23CB505T	Design Thinking	2	-	-	2	15	35	50

Course Objectives	Course Outcomes
<ol style="list-style-type: none"> To sensitize students about the concepts of STRATEGIC MANAGEMENT To make aware the interdependence of all the departments in an organization. To make the students aware about the business tactics and implementation of strategies. 	<p>At the end of the course students will be able to:</p> <ol style="list-style-type: none"> To learn the fundamental concepts of strategic management to analyze business situations and apply these concepts to solve business problems. To understand the fundamental principles of and interrelationships among business functions such as: R&D, production, marketing, finance, HR and information technology To understand the inter-relationships of business to individuals, other organizations, government and society. To analyze complex, unstructured qualitative and quantitative problems, using appropriate tools.

Unit I Introduction to Strategic Management	[10Hrs]
What is Different About Design thinking? Design Thinking Skills Principles of Design Thinking, The Basis for Design Thinking, The Design Thinking Team, Design Thinking Workshops and Meetings – Exercises and case based discussions	
Unit II Internal Environment of Firm- Recognizing a Firm's Intellectual Assets	[10Hrs]
Listening and Empathizing Techniques – observation – structured open ended approach - , Design Thinking Frameworks, Ideation tools – brainstorming, innovation heuristics, behavior models, overcoming cognitive fixedness – Exercises and case based discussions	
Unit III External Environments of Firm- Competitive Strategy	[10Hrs]
Use of Diagrams and Maps in Design Thinking – Empathy map. Affinity diagram, mind map, journey map, combining ideas into complex innovation concepts. Story telling – improvisation, scenario planning, and development of scenarios, evaluation tools, frog design and prototyping - – Exercises and case-based discussions Assess developer and user perspectives for bias – apply frameworks to strengthen communication – sustain a culture of innovation.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	The Design of Business: Why Design Thinking is the Next Competitive Advantage	Roger Martin	2009	Harvard Business Press

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Design Thinking: Understand – Improve– Apply"	Hasso Plattner, Christoph Meinel and Larry Leifer (eds)	2011	Springer
2.	Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School	Idris Mootee,	2013	John Wiley & Sons

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23CB506T(i)	PE I - Conversational Systems	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
<ul style="list-style-type: none"> To understand the impact of AI on conversational systems To acquire knowledge in various NLP techniques. To explore the underlying technologies for a conversational system. To explore the scope of contact centers, deployment and its implication. To acquire knowledge in advanced dialog management systems. 	<ul style="list-style-type: none"> Comprehend the underlying technologies behind a conversational system. Demonstrate Natural Language Processing techniques using Python/R. Design and deploy retrieval and generative chatbots. Create a digital virtual assistant application. Design and deploy an intelligent chatbot using Dialogflow.

Unit I: Introduction to Underlying Technologies Behind A Conversational System	[9 Hrs]
Introduction to conversational system – History of AI - Underlying technologies: Natural language processing, Natural language generator - Text to speech, Speech to text, Computer vision- Messaging Platforms-Smart speakers.	
Unit II: Natural Language Processing Techniques	[9 Hrs]
Natural language processing – Phases of NLP – General Chatbot architecture – Lexical knowledge network – Semantic analysis, Word sense Disambiguation- Sentiment analysis – Affective NLG.	
Unit III: Design of Chatbots	[9 Hrs]
Fundamentals of Conversational systems – Chatbot framework and architecture – Intent classification- Dialogue management strategies- UX design – Usage of conversational design tools.	
Unit IV: Scope of Contact Centers, Deployment and Its Implication	[9 Hrs]
Introduction to popular chatbot frameworks – Amazon lex, RASA channels: Facebook messenger, Google Home – Introduction to contact centers- CCAI Telecommunications - Fundamentals of building conversations with Dialogflow – Training the agent.	
Unit V: Role of ML In Conversational Systems	[9Hrs]
Role of ML in conversational systems – Advanced dialog management system – Language translation – Information extraction- Conversational metrics – XR technologies, XR-commerce.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Conversational AI: Dialogue Systems, conversational Agents, and Chatbots.	Michael McTear	1st edition	Springer

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Conversational AI: Chatbots that Work	Andrew Freed	1st edition	Manning
2	The Definitive Guide to Conversational AI with Dialogflow and Google Cloud	Scott Murray	1st Edition	Springer

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23CB506T(ii)	PE I -BUSINESS STRATEGY	2	-	-	2	15	35	50

Course Objectives	Course Outcomes
1. To sensitize students about the concepts of STRATEGIC MANAGEMENT 2. To make aware the interdependence of all the departments in an organization. 3. To make the students aware about the business tactics and implementation of strategies.	At the end of the course students will be able to: 1. To learn the fundamental concepts of strategic management to analyze business situations and apply these concepts to solve business problems. 2. To understand the fundamental principles of and interrelationships among business functions such as: R&D, production, marketing, finance, HR and information technology 3. To understand the inter-relationships of business to individuals, other organizations, government and society. 4. To analyze complex, unstructured qualitative and quantitative problems, using appropriate tools.

Unit I Introduction to Strategic Management	[10Hrs]
Importance of Strategic Management; Vision and Objectives; Schools of thought in Strategic Management; Strategy Content, Process, and Practice; Fit Concept and Configuration Perspective in Strategic Management	
Unit II Internal Environment of Firm- Recognizing a Firm's Intellectual Assets	[8Hrs]
Core Competence as the Root of Competitive Advantage; Sources of Sustained Competitive Advantage; Business Processes and Capabilities-based Approach to Strategy; The 7S Framework; Strategic Control and Corporate Governance	
Unit III External Environments of Firm- Competitive Strategy	[12Hrs]
Five Forces of Industry Attractiveness that Shape Strategy; The concept of Strategic Groups, and Industry Life Cycle; Generic Strategies; Generic Strategies and the Value Chain.	
Corporate Strategy, and Growth Strategies: The Motive for Diversification; Related and Unrelated Diversification; Business Portfolio Analysis; Expansion, Integration and Diversification; Strategic Alliances, Joint Ventures, and Mergers & Acquisitions	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Contemporary Strategic Management	Robert M. Grant	7TH	Blackwell

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Competitive Strategy	M.E. Porter		M.E. Porter
2.	Competitive Advantage	Richard Rumelt		

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COMPUTER SCIENCE AND BUSINESS SYSTEMS

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23CB506T(iii)	PE I- COMPILER DESIGN	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
<ol style="list-style-type: none"> To make students to understand and demonstrate basics of Compilation Process. To make students to understand and implement the concepts of various phases of Lexical Analysis, Syntax Analysis, Syntax Directed Translation Scheme. To make students to demonstrate Code generation and code Optimization techniques 	<p>Students will be able to:</p> <ol style="list-style-type: none"> Discuss and apply the concepts of formal language translator, various phases of compiler and demonstrate its analytical phases. Describe principles of Parsing and design various Top-Down and Bottom-Up Parsers Explain various forms of intermediate code and demonstrate use of SDTS to translate elementary programming constructs. Describe various optimization techniques and develop simple code generators. Explain storage allocation methods, error recovery techniques and apply various error recovery techniques in parsers.

Unit I: Introduction	[9Hrs]
Phases of compilation and overview. Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, relating regular expressions and finite automata, scanner generator (lex, flex).	
Unit II: Syntax Analysis (Parser):	[9Hrs]
Context-free languages and grammars, push-down automata, LL(1) grammars and top-down parsing, operator grammars, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison)	
Unit III: Semantic Analysis	[9Hrs]
Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree. Symbol Table: Basic structure, symbol attributes and management. Run-time environment: Procedure activation, parameter passing, value return, memory allocation, scope	
Unit IV: Intermediate Code Generation	[9Hrs]
Translation of different language features, different types of intermediate forms. Code Improvement (optimization): control-flow, data-flow dependence etc.; local optimization, global optimization, loop optimization, peep-hole optimization etc.	
Unit V: Architecture dependent code improvement	[9Hrs]
Instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Compilers Principles, Techniques, and Tools	Aho	Updated Second Edition	Pearson Education India
2	Lex & Yacc,	Levine R. John, Tony Mason and Doug Brown	First Edition	S K Kataria & Sons
3.	"Compiler Design"	O.G. Kakde		

Reference Book

S.N	Title	Authors	Edition	Publisher
1	The Design and Evolution of C++	Bjarne Stroustrup	Second Edition	Pearson Education India

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**FIFTH SEMESTER**

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23CB507T(i)	PE II –BEHAVIORAL ECONOMICS	2	-	-	2	15	35	50

Course Objectives	Course Outcomes
<ol style="list-style-type: none">To gain knowledge on current ideas and concepts regarding decision making in Economics.To learn different concepts of decision making from a behavioral science perspective.To study different behavioral science aspects which affect choices and performance of firms, households and other economic entities.	<ol style="list-style-type: none">Discuss the basic concepts of Economic theory.Apply the concepts of traditional and modern economics like beliefs, biases and choice while focusing on decision making.Compare and interconnect traditional and modern microeconomics with strategic choice.

Unit I: Introduction.	[8 Hrs]
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The neoclassical/standard model and behavioral economics in contrast; historical background; behavioral economics and other social sciences; theory and evidence in the social sciences and in behavioral economics; applications – gains and losses, money illusion, charitable donation.

Basics of choice theory: Revisiting the neoclassical model; utility in economics and psychology; models of rationality; connections with evolutionary biology and cognitive neuroscience; policy analysis – consumption and addiction, environmental protection, retail therapy; applications – pricing, valuation, public goods, choice anomalies.

Unit II: Beliefs, heuristics, biases, Choice:	[12 Hrs]
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Revisiting rationality; causal aspects of irrationality; different kinds of biases and beliefs; self-evaluation and self-projection; inconsistent and biased beliefs; probability estimation; trading applications – trade in counterfeit goods, financial trading behavior, trade in memorabilia.

Choice under uncertainty: Background and expected utility theory; prospect theory and other theories. Reference points; loss aversion; marginal utility; decision and probability weighting; applications – ownership and trade, income and consumption, performance in sports.

Intertemporal choice: Geometric discounting; preferences over time; anomalies of inter-temporal decisions; hyperbolic discounting; instantaneous utility; alternative concepts – future projection, mental accounts, heterogeneous selves, procedural choice.

Unit III: Strategic choice:	[10 Hrs]
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Game theory and Nash equilibrium – strategies, information, equilibrium in pure and mixed strategies, iterated games, bargaining, signaling, learning; applications – competitive sports, bargaining and negotiation, monopoly and market entry.

Individual preferences; choice anomalies and inconsistencies; social preferences; altruism; fairness; reciprocity; trust; learning; communication; intention; demographic and cultural aspects; social norms; compliance and punishment; inequity aversion; policy analysis – norms and markets, labor markets, market clearing, public goods; applications – logic and knowledge, voluntary contribution, compensation design.

Text Books

S.N	Title	Authors	Edition	Publisher
1	An Introduction to Behavioral Economics	N. Wilkinson and M. Klaes	Third Edition	Bloomsbury Academic

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Misbehaving: The Making of Behavioral Economics	Richard H. Thaler	First Edition.	W. W. Norton & Company
2	Predictably Irrational: The Hidden Forces That Shape Our Decisions	Dan Ariely	2010	Harper Perennial

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FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23CB507T(ii)	PE II- Computational Finance and Modelling	3			3	30	70	100

Course Objectives	Course Outcomes
<ul style="list-style-type: none"> To understand the financial markets and products which are traded. To know about the concept of Black- scholes framework. To explore the application areas which include the pricing of American options. To apply the statistical analysis of financial returns. To understand the methods to hedge in incomplete markets. 	<ul style="list-style-type: none"> Identify the financial markets and products which are traded. Apply the concept of Black - scholes framework. Examine the application areas which include the pricing of American options. Analyze the statistical analysis of financial returns. Identify the methods to hedge in incomplete markets.

Unit I: Financial Products and Markets	[9 Hrs]
Financial Products and Markets: Introduction to the financial markets and the products which are traded in them: equities, indices, foreign exchange, and commodities. Options contracts and strategies for speculation and hedging.	
Unit II: Black-Scholes framework	[9 Hrs]
Black-Scholes framework: Black-Scholes PDE: simple European calls and puts; put-call parity. Binary and Digital options. The Greeks: theta, delta, gamma, vega & rho and their role in hedging. American options: perpetual calls and puts. Volatility considerations - actual, historical, and implied volatility; local vol and volatility surfaces.	
Unit III: Applications	[9 Hrs]
Application areas: Pricing of American options – Binomial Model, VaR. Monte Carlo simulation – Introduction, Applications, use in solving applied problems on derivative pricing from current finance literature. Importance of Random Walk, martingale theory, the estimation of the “Greeks”.	
Unit IV: Statistical Analysis of Financial Returns	[9 Hrs]
Statistical Analysis of Financial Returns: Fat-tailed and skewed distributions, outliers, stylized facts of volatility, implied volatility surface, and volatility estimation using high frequency data. Put – Call parity.	
Unit V: Hedge Methods	[9Hrs]
Hedging in incomplete markets, American Options, Exotic options, Electronic trading, Statistical Arbitrage. Time value of money, Risk-return trade off.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Computational Finance: Numerical Methods for Pricing Financial Instruments (Quantitative Finance).	George Levy	1st edition	Butterworth-Heinemann Ltd

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Introduction to Computational Finance, (Quantitative Finance)	Omur Ugur	1st edition (2008)	Imperial College Press
2	Computational Finance: An Introductory Course with R	Argimiro Arratia	1st edition (2014)	Atlantis Press

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FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23CB507T(iii)	PE II -Psychology	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
<p>Explain the foundational concepts, research methods, and legal aspects of Industrial and Organizational Psychology, including job analysis, job design, and recruitment strategies. Identify and apply appropriate assessment and screening techniques to evaluate candidates effectively for organizational roles. Analyze performance management systems by setting goals, providing feedback, and conducting fair and objective performance evaluations.</p>	<p>Students will be able to</p> <ul style="list-style-type: none"> • Become conversant about the major content areas of Industrial Psychology (i.e., job analysis, recruitment, selection, employment law, training, performance management, and health/wellbeing issues in the workplace). • Gain further comfort with statistical concepts in the context of making personnel decisions to reinforce content learned in introductory statistics course. • Gain practical experience by completing a series of hands-on projects involving job analysis, selection decisions, training programs, and employee well-being. • Deepen their understanding of tests and measurements so that you can collect accurate information and make sound data-based decisions. • Prepare for other focused seminar courses in Industrial/Organizational Psychology or Human Resource Management.

Unit I	[09Hrs]
Introduction: I/O Psychology-definition. Research Methods, Statistics, and Evidence-based Practice, Introduction & Legal Context of Industrial Psychology, Job Analysis & Competency Modelling, Job Evaluation & Compensation, Job Design & Employee Well-Being, Recruitment..	
Unit II	[09Hrs]
Assessments and Screening Methods: Identifying Criteria & Validating Tests and Measures, Screening Methods, Intensive Methods.	
Unit III	[09Hrs]
Performance Evaluation: Performance Goals and Feedback, Performance Coaching and Evaluation, Evaluating Employee Performance.	
Unit IV	[09Hrs]
Employee Motivation: Employee Motivation, Satisfaction and Commitment, Fairness and Diversity.	
Unit V:	[09Hrs]
Leadership: Leadership, Organizational Climate, Culture, and Development, Teams in Organizations, the Organization of Work Behavior;	
Stress Management: Demands of Life and Work.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Work in the 21st Century,	Landy, F. J. and Conte, J. M.	2013	Oxford Blackwell Publishing
2	Industrial/Organizational Psychology: An Applied Approach	Aamodt, M	2015	Wadsworth Publishing

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Performance Management towards Organizational Excellence	TV.Rao	2016	Sage

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Chairman - BoS	Dean – Academics	Date of Release	Version	