SVKM's NMIMS
Mukesh Patel School of Technology Management & Engineering

Program:	B Tech (Computer Science and Business Systems)		Semester: V	
Course:	Design and Analysis of Algorithms		Code:	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorial Hours per week	Credit	Internal Continuous Assessment (ICA) (Marks -50 marks)	Term End Examinations (TEE) (Marks- 100 in Question paper)
3	2	0	4	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Fundamentals of Computer Science (BTCS01003), Data Structures and Algorithms (BTCS02003)

Objectives: This course provides a familiarity with major algorithm design paradigm. It also covers in depth analysis of the asymptotic performance of algorithms.

Outcomes: After successful completion of this course, students will be able to
1. Comprehend the space-time complexity of algorithms.
2. Implement and analyse divide and conquer approach and greedy algorithms.
3. Analyse dynamic programming and Backtracking and branch and bound design paradigm.

Detailed Syllabus:

Unit	Description	Duration
1	**Introduction:** Characteristics of Algorithm. Analysis of Algorithm: Asymptotic analysis of Complexity Bounds – Best, Average and Worst-Case behaviour; Asymptotic notations, Classifying functions by their asymptotic growth rates. Performance Measurements of Algorithm, Time and Space Trade-Offs, Analysis of Recursive Algorithms through Recurrence Relations: Substitution Method, Recursion Tree Method and Masters' Theorem.	07
2	**Divide and Conquer Technique and Greedy Technique:** **Divide and Conquer Technique:** The general method, control abstraction for divide and conquer, Finding the maximum and minimum: straightforward and recursive algorithms, Quick sort, Time complexity analysis.	06
3	**Greedy Technique:** The general method, control abstraction, Knapsack problem, Job sequencing with deadlines, Huffman codes, Case study on Minimum spanning trees: Prim's and Kruskal's algorithm, Single source shortest path Dijkstra's algorithm. Time complexity analysis	08
4	**Dynamic Programming:** The general method, principle of optimality, Multistage graphs,	12

	Single source shortest path Bellman Ford algorithm, Case Study: All pairs shortest paths – Floyd's Warshall Algorithm, 0/1-knapsack, The travelling salesperson problem and comparison with brute force approach, Longest Common Subsequence problem.	
5	**Backtracking and Branch and Bound:** The general method, the n–queens' problem, Sum of subsets, Hamiltonian cycles, Introduction to Branch and bound, Job sequencing with deadlines using Branch and bound	07
6	**Tractable and Intractable Problems**: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems.	
	Advanced Topics: Introduction to Approximation algorithms, Randomized algorithms, Heuristic Algorithms	05
	Miscellaneous Topics: Topological sorting, Network Flow Algorithm.	
	Total	45

Text Books:
1. Ellis Horowitz, and Sartaj Sahani, "Fundamentals of Computer Algorithms", 2nd edition, University Press, 2008.
2. Thomas H. Cormen, Charles E., Leiserson, Ronald L. Rivest, "Introduction to Algorithms", 3rd edition, MIT Press, 2009.

Reference Books:
1. Sara Baase, Alan Van Gelder, "Computer Algorithms: Introduction to Design and Analysis", 3rd edition, Addison-Wesley, 2000
2. Aho, Hopcroft, Ullman, "Data Structures and Algorithms", 6th Edition, Addison-Wesley, 2000.

Total Marks of Internal Continuous Assessment (ICA) : 50 Marks

Description of ICA	Marks
Test 1	10
Test 2	10
Term Work	30
Total Marks	50

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Signature   Signature
(Prepared by Concerned Faculty/HOD)   (Approved by Dean)

Program: B Tech (Computer Science and Business Systems)		Semester: V	
Course: Compiler Design		Code:	
Teaching Scheme		**Evaluation Scheme**	

Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks-50)	Term End Examinations (TEE) (Marks-100 in Question Paper)
3	2	0	4	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Formal language and automata theory (BTCS01001)

Objectives:
1. To Provide the foundation for understanding the theory and practice of compilers, learn programming language translation and compiler design concepts,
2. Understand language recognition, symbol table management, semantic analysis and code generation.

Outcomes: After completion of the course, students will be able to:
1. Comprehend the working of lexical analysis, parsing.
2. Understand the significance of code generation and code optimization.
3. Implement working module of compiler

Detailed Syllabus: (per session plan)

Unit	Description	Duration
1.	**Introduction:** Phases of compilation and overview. Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, regular expression to finite automata, scanner generator (lex, flex).	07
2.	**Syntax Analysis (Parser):** Context-free languages and grammars, push-down automata, LL(1) grammars and top-down parsing, operator grammars, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison)	10
3.	**Semantic Analysis:** Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree.	05
4.	**Symbol Table:** Basic structure, symbol attributes and management.	05

	Run-time environment: Procedure activation, parameter passing, value return, memory allocation, scope.	
5.	**Intermediate Code Generation:** Translation of different language features, different types of intermediate forms.	04
6.	**Code Improvement (optimization):** control-flow, data-flow dependence, local optimization, global optimization, loop optimization, peep-hole optimization.	05
7.	**Architecture dependent code improvement:** instruction scheduling (for pipeline), loop optimization (for cache memory), Register allocation and target code generation.	05
8.	**Advanced topics**: Type systems, data abstraction, compilation of Object Oriented features and non-imperative programming languages	04
	Total	**45**

Text Books:

1. V. Aho, R. Sethi and J. Ullman "Compilers: Principles, Techniques and Tools", 2nd Edition, Boston, Massachusetts, USA: Addison-Wesley, 2006.

2. Levine R. John, Tony Mason and Doug Brown "Lex & Yacc", 2nd Edition, O'Reilly media, 2007.

Reference Books:
1. Bjarne Stroustrup "The Design and Evolution of C++" 2nd edition, Addison-Wesley, 2007.

Any other information :
Total Marks of Internal Continuous Assessment (ICA) : 50 Marks
Distribution of ICA Marks :

Description of ICA	Marks
Test 1	10
Test 2	10
Term Work	30
Total Marks	50

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(Prepared by Concerned Faculty/HOD)   (Approved by Dean)

Program: B Tech (Computer Science and Business	**Semester: V**

Systems)	
Course: Fundamentals of Management	**Code:**

Teaching Scheme				Evaluation Scheme	
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks - 50)	Term End Examinations (TEE) (Marks- 50 in Question Paper)
3	0	0	3	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: NIL

Objectives:
To acquaint students with various facets of management, sensitize students on social issues impacting society in general and business in particular.

Outcomes: After completion of the course, students will be able to:
1. Comprehend concepts of management to Analyze and evaluate the influence of historical forces on the current practice of management
2. Develop the process of management's four functions: planning, organizing, leading, and controlling.
3. Recognize the ethical issues in corporate governance and to adhere to the ethical codes.

Detailed Syllabus: (per session plan)

Unit	Description	Duration
1	**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. **Functions of Management-** Planning, Organizing, Staffing, Directing, Controlling.	02
2	**Planning & Strategy-** Concept of planning, Significance of planning, Classification of planning: Strategic plan, Tactical plan and Operational plan, Process of planning, Barriers to effective planning. MBO, Management by Exception. Business Environment- Macro & Micro Environment, Understanding Management Contexts-Constraints & Challenges.Vision & Mission.	02
3	**Decision Making:** Managers as Decision makers. Types of decision-Programmed and Un-programmed decisions, concept of Rationality and bounded rationality in decision making, role of intuition in	02

	decision making. Steps in an effective decision-making process.	
4	**Organizing:** Formal and Informal Organization, Organization structures- mechanistic Vs Organic Structures, Types of structures (Simple, functional, Divisional & Matrix) Line and staff authority. Specialization, Centralization Vs Decentralization, Formalization. Structures with Narrow and wide spans.	02
5	**Individual Differences:** Personality & Individual characteristics, differences and significance, Diversity.	02
6	**Work Related Attitudes, Values and Perception:** Attitude and Behaviour, Major Job Attitudes, Values- Rockeach, Hofstede, Meaning and concept of Perception, Factors influencing perception. , Frequently used shortcuts in judging others	02
7	**Leading and Managing Teams:** Leader Vs Manager, Leadership Styles Leadership theories- Trait, Behavioural and Leadership. Groups Vs. teams, skills necessary to manage teams. Five stages of group/team development	02
8	**Motivation -** Types of Motivation; Relationship between Motivation, Performance and Engagement, Content Motivational Theories - Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y.	02
9	**Introduction to Major Areas of HRM:** Orientation to talent management – onboarding, recruitment, selection, appraisal, training, exit.	02
10	**Controlling:** Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non- Budgetary Controls. Characteristics of Effective Controls, Establishing control systems, Control frequency, and Methods.	02
11	**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	02
12	**Organizational Culture: Meaning** and dimensions, Role of founders' values and vision in creating and sustaining culture,Types of organizational cultures,Impact of culture on image and performance of	02

	the organization. , Managing Cultural Diversity	
13	**Organizational Outcomes :** Power & Influence- Sources of Power, Power tactics, Stress :Sources of stress at workplace, Stress Management, Impact of stress on performance.	02
14	**Organization Change:** Need for change, Resistance to change, how to overcome resistance to change, Kurt Lewin's process of change.	02
15	**Project presentations**	02
	Total	**30**

Text Books:
1. Daft RL, "Understanding the theory and design of organizations.",11th Edition, IGI Global, 2016.

Reference Books:
1. Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, "Organizational Behavior", 16th Edition, Pearson, 2018

Any other information:
Details of Internal Continuous Assessment (ICA).
Total Marks of Internal Continuous Assessment (ICA) : 50 Marks
Distribution of ICA Marks:

Description of ICA	Marks
Test 1	20
Test 2	20
Term work	30
Total Marks :	50

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Signature   Signature
(Prepared by Concerned Faculty/HOD)   (Approved by Dean)

Program: B Tech (Computer Science and Business Systems)				Semester: V	
Course: Business Strategy				Code:	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks - 50)	Term End Examinations (TEE) (Marks- 50 in Question Paper)
3	0	0	3	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Nil

Objectives: To familiarize the participants with the basic concepts of business strategy, facilitate the participants to apply the concepts to live corporate situations, and to explain contemporary concepts of strategy.

Outcomes: After successful completion of this course, students will be able to:
1. Comprehend fundamental concepts of strategic management to analyze business situations and apply these concepts to solve business problems.
2. Understand the fundamental principles of and interrelationships among business functions such as: R&D, production, marketing, finance, HR and information technology
3. Understand the inter-relationships of business to individuals, other organizations, government and society.
4. Analyze complex, unstructured qualitative and quantitative problems, using appropriate tools.

Detailed Syllabus: (per session plan)

Unit	Description	Duration
1	**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.	08
2	**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.	06
3	**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	06

	and the Value Chain.		
4	**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.		06
5	**Strategy Implementation: Structure and Systems:** The 7S Framework, Strategic Control and Corporate Governance.		04
6	**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.		05
7	**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.		10
	Total		**45**

Text Books:
1. Robert M. Grant, *Contemporary Strategic Management*, 7th Edition, Blackwell, 2012.

Reference Books:
1. Hout TM, Porter ME, Rudden E. "How global companies win out.", 1st Edition, Graduate School of Business Administration, Harvard University, 1982
2. Rumelt RP. Good strategy/bad strategy: The difference and why it matters. Strategic Direction.3rd Edition, High Bridge, 2012

Any other information:
Details of Internal Continuous Assessment (ICA)
Total Marks of Internal Continuous Assessment (ICA) : 50 Marks
Distribution of ICA Marks :

Description of ICA	Marks
Test 1	20
Test 2	20
Term work	30
Total Marks :	**50**

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Signature   Signature
(Prepared by Concerned Faculty/HOD)   (Approved by Dean)

Program: B Tech (Computer Science and Business Systems)				**Semester:** V	
Course: Design Thinking				**Code:**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- NIL in Question Paper)**
2	2	0	3	Marks Scaled to 50	---
Pre-requisite: Business Communication & value Science-I (BTCS01006), Business Communication & value Science-II (BTCS02006)					
Objectives: Recognize the importance of DT, Explain the phases in the DT process, List the steps required to complete each phase in DT process, Apply each phase in the DT process, Use doodling and story telling in presenting ideas and prototypes, Create value proposition statements as part of their presentations, Recognize how DT can help in functional work, Recognize how Agile and DT complement each other to deliver customer satisfaction.					
Outcomes: After completion of the course, students will be able to: 1. Identify the steps in the DT process 2. Recognize the steps in the empathize phase of DT and create Empathy Map 3. Identify the steps required to conduct an immersion activity 4. Create a prototype					
Detailed Syllabus: (per session plan)					

Unit	Description	Duration
1	**Why is Design Thinking important for business?** Stories and examples will be used to introduce Design Thinking to the participants. We will use relevant stories and the following videos. 1. YouTube video: The Design Thinking Process – Sprouts (3.57 mins) Leverage TCS-provided DT content to show the evolution of DT and why is important in present 2. Business environment. Can be a video. (2 mins) Lecturer to encourage the students to maintain their Satori slam book and capture their learning points in it.	01

2	**Why is Design Thinking important for you?** Experiential activity, Products that you loved and hated: In this activity, learners will have to share about a product they like of disliked based on their experience. What would they need in a bad product to make it good?	02
3	**What is DT?** Introduce the 5-Step Stanford Model using YouTube videos: The video will give a brief idea about the five steps: • 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) Start all over and iterate the flow as much as possible	01
4	**What is empathy?** Touch the target activity (Recap from Sem 2 Unit 4), Discussions in class Reference: FHIL | Stages of Design Thinking | EMPATHY (2:29 mins)	01
5	**How to empathize?** Moccasin Walk activity for 1 hour to allow learners experience stepping into the shoes of another person. *This is an individual activity.* Sharing observations with the group. Suggest that students try this even in their free time away from studies.	01
6	**Intro to Immersion Activity** Introduction to immersion activity through flowcharts and handouts and examples (to be provided by TCS DT Team) (steps and the question template: 1. We met; 2. We were amazed to realize that; 3. We wonder if this means It would change the world if)	01
7	**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.	02

	They need to interview people and fill up the DT question template (explained in the last class) 1. College cafeteria 2. College library 3. College sports facility 4. Transport facility near college	
8	**Creating personas** Start with YouTube videos explaining the process of persona creation: 1. Personas – What is a persona and how do I create one? (2019) https://www.youtube.com/watch?v=GNvLpfXCge8 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. **Reference:** https://www.interaction-design.org/literature/article/personas-why-and-how-you-should-use-them Lecturer to guide participants on getting the personas right (based on guidelines provided by TCS DT Team).	03
9	**Problem statements** Session will begin with YouTube videos on how to define problem statements in the Define phase. 1. FHIL | Stages of Design Thinking | REFRAME (1:55 mins) Lecturer will provide examples of problem statements in class (based on handouts provided by TCS DT Team)	01
10	**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	02

	review. Finally, lecturer will moderate/validate the problem statements (based on handouts provided by TCS DT Team)	
11	**How to Ideate?** The session will start with YouTube videos: 1. FHIL | Stages of Design Thinking | IDEATE (1:54 secs) 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)	01
12	**Ideation games** Game 1: Six Thinking Hats Game 2: Million-dollar idea	01
13	**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).	01
14	**Let's doodle!** Participants will first watch a video on doodling: Doodling – how it can help in presenting ideas during ideate and protype phases After that, participants will complete an activity on doodling.	01
15	**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	02

	from Unit- Sem-)	
	Suggested topics to be provided by the TCS DT team.	
16	**Why is a Prototype important in Design Thinking?**	01
	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, lecturer will share relevant examples and prototyping guidelines (provided by the TCS DT Team).	
	Finally, the participants will watch two YouTube videos:	
	1. FHIL | Stages of Design Thinking | PROTOTYPE	
	2. Prototyping Phase - Design Thinking | Coursera	
	https://www.coursera.org/lecture/patient-safety-project-planning/prototyping-phase-jVuQn	
17	**Prototype your idea**	02
	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.	
	Lecturer to share feedback based on guidelines provided by the TCs DT team.	
18	**Value Proposition Statement**	01
	You Tube: What is Value Proposition (by Venture Well) (3:51 mins)?	
	Lecturer to discuss the guidelines for creating a value proposition statement (to be provided by the TCS DT Team	
	Each group now needs to create value proposition statement for the solution they have suggested.	
19	**Testing in Design Thinking**	01
	Participants will first watch a YouTube video:	
	FHIL | Stages of Design Thinking | TESTING	

	After that lecturers will explain them the importance of Testing the prototype through stories (provided by the TCS DT Team). They will also explain how the loop works in DT between the Empathize and Testing phases.	
20	**Test the Prototype** Each group needs to test their prototype created earlier and: 1. Document user feedback 2. Write down their inference from the feedback	01
21	**Role of DT in your work** Lecturer conducts a group/open house discussion on: "How DT can help me to become a better coder?", Lecturer needs to capture the key learning points in these discussions.	01
22	Suggested session on: How Agile and DT complement each other to deliver customer satisfaction	01
23	**Share your Satori** Participants will be asked to share their Satori moments from the DT sessions	01
	Total	**30**

Text Books:
1. Idris Mootee, "Design Thinking for Strategic Innovation, CEO Idea Couture", 1st Edition, Wiley, 2014

Reference Books:
1. Nir Eyal," how to build habit forming products", 1st edition, Portfolio/penguin,2014
2. Rod Judkins, "The Art of Creative Thinking", 1st Edition, Perigee Books, 2016

3. Dan Senor and Saul singer, "Start Up nation", 1st Edition, Grand central publishing, 2011

4. Simon Sinek, "Start with Why", 1st edition, Portfolio/penguin,2011

Any other information:
Total Marks of Internal Continuous Assessment (ICA): 50 Marks
Distribution of ICA Marks :

Project

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.

Option 2: Each group will apply DT to create a prototype to improve any existing product or service.

For both options, groups need to complete all phases of the Stanford DT model and include the outputs of each phase in their presentation.

Lecturers will evaluate the project based on the rubric provided by the TCS DT Team.

Description of ICA	Marks
Test 1	10
Test 2	10
Term Work	30
Total Marks	50

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Signature
(Prepared by Concerned Faculty/HOD)

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Signature
(Approved by Dean)

Program: B Tech (Computer Science and Business Systems)				Semester: V	
Course:	Mini Project			Code:	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks - 100)	Term End Examinations (TEE) (Marks-_____ in Question Paper)
0	2	0	1	Marks Scaled to 50	-

Pre-requisite: Knowledge of any Programming Language, Software Engineering, Data Structures and Algorithms, DBMS

Objectives: This course prepares students to develop self learning attitude and working skills through software project development. Also helps development of document preparation skills using standard practices

Outcomes: After completion of the course, students will be able to :
1. Understand the problem statement in given domain and design solution for problem identified
2. Implement working model of the solution designed
3. Demonstrate the software product
4. Document the project work as per the standard guidelines

Detailed Syllabus:
A group of 2-3 students selects the problem definition for the project work and finalizes it with the help of faculty mentor. The project needs to be developed based on three tier architecture (Front end, logic development, database). The selected problem has to be implemented as working model using appropriate programming language.

Evaluation :
Each group is expected to maintain the log book. The log book needs to be evaluated by the mentor every week as the part of continuous evaluation. Each group must demonstrate the working project, submit the report and do the ppt presentation at the end of the semester. The exam can be taken by two examiners: one internal and one external examiner.

Contents of the Project Report :
1. Introduction
2. Problem Definition
3. Project Description

4. Details of development – Methods / Techniques / Data / Charts / Diagrams / Hardware and software used
5. Database design
6. Applications, Advantages and Limitations
7. Project Code & Snapshots/Output
8. Conclusion and Future scope
9. References.

The sequence in which the project report material should be arranged and bound is as follows:

1. Cover Page & Title page
2. Certificate by the Guide
3. Declaration by the Student
4. Acknowledgment
5. Abstract (1-2 pages long)
6. Table of Contents
7. List of figures
8. List of tables
9. abbreviations
10. Chapters
11. References
12. Appendices

Any other information :
Total Marks of Internal Continuous Assessment (ICA) : 100 Marks
Distribution of ICA Marks :

Description of ICA	Marks
Test 1	20
Test 2	20
Log Book	10
Final External Presentation	50
Total Marks :	100

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Signature   Signature
(Prepared by Concerned Faculty/HOD)   (Approved by Dean)

Program: B Tech (Computer Science and Business	**Semester: V**

Systems)	
Course: Cloud, Microservices & Application (Elective-I)	**Course Code:**

Teaching Scheme				Evaluation Scheme	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 100)**	**Term End Examinations (TEE) (Marks- 50 in Question Paper)**
3	2	0	4	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Object-Oriented Programming (BTCS03003)

Objectives:
The course intends to introduce students to the fundamentals of developing application on Cloud, specifically public clouds such as AWS, AZURE and Google.

Outcomes: After completion of the course, students will be able to:
1. Understand fundamentals and know how to design applications for Cloud
2. Develop applications using various services
3. Deploy applications on Cloud by using cloud native services
4. Analyse recent developments in Cloud computing

Detailed Syllabus: (per session plan)

Unit	Description	Duration
1	**Introduction**: Cloud Fundamentals; Cloud Computing reference model (NIST), Characteristics of Cloud Computing (NIST), Cloud service/Deployment Models. Cloud advantages and deployment process.	06
2	**Virtualization:** Introduction, Characteristics, Taxonomy, Pros and Cons of Virtualization, Examples	06
3	**Cloud Service Components and Providers:** Cloud Service Components, Cloud components Guiding Principle with respect to utilization/Security/Pricing. And the applications of Cloud. Public Cloud Platforms overview and their usage: AWS, Azure and Google	06
4	**API and Microservice fundamentals:** Application architectures-Monolithic & Distributed, Microservice fundamental and design approach, Cloud Native applications-12	09

	Factors App, Application integration process/Apification Process, API Fundamental. Microservice /API management, Spring boot Fundamental and design of microservice, API tools. Developer Portal. Applications of Microservice and APIFICATION	
5	**Devops tools**: Fundamentals, Tools and Applications, Containerization Process and application.	04
6	**Python:** Overview, Use Cases for Cloud Application development	04
7	**Application design and development:** Steps for Cloud application development, deployment and execution using containers-containerization of application and deployment using Kubernetes, Project Use Cases	04
8	**Cloud Security and Monitoring Tools**	03
9	**Recent trends in Cloud Computing**	03
	Total	**45**

Text Books:
1. Rajkumar Buyya, S. Thamarai Selvai, "Mastering Cloud computing and application programming",1st Edition, Elsevier, 2013

Reference Books:
1 Nick Antonopoulos and Lee Gillam, "Cloud Computing Principles, Systems and Applications", 1st Edition, Springer, 2017

Any other information:
Total Marks of Internal Continuous Assessment (ICA) : 50 Marks
Distribution of ICA Marks:

Description of ICA	Marks
Test 1	10
Test 2	10
Term Work	30
Total Marks	50

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Signature   Signature
(Prepared by Concerned Faculty/HOD)   (Approved by Dean)

SVKM's NMIMS
Mukesh Patel School of Technology Management & Engineering

Program:	B. Tech (Computer Science and Business Systems)			Semester: V	
Course:	Machine Learning (Elective-I)			Code:	
Teaching Scheme				**Evaluation Scheme**	
Lecture Hours per week	Practical Hours per week	Tutorial Hours per week	Credit	Internal Continuous Assessment (ICA) (50 marks)	Term End Examinations (TEE) (50 Marks in Question paper)
3	2	0	4	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Probability and Statistics (BTCS01002), Statistical Modelling (BTCS02002)

Objectives: This course introduces to the fundamental concepts in Machine Learning. Also, it covers Classification, Regression, Association rule mining, and Unsupervised algorithms in Machine Learning.

Outcomes: After successful completion of this course, students will be able to
   1. Understand the concept of machine learning and human learning
   2. Analyse the problem using Machine learning algorithms
   3. Evaluate the Model using performance evaluators

Detailed Syllabus:

Unit	Description	Duration
1	**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	3
2	**Classification:** Supervised Learning; The problem of classification, Feature engineering. Training and testing classifier models, Cross-validation, Model evaluation (precision, recall, F1-mesure, accuracy, area under curve), Statistical decision theory including discriminant functions 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.	15
3	**Statistical Model for classification:** Hidden Markov Models (HMM) with forward-backward and Vierbi algorithms, Sequence classification using HMM, Conditional random fields, Applications of sequence classification such as part-of-speech tagging.	6
4	**Regression:** Linear and Logistic Regression, Multi-variable regression, Model evaluation; Least squares regression, Regularization, LASSO, Applications of regression	10

5	**Association rule mining:** Association rule mining, Apriori Algorithm	3
6	**Unsupervised Learning**: Expectation-Maximization (EM) algorithm for unsupervised learning. **Clustering:** average linkage; Ward's algorithm; Minimum spanning tree clustering; K-nearest neighbors clustering; BIRCH; CURE; DBSCAN. **Detection Methods:** Anomaly and outlier detection methods	8
	Total	45

Text Books:

 1. Duda Richard O, and Peter E. Hart, "DG Stork Pattern Classification.", 1st Edition, John Wiley and Sons, 2001.

Reference Books:

1. Svensén, Markus, and Christopher M. Bishop, "Pattern recognition and machine learning.", 1st Edition, Springer, 2007
2. E. Alpaydin, "Introduction to Machine Learning", 3rd edition, Prentice-Hall, 2014.
3. A. Rostamizadeh, A. Talwalkar, and M. Mohri, "Foundations of Machine Learning", 2nd Edition,MIT Press, 2018
4. A. Webb, "Statistical Pattern Recognition", 3rd edition, Wiley, 2011.

Total Marks of Internal Continuous Assessment (ICA): 50 Marks
Distribution of ICA Marks:

Description of ICA	Marks
Test 1	10
Test 2	10
Term Work	30
Total Marks	50

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Signature   Signature

(Prepared by Concerned Faculty/HOD)   (Approved by Dean)