

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

TCS

Computer Science & Business Systems

Semester 5 Curriculum

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

DESIGN AND ANALYSIS OF ALGORITHMS (PCC-CS 404) + Lab

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.

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

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.

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.

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

Lab

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

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.

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

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

COMPILER DESIGN (PCC-CS 601) + Lab (LEX & YACC)

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).

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)

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.

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.

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.

Lab

Assignments using Lex and Yacc

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

Reference Books:

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

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

FUNDAMENTALS OF MANAGEMENT

Course Outcome(s):

This course will teach students the management theories, evolution of management over the years and few basic concepts without going into the details. After studying this course the students will develop an understanding about how organizations work and find it easier to grasp the intricacies of other management areas such as finance, marketing, strategy etc. which will be taken up in future terms.

Topics to Be Covered:

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

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

UNIT – VI

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*

Reference Books:

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

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

BUSINESS STRATEGY

Course Outcome(s):

This course will help students,

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

Topics to Be Covered:

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

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

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

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

Reference Books:

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.

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

DESIGN THINKING

<u>TEACHING SCHEME:</u>	<u>EXAMINATION SCHEME:</u>	<u>CREDITS ALLOTTED:</u>
Theory: 1 Hr./Week	Semester Examination: 50 marks	2
Practical: 1 Hr. / Week	Continuous Assessment: Yes	
Activity: 1 Hr. / Week	Term Work: 50 marks	

Course ID:

3.5 (3rd Year __ Semester 5)

	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	

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

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]
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
---------------------	----------

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

Textbooks:			
	There are no prescribed texts for Semester 5 – there will be handouts and reference links shared.		
Reference Books:			
1	Hooked by Nir Eyal		
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

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

	Apply	Ideating solutions	5
	Apply	Creating a prototype	10
Summative Assessment based on End Semester Project			
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 	Introduction and discussion	60 mins

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			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.		
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
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: <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) Start all over and iterate the flow as much as possible	Lecture and demo	60 mins

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
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. <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 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)	Lecture	45 mins
1	Conduct an	3	Immersion activity	Practical	180 mins

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
	immersion activity and fill up the DT question template		<p>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)</p> <ol style="list-style-type: none"> 1. College cafeteria 2. College library 3. College sports facility 4. Transport facility near college 		
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> <ol style="list-style-type: none"> 1. Personas – What is a persona and how do I create one? (2019) <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>	Lecture and practical	120 mins

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			<p>Reference: https://www.interaction-design.org/literature/article/personas-why-and-how-you-should-use-them</p> <p>Lecturer to guide participants on getting the personas right (based on guidelines provided by TCS DT Team).</p>		
2	Recognize the steps to create problem statements in the define phase of DT	2	<p>Problem statements</p> <p>Session will begin with YouTube videos on how to define problem statements in the Define phase.</p> <ol style="list-style-type: none"> 1. FHIL Stages of Design Thinking REFRAME (1:55 mins) <p>Lecturer will provide examples of problem statements in class (based on handouts provided by TCS DT Team)</p>	Lecture and demo	60 mins
2	Define the problem statements in the define phase of DT	3	<p>Defining problem statements</p> <p>Group activity, in which each group will define the key problem statements (max three) for their lead personas.</p>	Formative assessment	90 mins

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			<p>Each group will present while the remaining groups will do a peer review.</p> <p>Finally, lecturer will moderate/validate the problem statements (based on handouts provided by TCS DT Team)</p>		
3	Recognize the steps in the ideate phase of DT	1 and 2	<p>How to Ideate?</p> <p>The session will start with YouTube videos:</p> <ol style="list-style-type: none"> 1. FHIL Stages of Design Thinking IDEATE (1:54 secs) 2. What Is Six Thinking Hats? (Litmos Heroes) (1:58 secs) <p>Lecturer to briefly tell them about the guidelines of ideating (to be provided by TCS DT Team)</p>	Lecture and demo	60 mins
3	Apply the steps in the ideate phase of DT	3	<p>Ideation games</p> <p>Game 1: Six Thinking Hats</p> <p>Game 2: Million-dollar idea</p>	Activity	90 mins
3	Apply the steps in the ideate phase of DT	3	<p>Ideate to find solutions</p> <p>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</p>	Formative assessment	90 mins

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			<p>previous session. They will get scores based on how well they can apply the ideation methods.</p> <p>Lecturers will observe the groups separately and assign them scores based on specific rubric (provided by the TCS DT Team).</p>		
3	Recognize how doodling can help to express ideas	1	<p>Let's doodle!</p> <p>Participants will first watch a video on doodling:</p> <p>Doodling – how it can help in presenting ideas during ideate and prototype phases</p> <p>After that, participants will complete an activity on doodling.</p>	Demo and activity	60 mins
3	Recognize the importance of storytelling in presenting ideas and prototypes	1	<p>What is Storytelling in DT?</p> <p>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-)</p> <p>Suggested topics to be provided by the TCS DT team.</p>	Activity	120 mins
4	Recognize the importance of the prototype phase in DT	2	<p>Why is a Prototype important in Design Thinking?</p> <p>The session will start with an activity to drive home the importance of creating a prototype in the design thinking process.</p> <p>As part of debrief of the activity, lecturer will share relevant</p>	Activity and demo	60 mins

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			<p>examples and prototyping guidelines (provided by the TCS DT Team).</p> <p>Finally, the participants will watch two YouTube videos:</p> <ol style="list-style-type: none"> 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	<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 TCS DT team.</p>	Formative assessment	180 mins
4	Recognize the importance of service value proposition	2	<p>Value Proposition Statement</p> <p>You Tube: What is Value Proposition (by Venture Well)</p>	Lecture	120 mins 1635 mins

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
	Create a value proposition statement	3	<p>(3:51 mins)?</p> <p>Lecturer to discuss the guidelines for creating a value proposition 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

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
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. For both options, groups need to complete all phases of the Stanford DT model and include the outputs of each phase in their		12 hours

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			presentation. Lecturers will evaluate the project based on the rubric provided by the TCS DT Team.		
				Total	45 hours

CONVERSATIONAL SYSTEMS + Lab (Elective I)

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

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

Chapter 1: Fundamentals of Conversational Systems (Lectures - 3)

- **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**

Chapter 2: Foundational Blocks for Programming (Lectures - 3)

- Basic Python programming concepts
- Node Basics
- Coding Best Practices
- Evaluation Test (Hands On) – 1 HR

Chapter 3: Natural Language Processing (Lectures - 5)

- **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

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

- 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

Chapter 4: Building a chatbot/Conversational AI Systems (Lectures - 5)

- 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 (8 hrs)

Chapter 5: 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 (Lectures - 6)

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

Chapter 6: Contact Centers (Lectures - 1)

- Introduction to Contact centers – Impact & Terminologies

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

- Case studies & Trends, How does a Virtual Agent/Assistant fit in here?

Chapter 7: Overview on Conversational Analytics (Lectures - 1)

- Conversation Analytics : The need of it
- Introduction to Conversational Metrics

Chapter 8: Future – Where are we headed? (Lectures - 1)

- 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.

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

CLOUD, MICROSERVICES & APPLICATION + Lab (Elective I)

Please find embedded the syllabus in pdf format



CSBS_CloudApps_C
ourse_Summary.pdf

B.E. /B.Tech in Computer Science & Business Systems

Semester 5

MACHINE LEARNING + Lab (Elective I)

Topics to Be Covered:

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
2. 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 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
3. 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
4. Regression: Multi-variable regression; Model evaluation; Least squares regression; Regularization; LASSO; Applications of regression
5. Association rule mining algorithms including apriori
6. Expectation-Maximization (EM) algorithm for unsupervised learning
7. Clustering: average linkage; Ward's algorithm; Minimum spanning tree clustering; K-nearest neighbors clustering; BIRCH; CURE; DBSCAN
8. Anomaly and outlier detection methods

Lab Sessions:

- (1) Introduction to WEKA and R
- (2) Classification of some public domain datasets in UCI ML repository

Mini projects in the Lab:

- (1) Implementation of one clustering algorithm
- (3) Implementation of one association rule mining algorithm
- (4) Implementation of one anomaly detection algorithms
- (5) Implementation of EM algorithm for some specific problem

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.