

SCHOOL OF INFORMATION TECHNOLOGY, RGPV BHOPAL

SYLLABUS

B.Tech(Computer Science and Business System) IV Semester

CB 401 (OPERATING SYSTEMS)

UNIT I-Introduction: Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, Interrupt handling and System Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, Resource Manager view, process view and hierarchical view of an OS.

UNIT II-Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time. Scheduling algorithms: Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling; Real Time scheduling: RM and EDF.

UNIT III -I/O Hardware: I/O devices, Device controllers, Direct Memory Access, Principles of I/O.

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

UNIT IV-Inter-process Communication: Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Strict Alternation, Peterson's Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem, Barber's shop problem.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery. Concurrent Programming: Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP)

UNIT V-Memory Management: Basic concept, Logical and Physical address maps, Memory allocation: Contiguous Memory allocation – Fixed and variable partition – Internal and External fragmentation and Compaction. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

Case study: UNIX/Linux OS file system, shell, filters, shell programming, programming with the standard I/O, UNIX/Linux system calls.

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LABORATORY (OPERATING SYSTEMSLAB)

1. Unix/Linux commands (files directory, data manipulation, network communication etc), shell programming and vi editor
2. C programsfor implementation of the following:
 - a. Scheduling Algorithms
 - b. Shared memory
 - c. Thread and Multi Thread
 - d. Inter Process Communication
 - e. Deadlock Avoidance and Deadlock Detection
 - f. Semaphore
 - g. Memory Management
 - h. Indexing and Hashing
3. C Programs for implementing certain commands and a shell like Unix/Linux system shell, using the Unix/Linux System calls.

Text Books-

1. Operating System Concepts Essentials. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne.

Reference Books-

1. Operating Systems: Internals and Design Principles. William Stallings.
2. Operating System: A Design-oriented Approach. Charles Patrick Crowley.
3. Operating Systems: A Modern Perspective. Gary J. Nutt.
4. Design of the Unix Operating Systems. Maurice J. Bach.
5. Understanding the Linux Kernel, Daniel Pierre Bovet, .itaseC ocraM

Course Outcomes-

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

CO1: Understand the various OS functionalities and acquire the knowledge of various types of OS

CO2: Design and Implement CPU scheduling algorithms to meet and validate the scheduling criteria

CO3: Implement directories and perform various operations on files/directories in the file system

CO4: Apply the acquired knowledge of deadlocks to Design and implement deadlock free computer programs as well as understand the issues in inter process communication

CO5: Understand how memory is allocated to processes by OS and Implement algorithms related to main and Virtual memory techniques.

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CB-402 (DESIGN AND ANALYSIS OF ALGORITHMS)

UNIT I-Introduction: Characteristics of Algorithm. Analysis of Algorithm: Asymptotic analysis of Complexity Bounds – Best, Average and Worst-Case behavior; Performance Measurements of Algorithm, Time and Space Trade-Offs, Analysis of Recursive Algorithms through Recurrence Relations: Substitution Method, Recursion Tree Method and Masters' Theorem.

UNIT II-Fundamental Algorithmic Strategies: Brute-Force, Heuristics, Greedy, Dynamic Programming, Branch and Bound and Backtracking methodologies; Illustration of these techniques for Problem-Solving, Bin Packing, Knapsack, Travelling Salesman Problem.

UNIT III-Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

UNIT IV-Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.

UNIT V-Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE, Introduction to Quantum Algorithms.

LABORATORY (DESIGN AND ANALYSIS OF ALGORITHMS LAB)

Implementation of Different Algorithms based on various algorithmic strategies using C/C++

Text Books:

1. Fundamental of Computer Algorithms, E. Horowitz and S. Sahni.
2. The Design and Analysis of Computer Algorithms, A. Aho, J. Hopcroft and J. Ullman.

Reference Books:

1. Introduction to Algorithms, T. H. Cormen, C. E. Leiserson and R. L. Rivest.
2. Computer Algorithms: Introduction to Design and Analysis, S. Baase.
3. The Art of Computer Programming, Vol. 1, Vol. 2 and Vol. 3, .D. E. Knuth.

Course Outcomes-

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

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CB-403 (SOFTWARE ENGINEERING)

UNIT I-Introduction:Programming in the small vs. programming in the large; software project failures and importance of software quality and timely availability; of software engineering towards successful execution of large software projects; emergence of software engineering as a discipline, Software Engineering Historical Development from Jackson Structured Programming to Agile Development.

UNIT II-Software Project Management:Basic concepts of life cycle models – different models and milestones; software project planning –identification of activities and resources; concepts of feasibility study; techniques for estimation of schedule and effort; software cost estimation models and concepts of software engineering economics; techniques of software project control and reporting; introduction to measurement of software size; introduction to the concepts of risk and its mitigation; configuration management.

UNIT III-Software Quality Management and Reliability:Software quality; Garvin's quality dimensions, McCall's quality factor, ISO 9126 quality factor; Software Quality Dilemma; Introduction to Capability Maturity Models (CMM and CMMI); Introduction to software reliability, reliability models and estimation.

UNIT IV-Software Requirements Analysis, Design and Construction:Introduction to Software Requirements Specifications (SRS) and requirement elicitation techniques; techniques for requirement modelling – decision tables, event tables, state transition tables, Petri nets; requirements documentation through use cases; introduction to UML, introduction to software metrics and metrics-based control methods; measures of code and design quality.

Object Oriented Analysis, Design and Construction:Concepts -- the principles of abstraction, modularity, specification, encapsulation and information hiding; concepts of abstract data type; Class Responsibility Collaborator (CRC) model; quality of design; design measurements; concepts of design patterns; Refactoring; object-oriented construction principles; object oriented metrics.

UNIT V-Software Testing:Introduction to faults and failures; basic testing concepts; concepts of verification and validation; black box and white box tests; white box test coverage – code coverage, condition coverage, branch coverage; basic concepts of black-box tests – equivalence classes, boundary value tests, usage of state tables; testing use cases; transaction based testing; testing for non-functional requirements – volume, performance and efficiency; concepts of inspection; Unit Testing, Integration Testing, System Testing and Acceptance Testing.

Agile Software Engineering:Concepts of Agile Methods, Extreme Programming; Agile Process Model - Scrum, Feature; Scenarios and Stories

LABORATORY (SOFTWARE ENGINEERING LAB)

Development of requirements specification, function-oriented design using SA/SD, object-oriented design using UML, test case design, implementation using C++ and testing. Use of appropriate CASE tools and other tools such as configuration management tools, program analysis tools in the software life cycle.

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Text Books:

1. Software Engineering, Ian Sommerville
2. Software Engineering A Practitioner's Approach, Rogers S. Pressman and Bruce R. Maxim.

Reference Books:

1. The Essentials of Modern Software Engineering: Free the Practices from the Method Prisons!, Ivar Jacobson, Harold "Bud" Lawson, Pan-Wei Ng, Paul E. McMahon and Michael Goedicke.
2. Fundamentals of Software Engineering, Carlo Ghezzi, Jazayeri Mehdi and Mandrioli Dino.
3. Software Requirements and Specification: A Lexicon of Practice, Principles and Prejudices, Michael Jackson.
4. The Unified Development Process, Ivar Jacobson, Grady Booch and James Rumbaugh.
5. Design Patterns: Elements of Object-Oriented Reusable Software, Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides.
6. Software Metrics: A Rigorous and Practical Approach, Norman E Fenton and Shari Lawrence Pfleeger.
7. Software Engineering: Theory and Practice, Shari Lawrence Pfleeger and Joanne M. Atlee.
8. Object-Oriented Software Construction, Bertrand Meyer.
9. Object Oriented Software Engineering: A Use Case Driven Approach --Ivar Jacobson.
10. Touch of Class: Learning to Program Well with Objects and Contracts --Bertrand Meyer.
11. UML Distilled: A Brief Guide to the Standard Object Modeling Language --Martin Fowler.
12. Introduction to Business Domains for Software Engineers, Manoj Kumar Lal
13. Knowledge Driven Development – Bridging Waterfall and Agile Methodologies -- Manoj Kumar Lal

Course Outcomes-

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

- CO1: Define software engineering process and practices, and demonstrate various process models
- CO2: Identify different types of risks in software development
- CO3: Distinguish different testing strategies and its working
- CO4: Estimate the quality of software process
- CO5: Develop the SRS document for project.

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CB-404 (INTRODUCTION TO INNOVATION, IP MANAGEMENT AND ENTREPRENEURSHIP)

UNIT – I

Innovation: What and Why?

Innovation as a core business process, Sources of innovation, Knowledge push vs. need pull innovations.

Class Discussion- Is innovation manageable or just a random gambling activity?

UNIT – II

Building an Innovative Organization

Creating new products and services, Exploiting open innovation and collaboration, Use of innovation for starting a new venture

Class Discussion- Innovation: Co-operating across networks vs. ‘go-it-alone’ approach

UNIT – III

Entrepreneurship:

- Opportunity recognition and entry strategies
- Entrepreneurship as a Style of Management
- Maintaining Competitive Advantage- Use of IPR to protect Innovation

UNIT – IV

Entrepreneurship- Financial Planning:

- Financial Projections and Valuation
- Stages of financing
- Debt, Venture Capital and other forms of Financing

UNIT – V

Intellectual Property Rights (IPR)

- Introduction and the economics behind development of IPR: Business Perspective
- IPR in India – Genesis and Development
- International Context
- Concept of IP Management, Use in marketing

UNIT – VI

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Types of Intellectual Property

- Patent- Procedure, Licensing and Assignment, Infringement and Penalty
- Trademark- Use in marketing, example of trademarks- Domain name
- Geographical Indications- What is GI, Why protect them?
- Copyright- What is copyright
- Industrial Designs- What is design? How to protect?

Class Discussion- Major Court battles regarding violation of patents between corporate companies

Text Books:

1. Joe Tidd, John Bessant. Managing Innovation: Integrating Technological, Market and Organizational Change
2. Case Study Materials: To be distributed for class discussion

Course Outcomes-

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

CO1: Be familiar with creative and innovative thinking styles

CO2: Learn to investigate, understand and internalize the process of founding a startup

CO3: Learn to manage various types of IPR to protect competitive advantage

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CB-405 (DESIGN THINKING)

	Leadership Oriented Learning (LOL)		
Nature of Course		Behavioral	
Pre requisites		Completion of all units from Semesters 1, 2, 3 and 4	
Course Terminal Objectives:			
1	Recognize the importance of DT		
2	Explain the phases in the DT process		
3	List the steps required to complete each phase in DT process		
4	Apply each phase in the DT process		
5	Use doodling and storytelling in presenting ideas and prototypes		
6	Create value proposition statements as part of their presentations		
7	Recognize how DT can help in functional work		
8	Recognize how Agile and DT complement each other to deliver customer satisfaction		
Course Enabling Objectives:			
Upon completion of the course, students shall have ability to			
1	Recognize the importance of Design Thinking		[U]
2	Identify the steps in the DT process		[C]
3	Recognize the steps in the empathize phase of DT		[C]
4	Identify the steps required to conduct an immersion activity		[C]

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5	Conduct an immersion activity and fill up the DT question template	[AP]
6	Recognize the steps to create personas in the define phase of DT	[C]
7	Create personas in the define phase of DT	[AP]
8	Recognize the steps to create problem statements in the define phase of DT	[AP]
9	Define the problem statements in the define phase of DT	[E]
10	Recognize the steps in the ideate phase of DT	[C]
11	Apply the steps in the ideate phase of DT	[AP]
12	Recognize how doodling can help to express ideas	[U]
13	Recognize the importance storytelling in presenting ideas and prototypes	[U]
14	Recognize the importance of the prototype phase in DT	[C]
15	Create a prototype	[AP]
16	Recognize the importance of service value proposition	[C]
17	Create a value proposition statement	[AP]
18	Recognize the best practices of the testing phase in DT	[U]
19	Test a prototype created through a DT process	[AP]
20	Recognize how DT can help in functional work	[E]
21	Recognize how Agile and DT complement each other to deliver customer satisfaction	[C]
Course Contents:		
Total Hours:		45 hours
Textbooks:		
	There are no prescribed texts for Semester 5 – there will be handouts and reference links shared.	
Reference Books:		
1	Hooked by NirEyal	

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2	The Art of Creative Thinking by Rod Judkins		
3	Start Up nation by Dan Senor and Saul singer		
4	Start with Why by Simon Sinek		
Web References:			
1	What is Design Thinking? Interaction Design Foundation		
2	What are some of the good examples of design thinking? - Quora		
3	Design thinking 101: Principles, Tools & Examples to transform your creative process		
Online Resources:			
1	Understanding Design thinking WF NEN		
2	Design Thinking and Innovation at Apple Wei Li		
3	Stanford Webinar- Design Thinking = Method, Not Magic		
4	Stanford Design Thinking Virtual Crash Course		
5	So Many Uses- activity to spark creativity and design		
Assessment Methods & Levels (based on Bloom’s Taxonomy)			
Formative assessment (Max. Marks:20)			
Course Outcome	Bloom’s Level	Assessment Component	Mark s
	Apply	Defining problem statement	5
	Apply	Ideating solutions	5
	Apply	Creating a prototype	10
Summative Assessment based on End Semester Project			

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Bloom's Level		
Understand	Understand, Analyze, Apply Conduct and apply DT in the project.	50
Apply		
Analyze		

Lesson Plan

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
1	Recognize the importance of Design Thinking	2	<p>Why is Design Thinking important for business?</p> <p>Stories and examples will be used to introduce Design Thinking to the participants. We will use relevant stories and the following videos.</p> <ol style="list-style-type: none"> 1. YouTube video: The Design Thinking Process – Sprouts(3.57 mins) 2. Leverage TCS-provided DT content to show the evolution of DT and why is important in present business environment. Can be a video. (2 mins) <p>Lecturer to encourage the students to maintain their Satori slam book and capture their learning points in it.</p>	Introduction and discussion	60 mins
1	Recognize the importance of Design Thinking	2	<p>Why is Design Thinking important for you?</p> <p>Experiential activity</p> <p>Products that you loved and</p>	Activity	90 mins

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Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			<p>hated: In this activity, learners will have to share about a product they like or dislike based on their experience.</p> <p>What would they need in a bad product to make it good?</p>		
1	Identify the steps in the DT process	2	<p>What is DT?</p> <p>Introduce the 5-Step Stanford Model using YouTube videos:</p> <p>The video will give a brief idea about the five steps:</p> <ul style="list-style-type: none"> • Empathize (search for rich stories and find some love) • Define (user need and insights – their POV) • Ideate (ideas, ideas, ideas) • Prototype (build to learn) • Test (show, don't tell) <p>Start all over and iterate the flow as much as possible</p>	Lecture and demo	60 mins
1	Recognize the steps in the empathize phase of DT	2	<p>What is empathy?</p> <p>Touch the target activity (Recap from Sem 2 Unit 4)</p> <p>Discussions in class</p> <p>Reference: FHIL Stages of Design Thinking EMPATHY (2:29 mins)</p>	Activity	60 mins

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1	Identify the steps required to conduct an immersion activity	1 and 2	How to empathize? Moccasin Walk activity for 1 hour to allow learners experience stepping into the shoes of another person. <i>This is an individual activity.</i> Sharing observations with the group. Suggest that students try this even in their free time away from studies.	Activity and lecture	90 mins
1	Identify the steps required to conduct an immersion activity	1 and 2	Intro to Immersion Activity Introduction to immersion activity through flowcharts and handouts and examples (to be provided by	Lecture	45 mins
Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			TCS DT Team) (steps and thequestion template: <ol style="list-style-type: none"> 1. We met; 2. We were amazed to realize that; 3. We wonder if this means 4. It would change the world if) 		
1	Conduct an immersion activity and fill up the DT question template	3	Immersion activity Participants will be divided into four groups. Each group will need to visit any one of the following places to conduct an immersion activity. They need to interview people and fill up the DT question template (explained in the last class) <ol style="list-style-type: none"> 1. College cafeteria 2. College library 3. College sports facility 4. Transport facility near college 	Practical	180 mins

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2	<p>Recognize the steps to create personas in the define phase of DT</p> <p>Create personas in the define phase of DT</p>	<p>2</p> <p>3</p>	<p>Creating personas</p> <p>Start with YouTube videos explaining the process of persona creation:</p> <p>1. Personas – What is a persona and how do I create one? (2019)</p> <p>https://www.youtube.com/watch?v=GNvLpfXCge8</p> <p>Each group will create at least one persona based on the immersion study they conducted in the empathize stage (refer to the four question templates). The group can use A4 pages, colours and other props to create and display their respective persona.</p> <p>Reference: https://www.interaction-design.org/literature/article/personas-why-and-how-you-should-use-them</p>	Lecture and practical	120 mins
Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			Lecturer to guide participants on getting the personas right (based on guidelines provided by TCS DTTeam).		
2	<p>Recognize the steps to create problem statements in the define phase of DT</p>	2	<p>Problem statements</p> <p>Session will begin with YouTube videos on how to define problem statements in the Define phase.</p> <p>1. FHIL Stages of Design Thinking REFRAME (1:55mins)</p> <p>Lecturer will provide examples of problem statements in class (based on handouts provided by TCS DT</p>	Lecture and demo	60 mins

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			Team)		
2	Define the problem statements in the define phase of DT	3	Defining problem statements Group activity, in which each group will define the key problem statements (max three) for their lead personas. Each group will present while the remaining groups will do a peer review. Finally, lecturer will moderate/validate the problem statements (based on handouts provided by TCS DT Team)	Formative assessment	90 mins
3	Recognize the steps in the ideate phase of DT	1 and 2	How to Ideate? The session will start with YouTubevideos:	Lecture and demo	60 mins
Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			1. FHIL Stages of DesignThinking IDEATE (1:54secs) 2. What Is Six Thinking Hats?(Litmos Heroes) (1:58 secs) Lecturer to briefly tell them about the guidelines of ideating (to be provided by TCS DT Team)		
3	Apply the steps in the ideate phase of DT	3	Ideation games Game 1: Six Thinking Hats Game 2: Million-dollar idea	Activity	90 mins

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3	Apply the steps in the ideate phase of DT	3	Ideate to find solutions Participants will work in their assigned groups to ideate solutions for the problem statements they identified (as continuation of immersion activity) applying ideation methods discussed in the previous session. They will get scores based on how well they can apply the ideation methods. Lecturers will observe the groups separately and assign them scores based on specific rubric (provided by the TCS DT Team).	Formative assessment	90 mins
3	Recognize how doodling can help to express ideas	1	Let's doodle! Participants will first watch a video on doodling: Doodling – how it can help in presenting ideas during ideate and prototype phases After that, participants will complete an activity on doodling.	Demo and activity	60 mins
3	Recognize the importance of storytelling in presenting ideas and prototypes	1	What is Storytelling in DT? Activity- Research to find out about people who have used DT in providing solutions. Present their findings in forms of stories. (Recap from Unit- Sem-) Suggested topics to be provided by the TCS DT team.	Activity	120 mins
Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
4	Recognize the importance of the prototype phase in DT	2	Why is a Prototype important in Design Thinking? The session will start with an activity to drive home the importance of creating a prototype in the design thinking process. As part of debrief of the activity,	Activity and demo	60 mins

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			<p>lecturer will share relevant examples and prototyping guidelines (provided by the TCS DTTeam).</p> <p>Finally, the participants will watch two YouTube videos:</p> <p>1. FHIL Stages of Design Thinking PROTOTYPE</p> <p>2. Prototyping Phase - Design Thinking Coursera https://www.coursera.org/lecture/patient-safety-project-planning/prototyping-phase-jVuQn</p>		
4	Create a prototype	3	<p>Prototype your idea</p> <p>This is a group activity in which the participants will work in groups (created at the beginning of the course, in which they did immersion, persona creation, defining problem statement and ideating) to create prototypes based on the solutions they had identified.</p> <p>Lecturer to share feedback based on guidelines provided by the TCsDT team.</p>	Formative assessment	180 mins
4	<p>Recognize the importance of service value proposition</p> <p>Create a value proposition statement</p>	<p>2</p> <p>3</p>	<p>Value Proposition Statement</p> <p>You Tube: What is Value Proposition (by Venture Well)(3:51 mins)?</p> <p>Lecturer to discuss the guidelines for creating a value proposition</p>	Lecture	<p>120 mins</p> <p>1635 mins</p>
Unit No	Objective	Bloom's Level	Content	Type of Class	Duration

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			<p>statement (to be provided by the TCS DT Team)</p> <p>Each group now needs to create value proposition statement for the solution they have suggested.</p>		
4	Recognize the best practices of the testing phase in DT	1	<p>Testing in Design Thinking</p> <p>Participants will first watch a YouTube video:</p> <p>FHIL Stages of Design Thinking TESTING</p> <p>After that lecturers will explain them the importance of Testing the prototype through stories (provided by the TCS DT Team).</p> <p>They will also explain how the loop works in DT between the Empathize and Testing phases.</p>	Lecture	60 mins
	Test a prototype created through a DT process	3	<p>Test the Prototype</p> <p>Each group needs to test their prototype created earlier and:</p> <ol style="list-style-type: none"> 1. Document user feedback 2. Write down their inference from the feedback 3. Suggest next steps (the loop that happens in DT) 	Activity	120 mins
4	Recognize how DT can help in functional work	1	<p>Role of DT in your work</p> <p>Lecturer conducts a group/open house discussion on:</p> <p>“How DT can help me to become a better coder?”</p> <p>Lecturer needs to capture the key learning points in these discussions.</p>	Discussion	60 mins

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4	Recognize how Agile and DT complement each other to deliver customer satisfaction	1	<p>Suggested session on:</p> <p>How Agile and DT complement each other to deliver customersatisfaction</p>	Lecture	45 mins
4			<p>Share your Satori</p> <p>Participants will be asked to share their Satori moments from the DT sessions</p>	Reflection activity	60 mins
Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
					33 hours
			<p>Project</p> <p>Option 1: Each group needs to present a Prototype of how they can apply DT in their functional work or coding. Examples will be provided to explain what exactly they need to do.</p> <p>Option 2: Each group will apply DT to create a prototype to improve any existing product or service.</p> <p>For both options, groups need to complete all phases of the Stanford DT model and include the outputs of each phase in their presentation.</p> <p>Lecturers will evaluate the project based on the rubric provided by the TCS DT Team.</p>		12 hours
				Total	45 hours

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CB-406 (OPERATIONS RESEARCH)

Unit-I: Introduction to OR

Origin of OR and its definition. Concept of optimizing performance measure, Types of OR problems, Deterministic vs. Stochastic optimization, Phases of OR problem approach – problem formulation, building mathematical model, deriving solutions, validating model, controlling and implementing solution.

Unit-II Linear Programming

Linear programming – Examples from industrial cases, formulation & definitions, Matrix form. Implicit assumptions of LPP.

Some basic concepts and results of linear algebra – Vectors, Matrices, Linear Independence/Dependence of vectors, Rank, Basis, System of linear eqns., Hyperplane, Convex set, Convex polyhedron, Extreme points, Basic feasible solutions.

Geometric method: 2-variable case, Special cases – infeasibility, unboundedness, redundancy & degeneracy, Sensitivity analysis.

Simplex Algorithm – slack, surplus & artificial variables, computational details, big-M method, identification and resolution of special cases through simplex iterations.

Duality – formulation, results, fundamental theorem of duality, dual-simplex and primal-dual algorithms.

Unit-III Transportation and Assignment problems

TP - Examples, Definitions – decision variables, supply & demand constraints, formulation, Balanced & unbalanced situations, Solution methods – NWCR, minimum cost and VAM, test for optimality (MODI method), degeneracy and its resolution.

AP - Examples, Definitions – decision variables, constraints, formulation, Balanced & unbalanced situations, Solution method – Hungarian, test for optimality (MODI method), degeneracy & its resolution.

Unit-IV

PERT – CPM: Project definition, Project scheduling techniques – Gantt chart, PERT & CPM, Determination of critical paths, Estimation of Project time and its variance in PERT using statistical principles, Concept of project crashing/time-cost trade-off.

Inventory Control: Functions of inventory and its disadvantages, ABC analysis, Concept of inventory costs, Basics of inventory policy (order, lead time, types), Fixed order-quantity models – EOQ, POQ & Quantity discount models. EOQ models for discrete units, sensitivity analysis and Robustness, Special cases of EOQ models for safety stock with known/unknown stock out situations, models under prescribed policy, Probabilistic situations.

Unit-V

Queuing Theory: Definitions – queue (waiting line), waiting costs, characteristics (arrival, queue, service discipline) of queuing system, queue types (channel vs. phase).

Kendall's notation, Little's law, steady state behaviour, Poisson's Process & queue, Models with examples - M/M/1 and its performance measures; M/M/m and its performance measures; brief description about some special models.

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Simulation Methodology: Definition and steps of simulation, random number, random number generator, Discrete Event System Simulation – clock, event list, Application in Scheduling, Queuing systems and Inventory systems.

LABORATORY (OPERATIONS RESEARCH)

1. Formulation of linear programming problems.
2. Solution of linear programming problem using graphical method with:
 - i. Multiple constraints
 - ii. Unbounded solution
 - iii. Infeasible solution
 - iv. Alternative or multiple solution
3. Enumeration of all basic solutions for linear programming problem.
4. Solution of linear programming problem with simplex method.
5. Problem solving using Big M method.
6. Problem solving using two phase method.
7. Solution on primal problem as well as dual problem.
8. Solution based on dual simplex method.
9. Verification of weak duality, strong duality and complementary slackness property.
10. Solution of transportation problem.
11. Solution of assignment problem.
12. Solution of integer programming problem using Branch and Bound method.
13. Solution of integer programming problem using Gomory's cutting plane method.
14. Simulation: Random number generation.
15. Monte Carlo method.
16. Performance measures for M/M/1 queuing model.
17. ABC analysis.
18. Inventory model.

Text Books:

1. Operations Research: An Introduction. H.A. Taha.

Reference Books:

1. Linear Programming. K.G. Murthy.
2. Linear Programming. G. Hadley.
3. Principles of OR with Application to Managerial Decisions. H.M. Wagner.
4. Introduction to Operations Research. F.S. Hiller and G.J. Lieberman.
5. Elements of Queuing Theory. Thomas L. Saaty.
6. Operations Research and Management Science, Hand Book: Edited By A. Ravi Ravindran.
7. Management Guide to PERT/CPM. Wiest & Levy.
8. Modern Inventory Management. J.W. Prichard and R.H. Eagle.

Course Outcomes-

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

**B.TECH
COMPUTER SCIENCE AND BUSINESS
SYSTEM
SEMESTER V SYLLABUS**

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SYLLABUS

B.Tech(Computer Science and Business System) V Semester

CB-501 SOFTWARE DESIGN WITH UML

UNIT – I

INTRODUCTION TO SOFTWARE ENGINEERING AND UML: Introduction- Software

Engineering Concepts- Development activities- Managing software development- UML introduction- modeling concepts- Project organization and communication.

UNIT – II

REQUIREMENTS ELICITATION AND ANALYSIS: Introduction-Requirement Elicitation Concepts- Requirements Elicitation Activities- Managing Requirements Elicitation- Case Study: ARENA-Analysis concepts- Analysis activities: From Use cases to Objects- Managing Analysis.

UNIT – III

STATIC UML DIAGRAMS: Class Diagram- Elaboration - Domain Model- Finding conceptual classes and description classes- Associations- Attributes- Domain model refinement- Finding conceptual class Hierarchies- Aggregation and Composition- Relationship between sequence diagrams and use cases - When to use Class Diagrams

UNIT – IV

DYNAMIC UML DIAGRAMS: Dynamic Diagrams- UML interaction diagrams - System sequence diagram - Collaboration diagram- When to use Communication Diagrams- State machine diagram and Modelling - When to use State Diagrams-Activity diagram- When to use activity diagrams Implementation Diagrams- UML package diagram-When to use package diagrams- Component and Deployment Diagrams- When to use Component and Deployment diagrams

UNIT – V

DESIGN PATTERNS: Design Pattern- Describing Design Patterns- How design patterns solve design problems- Selecting a design Pattern- Using a design pattern- Case Study: Designing a Document Editor

List of Experiments

Students should design a mini project and should apply the following experiments.

1. Requirement Engineering
 1. Writing Problem Statement
 2. Writing Requirement Specification
 - SRS
 - Use Case
 3. Planning Project with PERT Diagram
2. **Designing Project.**
 1. Use Case Diagrams
 2. Interaction Diagrams
 3. State chart Diagrams
 4. Activity Diagrams

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5. Class Diagrams
6. Package Diagrams
7. Component Diagrams
8. Deployment Diagrams.
9. Mapping Design to code.

Text Book

1. Bernd Bruegge and Allen H. Dutoit, “Object-Oriented Software Engineering: using UML, Patterns, and Java”, Third Edition, Prentice Hall, 2010.

Reference Books:

1. Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides, “Design Patterns: Elements of Reusable Object-Oriented Software” Addison-Wesley Professional, 1994.
2. Ali Bahrami, “Object Oriented Systems Development”, McGraw Hill Edition, 2017.

Online Resources

3. https://www.umsl.edu/~sauterv/analysis/488_f01_papers/quillin.htm
4. <https://medium.com/omarelgabrys-blog/object-oriented-analysisand-design-introduction-part-1-a93b0ca69d36>

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CB-502 COMPILER DESIGN

UNIT – I

Introduction: 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): Context-free languages and grammars, push-down automata, LL(1) grammars and top-down parsing, operator grammars, LR(0), 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: 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: 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: instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation.

Advanced topics: Type systems, data abstraction, compilation of Object Oriented features and non-imperative programming languages.

List of Experiments

1. Implement a lexical analyzer to recognize tokens in C. (identifiers, constants, operators, keywords etc.).
2. Design a Calculator using LEX.
3. Identify an arithmetic expression using LEX and YACC.
4. Evaluate expression that takes digits, *, + using YACC.
5. Generate Three address codes for a given expression (arithmetic expression, flow of control).
6. Implement Code Optimization Techniques like copy propagation, dead code elimination, common sub expression elimination.
7. Generate Target Code (Assembly language) for the given set of Three Address Code.

Books:

1. Compilers: Principles, Techniques and Tools, V. Aho, R. Sethi and J. Ullman. Pearson Education
2. Lex & Yacc, Levine R. John, Tony Mason and Doug Brown, O'Reilly

Reference Books:

1. The Design and Evolution of C++, Bjarne Stroustrup.
2. Compiler Design, Raghavan, TMH Pub.
3. Compiler Construction: Principles and Practice, Loudon, Cengage Learning
4. Compiler Design in C, A. C. Holub. Prentice-Hall Inc., 1993.
5. Writing compiler & Interpreters, Mak, Willey Pub.

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CB-503 FUNDAMENTALS OF MANAGEMENT

UNIT – I

Management Theories: 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.

UNIT – II

Functions of Management- Planning, Organizing, Staffing, Directing, Controlling

UNIT – III

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

UNIT – IV

Organizational Design: Classical, Neoclassical and Contingency approaches to organizational design; Organizational theory and design, Organizational structure (Simple Structure, Functional Structure, Divisional Structure, Matrix Structure)

UNIT – V

Managerial Ethics: 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

Leadership: Concept, Nature, Importance, Attributes of a leader, developing leaders across the organization, Leadership Grid.

Home Assignment:

The topic for class discussion will be mentioned beforehand and students should be ready to discuss these topics (in groups) in class. Students are required to meet in groups before coming to class and prepare on the topic. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.

1. Topic: Corporate social responsibility (CSR) and HRM implications: What does it mean to be socially responsible within an increasingly financially driven market economy?
2. Topic: Leaders are Born, Not Made! The debate

Text Books:

1. Understanding the Theory and Design of Organizations by Richard L. Daft, 11e, Cengage, 2020
2. Management by James Arthur, Finch Stoner, R. Edward Freeman, and Daniel R Gilbert 6th Ed; Publisher: Pearson Education/Prentice Hall
3. Organizational Behaviour by Stephen P. Robbins, Prentice Hall, 2013

Reference Books:

1. Organizational Behaviour by Fred Luthans, Mc Graw-Hill, 2013
2. Organizational Behavior by Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, 16e, Pearson Education, 2016
3. Business Ethics: Ethical Decision Making & Cases, by O. C. Ferrell, John Fraedrich, Linda Ferrell, 12th edition, Cengage, 2017

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CB-504 Business Strategy

UNIT – I

Introduction to Strategic Management, 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, Core Competence as the Root of Competitive Advantage, Sources of Sustained Competitive Advantage, Business Processes and Capabilities-based Approach to Strategy.

UNIT – III

External Environments of Firm- Competitive Strategy, 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.

UNIT – IV

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

UNIT – V

Strategy Implementation: Structure and Systems, The 7S Framework, Strategic Control and Corporate Governance

Home Assignment:

- Latest business events would be discussed in class and students should be ready to discuss these events (in groups). The topic will be mentioned beforehand. Students are required to meet in groups before coming to class and prepare on the topic.
- There will be periodic homework assignments relating to the course concepts or mini-cases. Specific instructions will be given separately.

Final Project:

Students (in groups) are required to work on a project and submit the project report and deliver presentation. The topic of the project will be given later.

Text Books:

1. Contemporary Strategic Management by Robert M. Grant, 7th Edition, Blackwell, 2012
2. Competitive Strategy by Michael E. Porter, The Free Press, 1980
3. Competitive Advantage by Michael E. Porter, The Free Press, 1985

Reference Books:

1. Competitive Strategy, 1980.M.E. Porter,
2. Competitive Advantage, 1985 Richard Rumelt (2011).
3. Good Strategy Bad Strategy: The Difference and Why It Matters by Richard Rumelt, Profile Books Ltd, 2013
4. Strategic Management by Francis Cherunilam, 4th Edition, HPH, 2016
5. Strategic Management and Business Policy by Azhar Kazmi, McGraw Hill Education, 2018

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CB-505 Business Communication & Value Science-III

Unit I

SWOT and Motivation in Real Life Scenarios, SWOT and Life Positions; Create your SWOT; SWOT Vs. TOWS – The Balancing Act; Presentation on the strengths identified to survive in the VUCA World; Motivation; Scenario based activity on identifying and leveraging motivation; Present findings and approaches as groups.

Unit II

Pluralism in Cultural Spaces Rivers of India; Awareness and respect for pluralism in cultural spaces; Rhythms of India (Cultures in India; Global, Glocal, Translocational, Debate on Global, Glocal, translocational impacts; Cross-cultural communication; Culture shock; Gender awareness - Gender awareness campaign

Unit III

Role of science in nation building, Role of science post- independence, Introduction to technical writing, Basic rules of technical writing through examples. Practice activity on technical writing. Application of technical writing in real-life scenarios. Maslow's theory - Recognize how motivation helps real life - Leverage motivation in real-life scenarios.

Unit IV

Introduction to Artificial Intelligence, Importance of AI, AI in Everyday Life

Text Book(s)

1. Kumar, Sanjay and Pushp Lata. English Language and Communication Skills for Engineers, Oxford University Press.

Reference Books

2. Pringle, A. S., & O'Keefe, S. S. (2009). Technical Writing 101: A Real-World Guide to Planning and Writing Technical Content (3rd ed.). Scriptorium Publishing Services, Inc.
4. Alfred, G. J., Brusaw, C. T., & Oliu, W. E. (2011). Handbook of Technical Writing, Tenth Edition (10th ed.). St. Martin's Press.
5. Reynolds, S., Valentine, D., & Munter, M. M. (2019). Guide to Cross-Cultural Communications (2nd Edition) (Guide to Series in Business Communication) (2nd ed.). Pearson
6. Hurn, B., & Tomalin, B. (2016). Cross-Cultural Communication: Theory and Practice (1st ed. 2013 ed.). Palgrave Macmillan.

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CB-506 (A) Conversational Systems

Unit I

Fundamentals of Conversational Systems:

Introduction: Overview, Case studies, Explanation about different modes of engagement for a human being, History and impact of AI.

Underlying Technologies: Natural Language Processing, Artificial Intelligence and Machine Learning, NLG, Speech-To-Text, Text-To-Speech, Computer Vision etc.

Introduction to Top players in Market – Google, MS, Amazon & Market trends.

Messaging Platforms (Facebook, WhatsApp) and Smart speakers – Alexa, Google Home and other new channels. Ethical and Legal Considerations in AI Overview

Unit II

Foundational Blocks for Programming: Basic Python programming concepts, Node Basics.

Natural Language Processing: Introduction: Brief history, Basic Concepts, Phases of NLP, Application of chatbots etc. General chatbot architecture,

Basic concepts in chatbots: Intents, Entities, Utterances, Variables and Slots, Fulfillment. Lexical Knowledge Networks (WordNet, Verbnet, PropBank, etc). Lexical Analysis, Part-of-Speech Tagging, Parsing/Syntactic analysis, Semantic Analysis, Word Sense Disambiguation. Information Extraction, Sentiment Analysis), Affective NLG

Unit III

Building a chatbot/Conversational AI system: Fundamentals of Conversational Systems (NLU, DM and NLG), Chatbot framework & Architecture, Conversational Flow & Design, Intent Classification (ML and DL based techniques), Dialogue Management Strategies, Natural Language Generation, UX design, APIs and SDKs, Usage of Conversational Design Tools.

Introduction to popular chatbot frameworks – Google Dialog flow, Microsoft Bot Framework, Amazon Lex, RASA Channels: Facebook Messenger, Google Home, Alexa, WhatsApp, Custom Apps. Overview of CE Testing techniques, A/B Testing, Introduction to Testing Frameworks - Botium /Mocha ,Chai. Security & Compliance – Data Management, Storage, GDPR, PCI.

Unit IV

Role of ML/AI in Conversational Technologies –Brief Understanding on how Conversational Systems uses ML technologies in ASR, NLP, Advanced Dialog management, Language Translation, Emotion/Sentiment Analysis, Information extraction, etc. to effectively converse

Unit V

Contact Centers: Introduction to Contact centers – Impact & Terminologies. Case studies & Trends, How does a Virtual Agent/Assistant fit in here?

Overview on Conversational Analytics: Conversation Analytics: The need of it, Introduction to Conversational Metrics.

Future– Where are we headed? Summary, Robots and Sensory Applications overview, XR Technologies in Conversational Systems, XR-Commerce, What to expect next? – Future technologies and market innovations overview.

List of Experiments

1. A python program to identify morphological features of a word by analysing it.
2. A python program to generate word forms from root and suffix information.
3. A python program to perform morphological analysis of a word by the use of Add-Delete table.
4. A python program to calculate the bigrams from a given corpus and calculate probability of a

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sentence.

5. A python program to do sentiment analysis for the given dataset and to classify sentences based on their categories.
6. A python program to find Parts – Of - Speech tags of words in a sentence.
7. A python program to know the importance of context and size of training corpus in learning Parts of Speech and understand the concept of chunking and get familiar with the basic chunk tagset.
8. A python program to detect the entities from the dataset and tag them based on their categories.
9. A python program to build a Neural Network to recognize handwritten digits using MNIST dataset.
10. A python program to build a Recurrent Neural Model with Keras.
11. Formulate a problem statement for mini-project to build a chatbot for an application that proves its importance from a social perspective.

Text Books:

1. Designing Voice User Interfaces: Principles of Conversational Experiences 1st Edition by Cathy Pearl, O'Reilly
2. Conversational Interfaces: Principles of Successful Bots, Chatbots & Messaging Apps By Mariya Yao

References:

1. Bot Business 101: How to start, run & grow your Bot / AI business By Ekim Kaya
2. Designing Bots: Creating Conversational Experiences By Amir Shevat O'Reilly
3. Designing Conversational Interfaces By Alper Çuğun

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CB-506 (B) Cloud, Microservices & Application

Unit I

Cloud Fundamentals; Cloud Service Components, Cloud service/Deployment Models. Cloud components Guiding Principle with respect to utilization/Security/Pricing. and the applications of Cloud.. Public Cloud Platforms overview and their usage.

Unit II

Application architectures-Monolithic & Distributed, Microservice fundamental and design approach, Cloud Native applications-12 Factors App.

Unit III

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 IV

Devops fundamentals: Tools and Applications Containerization Process and application. Python-Refresher, Use cases for cloud application development.

Unit V

Design and developing solution steps using containers & containerization of application and deployment using Kubernetes, Cloud Security and Monitoring Tools

List of Experiments

1. Find procedure to run the virtual machine of different configuration using virtual-manager.
2. Virtualize a machine and check how many virtual machines can be utilized at a particular time.
3. Create a VM Clone and attach virtual block to the cloned virtual machine and check whether it holds the data even after the release of the virtual machine.
4. Create a Snapshot of a VM at a given point in time and test the snapshot by restoring the VM to that time. (Note: Testing can be done by installing an application and then restore it.)
5. Develop a simple application to understand the concept of PAAS using GAE/Amazon Elastic Beanstalk/IBM Blue Mix and launch it.
6. Test how a SaaS applications scales in response to demand.
7. Find the procedure to launch a Cloud instance using a Public IaaS cloud like AWS/GCP.
8. Setup a Private Cloud by performing the procedure using a Single node OPENSTACK implementation.
9. Find the procedure to develop a DevSecOps – Cloud (AWS, GCP, Azure).
10. Find the procedure to develop a DevSecOps – Cluster (Kubernetes).
11. Find the procedure to develop a Container (Docker).

To Build and Test Your Docker Images in the Cloud with Docker commands.

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Text Books:

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011
2. Cloud Computing Virtualization Specialist Complete Certification Kit - Study Guide Book, Ivanka Menken Gerard Blokdijs, 2009
3. Cloud Security: A Comprehensive Guide to Secure Cloud Computing By Ronald L. Krutz, Russell Dean Vines

Reference Books:

1. Cloud Computing: A Practical Approach, Anthony T. Velte, Tobe J. Velte, Robert Elsenpeter, Publication Person Education, 2009
2. Storage Virtualization: Technologies for Simplifying Data Storage and Management, Tom Clark, Addison-Wesley, 2005
3. Cloud Computing Technologies and Strategies of the Ubiquitous Data Center, Curtis Franklin Jr. Brian J.S. Chee, 2010
4. Introduction to Cloud Computing: Business & Technology, Timothy Chou, 2009

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CB-506 (C) Machine Learning

UNIT – I

Introduction to Machine Learning (ML); Relationship between ML and human learning; A quick survey of major models of how machines learn; Example applications of ML.

UNIT – II

Classification: Supervised Learning; The problem of classification; Feature Engineering; Training and testing classifier models; Cross-validation; Model evaluation (precision, recall, F1-measure, accuracy, area under curve); Statistical decision theory including discriminant function and decision surfaces; Naive Bayes classification; Bayesian networks; Decision Tree and Random Forests; k-Nearest neighbor classification; Support Vector Machines; Artificial neural networks including backpropagation; Applications of classifications; Ensembles of classifiers including bagging and boosting.

UNIT – III

Hidden Markov Models (HMM) with forward-backward and Viterbi algorithms; Sequence classification using HMM; Conditional random fields; Applications of sequence classification such as part-of-speech tagging.

UNIT – IV

Regression: Multi-variable regression; Model evaluation; Least squares regression; Regularization; LASSO; Applications of regression

UNIT – V

Association rule mining algorithms including apriori, Expectation-Maximization (EM) algorithm for unsupervised learning. Clustering: Average linkage; Ward's algorithm; Minimum spanning tree clustering; K- nearest neighbours clustering; BIRCH; CURE; DBSCAN, Anomaly and outlier detection methods.

List of Experiments

1. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate- Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
2. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file. A python program to implement decision tree
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Python ML libraries.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the support vector Classifier model to perform this task. Python can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Python ML libraries can be used for this problem.
8. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points.

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Select appropriate data set for your experiment and draw graphs.

10. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Python ML API in the program.
11. Implementation of a mini project – Stock prices predictor/ Sports predictor/ Sentiment analyzer/ Healthcare predictor.

Text Books:

1. Machine Learning, Tom M. Mitchell, vMcGraw-Hill
2. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007

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. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer 2009
4. Pattern Classification, 2/e, R.O. Duda, P.E. Hart, D.G. Stork, Wiley, 2001
5. Pattern Recognition and Machine Learning, C. Bishop, Springer, 2007
6. Introduction to Machine Learning, 3/e, E. Alpaydin, Prentice-Hall, 2014
7. Foundations of Machine Learning, A.Rostamizadeh, A. Talwalkar, M. Mohri, MIT Press
8. Statistical Pattern Recognition, 3/e, A. Webb, Wiley, 2011

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**B.TECH
COMPUTER SCIENCE AND BUSINESS
SYSTEM
SEMESTER VI SYLLABUS**

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SYLLABUS

B.Tech(Computer Science and Business System) VI Semester

CB-601 COMPUTER NETWORK

Objectives:

- Understand the concepts of computer networks and learn techniques for bandwidth utilization.
- Be exposed to various addressing schemes and error detection-correction of data.
- Learn the routing protocols, transport layer, flow control and congestion control algorithms.
- Be familiar with real time applications of networking devices and tools.
- To write different applications using different types of sockets.

UNIT – I

FUNDAMENTALS AND PHYSICAL LAYER: Introduction: Computer networks and distributed systems, Classifications of computer networks, Preliminaries of layered network structures. Data communication components: Representation of data and its flow, various connection topology, Protocols and standards, OSI model, Transmission Media. LAN: Wired LAN, Wireless LAN, Virtual LAN. Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

UNIT – II

DATA LINK LAYER AND MEDIUM ACCESS SUB LAYER: Fundamentals of Error Detection and Error Correction, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go-back-N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA.

UNIT – III

NETWORK LAYER: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP-Delivery, Forwarding and Unicast Routing protocols.

UNIT – IV

TRANSPORT LAYER: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service (QoS), QoS improving techniques - Leaky Bucket and Token Bucket algorithms.

UNIT – V

APPLICATION LAYER AND SECURITY:

Application Layer: DNS, DDNS, TELNET, EMAIL, FTP, WWW, HTTP, SNMP, Bluetooth, Firewalls.

Network Security: Electronic mail, Directory services and network management, Basic concepts of Cryptography.

List of Experiments

1. Learn to use basic commands.
2. Configuration of Network in Linux Environment.
3. Assignment of IP Address to computers.
4. Implementation of Subnet mask in IP addressing.

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5. Implementation of setup of a Local Area Network (using Switches) – Minimum 3 nodes and Internet.
6. To capture, save, and analyse network traffic on TCP / UDP / IP / HTTP / ARP /DHCP /ICMP /DNS using Wireshark Tool.
7. Write a socket PING program to test the server connectivity.
8. Study of system administration and network administration.
9. Study of socket programming and client server model using TCP and UDP.
10. Programs using TCP Sockets (like date and time server & client, echo server & client, chat etc.)
11. Programs using UDP Sockets (like echo server, chat, simple DNS).
12. Simulation of sliding window.
13. Implementation of ARP.

Course Outcomes:

1. On completion of the course, the students will be able to:
2. Choose the required functionality at each layer for given application.
3. Trace the flow of information from one node to another node in the network.
4. Apply the knowledge of addressing scheme and various routing protocols in data communication to select optimal path.
5. Monitor the traffic within the network and analyze the transfer of packets.
6. Develop real time applications of networks using socket programming.

Text Book

1. Andrew S. Tanenbaum and David J. Wetherall, “Computer Networks”, 5th edition, Pearson education, 2016.
2. William Stallings, “Data and Computer Communication”, 10th edition, Pearson education, 2017.

Reference Books:

3. Kaufman, R. Perlman and M. Speciner, “Network Security”, Pearson education, 2017.
4. W. Richard Stevens, “UNIX Network Programming, Vol. 1,2 & 3”, Prentice-Hall of India, 2004.

Online Resources

5. https://www.umsl.edu/~sauterv/analysis/488_f01_papers/quillin.htm
6. <https://medium.com/omarelgabrys-blog/object-oriented-analysisand-design-introduction-part-1-a93b0ca69d36>

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CB-602 INFORMATION SECURITY

Objectives:

- To understand the overview of computer security.
- To understand the information security policy and system design.
- To understand techniques of system security.
- To learn about various applications of system security.
- To learn about operating system and database security.

UNIT-I

OVERVIEW OF COMPUTER SECURITY: The Basic Components- Confidentiality, integrity and availability; Security policy and procedure; Assumptions and Trust; Security Assurance, Implementation and operational issues; Security Life Cycle -Access Control Models: Role based Model.

UNIT-II

SECURITY POLICIES AND SYSTEM DESIGN: Types of Security Policies-Confidentiality policies: Goals of Confidentiality Policies, The Bell-LaPadula Model- Integrity policies: Biba Integrity Model, Clark-Wilson Integrity Model -Hybrid policies: Chinese Wall Model, Clinical Information Systems Security Policy. Access Control Mechanisms: Access Control Lists-Information Flow:

Compiler-Based Mechanisms, Execution-Based Mechanisms- Confinement Problem: Isolation, Covert Channels- Assurance: Building Secure and Trusted Systems- Evaluating Systems: Goals of Formal Evaluation.

UNIT-III

SYSTEM SECURITY: Malicious Logic: Trojan Horses, Computer Viruses, Computer Worms- Vulnerability Analysis: Penetration Studies, Vulnerability Classification-Auditing: Anatomy of an Auditing System, Auditing Mechanisms, Audit Browsing- Intrusion Detection: Architecture, Organization of Intrusion Detection Systems- Design Principles- Representing Identity: Files and Objects, Users, Groups and Roles, Naming and Certificates.

UNIT-IV

APPLICATIONS: Network Security: Policy Development, Network Organization- System Security: Policy- User Security: Policy, Access, Files and Devices- Program Security: Requirements and Policy, Design, Case Study: Common Security-Related Programming Problems.

UNIT-V

OPERATING SYSTEM AND DATABASE SECURITY: Operating System Security: Security Architecture, Analysis of Security in Linux/Windows-Database Security: Security Architecture, Database Auditing-Case Study: Discretionary Access Control.

LIST OF EXPERIMENTS

1. Analysis of security in Unix/Linux.
2. Administration of users, password policies, privileges and roles.
3. Implementation of discretionary access control and mandatory access control.
4. Demonstrate intrusion detection system (ids) using any tool Eg. Snort or any other software.
5. Implementation of IT audit, malware analysis and vulnerability assessment and generate the report.
6. Implementation of mobile audit and generate the report of the existing artifacts.
7. Implementation of OS hardening and RAM dump analysis to collect the artifacts and other

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information.

8. Implementation of digital forensics tools for disk imaging, data acquisition, data extraction and data analysis and recovery.
9. Perform mobile analysis in the form of retrieving call logs, SMS log, all contacts list using the forensics tool like SAFT.
10. Implementation to identify web vulnerabilities, using OWASP project.

Course Outcomes:

1. On completion of the course, the students will be able to
2. Discuss the basics of information security and international standards.
3. Analyse information security policy and system design.
4. Comprehend system level security.
5. Apply system level security in various environments.
6. Analyze the operating system and database security methods.

Text Book(s):

1. Ross Anderson, "Security Engineering: A Guide to Building Dependable Distributed Systems", Third Edition, Wiley, 2021.
2. M. Bishop, "Computer Security: Art and Science", 2nd Edition, Pearson Education, 2019.
3. M. Stamp, "Information Security: Principles and Practice", 2nd Edition, Wiley, 2011.

Reference Books:

1. C.P. Pfleeger, S.L. Pfleeger, J. Margulies, "Security in Computing", 5th Edition, Prentice Hall, 2015.
2. David Wheeler, "Secure Programming HOW TO", v3.010 Edition, 2003.
3. Michael Zalewski, "Browser Security Handbook", Google Inc., 2009.
4. M. Gertz, S. Jajodia, "Handbook of Database Security", Springer, 2008.

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CB-603 ARTIFICIAL INTELLIGENCE

Objectives:

- To understand the intelligent agents and formulate a problem in search space.
- To analyze the problem and learn the different search techniques.
- To learn the constraint satisfaction problem and game theory.
- Study the system of knowledge representation using rules and reasoning.
- To gain knowledge on probabilistic reasoning and expert systems.

UNIT-I

INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND PROBLEM-SOLVING

AGENT: Intelligent agents, agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. Problems of AI, AI technique, Tic - Tac - Toe problem. Defining the problem as state space search, production system, problem characteristics, and issues in the design of search programs.

UNIT-II

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, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search.

UNIT-III

CONSTRAINT SATISFACTION PROBLEMS AND GAME THEORY: Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

UNIT-IV

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, matching, control knowledge.

UNIT-V

PROBABILISTIC REASONING AND EXPERT SYSTEMS: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Planning Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.

Expert Systems: Representing and using domain knowledge, expert system shells, and knowledge acquisition.

List of Experiments

1. Programs on Problem Solving
 - a. Write a program to solve 8 Queens problem
 - b. Solve any problem using depth first search
 - c. Implement MINIMAX algorithm
 - d. Implement A* algorithm
2. Programs on Decision Making and Knowledge Representation
 - a. Introduction to PROLOG

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- b. Implementation of Unification and Resolution Algorithm.
- c. Implementation of Backward Chaining
- 3. Programs on Planning and Learning
 - a. Implementation of Blocks World program.
 - b. Implementation of SVM for an application using python.
 - c. Implementing Artificial Neural Networks for an application using python.
 - d. Implementation of Decision Tree
 - e. Implementation of K-mean algorithm

Text Books:

- 4. Stuart J. Russell, Peter Norvig , “Artificial Intelligence –A Modern approach”, 3rd Pearson Education, 2016.
- 5. Artificial Intelligence, Russel, Pearson

Reference Books:

- 1. Ritch & Knight, ”Artificial Intelligence”, Third Edition, Tata McGraw Hill, 2009.
- 2. Patterson, “Introduction to Artificial Intelligence & Expert Systems”, First Edition, Pearson, 2015.
- 3. Saroj Kaushik, “Logic & Prolog Programming”, First Edition, New Age International, 2008.
- 4. Joseph C. Giarratano, Gary D. Riley,”Expert Systems: Principles and Programming”, Fourth Edition, Cengage, 2007.

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CB-604 FINANCIAL & COST ACCOUNTING

Objectives:

- To create an awareness about the importance and usefulness of the accounting concepts and their managerial implications.
- To develop an understanding of the financial statements and the underlying principles and learn to interpret financial statements.
- To create awareness about cost accounting, different types of costing and cost management.
- Understand how financial statement information can help solve business problems and increase the ability to read and understand financial statements and related information.

UNIT-I

ACCOUNTING CONCEPT: Introduction, Techniques and Conventions, Financial Statements- Understanding & Interpreting Financial Statements. Company Accounts and Annual Reports- Audit Reports and Statutory Requirements, Directors Report, Notes to Accounts, Pitfalls.

UNIT-II

ACCOUNTING PROCESS: Book Keeping and Record Maintenance, Fundamental Principles and Double Entry, Journal, Ledger, Trial Balance, Balance Sheet, Final Accounts ,Cash Book and Subsidiary Books, Rectification of Errors.

UNIT-III

FINANCIAL STATEMENTS: Form and Contents of Financial Statements, Analyzing and Interpreting Financial Statements, Accounting Standards.

Class Discussion: Corporate Accounting Fraud- A Case Study of Satyam.

UNIT-IV

CASH FLOW AND FUND FLOW TECHNIQUES: Introduction, How to prepare – Cash flow and Fund flow, Difference between them.

UNIT-V

COSTING SYSTEMS: Elements of Cost, Cost Behavior, Cost Allocation, Overhead Allocation, Unit Costing, Process Costing, Job Costing, Absorption Costing, Marginal Costing, Cost Volume Profit Analysis, Budgets, ABC Analysis.

Class Discussion: Application of costing concepts in the Service Sector.

Course Outcomes:

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

1. Understand the theories, concept, and evolution of management.
2. Demonstrate the ability to employ the management way of thinking.
3. Understand how organizations work and find it easier to grasp the intricacies of other management areas such as finance, marketing, strategy etc.
4. Understand the qualities of a leader in the managerial aspect in future terms.
5. Understand the managerial ethics and CSR and its importance.

Text Books:

1. Robert N Anthony, David Hawkins, Kenneth Marchant, “Accounting: Texts and Cases”, Thirteenth

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Edition, McGraw-Hill, 2017.

2. M.Y.Khan & P.K.Jain, “Management Accounting”, Tata McGraw Hill, 2011.
3. R.Narayanaswamy, Financial Accounting – A managerial perspective, Fifth Edition, PHI Learning, New Delhi, 2011.

Reference Books:

1. Jan Williams, “Financial and Managerial Accounting – The basis for business Decisions”, Fifteenth Edition, Tata McGraw Hill Publishers, 2010.
2. Horngren, Surdem, Stratton, Burgstahler, Schatzberg, “Introduction to Management Accounting”, Sixteenth Edition, PHI Learning, 2014.

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CB-605 Business Communication & Value Science-IV

Objectives:

- To recognize the best practices of communicative writing.
- To understand the importance of emotional intelligence in personal and professional lives.
- To understand how stress impacts life and work.
- To use the best practices to manage stress.
- To understand how to make start-ups and public speaking.

UNIT-I

COMMUNICATIVE WRITING: Concepts: Principles of Communicative writing – Formal Business letters – Writing Proposals – Use of charts in communicative writing – use of business idioms – corporate terms. Activity: Group business proposals – presentation of proposal – Story telling using charts and graphs (demonstrative speech).

UNIT-II

EMOTIONAL INTELLIGENCE: Concepts: Concepts of emotional intelligence – Its importance in human life and professional life – difference between Emotional quotient and Intelligent quotient – Corporate etiquette Activity: Any two Anubhaav activities – 10 ways to build Emotional Intelligence by Daniel Goleman – Mock interview.

UNIT-III

CONFLICT MANAGEMENT: Concepts: Conflicts – Corporate and workplace conflicts – reason and impacts of conflicts – guidelines to manage conflicts. Teams - role of team player – stress – stress management – importance of feedbacks – Time Management. Activity: Creating posters with stress management tips – open house discussion on challenges of time management –Tracking time activity.

UNIT-IV

CORPORATE SOCIAL RESPONSIBILITY: Concepts: Corporate Social Responsibility - Social responsibilities of companies - Diversity in workplace – Individual social responsibility – Social connect – life skills – empathy. Activity: Discussion & Role play in diversity – Ubuntu story of social responsibility – creating audio embedded PPT on the concept of social responsibility.

UNIT-V

DESIGN THINKING & PUBLIC SPEAKING: Concepts: Design thinking – importance of start-ups – Proof of concept for start-ups – Best practices – Art of Public speaking Activity: Pitch in start-up idea – watching videos of public speaking – Finding similarities among world famous speeches – watching videos of Sw. Vivekananda's speech – Martin Luther King's My Dream speech.

List of Experiments

1. Write formal business letter for proposal of goods item.
2. Create a presentation based on business proposal.
3. Perform activities to test IQ.
4. Perform activities to build emotional intelligence.
5. Create posters based on social issues.
6. Create a presentation based on social issues and our responsibility.
7. Create a presentation based on new startup idea.
8. Perform an activity based on public speaking.
9. Perform group discussion on current social issues.

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Course Outcomes:

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

1. Recognize the best practice of Communicative writing.
2. Apply emotional intelligence in real life scenarios.
3. Identify the best practices of stress management.
4. Recognize the attributes needed to function and grow in a corporate environment.
5. Apply the best practices of public speaking.

Reference Books:

1. Daniel Goleman,” Emotional Intelligence: Why it Can Matter More Than IQ”, Bloomsbury, 2004.
2. Ryback David, “Putting Emotional Intelligence To Work”, CRC Press, 1998.
3. Dale Carnegie, “How to Develop Self Confidence and Improve Public Speaking - Time - Tested Methods of Persuasion”, Ebury Publishing, 1998.
4. Chris Anderson, “TED Talks: The official TED guide to public speaking: Tips and tricks for giving unforgettable speeches and presentations”, Hachette, 2016.

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CB-606 (A) Robotics and Embedded Systems

Objectives:

- To understand the concept of Industry 4.0 and technologies for cognitive robotics
- To understand the fundamentals of robotics operating systems
- To understand the role of AI in cognitive robotics
- To understand and demonstrate the role of Data Science and their working principles in robotics
- To demonstrate the concepts of cloud computing with robot on various real time applications

UNIT-I

INTRODUCTION TO MODERN DAY ROBOTICS AND THEIR INDUSTRIAL APPLICATIONS:

Industry 4.0 Concept: Background and Overview-Industry 4.0 technologies: implementation patterns in manufacturing companies-Evolution of Industrial Robots and their Applications-Advancements in Robotics and Its Future Uses-Types of robotics in various fields for applications.

Technologies essential for Cognitive Robotics: Computer systems and Technologies relevant to modern day robotics- Robotic Process Automation: Overview of RPA and its applications-RPA, AI, and Cognitive Technologies for Leaders- Introduction to Robotics: Analysis, Control, Applications.

UNIT-II

BASICS OF ROBOTIC OPERATING SYSTEM: Basics of Robotic operating System: ROS for beginners an overview- Introduction to the Robot Operating System (ROS) Middleware - Secure communication for the Robot Operating System - An Introduction to Robot Operating System: The Ultimate Robot Application Framework by Adnan.

Quality of Service and Cybersecurity Communication Protocols -Analysis for the Robot Operating System Robotics systems communication- Threat modelling using ROS.

Towards cloud robotic system: A case study of online co-localization for fair resource competence- A Case Study on Model-Based Development of Robotic Systems using Monti Arc with Embedded Automata.

UNIT-III

AI IN THE CONTEXT OF COGNITIVE ROBOTICS AND ROLE OF AI IN ROBOTICS: Foundation for Advanced Robotics and AI- A Concept for a Practical Robot Design Process- Demo to train A Robot Using AI - Deep learning core applications-Deep learning business applications.

Introduction to computer vision and application of Vision Systems in Robotics: Concepts of computer vision and the how vision systems are becoming essential part of Robotics-Computer Vision: Models, Learning, and Inference - Mastering Computer Vision with TensorFlow 2.x: Build advanced computer vision applications using machine learning and deep learning techniques- Machine Vision Applications- Application areas for vision systems-Robot inspection case study- Autonomous driving using 3D imaging case study.

UNIT-IV

DATA SCIENCE AND BIG DATA IN THE CONTEXT OF COGNITIVE ROBOTICS: Cognitive Technologies: The Next Step Up for Data and Analytics in robotics-Cognitive Deep Learning Technology for Big Data Cognitive Assistant Robots for Reducing Variability in Industrial Human-Robot Activities.

Introduction to Python and R Programming in the context of Robotics: Introduction to Python - Python Functions for Data Science-Basic ROS Learning Python for robotics- An introduction to R - The R in Robotics rosR: A New Language Extension for the Robot Operating System.

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Artificial Intelligence and Robotics - The Review of Reliability Factors Related to Industrial Robots
-Failure analysis of mature robots in automated production- Data Analytics for Predictive Maintenance of Industrial Robots - Failure Is an Option: How the Severity of Robot Errors Affects Human-Robot Interaction.

UNIT-V

CONCEPTS OF CLOUD COMPUTING, CLOUD PLATFORMS AND IT APPLICATIONS IN ROBOTICS: Learning Cloud Computing: Core Concepts - Cloud Computing: Private Cloud Platforms -Robot as a Service in Cloud Computing -Cloud Computing Technology and Its Application in Robot Control - A Comprehensive Survey of Recent Trends in Cloud

Robotics Architectures and Applications - Google's cloud robotics and high computing needs of industrial automation and systems-The role of cloud and opensource software in the future of robotics-The Power of Cloud Robotics by Robotics Industry Association.

List of Experiments

1. Build a Self-Driving Robot that can automatically follow a line
2. Build a basic obstacle-avoiding robot and improve the design to help it avoid getting stuck
3. Build a Humanoid Robot
4. Autonomous Robot Navigation using Computer Vision for exhaustive path-finding
5. A Mobile Autonomous Chemical Detecting Robot
6. Build a voice controlled robot
7. Web-Controlled Mobile Video-Enabled Robotic Litter Collection Device
8. Utilizing Artificial Neural Networks to Create a Learning Robot
9. Hospital Sanitizing Robot
10. Autonomous Robotic Vehicle: Saving lives, preventing accidents one at a time
11. Build a robot with Python and 3D Printed Robotic Arm
12. Build an Intelligent Irrigation Control System
13. AI-powered Hearing Aid
14. Fire Extinguishing Robot
15. Remote Operated Spy Robot Circuit

Course Outcomes:

1. Develop skills of using advanced software for solving practical problems in robotics pertaining to various industries
2. Understand the basics of Robotic operating systems and communication system
3. Understand basic concepts and technological advancements in AI and robotics
4. Understand and apply several statistical analysis techniques, business analytics for cognitive robotics and programming of robots using python and R languages
5. Understand and apply the cloud computing concepts in robotics

Text Books:

3. Saeed Benjamin Niku, "Introduction to Robotics: Analysis, Control, Applications", Wiley Publishers, 2nd edition, 2011.
4. Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.
5. Francis X. Govers, "Artificial Intelligence for Robotics: Build Intelligent Robots that Perform Human Tasks Using AI Techniques", Packt publishing, 2018.

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Reference Books:

1. Krishnendu Kar, "Mastering Computer Vision with TensorFlow 2.x: Build Advanced Computer Vision Applications Using Machine Learning and Deep Learning Techniques", Packt publishing, 2020.
2. Armando Vieira, Bernardete Ribeiro," Introduction to Deep Learning Business Applications for Developers from Conversational Bots in Customer Service to Medical Image processing",Apress, 2018.
3. Steve Heath, "Embedded System Design 2nd Edition", EDN Series for Design Engineers, 2003

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CB-606 (B) MODERN WEB APPLICATIONS

Objectives:

- To understand different internet technologies.
- Know the importance of object oriented aspects of scripting.
- Understand creating database connectivity using PHP and MySQL.

UNIT-I

INTRODUCTION TO INTERNET & WORLD WIDE WEB: History of the Internet & World-Wide Web, Web Browsers, Web Servers, Uniform Resource Locator, Tools and Web Programming Languages. Web Standards, Categories of Web Applications, Characteristics of Web Applications, Tiered Architecture.

UNIT-II

HYPERTEXT MARKUP LANGUAGE (HTML) AND CASCADING STYLE SHEETS (CSS):

HTML: Basic HTML page, Text Formatting, Table, Headers, Linking, Images, List, Meta Elements.

CSS: Inline, Internal and External Style Sheet, Bootstrap-CSS Text, CSS forms, CSS components drop down.

UNIT-III

JAVASCRIPT AND EXTENSIBLE MARKUP LANGUAGE(XML):

JavaScript: Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script, Bootstrap- JS Alert, JS Button, JS popover.

XML: Introduction, Structuring Data, Document Type Definition, XML Vocabularies, Document Object Model (DOM) with JavaScript, Extensible Stylesheet Language Transforms (XSL).

UNIT-IV

PHP BASICS: Writing Basic PHP Programs: Creating PHP Programs, Numbers and Strings, Literals and Variables, Operators and Functions.

Form & PHP: Creating Form Controls, Using Values Returned From, Forms Using PHP.

UNIT-V

PHP DATABASE CONNECTIVITY: PHP Database Connectivity: Connecting to MySQL Server, Selecting Databases, Checking for Errors, Closing the MySQL Server Connection.

Manipulating Data in MySQL Using PHP: Inserting, Viewing, Updating and Deleting Records, Manipulating joined tables.

User Authentication: Creating Session, Authorization Level.

List of Experiments

1. Create a HTML page with frames, links, tables and other tags for highlighting the facilities in the Department in your College. State the assumptions you make (business logic you are taking into consideration).
2. Create a web page with the following using HTML:
 - a. To embed a map in a web page.
 - b. To fix the hot spots in that map.
 - c. Show all the related information when the hot spots are clicked.
 - d. Embed an image map picture (India map) on a Web page that provides different links to other

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Web pages (different states) and show the all the related information depending on where a user clicks on the image.

- e. Create a webpage to embed a human body image, identify and display all the related information about the human body parts (head, eye, nose, finger etc.) based on the user clicks on the human body image map.
3. Create a web page with the following:
 - a. Cascading style sheets.
 - b. Embedded style sheets.
 - c. Inline style sheets.
 - d. Use your college information for the web pages.
4. Create a User Registration form with First Name, Last name, Address, City, State, Country, Pincode, Username and Password fields for a General login webpage and satisfy the following criteria:
 - a. Create a validate() function that does the following:
 - b. Checks that the First Name, Last Name, City, Country, Username, and Password fields are filled out.
 - c. Checks that the Pincode is exactly 6 numeric.
 - d. Checks that the state is exactly two characters.
 - e. Checks that the email is a valid email address.
 - i. false if email has fewer than 6 characters
 - ii. false if email does not contain an @ symbol
 - iii. false if email does not contain a period (.)
 - iv. true otherwise
5. Write a DTD for a XML document that declares an address book containing contacts. Each contact has a name and address. An address should contain attributes for street name, state and phone number. Write a XML document and validate it against this DTD.
6. Create and save a XML document at the server, which contains 10 users information. Write a Program, which takes user Id as an input and returns the user details by taking the user information from the XML document.
7. Create a XML to represent the BOOKS catalog that has the following elements (TITLE, ISBN NO, AUTHOR, PUBLISHER, and PRICE). Display the book details styled with XSLT.
8. Create an Extensible markup language to represent the students mark information of a class. Create a webpage to display all the students consolidated mark statement with pass (green color) or fail (red color) using XSLT.
9. Write programs in PHP to create three-tier applications:
 - a. for conducting on-line examination.
 - b. for displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
10. Session tracking using hidden form fields and Session tracking for a hit count.
11. Convert the static webpages of programs 1 to 4 into dynamic web pages using PHP and cookies. Hint: Users information (user id, password, credit card number) would be stored in web.xml.
12. Write a PHP program for Employee Details which includes EmpID, Name, Designation, Salary, DOJ, etc., to connect with the database and execute queries to retrieve and update data. Prepare the report for single and group of employees based on the end user needs.
13. Consider a Library Management System. Develop a JavaScript program that will validate the controls in the forms you have created for the application. State the assumptions you make (business logic you are taking into consideration). Note: Your application must access a database using PHP.

Course Outcomes:

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

1. Construct a basic website using HTML and Cascading Style Sheets.
2. Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
3. Construct simple web pages in PHP and to represent data in XML format.
4. Design and implement server side programs using PHP.

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5. Do database manipulation using MySQL and authenticate data.

Text Books:

1. Deitel P. J., Deitel H. M. and Deitel A., "Internet and World Wide Web: How to Program", Fifth Edition, Pearson Prentice Hall, 2012.
2. Jon Duckett, "HTML & CSS: Design and Build Websites", First Edition, John Wiley & Sons, 2011.
3. Naramore E., Gerner J., Scouarnec Y.L., et al., "Beginning PHP5, Apache, MySQL Web Development: Programmer to Programmer", John Wiley & Sons Inc., 2005.

Reference Books:

1. Sebesta R. W., "Programming the World Wide Web", Eight Edition, Pearson, 2014.
2. Pressman R. and Lowe D., "Web Engineering: a practitioner's approach", First Edition, McGrawHill, 2008.
3. Kappel G., et al., "Web Engineering: The Discipline of systematic Development of Web Applications", First Edition, John Wiley & Sons, 2006.
4. Suh W., "Web Engineering: Principles and Techniques", Idea Group Inc., 2005.
5. Ullman L., "PHP for the Web: Visual Quick Start Guide", Fifth Edition, Peach pit Press, 2016.

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CB-606 (C) DATA MINING AND ANALYTICS

Objectives:

- To introduce the fundamental concepts of data mining and data representation.
- To learn the data preprocessing task and attribute oriented analysis
- To understand the association rules, classification and prediction algorithms
- To learn and apply the linear and non-linear models of data analysis
- To understand the time series analysis and aspects of prescriptive analysis

UNIT-I

INTRODUCTION AND KNOWLEDGE REPRESENTATION: Introduction - Related technologies - Machine Learning, DBMS, OLAP, Statistics, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Task relevant data, Background knowledge, Representing input data and output knowledge, Visualization techniques, Applications.

UNIT-II

DATA PREPROCESSING: Data preprocessing: Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies. Attribute-oriented analysis: Attribute generalization, Attribute relevance, Class comparison, Statistical measures.

UNIT-III

ASSOCIATION AND MINING METHODS: Association rules: Motivation and terminology, Basic idea: item sets, Generating item sets and rules efficiently, Correlation analysis. Classification: Basic learning/mining tasks, Inferring rudimentary rules: 1R, algorithm, Decision trees, covering rules. Prediction: The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance- based methods (nearest neighbor), linear models.

UNIT-IV

LINEAR AND NON-LINEAR MODELS:

Descriptive analytics: Data Modeling, Trend Analysis, Simple Linear Regression Analysis Forecasting models: Heuristic methods, predictive modeling and pattern discovery, Logistic Regression: Logit transform, ML estimation, Tests of hypotheses, Wald test, LR test, score test, test for overall regression, multiple logistic regression, forward, backward method, interpretation of parameters, relation with categorical data analysis. Interpreting Regression Models, Implementing Predictive Models.

Generalized Linear model: Link functions such as Poisson, binomial, inverse binomial, inverse Gaussian, Gamma. Non Linear Regression (NLS): Linearization transforms, their uses & limitations, examination of non-linearity, initial estimates, iterative procedures for NLS, grid search, Newton-Raphson, steepest descent, Marquardt's methods. Introduction to semiparametric regression models, additive regression models. Introduction to nonparametric regression methods

UNIT-V

TIME SERIES ANALYSIS:

Time Series Analysis: Auto - Covariance, Auto-correlation and their properties. Exploratory time series analysis, Test for trend and seasonality, Exponential and moving average smoothing, Holt – Winter smoothing, forecasting based on smoothing.

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Linear time series models: Autoregressive, Moving Average, Autoregressive Moving Average and Autoregressive Integrated Moving Average models; Estimation of ARIMA models such as Yule-Walker estimation for AR Processes, Maximum likelihood and least squares estimation for ARIMA Processes, Forecasting using ARIMA models.

Prescriptive Analytics: Mathematical optimization, Networks modeling-Multi-objective optimization-Stochastic modeling, Decision and Risk analysis, Decision trees.

List of Experiments:

1. Installing Weka and exploring a dataset.
2. Loading a dataset and visualizing the Data
3. Preprocessing a dataset from a real domain (Medical/Retail/Banking)
4. Building a classifier- Run Decision Tree, Naïve Bayesian Classifier, NN classifier and SVM.
5. Mining Association Rules- Run Apriori Algorithm.
6. Building a statistical model using a sample dataset – preprocessing, hypothesis building, model fitting, model validation and interpretation of results.
7. Implementation of linear regression technique for statistical model building.
8. Implementation of Non-linear regression technique for statistical model building.

Course Outcomes:

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

1. Understand the fundamentals of data mining and data representation.
2. Perform preprocessing tasks for the data set.
3. Apply association rules and predictive methods for data mining.
4. Build data models using linear and non-linear regression techniques.
5. Gain knowledge on time series analysis and prescriptive analysis.

Text Books:

4. Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2012.
5. Lior Rokach and Oded Maimon, “Data Mining and Knowledge Discovery Handbook”, Springer, 2nd edition, 2010.
6. Ian H. Witten, Eibe Frank and Mark A. Hall “Data Mining: Practical Machine Learning Tools and Techniques”, Fourth Edition, Elsevier, 2017.

Reference Books:

9. Draper, N. R. and Smith, H., “Applied Regression Analysis”, Third Edition, John Wiley, 1998.
10. Hosmer, D. W. and Lemeshow, S., “Applied Logistic Regression”, Third Edition, Wiley, 2003.
11. Daniel T.Larose, “Data Mining Methods and Models”, Wiley-Interscience, 2006.
12. Jason Brownlee “Machine Learning Mastery with Weka” ,2020.
13. <http://garfield.library.upenn.edu/classics1989/A1989AV48500001.pdf>

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**B.TECH
COMPUTER SCIENCE AND BUSINESS SYSTEM
SEMESTER VII SYLLABUS**

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SYLLABUS

B.Tech(Computer Science and Business System) VII Semester

CB-701 USABILITY DESIGN OF SOFTWARE APPLICATIONS

Objectives:

- ☐ To learn the fundamentals of User Centred Design, their relevance and contribution to businesses.
- ☐ To study the principles of heuristic evaluation for interactive design.
- ☐ To understand the appreciation of user research, solution conceptualization and validation as interwoven activities in the design and development lifecycle.
- ☐ To familiarize the facets of User Experience (UX) Design, particularly as applied to the digital artefacts.
- ☐ To implement complex mobile/web applications.

UNIT-I INTRODUCTION TO USER CENTRED DESIGN

Basics of User Centred Design-Elements-Models and approaches-User Centred Design Principles-Usability-UCD Process-Analysis tools: personas, scenarios, and essential use cases with examples-User-Centred Design and Agile aspects of User Centred Design.

UNIT-II INTERACTIVE DESIGN EVALUATION

Introduction to Interactive Design process – Interactive design in practice – Introducing evaluation – Evaluation: Inspection, Analysis and Models – Inspection: Heuristic Evaluation: 10 Heuristic Principles, Examples – Case study: A Heuristic Evaluation of Iraq E-Portal.

UNIT-III DEVELOPMENT OF APPLICATION

Case Study: Development of any application like mobile or web based on User Centred Design – Design lifecycle: Establishing Requirements, Design, Prototyping and Construction.

UNIT-IV UX RESEARCH

Understanding users, their goals, context of use, and environment of use. Research Techniques: Contextual Enquiry, User Interviews, Competitive Analysis for UX.

UNIT-V ITERATIVE PRODUCT DEVELOPMENT

The Problem with Complexity - Iterative Product Development - Scenarios and Persona Technique, Design Thinking Technique: Discovery and brainstorming - Concept Development - Prototyping Techniques : Paper, Electronic, Prototyping Tools – Review and feedback

List of Experiments

- 1 Product Appreciation Assignment – Evaluating the product from User Centred Design aspects such as functionality, ease of use, ergonomics, and aesthetics.
- 2 Heuristic Evaluation: Group Assignment initiation (Website and App) Evaluation for key tasks of the app or website for heuristic principles, severity, recommendations.
- 3 Students will identify a project in the given domain (Healthcare, E-Commerce, Online Learning Platforms, Gaming, Point-of-Sale, Smart Things) and its related website or mobile app to redesign. They will take this redesign project through the design lifecycle:
Discovery
Define Design
Implement (Design Prototype) Usability
Testing
The below design methods and techniques will be imparted w.r.t. the group project selected by the students.
- 4 Presentation of Persona for the group project
- 5 Task flow detailing for the project
- 6 Project Prototyping Iteration 1
- 7 Project Prototyping Iteration 2
- 8 Final Product Demo(Mobile or Web Application)

Course Outcomes:

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

- ☐ Understand the fundamentals and importance of User-Centred design.
- ☐ Perform design evaluation by applying the heuristic principles.

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- ☐ Develop an application focusing on the design aspects.
- ☐ Do research on understanding user requirement.
- ☐ Perform iterative product development using prototyping technique.

Text Book (s):

- 1 Jenny Preece, Helen Sharp and Yvonne Rogers, “Interaction Design: Beyond Human-Computer Interaction”, 3rd Edition, 2004.
- 2 Jonny Schneider , “Understanding Design Thinking, Lean, and Agile”, 1st Edition, 2020.

Reference Books:

- 1 Alan Cooper and Robert Reimann, “About Face”, John Wiley, 4th Edition.
- 2 Elizabeth Goodman, Mike Kuniavsky, Andrea Moed, “Observing the User Experience: A Practitioner's Guide to User Research”, 2nd Edition, 2012.
- 3 Jesse James Garrett, The Elements of User Experience: User-Centered Design for the Web and Beyond, 2nd Edition, 2010.

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CB-702 IT Workshop (Matlab)

Objectives:

- ☐ To introduce the students with the basic features of MATLAB for problem solving.
- ☐ To introduce the students about the Mathematical functions like matrix generation and Plotting with multiple data sets, line styles and colors.
- ☐ To introduce the students about the Array operations and solving Linear equations in MATLAB.
- ☐ To introduce the students about the control flow and operators using if-end structures and loops.

UNIT-I INTRODUCTION TO MATLAB

Introduction to MATLAB: History, basic features, strengths and weaknesses, good programming practices and plan your code. Working with variables, workspace and miscellaneous commands: Creating MATLAB variables, overwriting variable, error messages, making corrections, controlling the hierarchy of operations or precedence, controlling the appearance of floating point number, managing the workspace, keeping track of your work session, entering multiple statements per line, miscellaneous commands.

UNIT-II MATRIX, ARRAY AND BASIC MATHEMATICAL FUNCTIONS

Matrix generation, entering a vector, entering a matrix, matrix indexing, colon operator, linear spacing, creating a sub-matrix, dimension, matrix operations and functions matrix generators, special matrices, array and array operations, solving linear equations, other mathematical functions.

UNIT-III BASIC PLOTTING

Overview, creating simple plots, adding titles, axis labels, and annotations, multiple data sets in one plot, specifying line styles and colours.

UNIT-IV INTRODUCTION TO PROGRAMMING

Introduction to programming: Introduction, M-File Scripts, script side-effects, M-File functions, anatomy of a M-File function, input and output arguments, input to a script file, output commands. Control flow and operators: "if ... end" structure, relational and logical operators, "for ... end" loop, "while ... end" loop, other flow structures, operator precedence, saving output to a file.

UNIT-V DEBUGGING M-FILES

Debugging process, preparing for debugging, setting breakpoints, running with breakpoints, examining values, correcting and ending debugging, correcting an M-file.

List of Experiments

- 1 Programs using mathematical, relational expressions and the operators.
- 2 Vectors and Matrices: Programs using array operations and matrix operations (such as matrix multiplication).
- 3 Programs on input and output of values.
- 4 Selection Statements: Experiments on if statements, with else and elseif clauses and switch statements.
- 5 Loop Statements and Vectorizing Code: Programs based on the concepts of counted (for) and conditional (while) loops.
- 6 Programs based on scripts and user-defined functions.
- 7 Programs on Built-in text manipulation functions and conversion between string and number types.
- 8 Programs based on two main data structures: cell arrays and structures.
- 9 Programs based on Data Transfer
- 10 Programs based on Advanced Functions.
- 11 Introduction to Object-Oriented Programming and Graphics.
- 12 Programs based on Advanced Plotting Techniques.
- 13 Programs based on sound files and image processing.
- 14 Programs based on Advanced Mathematics.

Course Outcomes:

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

- ☐ Write fundamental programs in MATLAB, creating variables and mathematical functions.
- ☐ Understand how to program matrix operations, array operations and how to solve the system of linear equations.
- ☐ Program the fundamentals concepts of basic Plotting consisting of simple and multiple data sets in one plot.
- ☐ Understand how to program M-file scripts, M- file functions, Input –output Arguments and program control flow operators, loops, flow structures.
- ☐ Use the debugging process and debugging M-files.

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Text Books:

- 1 Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, “Digital Image Processing using MATLAB”, Pearson Education, Inc., 2004.
- 2 Stormy Attaway, Butterworth-Heinemann, “MATLAB: A Practical Introduction to Programming and Problem Solving”, 5th Edition, 2018.

References:

- 1 <https://www.mathworks.com/content/dam/mathworks/mathworks-dot com/moler/exm/book.pdf>
- 2 https://www.mathworks.com/help/releases/R2014b/pdf_doc/matlab/getstart.pdf

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CB-703 FINANCIAL MANAGEMENT

Objectives:

- ☐ Understand the functional distinctions of a Finance Manager.
- ☐ Comprehend the technique of making decisions related to finance function.
- ☐ Understand the techniques involved in deciding upon purchase or sale of securities.
- ☐ An overview and generating investment project proposals.
- ☐ Motives for holding cash and receivables.

UNIT-I INTRODUCTION

Introduction to Financial Management - Goals of the firm - Financial Environments. Time Value of Money: Simple and Compound Interest Rates, Amortization, Computing more than once a year, Annuity Factor.

UNIT-II VALUATION OF SECURITIES

Bond Valuation, Preferred Stock Valuation, Common Stock Valuation, Concept of Yield and YTM. Risk & Return: Defining Risk and Return, Using Probability Distributions to Measure Risk, Attitudes Toward Risk, Risk and Return in a Portfolio Context, Diversification, The Capital Asset Pricing Model (CAPM).

UNIT-III CAPITAL BUDGETING

The Capital Budgeting Concept & Process - An Overview, Generating Investment Project Proposals, Estimating Project, After Tax Incremental Operating Cash Flows, Capital Budgeting Techniques, Project Evaluation and Selection - Alternative Methods.

UNIT-IV COST OF CAPITAL, OPERATING & FINANCIAL LEVERAGE

Cost of Capital : Concept , Computation of Specific Cost of Capital for Equity - Preference – Debt, Weighted Average Cost of Capital – Factors affecting Cost of Capital 4L.

Operating & Financial Leverage: Operating Leverage, Financial Leverage, Total Leverage and Indifference Analysis in leverage study.

UNIT-V WORKING CAPITAL MANAGEMENT

Working Capital Management: Overview, Working Capital Issues, Financing Current Assets (Short Term and Long Term- Mix), Combining Liability Structures and Current Asset Decisions, Estimation of Working Capital. Accounts Receivable Management: Credit & Collection Policies, Analyzing the Credit Applicant, Credit References, Selecting optimum Credit period. 4L. Cash Management: Motives for Holding cash, Speeding Up Cash Receipts, Slowing Down Cash Payouts, Electronic Commerce, Outsourcing, Cash Balances to maintain, Factoring.

Course Outcomes:

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

- ☐ Identify the basic concepts of financial management and time value of money.
- ☐ Understand the various processes involved in securities market.
- ☐ Evaluate and choose the best project from alternatives based on cost-benefit analysis.
- ☐ Compute the fundamental concepts of financial management.
- ☐ Influence the concept for deciding financial angle of IT projects.

Text Books:

- 1 Chandra Prasanna, “Financial Management - Theory & Practice”, Tata McGraw Hill, 10th Edition, 2019.
- 2 M.Y.Khanand and P.K.Jain, “Financial management, Text, Problems and Cases”, Tata Mc Graw Hill, 5th Edition, 2000.
- 3 I.M.Pandey, “Financial Management”, Vikas Publishing House Pvt.Ltd., 8th Edition, 2007.
- 4 Aswat Damodaran, “Corporate Finance Theory and Practice”, John Wiley & Sons, 2nd Edition, 2008.
- 5 James C.Vanhorne, “Fundamentals of Financial Management”, PHI Learning, 11th Edition, 2008.

Reference Books:

- 1 Van Horne and Wachowicz, “Fundamentals of Financial Management”, Prentice Hall, 13th Edition, 2009.
- 2 Brigham and Ehrhardt, “Financial Management Theory and Practice”, 11th edition, Cengage Learning, 2011.