UE23CS251A : SoC Design and Computer Architecture (4-0-2-4-5)

# of Sessions: 120

Class #	Unit # Chapter Title/Reference Literature	Topics to be Covered	% of Portion covered	
			% of Syllabus	Cumulative %
1	**T1: Chapter 2 Combinational Logic Design:**2.1, 2.2, 2.7 **Chapter 5 Digital Building Blocks:** 5.2.1, 5.2.2 **Chapter 3 Sequential Logic Design** 3.2 (excluding 3.2.7) 3.3 (excluding 3.3.1, 3.3.3) 3.4 (excluding 3.4.4) 3.4.1, examples 3.6, 3.7, 3.9 **Handout :** Link 1	Boolean Functions	25%	25%
2		K-Maps		
3		K-Maps		
4		HDL and Verilog Basics		
5		HDL and Verilog Basics		
6		Combinatorial Logic Design- Adder		
7		A1: Verilog Practice Programs		
8		L1: Basic Gates		
9		L1: Adder (One bit & N-bit)		
10		Combinatorial Logic Design- Subtracter		
11		Combinatorial Logic Design- MUX/Demux		
12		Combinatorial Logic Design- MUX/Demux		
13		Combinatorial Logic Design- Shifters		
14		Sequential Logic Design- Latches & Flip Flop		
15		Sequential Logic Design- Latches & Flip Flop		
16		A2: Write a Verilog code and test bench for Flip-Flop, Synchronous Register		
17		L2: Design of an ALU		
18		L2: Design of an ALU		
19		Combinational Logic Design Examples		
20		Combinational Logic Design Examples		
21		Design of Finite State Machine		
22		Design of Finite State Machine		
23		Design of Finite State Machine		
24		Design of Finite State Machine -Counters		
25		A3: Write a Verilog code and test bench for Counters		
26		L2: Design of an ALU		
27		L2: Design of an ALU		
28		Design of Finite State Machine-Counters		
29		Design of Finite State Machine-Counters		

30		Memory Arrays		
31	R3: Chapter 6 Arithmetic 6.4 Handout Link 2 29.2.3, 29.3.2 Chapter 5 Digital Building Blocks 5.3.2 (excluding subsections Rounding and Floating-Point Addition) Chapter 6 Architecture 6.1, 6.2 6.3, 6.4.1 6.4.2, 6.4.3 (exclude switch/case statements) 6.4.4 (exclude magnitude comparison), 6.5 Chapter 7 Microarchitecture 7.1, 7.2,7.3,7.4	Adder/Multiplier (Shift Add & Wallace Tree)	25%	50%
32		Adder/Multiplier (Shift Add & Wallace Tree)		
33		Adder/Multiplier (Shift Add & Wallace Tree)		
34		A4: Write a Verilog code and test bench for Prefix adders.		
35		L3: Design of a Register File.		
36		L3: Design of a Register File.		
37		Adder/Multiplier (Shift Add & Wallace Tree)		
38		Divider Circuit		
39		Floating Point Units		
40		Assembly Language		
41		Assembly Language		
42		Machine Language & Addressing Modes		
43		Machine Language & Addressing Modes		
44		Machine Language & Addressing Modes		
45		A5: Write a Verilog code and test bench for Multiplier or Divider circuit.		
46		L4: Design of Program Counter and Data Path Design		
47		L4: Design of Program Counter and Data Path Design		
48		Single Cycle Processor Data Path and Control		
49		Single Cycle Processor Data Path and Control		
50		Single Cycle Processor Data Path and Control		
51		Multi Cycle Processor Data Path and Control		
52		Multi Cycle Processor Data Path and Control		
53		Multi Cycle Processor Data Path and Control		
54		Multi Cycle Processor Data Path and Control		
55		L5: Control Logic Design		
56		L5: Control Logic Design		
57		L6: Fetch/Decode/Execute logic implementation for ARM instruction		
58		L6: Fetch/Decode/Execute logic implementation for ARM instruction		
59		L6: Fetch/Decode/Execute logic implementation for ARM instruction		
60		L6: Fetch/Decode/Execute logic implementation for ARM instruction		
61	1.6,2.3 of R2, A-3 of T2, pg no: 51-55 of R2 Chapter 3.1 to 3.5 of T1	RISC & CISC Instruction Set Architecture(ISA)	25%	75%
62		RISC & CISC Instruction Set Architecture(ISA)		
63		RISC & CISC Instruction Set Architecture(ISA)		

64	6.8,5.6 of T2 Appendix C-1, C-2, Sec 1.1 , 1.4, 1.5 of T2 Appendix B.1, B.2, B.3 of T2	Addressing modes & Operands		
65		Addressing modes & Operands		
66		A6: Implementation of ARM7TDMI-ISA to Block transfer of data items, Find sum of N data items in the memory		
67		L7: ARM Instruction Set and Sample Programs		
68		L7: ARM Instruction Set and Sample Programs		
69		Instruction Set: Encoding, Operations, Control Flow		
70		Instruction Set: Encoding, Operations, Control Flow		
71		3 and 5 stage Pipe Lining		
72		3 and 5 stage Pipe Lining		
73		Pipeline Hazards		
74		Pipeline Hazards		

75		A7: Consider the following sequence of instructions in MIPS architecture.
		LDR R1, [R2,#40]
		ADD R2, R3, R3
		ADD R1, R1, R2
		STR R1, [R2,#20]
		a. Find all dependencies in this instruction sequence.
		b. Find all hazards in this instruction sequence for a five stage pipeline with and without data forwarding.
		c. Find whether NOPs are required to be introduced inspite of data forwarding in this instruction sequence		

76		L8: ARM Instruction Set and Sample Programs		
77		L8: ARM Instruction Set and Sample Programs		
78		Stalling & Forwarding		
79		Branch Prediction		
80		Branch Prediction		
81		Cache Memory Basics		
82		Direct Mapped and Set Associatice Cache Memories		
83		Direct Mapped and Set Associatice Cache Memories		
84		Direct Mapped and Set Associatice Cache Memories		
85		Direct Mapped and Set Associatice Cache Memories		

86		A8: Consider the following sequence of instructions in MIPS architecture.
		LDR R1, [R6,#40]
		BEQ R2, R3, LABEL2 ; BRANCH TAKEN
		ADD R1, R6, R4
		LABEL2:BEQ R1,R2, LABEL1 ; BRANCH NOT TAKEN
		STR R2,[R4, #20]
		AND R1, R1, R4
		
		a. Draw the pipeline execution diagram for this code, assuming there are no delay slots and that branches execute in the EX stage.
		b. Repeat the exercise mentioned in a and draw the		

		pipeline execution diagram for this code, assuming that delay slots are used by writing a “SAFE INSTRUCTION” in the delay slot.		
87		L9: PARACHACHE Simulator & Cache Performace Optimisation		
88		L9: PARACHACHE Simulator & Cache Performace Optimisation		
89		Cache Performance (ARM & X86 Case studies)		
90		Cache Performance (ARM & X86 Case studies)		
91	T2: Sec 1.9 ,Sec 3.1, 4.1 Handouts	Memory Hierarchy	25%	100%
92		Memory Hierarchy		
93		Address Translation		
94		Address Translation		
95		Address Translation		
96		L10: Cycle Accurate Instruction Set Simulation with Pipelining		
97		L10: Cycle Accurate Instruction Set Simulation with Pipelining		
98		Interrupts and Virtual Memory		
99		Interrupts and Virtual Memory		
100		Interrupts and Virtual Memory		
101		Page Table andTLB		
102		Page Table andTLB		
103		Page Table andTLB		
104		Page Replacement policies		
105		Page Replacement policies		
106		I/O Systems		
107		Advanced Micro Architectures		
108		Advanced Micro Architectures		
109		Flynn's Taxonomy and Multicore Architectures		
110		Flynn's Taxonomy and Multicore Architectures		
111		Flynn's Taxonomy and Multicore Architectures		
112-120		Project Work		

Tool/ Languages: ARM Simulator, Verilog IDEs, FPGA programming Tools, ARM Dev Kit and IDE's

Text Books:

1. “Digital Design and Computer Architecture - Arm Edition “, Sarah L Harris and David Money Harris, , Morgan Kaufmann, 2016
2. "Computer Architecture : A Quantitative Approach”, J L Hennessey, D A Patterson, 5th Edition,

Morgan Kaufmann, 2011

References:

1. "The Definitive Guide to ARM Processors", Joseph Yiu, 2nd Edition, Newnes, 2015
2. "ARM System-on-Chip Architecture", Steve Furber, 2nd Edition, Pearson, 2015
3. Computer Organization, Carl Hamacher, SafwatZaky, ZvonkoVranesic, Fifth Edition,Mc Graw Hill,2002
4. "Computer Organisation and Design", David A Patterson, John L Hennessey,5th Edftion, Elesevier, 2016
5. "Computer Systems for Programmers – A Programmer's Perspective", Randal E Bryant, David R O'Hallaron, 3rd Edition, Pearson, 2019

Data Structures and its Application – UE22CS252A (5-0-2-5-5)

# of Sessions: 112

Class #	Unit # Chapter Title/Reference Literature	Topics to be Covered	% of Portion covered	
			% of Syllabus	Cumulative %
1	Unit 1: Linked List and Stack T1/R1	Overview of the C, Introduction to Data Structures.	25	25
2		Pointers, Structures		
3		Functions & Recursion		
4		Static and Dynamic Memory Allocation		
5		Abstract Data Type (ADT), List as an ADT, List as a data structure		
6		List Implementation using Array.		
7,8		**LAB-1**		
9		Singly Linked List (SLL) insert operations: beginning, end		
10		SLL : insert & delete at a specified position, destroy list operation		
11		SLL delete operations: beginning, end, at a specified position		
12		SLL Operations : other operations like search operation, concatenate etc..		
13		Doubly Linked List (DLL) insert operations: beginning, end, at a specified position, destroy list operation		
14		DLL delete operations: beginning, end, at a specified position, search operation		
15,16		**LAB 2**		
17		Ordered Double Linked List		
18		Circular Singly Linked List		
19		Circular Doubly Linked List		
20		Sparse matrix and its representation using Multi list, Case Study – Skip List		
21		Basic structure of a stack, stack using arrays		

22		Stack using linked list.		
23,24		**LAB 3**		
25		Applications of stack: Function execution, Nested functions.		
26		Applications of stack: Conversion of an expression from Infix to postfix / prefix		
27		Applications of stack: Evaluation of a postfix expression using stack		
28		Applications of stack:Parenthesis matching using stack		
29	Unit 2 – Queue & Binary Trees T1/R1	Basics of Queue Data Structure, Linear Queue using Array.	**25**	**50**
30		Queue using Linked List		
31,32		**LAB-4**		
33		Circular queue using array and linked list		
34		Priority queue using array		
35		Priority queue using linked list		
36		Double ended queue (Deque) using array and linked list		
37		Other Queue Operations : Stacks usig Queue, Queue using Stacks		
38		Applications of Queue: Case Study – Josephus problem		
39,40		**LAB 5**		
41		Binary Tree and Binary Search Tree (BST) : definition, properties		
42,43		Binary Trees using Dynamic Memory Allocation.		
44		n-ary tree, Forest, conversion of an n-ary tree and Forest to Binary Tree		
45		BST using arrays		
46		BST using Linked List		
47,48		**LAB 6**		
49		BST Traversal: Inorder, preorder, postorder.		
50		Other tree operations-finding the height, depth, count no of nodes, leaf nodes		
51,52		Node deletion operation on a Binary Search Tree		
53,54		Binary Search Tree Traversals using iteration.		
56,57		**LAB-7**		

58,59		Revision / HALP		
60,61	Unit 3 – Application of Trees , Basics of Graphs T1/R1	Expression Tree	**25**	**75**
62,63		Threaded Binary Tree		
64		Heap Tree and its properties		
65,66		**LAB-8**		
67		Heap using Array - Bottom up Heap construction		
68,69		Heap using Array – Top dowm Heap Construction		
70		Priority Queue using min and max heap		
71		Balanced Tree : Definiation, AVL Tree		
72,73		**LAB 9**		
74,75		Rotation in AVL Tree		
76		Splay Tree		
77		Graphs: Introduction, properties.		
78		Graphs : Types og Graphs, Applications and Representation		
79		Graphs using adjacency matrix and Adjacency List		
80,81		**ASSIGNMENT / Mini Project**		
82		Graph Traversal Techniques – DFS & BFS with examples		
83		Depth First Search (DFS) traversal of a graph		
84		Breadth first search (BFS) traversal of a graph		
85		HALP/Revision		
87	Unit 4: Applications of Graph, Hashing, Trie ,Suffix Trees T1/R1	Application of BFS and DFS: Connectivity of graph	**25**	**100**
88		Application of BFS and DFS: finding path in a network		
89		Application of BFS and DFS: To check if there exists a cycle in a given graph.		
90,91		**LAB 10**		
92,93		Case Study: Indexing in databases (B Tree: K-way tree), Introduction, Properties		
94,95		Hashing: Simple mapping, hash function, hash table		
96		Collision handling using seperate Chaining.		
97,98		**LAB 11**		
99,100		Collision handling using linear and quadratic		

		probing.		
101,102		Collision handling using double hashing and rehashing.		
103,104		Introduction to Trie trees, properties, Application.		
105,106		**LAB-12**		
107		Trie trees: Insert & Search, Delete		
108		Application of Trie : Display the words in a trie in lexicographic order, Prefix based search, multi pattern search		
109		Application of Trie : Word Prediction, Auto Complete Feature		
110		Suffix Tree : Introduction, Properties, Construction.		
111		**Mini Project/ Assignment**		
112		Revision/ HALP		

Tool/ Languages: C Programming Language

Text Book:

1. “Data Structures using C / C++” , Langsum Yedidyah, Moshe J Augenstein, Aaron M Tenenbaum Pearson Education Inc, 2nd edition, 2015.

Reference Book:

1. “Data Structures and Program Design in C”, Robert Kruse, Bruce Leung, C.L Tondo, Shashi Mogalla, Pearson, 2nd Edition, 2019.

Evaluation Policy

	Conducted	**Scaled to**
ISA -1 (Unit 1 & Unit 2)	40	20
ISA -2 (Unit 3 & Unit 4)	40	20
Experiential Learning / HALP (Assignment +Mini Project)	20	10
Lab (Total 10 Labs)	10	20
ESA	**100**	**50**
Total		**120(scaled to 100)**

STATISTICS FOR DATA SCIENCE (4–0–0–4)

Subject Code: UE22CS241A **No. of Hours: 84**

Class #	Chapter Title/Reference Literature	Topics to be covered	% of Portion	
			% of syllabus	Cumulative
1.	**Unit: 1** **Introduction to Data Science and Data Visualization** **T1: Chapter 1 1.1-1.3**	**Introduction to Data Science:** Motivating Examples and Scope	25	21
2.		**Sampling:** Introduction, Sample, Population		
3.		Types of population – Tangible, Conceptual. (1.1)		
4.		Sampling Methods (1.1)		
5.		Sampling Errors – Handout 1		
6.		**Hands on session: Purpose and Components of Python- A quick recap,**		
7.		**Getting and Analyzing Data:** Scraping the Web (Handout 2) **Hands on Session-Web Scraping with Beautiful Soup**		
8.		**Getting and Analyzing Data:** Reading Files (.csv) (Handout 3) **Hands on Session Reading Files with Pandas**		
9.		**Data Cleaning:** Need for Data Cleaning, Basics of Data Cleaning.(Handout 4) **Hands on Session- Data Cleaning with Pandas**		
10.		**Statistics :**Introduction, Types of Statistics, Summary Statistics(1.2)		
11.		Types of Data, Types of Experiments – Controlled and Observational study (1.1)		
12.		Summary Statistics (cont.), Statistic and Parameter.(1.2)		
13.		**Data Visualization and Interpretation :** **Graphical summaries -** Histogram – Equal and Unequal Widths (1.3) **Hands on Session-Data Visualization with Matplotlib and Seaborn**		
14.		Visualizing Data: Box Plots (1.3) **Hands on Session-Data Visualization with Matplotlib and Seaborn**		
15.		**Tutorial 1: Sample Exercise Problem Solving**		
16.		**Visualizing Data:** Line Plots, **Hands on Session-Data Visualization with Matplotlib and Seaborn**		
17.		Visualizing Data: Bar Charts, Scatter plots – Handout 5, **Hands on Session-Data Visualization with Matplotlib and Seaborn**		

18.		Heat Maps-Handout 6 **Hands on Session-Data Visualization with Matplotlib and Seaborn**		
19.		Good vs. Bad Visualization.(Handout 7)		
20.		**Tutorial 1: Sample Exercise Problem Solving**		
21.		**Case Study : Real world Application**		
22.	**Unit: 2** **Applications of Probability Distributions and Principles of Point Estimation** **T1: Chapter 2 2.4 -2.5 Chapter 4 4.1 – 4.3, 4.5, 4.9 – 4.11**	**Applications of Probability Distributions and Principles of Point Estimation:** Introduction	51	43
23.		Chebyshev's inequality (2.4),		
24.		Linear Functions of Random variables(2.5)		
25.		Independent Random Variables		
26.		Normal Probability Plots(4.10)		
27.		Normal Probability Plot (4.10) **Hands on session**		
28.		Introduction Generation of Random Variates		
29.		Techniques for Generation of Random Variates		
30.		Generation of Random Variates with applications		
31.		Sampling Distribution **Hands on Session**		
32.		The Central Limit Theorem		
33.		The Central Limit Theorem and Applications, (4.11) **Hands on session**		
34.		Principles of Point Estimation:Introduction		
35.		Mean Squared Error for Bernoulli, Binomial,		
36.		Mean Squared Error for Poission, Normal		
37.		Maximum Likelihood Estimate for Bernoulli, Binomial		
38.		Maximum Likelihood Estimate for Poission, Normal		
39.		**Tutorial 2: Sample Exercise Problem Solving**		
40.		**Tutorial 2: Sample Exercise Problem Solving**		
41.		**Case Study : Real world Application**		
42.		**Revision Unit-1**		
43.		**Revision Unit-2**		
44.	**Unit: 3** **Confidence Intervals and Hypothesis Testing** **Chapter 5 5.1-5.4,5.7 T1: Chapter 6**	**Confidence Intervals:** Introduction,	75	63
45.		Interval estimates foe Mean of Large and Small Samples,		
46.		Probability versus Confidence		
47.		Determining the Sample Size Needed for a Confidence Interval of Specified Width		
48.		Interval estimates for proportion of large samples. (5.2)		
49.		Interval estimates for proportion of Small Samples.(5.3)		
50.		Student's t Distribution **Hands on session**		
51.		Confidence Intervals for the Difference between Two Means for large samples(5.4),		

52.	**6.1 – 6.3, 6.5,**	Confidence Interval estimates for paired data.(5.7)		
53.		Factors affecting Margin of Error.(Handout 11) **Hands on session**		
54.		**Hypothesis Testing:** Introduction (6.1)		
55.		Hypothesis testing for a Population Mean (6.1)		
56.		Drawing conclusions from the results of Hypothesis tests(6.2)		
57.		Relationship between Hypothesis Tests and Confidence Intervals		
58.		Population proportion of Large samples (6.3)		
59.		Population proportion of Small samples		
60.		Large - Sample tests for Difference between two means (6.5)		
61.		**Hands on session :Hypothesis Testing**		
62.		**Tutorial 3: Sample Exercise Problem Solving**		
63.		**Case Study : Real world Application**		
64.	**Unit: 4 Distribution Free Tests and Linear Regression** **T1: Chapter 6 6.9, 6.10, 6.12** **T1: Chapter 6 6.13** **T1: Chapter 7 7.1 – 7.4**	Distribution Free Tests. (6.9)	100	84
65.		Chi-squared Test.(6.10)		
66.		The Chi-Square Test for Homogeneity and for Independence		
67.		Fixed Level Testing (6.12)		
68.		Critical Points and Rejection Regions		
69.		Type I and Type II Errors (6.12)		
70.		Power of a Test.(6.13)		
71.		Factors affecting Power of a Test.(Handout 12)		
72.		**Simple Linear Regression:** Introduction		
73.		Correlation.(7.1)		
74.		The Least squares Line.(7.2)		
75.		Predictions using regression models		
76.		Uncertainties in Regression Coefficients.(7.3)		
77.		Checking Assumptions and transforming data.(7.4)		
78.		The Multiple Regression Model		
79.		The Statistics s2 , R2 , and F		
80.		**Hands on session on Linear regression contd.**		
81.		**Tutorial 4: Sample Exercise Problem Solving**		
82.		**Case Study : Real world Application**		
83.		**Revision Unit-3**		
84.		**Revision Unit-4**		

Literature:

Book Type	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Text Book	T1	Statistics for Engineers and Scientists, William Navidi.	4th	McGraw Hill Education, India	2013
Reference Book	T2	The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation, and Modeling, Raj Jain		Wiley	2008
Reference Book	T3	Data Science From Scratch, Joel Grus	1st	O'Reilly	2015
Reference Book	T4	Sampling- Design and Analysis, Sharon L. Lohr	2nd	Cengage	2010
Reference Book	T5	Statistics for Engineers and Scientists, William Navidi.	3rd	McGraw Hill Education, India	2010

Tools / Languages/Libraries Covered:

UE22CS242A - WEB TECHNOLOGIES (4:0:0:4:4)

Course Information

Web Technologies course demonstrates an in-depth understanding of the technologies necessary for designing and developing a rich web application in an efficient way.

Course Outcomes:

At the end of the course, the student will be able to,

1. Understand basic web technologies like HTML, CSS and JavaScript
2. Achieve rich user experience by implementing HTML5 features and Asynchronous communication using AJAX and JQuery
3. Understand MERN stack layers (MongoDB, ExpressJS, ReactJS and NodeJS) and create rich User Interface using React JS
4. Integrate the UI with MongoDB database through NodeJS and create RESTful Web services using ExpressJS

# of Credits: 4 **# of Hours: 63**

Class #	Chapter Title/Reference Literature	Topics to be Covered	% of Portions Covered	
			% of Syllabus	Cumulative %
1.	**UNIT 1(14 hours)**	Introduction to Web Architecture and Web protocols (HTTP Request Response Formats, URLs)	**25%**	**25%**
2.		Basic Mark-ups & syntax		
3.		HTML elements & attributes		
4.		Web Form 2.0 & Form Controls		
5.		HTML5 (New Tags, Inputs, Elements and Controls)		
6.		CSS3.0-Styles and Style sheets		
7.		Selectors		
8.		Style properties		
9.		Box Model and Positioning		
10.		JavaScript Basics(Variables, Scope)		
11.		JavaScript Basics: Functions, Hoisting		
12.		JavaScript Built-in Objects		
13.		JavaScript Objects		
14.		Prototypal Inheritance		
15.		DOM Manipulations		
16.		DOM Manipulations Examples		
17.		Events		
18.		Event Handling in JavaScript		
19.		Event Handling Examples		
20.		Assignment -1		
21.				
22.	**UNIT 2(14 hours)**	HTML5 (APIs),	**25%**	**50%**
23.		Audio, Video and Progress		
24.		Audio, Video and Progress		
25.		Canvas, SVG		

26.		File api, geolocation,		
27.		web workers		
28.		JQuery (Introduction, Handling events)		
29.		JQuery (Introduction, Handling events)		
30.		Callbacks & Promises		
31.		Callbacks & Promises		
32.		Single Page Application		
33.		XML Vs JSON		
34.		Asynchronous Communication- XHR (properties and methods)		
35.		Asynchronous Communication- XHR (properties and methods)		
36.		$.ajax,$.get,$.post, $load		
37.		Fetch API		
38.		ReactJS - MERN Introduction		
39.		React Classes and Components		
40.		React Component Styling		
41.		Assignment -2		
42.				
ISA 1 and ISA 2				
43.	**UNIT 3(14 hours)**	Complex components	**25%**	**75%**
44.		Properties, States and Context		
45.		Component lifecycle methods		
46.		Stateless components		
47.		Refs		
48.		Keys		
49.		Event Handling		
50.		React Hook		
51.		React Hook		
52.		Understanding Node JS Architecture		
53.		Set up Node JS app		
54.		Node Modules		
55.		Node Modules		
56.		Buffers,		
57.		Streams,		
58.		File system		
59.		HTTP Module		
60.		Handling HTTP Requests - 2		
61.		Programming Examples		
62.		Assignment -3		
63.				
64.	**UNIT 4(14 hours)**	Mongo DB- Documents, Collections	**25%**	**100%**
65.		Mongo DB- Documents, Collections		
66.		Reading to DB		
67.		Writing to DB		
68.		MongoDB Node JS Driver		
69.		Running a react application on NodeJS (Hands-on)		
70.		React Router		
71.		ExpressJS - Introduction to Web services		
72.		REST API's		
73.		Express Framework Overview		

74.		Express Framework Overview		
75.		Routing		
76.		URL Binding		
77.		Error Handling		
78.		Express Middleware		
79.		Form Data		
80.		File Upload		
81.		Programming Examples		
82.		Programming Examples		
83.		Assignment -4		
84.				
ISA 3 and ISA 4				

Tools / Languages:
HTML, CSS, JavaScript and MERN Technologies

Books:

Book Type	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Text Book	T1	Learning PHP, MySQL & JavaScript, 5th Edition. by Robin Nixon. May 2018, O'Reilly Media, Inc. ISBN: 9781491978917	2nd	Wiley Publishing	2018
Text Book	T2	Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node by Vasan Subramanian. March 2017, Apress	1st	O'Reilly	2017
Reference Book	R1	Beginning Node.js, Express & MongoDB Development by Greg Lim, July 2019	1st	McGraw Hill	2019
Reference Book	R2	Learning React, Functional Web Development with React and Redux By Alex Banks and Eve Porcello, May 2017, O'Reilly Media	1st	O'Reilly Media	2017

Course Plan Summary	Hours	Classes
Units Distribution	57	76
Assignments (4 Nos.)	6	8
Total	**63**	**84**

PES UNIVERSITY, Bangalore

(Established under Karnataka Act No. 16 of 2013)

Department of Computer Science & Engineering

UE22CS243A: Automata Formal Language and Logic

Course Information

Sessions	Unit	Topic	Chapter & Section	% Coverage	
				Unit	Total
1	1	Mathematical Preliminaries	T1-1.1	25	25
2		Basic Notations	T1-1.2		
3		Deterministic Finite Acceptors	T1-2.1		
4					
5					
6					
7					
8		Non -Deterministic Finite Acceptors, λ-NFA	T1-2.2		
9					
10		Equivalence of Deterministic and Non-deterministic Finite Acceptors	T1-2.3		
11					
12		Reduction of the number of states in Finite Automata (Minimization of DFA)	T1-2.4		
13					
14					
15		Regular Expressions	T1-3.1		
16					
17		Connection between Regular Expressions Regular Languages	T1-3.2		
18					
19		Regular Grammars	T1-3.3		
20					
21	2	Properties of Regular Languages	T1-4.1, 4.2	25	50
22					
23		Pumping Lemma and identifying Non–Regular Languages	T1-4.3		
24					
25					
26					
27		Context Free Grammars	T1-5.1		
28					
29					
30					
31		Formal Definitions of Pushdown Automata	T1-7.1		
32					
33		Deterministic Pushdown Automata	T1-7.3		
34					
35					
36		Non-Deterministic Pushdown Automata	T1-7.1		
37					
38					
39		Unit-1 revision			
40		Unit-1 revision			
41		Unit-2 revision			

PES UNIVERSITY, Bangalore

(Established under Karnataka Act No. 16 of 2013)

Department of Computer Science & Engineering

42		Unit-2 revision			
	ISA-1				
43	3	Parsing and Ambiguity	T1-5.2	25	75
44		Methods for Transforming Grammars	T1-6.1		
45					
46		Two important Normal Forms	T1-6.2		
47					
48		A Membership Algorithm for Context–Free Languages	T1-6.3		
49					
50		Pushdown down Automata and Context Free Languages	T1-7.2		
51					
52		Properties of Context–Free Languages	T1-8.2		
53					
54		Pumping Lemma for Context–Free Languages	T1-8.1		
55					
56		The Standard Turing Machine	T1-9.1		
57					
58					
59					
60		Combining Turing Machine for Complicated Tasks	T1-9.2		
61					
62		Turing Thesis	T1-9.3		
63		Recursive and Recursively Enumerable Languages	T1-11.1		
64	4	Context Sensitive Grammar and Languages	T1-11.3	25	100
65					
66		The Chomsky Hierarchy	T1-11.4		
67		Some Problems that Cannot be solved by Turing Machine, PCP	T1-12.1, 12.3		
68					
69		Propositional Logic: A very simple logic	T2-7.4		
70		Syntax	T2-7.4.1		
71		Semantics	T2-7.4.2		
72		A simple knowledge Base	T2-7.4.3		
73		A simple Inference procedure	T2-7.4.4		
74		Inferences and Proofs	T2-7.5.1		
75					
76		Proof by resolution	T2-7.5.2		
77		First Order Logic: Syntax and Semantics of First order logic	T2-8.2		
78					
79		Numbers, Sets and Lists	T2-8.3.3		
80		Example - The electronic circuit Domain	T2-8.4.2		
81		Unit-3 revision			
82		Unit-3 revision			
83		Unit-4 revision			
84		Unit-4 revision			
	ISA-2				

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Department of Computer Science & Engineering

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