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Choice Based Credit System (CBCS)-2019-20

SEMESTER V

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY				
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTCSCS301	UG	Design And Analysis of Algorithms	2	0	2	3	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based on following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES

Student will have ability:

1. Understand and compare important algorithmic design paradigms and methods of analysis.
2. To choose and extend efficient algorithms required for designs.
3. Understand the limitation of algorithm power.
4. Analyze the asymptotic performance of algorithms.
5. Synthesize efficient algorithms in common engineering design situations

COURSE OUTCOMES

Upon completion of the subject, Students will be able:

1. Interpret the performance of algorithms using analysis techniques
2. Examine the fundamental algorithmic strategies.
3. Compare the fundamental algorithmic strategies.
4. Implement Graphs and trees algorithms.
5. Interpret the tractable or intractable problem.
6. Summarize the advance types of algorithms.

SYLLABUS

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,

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Branch and Bound and Backtracking methodologies; Illustrations 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.

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.

REFERENCES:

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.
4. Quantum Computation and Quantum Information, Michael A. Nielsen and Isaac L. Chuang.

List of Practical's:

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

Shri Vaishnav Vidyapeeth Vishwavidyalaya
B.Tech. (Computer Science and Business Systems –TCS)
Choice Based Credit System (CBCS)-2019-20

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTCSCS302	**UG**	**Compiler Design**	**3**	**0**	**2**	**4**	**60**	**20**	**20**	**30**	**20**

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COURSE OBJECTIVES

Student will have ability:

1. Understand the phases of the Compiler and utilities of Automata.
2. Give the implementation details of Top-Down and Bottom-up Parsers and its types.
3. Describe the importance of the Semantic Phase and Symbol Table in Compiler.
4. Give the descriptions for the Synthesis Model of the Compiler w.r.t Analysis Model.
5. Understand the Architecture of the Computer and few advanced topics for a Compiler.

COURSE OUTCOMES

Upon completion of the subject, Students will be able:

1. Define the Compiler along with phases and basic programs in LEX.
2. Develop programs for various kinds of the Parsers.
3. Write simple programs related to Type Checking, Parameter Passing and Overloading.
4. Implement the concepts of Code Optimizations and Code Generations.
5. Provide the Case Studies of Object-Oriented Compilers.

SYLLABUS

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(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison)

UNIT III

Semantic Analysis: 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,

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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.

TEXT BOOKS:

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

REFERENCES:

1. The Design and Evolution of C++, Bjarne Stroustrup.

List of Practical's:

1. Assignments using Lex and Yaac

Shri Vaishnav Vidyapeeth Vishwavidyalaya
B.Tech. (Computer Science and Business Systems –TCS)
Choice Based Credit System (CBCS)-2019-20

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTCSMS303	UG	Fundamentals of Management	3	1	0	4	60	20	20	0	0

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COURSE OBJECTIVES

Student will have ability:

1. This subject is designed to provide a basic understanding to the students with reference to working of business organizations through the process of management.
2. The first part of this course will give a brief understanding of the managerial functions of planning (including decision making) and organizing.
3. To understand the core management principles which applies to individuals, medium and large organizations. The students are expected to learn the basics of management functions and realize the ideal characteristics of a manager. The impetus of this subject is to make the students familiarize with the professional skills required to be an effective manager.
4. This subject will familiarize the students with organizational, group and individual behavior.
5. The objective of the course is to disseminate the theory and practice of moral code of conduct and familiarize the students with the concepts of "right" and "good" in individual, social and professional context

COURSE OUTCOMES

Upon completion of the subject, Students will be able:

1. Understand the major functions of management viz. Planning, Organizing, Staffing, leading and controlling.
2. Describe the interrelationship among the various functions of Management
3. Develop a general management perspective
4. Use analytical skills for decision making.
5. To describe human behavior and that of others in an organizational setting
6. To examine important aspects of group slash team processes and manage them.
7. To equip students with understanding of the ethical philosophies, principles, models that directly and indirectly affect personal and professional life.

SYLLABUS

UNIT I

Management Theories: Concept and Foundations of Management, Evolution of Management Thoughts [Pre-Scientific Management Era (before 1880), Classical management Era (1880-1930),

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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. Richard L. Daft, Understanding the Theory and Design of Organizations

REFERENCES:

1. Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, Organizational Behavior

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B.Tech. (Computer Science and Business Systems –TCS)
Choice Based Credit System (CBCS)-2019-20

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTCSMS304	UG	Business Strategy	3	0	0	3	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
*__Teacher Assessment__ shall be based on following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OUTCOMES

Upon completion of the subject, Students will be able:

1. To learn the fundamental concepts of strategic management to analyze business situations and apply these concepts to solve business problems.
2. To understand the fundamental principles of and interrelationships among business functions such as: R&D, production, marketing, finance, HR and information technology
3. To understand the inter-relationships of business to individuals, other organizations, government and society.
4. To analyze complex, unstructured qualitative and quantitative problems, using appropriate tools.

SYLLABUS

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

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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. Robert M. Grant (2012). Contemporary Strategic Management, Blackwell, 7th Edition.

REFERENCES:

1. M.E. Porter, Competitive Strategy, 1980.M.E. Porter,
2. Competitive Advantage, 1985 Richard Rumelt (2011).
   Good Strategy Bad Strategy: The Difference and Why It Matters.

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B.Tech. (Computer Science and Business Systems –TCS)
Choice Based Credit System (CBCS)-2019-20

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTCSH305	**UG**	**Design Thinking**	**2**	**0**	**2**	**3**	**60**	**20**	**20**	**30**	**20**

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SYLLABUS

	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**		

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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]
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 protypes	[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
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**	**Marks**
	Apply	Defining problem statement	5
	Apply	Ideating solutions	5
	Apply	Creating a prototype	10

Summative Assessment based on End Semester Project

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

Lesson Plan

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
	Recognize the importance of Design Thinking	2	**hy is Design Thinking important for business?** tories 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) 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) ecturer to encourage the students to maintain their Satori slam book and capture their learning points in it.	Introduction and discussion	60 mins

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
1	Recognize the importance of Design Thinking	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?	Activity	90 mins

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1	Identify the steps in the DT process	2	**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	Lecture and demo	60 mins
1	Recognize the steps in the empathize phase of DT	2	**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)	Activity	60 mins
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. *This is an individual activity.* 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	1 and 2	**Intro to Immersion Activity**	Lecture	45 mins

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
	required to conduct an 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 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) 1. College cafeteria 2. College library 3. College sports facility 4. Transport facility near college	Practical	180 mins

	Recognize the steps to create personas in the define phase of DT Create personas in the define phase of DT	2 3	**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:**	Lecture and practical	120 mins

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			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).		
2	Recognize the steps to create problem statements in the define phase of DT	2	**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)	Lecture and demo	60 mins

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 YouTube videos: 1. FHIL | Stages of Design	Lecture and demo	60 mins
Unit No	**Objective**	**Bloom's Level**	**Content**	**Type of Class**	**Duration**
			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)		
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

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 protype phases After that, participants will complete an activity on doodling.	Demo and activity	60 mins
3	Recognize the importance storytelling in presenting ideas and protypes	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
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	Activity and demo	60 mins
Unit No	**Objective**	**Bloom's Level**	**Content**	**Type of Class**	**Duration**

			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		
4	Create a prototype	3	**Prototype your idea** 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.	Formative assessment	180 mins

4	Recognize the importance of service value proposition Create a value proposition statement	2 3	**Value Proposition Statement** 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.	Lecture	120 mins 1635 mins
4	Recognize the best	1	**Testing in Design Thinking**	Lecture	60 mins

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
	practices of the testing phase in DT		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.		
	Test a prototype created through a DT process	3	**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 3. Suggest next steps (the loop that happens in DT)	Activity	120 mins
4	Recognize how DT can help in functional work	1	**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.	Discussion	60 mins
4	Recognize how Agile and DT complement each other to deliver customer satisfaction	1	Suggested session on: **How Agile and DT complement each other to deliver customer satisfaction**	Lecture	45 mins
4			**Share your Satori** Participants will be asked to share their Satori moments from the DT sessions	Reflection activity	60 mins
					33 hours

			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.		12 hours
Unit No	**Objective**	**Bloom's Level**	**Content**	**Type of Class**	**Duration**
			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.		
				Total	**45 hours**

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COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTCSDTS3063	UG	Elective I (Machine Learning)	2	1	2	4	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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COURSE OBJECTIVES

Student will have ability:

1. Understand parametric density estimation.
2. Learn to develop statistical models.
3. Apply machine Learning models in real world application.

COURSE OUTCOMES

Upon completion of the subject, Students will be able:

1. Able to develop statistical model.
2. Able to predict label of unseen data.
3. Able to estimate density distribution of observations.

SYLLABUS

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-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 back propagation; Applications of classifications; Ensembles of classifiers including bagging and boosting

UNIT III

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

UNIT IV

Regression: Multi-variable regression; Model evaluation; Least squares regression; Regularization; LASSO; Applications of regression ,Association rule mining algorithms including apriori

UNIT V

Expectation-Maximization (EM) algorithm for unsupervised learning, Clustering: average linkage; Ward's algorithm; Minimum spanning tree clustering; K-nearest neighbors clustering; BIRCH; CURE; DBSCAN, Anomaly and outlier detection methods.

References:

1. R.O. Duda, P.E. Hart, D.G. Stork, Pattern Classification, 2/e, Wiley, 2001.
2. C. Bishop, Pattern Recognition and Machine Learning, Springer, 2007.
3. E. Alpaydin, Introduction to Machine Learning, 3/e, Prentice-Hall, 2014.
4. A. Rostamizadeh, A. Talwalkar, M. Mohri, Foundations of Machine Learning, MIT Press.
5. A. Webb, Statistical Pattern Recognition, 3/e, Wiley, 2011.

List of Practical's:

1. Introduction to WEKA and R Classification of some public domain datasets in UCI ML repository

Mini projects in the Lab:

1. Implementation of one clustering algorithm
2. Implementation of one association rule mining algorithm
3. Implementation of one anomaly detection algorithms
4. Implementation of EM algorithm for some specific problem

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment *	END SEM University Exam	Teachers Assessment *
BTCSH3073	UG	Elective II(Industrial Psychology)	2	1	2	4	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
*__Teacher Assessment__ shall be based following components: Quiz/Assignment/Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES

Introduces students to the content areas of industrial psychology and the application of psychological theory to organizational issues. Topics include employment law, job analysis, recruitment and selection, training, performance appraisal and discipline, employee motivation, and workplace safety. Using an applied approach, this course will help prepare students for their roles as employees and managers.

COURSE OUTCOMES

Students will be able to

1. Become conversant about the major content areas of Industrial Psychology (i.e., job analysis, recruitment, selection, employment law, training, performance management, and health/well-being issues in the workplace).
2. Gain further comfort with statistical concepts in the context of making personnel decisions to reinforce content learned in PSY203 or an equivalent introductory statistics course.
3. Gain practical experience by completing a series of hands-on projects involving job analysis, selection decisions, training programs, and employee well-being.
4. Deepen your understanding of tests and measurements so that you can collect accurate information and make sound data-based decisions.
5. Prepare for other focused seminar courses in Industrial/Organizational Psychology or Human Resource Management.

SYLLABUS

UNIT – I

What is I/O Psychology? Research Methods, Statistics, and Evidence-based Practice,
Introduction & Legal Context of Industrial Psychology, Job Analysis & Competency Modeling, Job Evaluation & Compensation, Job Design & Employee Well-Being, Recruitment

UNIT – II

Identifying Criteria & Validating Tests and Measures, Screening Methods, Intensive Methods,

UNIT – III

Performance Goals and Feedback, Performance Coaching and Evaluation, Evaluating Employee Performance,

UNIT – IV

Employee Motivation, Satisfaction and Commitment, Fairness and Diversity

UNIT – V

Leadership, Organizational Climate, Culture, and Development, Teams in Organizations, The Organization of Work

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Behavior

UNIT – VI

Stress Management: Demands of Life and Work

Text Book:

Landy, F. J. and Conte, J. M. (2013). Work in the 21st Century (4th Edition). Oxford: Blackwell Publishing

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTCSCS308	UG	Mini Project	0	0	2	1	0	0	0	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/Project/Participation in Class, given that no component shall exceed more than 10 marks.

Guideline and instruction for Mini Project

Project will be developed in group. After the approval of project topic students are allowed to work on the project. For the successful completion of Mini Project students has to submit the following document and also present the PPT presentation on following:

1. **Synopsis**
2. **SRS**
3. **Implementation and test plan**
4. **Project Report**

S.No	Particular
1	Group formation and submission of Project topic.
2	Guide allotment and topic finalization
3	Presentation-I Contents: 1. Problem Domain 2. Literature Survey 3. Feasibility Study 4. References
4	Synopsis Submission
5	Presentation –II Contents: 1. SRS/URD 2. Implementation & Test Plan
6	Presentation –II1

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	Contents: 1. Detail Design 2. Implementation & Test Plan
7	Project Report Submission

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment *	END SEM University Exam	Teachers Assessment *
BTCSDTS3061	UG	Elective II(CONVERSATIONAL SYSTEMS)	2	1	2	4	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
*__Teacher Assessment__ shall be based following components: Quiz/Assignment/Project/Participation in Class, given that no component shall exceed more than 10 marks.

Objective of this course - The objective of the course is to

- Enable attendees to acquire knowledge on chatbots and its terminologies
- Work with ML Concepts and different algorithms to build custom ML Model

Better understand on Conversational experiences and provide better customer experiences

Unit 1

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 2

Foundational Blocks for Programming : Basic Python programming concepts ,Node Basics **,**Coding Best Practices**,**Evaluation Test (Hands On)

Unit 3

Natural Language Processing

Introduction: Brief history, Basic Concepts, Phases of NLP, Application of chatbotsetc

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,NLP using Python - Make use of any of the NLP libraries like NLTK, spaCy, StanfordNLP etc. (Practice session to use an NLP Tool -Hands on),Affective NLG.

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Unit 4: Building a chatbot/Conversational AI Systems
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
Building a Voice/Chat Bot - Hands on

Project 1: Case Study to build a learning chatbot

Unit 5: Role of ML/AI in Conversational Technologies –Brief Understanding on how Conversational Systems uses ML technologies inASR, NLP, Advanced Dialog management, Language Translation, Emotion/Sentiment Analysis, Information extraction ,etc. to effectively converse

Project 2: Case Study to build a ML Model using LSTM/any RNN and integrate with chatbot (10 hrs)
Contact Centers

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

Overview onConversational 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

Brief write-up about the course encapsulating the below points (100 words max):

a. **About the technology** - Ever increasing customer expectations (emotional connect, 24x7 availability, real-time responses, enterprise presence in their preferred platform or channel), changing preferences and demand for personalized services - Hence Conversational Experiences will use the right mix of multi-modal experience involving – NLP, Speech, Multi-media, Vision, Virtual reality – for better and personalized results of Customer acquisition, retention and revenue.

b. **Current market demand** - According to the recently updated International Data Corporation (IDC) Worldwide Artificial Intelligence Systems Spending Guide, spending on AI systems will reach $97.9 billion in 2023, more than two and one half times the $37.5 billion that will be spent in 2019. The compound annual growth rate (CAGR) for the 2018-2023 forecast period will be 28.4 %.(https://www.idc.com/getdoc.jsp?containerId=prUS45481219). Globally vendors of Consumer devices – phones, speakers, displays, wearables – are competing and investing billions to make them feature-rich, more powerful, connected and affordable.

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment *	END SEM University Exam	Teachers Assessment *
BTCSH3071	UG	Elective II(Behavioral Economics)	2	1	2	4	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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Course Objective
To impart knowledge on current ideas and concepts regarding decision making in Economics, particularly from a behavioral science perspective, which can affect choices and behavior of firms, households and other economics entities

Course Outcome
Students will be able to understand and apply various concepts in traditional and modern Microeconomics, focusing on decision making, and develop a holistic understanding of these concepts and their interconnections

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

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

Unit III
Beliefs, heuristics and biases
Revisiting rationality; causal aspects of irrationality; different kinds of biases and beliefs; self-evaluation and self-projection; inconsistent and biased beliefs; probability estimation; trading applications – trade in counterfeit goods, financial trading behavior, trade in memorabilia

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

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Unit V

Intertemporal choice

Geometric discounting; preferences over time; anomalies of inter-temporal decisions; hyperbolic discounting; instantaneous utility; alternative concepts – future projection, mental accounts, heterogeneous selves, procedural choice; policy analysis – mobile calls, credit cards, organization of government; applications – consumption and savings, clubs and membership, consumption planning

Unit VI

Strategic choice

1. Review of game theory and Nash equilibrium – strategies, information, equilibrium in pure and mixed strategies, iterated games, bargaining, signaling, learning; applications – competitive sports, bargaining and negotiation, monopoly and market entry

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

Text Book: An Introduction to Behavioral Economics, by N. Wilkinson and M. Klaes

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment *	END SEM University Exam	Teachers Assessment *
BTCSH3072	UG	Elective II(Computational Finance &Modeling)	2	1	2	4	60	20	20	30	20

Computational Finance &Modeling (Elective – II)

Course Objective:

Post successful completion of this course, students will be able to:

1. Understand existing financial models in a quantitative and mathematical way.
2. Apply these quantitative tools to solve complex problems in the areas of portfolio management, risk management and financial engineering.
3. Explain the approaches required to calculate the price of options.
4. Identify the methods required to analyse information from financial data and trading systems.

Topics to Be Covered:

UNIT – I

Numerical methods relevant to integration, differentiation and solving the partial differential equations of mathematical finance: examples of exact solutions including Black Scholes and its relatives, finite difference methods including algorithms and question of stability and convergence, treatment of near and far boundary conditions, the connection with binomial models, interest rate models, early exercise, and the corresponding free boundary problems, and a brief introduction to numerical methods for solving multi-factor models.

UNIT – II

Black-Scholes framework: Black-Scholes PDE: simple European calls and puts; put-call parity. The PDE for pricing commodity and currency options. Discontinuous payoffs - Binary and Digital options. The Greeks: theta, delta, gamma, vega&rho and their role in hedging. The mathematics of early exercise - American options: perpetual calls and puts; optimal exercise strategy and the smooth pasting condition. Volatility considerations - actual, historical, and implied volatility; local vol and volatility surfaces.

Simulation including random variable generation, variance reduction methods and statistical analysis of simulation output. Pseudo random numbers, Linear congruential generator, Mersenne twister RNG. The use of Monte Carlo simulation in solving applied problems on derivative pricing discussed in the current finance literature. The technical topics addressed include importance sampling, Monte Carlo integration, Simulation of Random walk and approximations to diffusion processes, martingale control variables, stratification, and the estimation of the "Greeks. "

UNIT – III

Financial Products and Markets: Introduction to the financial markets and the products which are traded in them: Equities, indices, foreign exchange, and commodities. Options contracts and strategies for speculation and hedging.

UNIT – IV

Application areas include the pricing of American options, pricing interest rate dependent claims, and credit risk. The use of importance sampling for Monte Carlo simulation of VaR for portfolios of options.

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UNIT –V

Statistical Analysis of Financial Returns: Fat-tailed and skewed distributions, outliers, stylized facts of volatility, implied volatility surface, and volatility estimation using high frequency data.

UNIT –VI

Copulas, Hedging in incomplete markets, American Options, Exotic options, Electronic trading, Jump Diffusion Processes, High-dimensional covariance matrices, Extreme value theory, Statistical Arbitrage.

References:

1. R. Seydel: Tools for Computational Finance, 2nd edition, Springer-Verlag, New York, 2004.
2. P. Glasserman: Monte Carlo Methods in Financial Engineering, Springer-Verlag, New York,2004.
3. W. Press, S. Teukolsky, W. Vetterling and B. Flannery, Numerical Recipes in C: The Art of Scientific Computing, 1997. Cambridge University Press, Cambridge, UK. Available on-line at: http://www.nr.com/
4. A. Lewis: Option Valuation under Stochastic Volatility, Finance Press, Newport Beach,California, 2000.
5. A. Pelsser: Efficient Methods for Valuing Interest Rate Derivatives, Springer-Verlag, New York,2000.
6. D. Ruppert, Statistics and Data Analysis for Financial Engineering
7. R. Carmona: Statistical Analysis of Financial Data in S-Plus
8. N. H. Chan, Time Series: Applications to Finance
9. R. S. Tsay, Analysis of Financial Time Series
10. J. Franke, W. K. Härdle and C. M. Hafner, Statistics of Financial Markets: An Introduction

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment *	END SEM University Exam	Teachers Assessment *
BTCSDTS3062	**UG**	**Cloud, Microservices & Application**	**2**	**1**	**2**	**4**	**60**	**20**	**20**	**30**	**20**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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Syllabus

Unit 1

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 2

Application architectures-Monolithic & Distributed, Microservice fundamental and design approach, Cloud Native applications-12 Factors App. . Application integration process/Apification Process, API Fundamental. Microservice /API management, Spring boot Fundamental and design of microservice, API tools. Developer Portal. Applications of Microservice and APIFICATION.,

Unit 3

Devops fundamentals. , Tools and Applications Containerization Process and application.

Unit 4

Python- Refresher, Use cases(Overview, Use cases for cloud application development)

Unit 5

Cloud Security and Monitoring Tools.

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