Effective from 1st July 2025

Department of CS&E and IT, JIIT Noida

2024 onwards Curriculum for B. Tech. in Computer Science & Engineering

Category – **BSC:** Basic Science Courses, **ESC:** Engineering Science Courses including Workshop, Drawing, etc., **HSC:** Humanities & Social Sciences including Management Courses, **PCC:** Professional Core Courses, **PEC:** Professional Elective Courses Relevant to Chosen Specialization/Branch, **OEC:** Open Subjects–Electives, **PRC:** Project Work, Seminar & Internship, **OMC:** Mandatory Courses

FIRST SEMESTER

S. No.	Course			Contact Hours				Credits
	Category	Course Code	Course Title	L	T	P	Total	
1	BSC	15B11MA111	Mathematics-1	3	1	0	4	4
2	BSC	15B11PH111	Physics-1	3	1	0	4	4
3	BSC	15B17PH171	Physics Lab-1	0	0	2	2	1
4	ESC	15B11CI111	Software Development Fundamentals-I	3	1	0	4	4
5	ESC	24B15CS111	Software Development Fundamentals Lab-I	0	0	2	2	1
6	ESC	24B11EC111	Basic Electronics	3	1	0	4	4
7	ESC	24B15EC111	Basic Electronics Lab	0	0	2	2	1
8	HSC	15B11HS112	English	1	0	2	3	2
9	ESC	18B15GE111	Engineering Drawing & Design	0	0	3	3	1.5
Total							**28**	**22.5**

SECOND SEMESTER

S. No.	Course			Contact Hours				Credits
	Category	Course Code	Course Title	L	T	P	Total	
1	BSC	15B11MA211	Mathematics-2	3	1	0	4	4
2	BSC	15B11PH211	Physics-2	3	1	0	4	4
3	BSC	15B17PH271	Physics Lab-2	0	0	2	2	1
4	ESC	15B11CI121	Software Development Fundamentals-II	3	1	0	4	4
5	ESC	24B15CS121	Software Development Fundamentals Lab-II	0	0	2	2	1
6	HSC	24B16HS111	Life Skills & Professional Communication Lab	0	0	2	2	Qualifying
7	ESC	18B15GE112	Workshop	0	0	3	3	1.5
8	HSC	24B11HS111	Universal Human Values (UHV)	2	1	0	3	3
Total							**24**	**18.5**

THIRD SEMESTER

S. No.	Course			Contact Hours				Credits
	Category	Course Code	Course Title	L	T	P	Total	
1	BSC	25B11MA213	Mathematical Foundations for Artificial Intelligence and Data Science	3	1	0	4	4
2	PCC	24B11CS212	Theory of Computation	3	0	0	3	3
3	PCC	15B11CI311	Data Structures	3	1	0	4	4
4	PCC	15B17CI371	Data Structures Lab	0	0	2	2	1
5	PCC	24B11CS213	Database Management Systems	3	0	0	3	3
6	PCC	24B15CS213	Database Management Systems Lab	0	0	2	2	1
7	PCC	24B15CS214	Unix Programming Lab	1	0	2	3	2
8	PCC	24B15CS215	Object Oriented Programming using Java	0	0	2	2	1
9	HSC	15B11HS211	Economics	2	1	0	3	3
10	PRC	24B17CS211	Summer Training-I (4 weeks)	0	0	0	0	2
			Total				**26**	**24**

FOURTH SEMESTER

S. No.	Course			Contact Hours				Credits
	Category	Course Code	Course Title	L	T	P	Total	
1	HSC	XXXXXXX	HSS Elective – 1	2	1	0	3	3
2	PCC	25B11EC311	Digital Systems and Computer Organisation	3	0	0	3	3
	PCC	25B15EC311	Digital Systems and Computer Organisation Lab	0	0	2	2	1
3	PCC	24B11CS221	Design and Analysis of Algorithms	3	1	0	4	4
4	PCC	24B15CS221	Design and Analysis of Algorithms Lab	0	0	2	2	1
5	PCC	24B11CS222	Artificial Intelligence and Machine Learning	3	0	0	3	3
6	PCC	24B15CS222	Artificial Intelligence and Machine Learning Lab	0	0	2	2	1
7	PCC	24B11CS223	Software Engineering	3	0	0	3	3
9	PCC	24B15CS224	Competitive Programming Lab	1	0	2	3	2
10	PEC	XXXXXXX	Discipline Elective – 1	2	0	0	2	2
11	PEC	XXXXXXX	Discipline Elective – 1 Lab	0	0	2	2	1
12	OMC	19B13BT211	Environmental Studies	3	0	0	3	Qualifying
			Total				**32**	**24**

FIFTH SEMESTER

S. No.	Course			Contact Hours				Credits
	Category	Course Code	Course Title	L	T	P	Total	
1	PCC	24B11CS312	Operating Systems	3	0	0	3	3
2	PCC	24B15CS312	Operating Systems Lab	0	0	2	2	1
3	PCC	24B11CS313	Computer Networks	3	1	0	4	4
4	PCC	24B15CS313	Computer Networks Lab	0	0	2	2	1
5	PCC	24B15CS314	Full Stack Development Lab	0	0	2	2	1
6	PEC	XXXXXXX	Discipline Elective – 2	2	0	0	2	2
7	PEC	XXXXXXX	Discipline Elective – 2 Lab	0	0	2	2	1
8	PEC	XXXXXXX	Discipline Elective – 3	2	0	0	2	2
9	PEC	XXXXXXX	Discipline Elective – 3 Lab	0	0	2	2	1
10	BSC	XXXXXXX	Science Elective	3	0	0	3	3
11	OMC	18B12HS311	Indian Constitution & Traditional Knowledge	3	0	0	3	Qualifying
12	PRC	24B17CS311	Summer Training-II (6 weeks)	0	0	0	0	2
			Total				**27**	**21**

SIXTH SEMESTER

S. No.	Course			Contact Hours				Credits
	Category	Course Code	Course Title	L	T	P	Total	
1	PCC	24B11CS321	Web Technology	3	0	0	3	3
2	PCC	24B15CS321	Web Technology Lab	0	0	2	2	1
3	PCC	24B11CS322	Advanced Data Structures and Algorithms	3	0	0	3	3
4	PCC	24B15CS322	Advanced Data Structures and Algorithms Lab	0	0	2	2	1
5	PCC (FLEXI CORE)	24B11CS323 **OR** 24B11CS324	Distributed and Cloud Computing **OR** Information Security and Cryptography	3	0	0	3	3
6	PEC	XXXXXXX	Discipline Elective – 4	3	0	0	3	3
7	PEC	XXXXXXX	Discipline Elective – 5	3	0	0	3	3
8	OEC	XXXXXXX	Open Elective – 1	2	0	0	2	2
9	Value Added	XXXXXXX	Selected Value Added Course	2	0	0	2	Audit
10	HSC	24B15HS311	Soft Skill For Employability	0	0	2	2	1
11	PRC	24B17CS312	Minor Project	0	0	4	4	2
			Total				**29**	**22**

SEVENTH SEMESTER

S. No.	Course			Contact Hours				Credits
	Category	Course Code	Course Title	L	T	P	Total	
1	PEC	XXXXXXX	Discipline Elective – 6	3	0	0	3	3
2	OEC	XXXXXXX	Open Elective – 2	3	0	0	3	3
3	PRC	15B19CI791	Major Project Part – 1	0	0	0	8	4
4	PRC	24B17CS411	Summer Training - III (6 weeks)	0	0	0	0	4
			Total				**14**	**14**

EIGHTH SEMESTER

S. No.	Course			Contact Hours				Credits
	Category	Course Code	Course Title	L	T	P	Total	
1	PEC	XXXXXXX	Discipline Elective –7	3	0	0	3	3
2	OEC	XXXXXXX	Open Elective –3	3	0	0	3	3
3	PRC	15B19CI891	Major Project Part –2	0	0	0	16	8
			Total				**22**	**14**

Total Program Credits: 22.5 + 18.5 + 24 + 24 + 21 + 22 + 14 + 14 = 160

Certificate of Proficiency:

Students of B. Tech may be provided an additional certificate of proficiency in stream X* provided they fulfil the following conditions:

(a) Qualify for the award of B. Tech degree in the minimum period.

(b) Have passed in minimum of > 50% of B. Tech elective subjects** taken from the stream X.

(c) Grade Point Average in the elective subjects of (b) is > 7.0

(d) Major Project has been done in stream X with at least ‘A’ grade

(e) CGPA 160 credits for 2018-19 or later admitted batches of B. Tech level is > 6.5.

* There are total five proficiency areas offered by the CS&E and IT Dept. Students may choose at least five (i.e. >50%) courses out of their seven Discipline Electives (DE1 to DE7) to avail the opportunity of earning proficiency area certificate subject to fulfillment of above clauses

**List of such electives is provided under the head, “List of Proficiency Areas and Courses”

Department of CS&E and IT, JIIT Noida

Bucket Wise Tentative List of Discipline Electives **(To be updated time to time)**

Discipline Elective – 1 and Discipline Elective – 1 Lab (offered in 4th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	25B12CS211	Fundamentals of Data Analytics	2	0	0	2	2
2	25B12CS212	Fundamentals of Mobile Application Development	2	0	0	2	2
3	25B12CS213	Fundamentals of Smart Systems and IoT	2	0	0	2	2
4	XXXXXXX	Introduction to Compiler Design	2	0	0	2	2
5	25B16CS211	Fundamentals of Data Analytics Lab	0	0	2	2	1
6	25B16CS212	Fundamentals of Mobile Application Development Lab	0	0	2	2	1
7	25B16CS213	Fundamentals of Smart Systems and IoT Lab	0	0	2	2	1
8	XXXXXXX	Introduction to Compiler Design Lab	0	0	2	2	1

Discipline Elective – 2 and Discipline Elective – 2 Lab (offered in 5th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	XXXXXXX	Fundamentals of Soft Computing	2	0	0	2	2
2	XXXXXXX	Fundamentals of Computer and Cyber Security	2	0	0	2	2
3	XXXXXXX	Data Mining and Data Warehousing	2	0	0	2	2
4	XXXXXXX	Agile Software Development Process	2	0	0	2	2
5	XXXXXXX	IoT Analytics	2	0	0	2	2
6	XXXXXXX	Fundamentals of Soft Computing Lab	0	0	2	2	1
7	XXXXXXX	Fundamentals of Computer and Cyber Security Lab	0	0	2	2	1
8	XXXXXXX	Data Mining and Data Warehousing Lab	0	0	2	2	1
9	XXXXXXX	Agile Software Development Process Lab	0	0	2	2	1
10	XXXXXXX	IoT Analytics Lab	0	0	2	2	1

Discipline Elective – 3 and Discipline Elective – 3 Lab (offered in 5th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	XXXXXXX	Image Processing and Computer Vision	2	0	0	2	2
2	XXXXXXX	Introduction to Blockchain Technology	2	0	0	2	2
3	XXXXXXX	Computing for Data Science	2	0	0	2	2
4	XXXXXXX	Sensor Technology & Android Programming	2	0	0	2	2
5	XXXXXXX	Concept of Graph Theory	2	0	0	2	2
6	XXXXXXX	Image Processing and Computer Vision Lab	0	0	2	2	1
7	XXXXXXX	Introduction to Blockchain Technology Lab	0	0	2	2	1
8	XXXXXXX	Computing for Data Science Lab	0	0	2	2	1
9	XXXXXXX	Sensor Technology & Android Programming Lab	0	0	2	2	1
10	XXXXXXX	Concept of Graph Theory Lab	0	0	2	2	1

Discipline Elective – 4 (offered in 6th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	18B12CS428	Introduction to Deep Learning	3	0	0	3	3
2	22B12CS419	Cryptocurrency Technologies	3	0	0	3	3
3	16B1NCI648	Information Retrieval and Semantic Web	3	0	0	3	3
4	22B12CS422	Cloud Computing Essentials: Azure and AWS	3	0	0	3	3

Discipline Elective – 5 (offered in 6th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	21B12CS417	Machine Learning and Big Data	3	0	0	3	3
2	21B12CS415	Secure Design of Software Systems	3	0	0	3	3
3	21B12CS413	Fog and Edge Computing	3	0	0	3	3

Discipline Elective – 6 (offered in 7th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	17B1NCI731	Machine Learning and Natural Language Processing	3	0	0	3	3
2	21B12CS418	Ethical Hacking & Prevention	3	0	0	3	3
3	21B12CS314	Introduction to Large Scale Database Systems	3	0	0	3	3
4	19B12CS427	Introduction to DevOps	3	0	0	3	3
5	22B12CS411	Industrial Automation and IOT	3	0	0	3	3

Discipline Elective – 7 (offered in 8th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	22B12CS415	AI for Healthcare & Smart Systems	3	0	0	3	3
2	22B12CS412	Digital Forensics and Cyber Laws	3	0	0	3	3
3	15B1NCI732	Social Network Analysis	3	0	0	3	3
4	22B12CS420	Software Construction using Kubernetics and Micro-services	3	0	0	3	3

Value Added Course (offered in 6th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	25B18CS311	Advanced Data Structures and Algorithms Workshop	1	0	2	3	Audit
2	25B18CS312	GenAI Workshop	1	0	2	3	Audit
3	25B18CS313	Advanced Java Programming Workshop	1	0	2	3	Audit
4	25B18CS314	Ethical Hacking Workshop	1	0	2	3	Audit

Department of CS&E and IT
Proficiency Areas & Courses (2024 onwards curricula)

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(a) Qualify for the award of B. Tech degree in the minimum period.

(b) Have passed in minimum of > 50% of B. Tech elective subjects** taken from the stream X.

(c) Grade Point Average in the elective subjects of (b) is > 7.0

(d) Major Project has been done in stream X with at least 'A' grade

(e) CGPA 160 credits for 2018-19 or later admitted batches of B. Tech level is > 6.5.

* There are total five proficiency areas (detailed subsequently as P1, P2, P3, P4, and P5) offered by the CS&E and IT Dept. Students may choose at least five (i.e. >50%) courses out of their seven Discipline Electives (DE1 to DE7) to avail the opportunity of earning proficiency area certificate subject to fulfillment of above clauses

**List of such electives is provided under the head, "List of Proficiency Areas & Courses"

List of Proficiency Areas & Courses

P1: Artificial Intelligence and Machine Learning

P2: Information and Cyber Security

P3: Data Science and Analytics

P4: Solution Architecture

P5: Smart Systems

Departmental Electives:

DE1 (4th Sem); **DE2, DE3** (5th Sem); **DE4, DE5** (6th Sem); **DE6** (7th Sem); **DE7** (8th Sem)

S No	DE#	Elective Name	Course Code					
				P1	P2	P3	P4	P5
1	DE1	Fundamentals of Data Analytics	25B12CS211			Y		
2	DE1	Fundamentals of Mobile Application Development	25B12CS212				Y	
3	DE1	Fundamentals of Smart Systems and IoT	25B12CS213					Y
4	DE1	Fundamentals of Data Analytics Lab	25B16CS211			Y		
5	DE1	Fundamentals of Mobile Application Development Lab	25B16CS212				Y	
6	DE1	Fundamentals of Smart Systems and IoT Lab	25B16CS213					Y
7	DE2	Fundamentals of Soft Computing	XXXXXXX	Y				
8	DE2	Fundamentals of Computer and Cyber Security	XXXXXXX		Y			
9	DE2	Data Mining and Data Warehousing	XXXXXXX			Y		
10	DE2	Agile Software Development Process	XXXXXXX				Y	
11	DE2	IoT Analytics	XXXXXXX					Y
12	DE2	Fundamentals of Soft Computing Lab	XXXXXXX	Y				
13	DE2	Fundamentals of Computer and Cyber Security Lab	XXXXXXX		Y			
14	DE2	Data Mining and Data Warehousing Lab	XXXXXXX			Y		
15	DE2	Agile Software Development Process Lab	XXXXXXX				Y	
16	DE2	IoT Analytics Lab	XXXXXXX					Y

17	DE3	Image Processing and Computer Vision	XXXXXXX	Y				
18	DE3	Introduction to Blockchain Technology	XXXXXXX		Y			
19	DE3	Computing for Data Science	XXXXXXX			Y		
20	DE3	Sensor Technology & Android Programming	XXXXXXX					Y
21	DE3	Image Processing and Computer Vision Lab	XXXXXXX	Y				
22	DE3	Introduction to Blockchain Technology Lab	XXXXXXX		Y			
23	DE3	Computing for Data Science Lab	XXXXXXX			Y		
24	DE3	Sensor Technology & Android Programming Lab	XXXXXXX					Y
25	DE4	Introduction to Deep Learning	18B12CS428	Y				
26	DE4	Cryptocurrency Technologies	22B12CS419		Y			
27	DE4	Information Retrieval and Semantic Web	16B1NCI648			Y		
28	DE4	Cloud Computing Essentials: Azure and AWS	22B12CS422					Y
29	DE5	Machine Learning and Big Data	21B12CS417	Y		Y		
30	DE5	Secure Design of Software Systems	21B12CS415		Y		Y	
31	DE5	Fog and Edge Computing	21B12CS413					Y
24	DE6	Machine Learning and Natural Language Processing	17B1NCI731	Y				
25	DE6	Ethical Hacking & Prevention	21B12CS418		Y			
26	DE6	Introduction to Large Scale Database Systems	21B12CS314			Y		
27	DE6	Introduction to DevOps	19B12CS427				Y	
28	DE6	Industrial Automation and IOT	22B12CS411					Y
29	DE7	AI for Healthcare & Smart Systems	22B12CS415	Y				Y
30	DE7	Digital Forensics and Cyber Laws	22B12CS412		Y			
31	DE7	Social Network Analysis	15B1NCI732			Y		
32	DE7	Software Construction using Kubernetics and Micro-services	22B12CS420				Y	

B.Tech. in Computer Science & Engineering (BTech-CSE) - 2024 Onwards Curricula

Course Outlines (Core Courses)

Core Courses offered by Dept. of CS&E and IT in First Semester of BTech-CSE

1. 15B11CI111 - Software Development Fundamentals – 1 (3-1-0)

Software development life cycle, step by step solutions to simple problems, developing logic/flow-chart/pseudo-code to solve problems like logical games, puzzles, etc. **[6 Lectures]**; Programming in C – general introduction and structure of a C program, variables, constants, data types, operators, and control flow **[9 Lectures]**; Array in C programming, 1D/2D array and related operations, searching (linear and binary) and sorting algorithms (bubble, selection, and insertion) on array; Strings and related operations in C programming **[9 Lectures]**; Functions in C programming, functions using pass by value & pass by reference, recursive functions **[4 Lectures]**; Structures and Union in C Programming, array of structures, structures using function **[4 Lectures]**; Pointers in C, arithmetical operations on pointers, functions using pass by reference, dynamic memory allocation for arrays and structures **[6 Lectures]**; File Handling in C programming, different types of files like binary file and text file, creation of files using different modes and respective operations, end of file, traversing the file for structured and unstructured data **[4 Lectures]**.

Total: 42 Lectures

2. 24B15CS111 - Software Development Fundamentals – 1 Lab (0-0-1)

Developing logic/flow-chart/pseudo-code to solve problems like games, puzzles, etc. **[2 Labs]**; Writing C programs involving, variables, constants, data types, operators, operators precedence, associativity, conditional statements (if, if-else, switch case, etc.) and iterative control statements (do-while, while, and for) **[3 Labs]**; Implementation of 1D/2D array in C programming, implementation of different operations on 1D/2D array like, initialization, traversal, addition, multiplication, transpose, searching, sorting, etc.; strings, and related operations **[2 Labs]**; Implementation of functions in C programming, user defined functions and inbuilt functions, function calling using pass by value, recursive functions to solve problems, like palindrome, factorial, Fibonacci series **[2 Labs]**; Implementation of structure and union in C, structure variable, dot and arrow operators, array of structures, structure using functions **[2 Labs]**; Writing C programs involving pointers, arithmetical operations on pointers, dynamic memory allocation for 1D/2D array and structures, functions using pass by reference **[2 Labs]**; Creating files in C programming using different modes of file handling, performing operations on files, like read, write, update, close, and traverse the file for structured and unstructured data **[1 Lab]**

Total: 14 Labs

Core Courses offered by Dept. of CS&E and IT in Second Semester of BTech-CSE

3. 15B11CI121 - Software Development Fundamentals – II (3-1-0)

Procedural and object-oriented programming approaches, characteristics of object-oriented languages, separation of behavior and implementation **[1 Lecture]**; Object-oriented programming using C++: Objects, classes, constructors, destructors, function & operator overloading, static & friend functions and classes **[8 Lectures]**; Inheritance in C++, method overriding, types of inheritance, like, multiple inheritance, etc. **[3 Lectures]**; Virtual functions, abstract class, dynamic dispatch, representations of method tables, RTTI **[3 Lectures]**; Class diagram, relationships of association, aggregation, composition, and inheritance **[6 Lectures]**; Exception handling in C++, re-throwing exceptions; Function templates and their overloading, class templates; Collection classes and iteration protocols (STL) **[9 Lectures]**; Fundamentals of data structures, dynamic memory allocation, overview of linear and non-linear DS; Limitations of array and need of linked list, different types of linked list; Stack and Queue, stack and queue operations using STL; Recursion, recursion removal using stack, recursive approaches to solve problems like Tower of Hanoi, N-queen, rat in a maze, etc. **[12 Lectures]**

Total: 42 Lectures

4. 24B15CS121 - Software Development Fundamentals – II Lab (0-0-1)

Output based C++ programs to implement the concepts of Objects, Classes, Internal representations of Objects, encapsulation, Constructors, Destructors, Function and Operator Overloading, Static and Friend Functions **[3 Labs]**; Write programs in C++ to implement Inheritance, Method Overriding, Private and Public Inheritance, Multiple Inheritance **[2 Labs]**; Write programs in C++ involving Virtual Functions, Abstract Classes, Dynamic Dispatch, operator overriding, etc. **[1 Lab]**; Write programs in C++ to implement the relationships of Association, Aggregation, Composition, and Inheritance **[2 Labs]**; Write programs in C++ to handle Exceptions, Re-throwing exceptions, Function Templates, Overloading Functions Template, Class Templates, Collection classes and iteration protocols (STL) **[2 Labs]**; Programs for Dynamic Memory Allocation, Abstract Data Types; Templates and STL to implementation linear data structures like Array, Linked List, Stack and Queue; implementation of recursive algorithm to solve different problems **[4 Labs]**

Total: 14 Labs

Core Courses offered by Dept. of CS&E and IT in Third Semester of BTech-CSE

5. 24B11CS212 - Theory of Computation (3-0-0)

General introduction, Complexity theory, Computability theory, Automata theory, Mathematical preliminaries **[3 Lectures]**; Finite Automata and Regular Languages, Deterministic finite automata, Regular operations, Non-deterministic finite automata, Equivalence of DFA sand NFAs, Closure under the regular operations, Regular expressions, Equivalence of regular expressions and regular languages, The pumping lemma and non-regular languages **[14 Lectures]**; Context-Free Languages, Context-free grammars, Chomsky normal form, Push down automata, Equivalence of push down automata and context-free grammars, The pumping lemma for context-free languages **[14 Lectures]**; Turing Machines, Examples of Turing Machines, Multi-tape Turing machines **[5 Lectures]**; Decidable and Undecidable Languages; Complexity Theory, The complexity class P, The complexity class NP, Non-deterministic algorithms, NP-complete languages **[6 Lectures]**;

Total: 42 Lectures

6. 15B11CI311 - Data Structures (3-1-0)

Overview of linear data structures: array, linked list, stack, and queue **[3 Lectures]**; Searching and sorting algorithms – Interpolation Search, Median Search; Hashing – Hash Table, Chaining, Probing; Sorting – Merge, Quick, Radix, Bucket, and Count; Time and Space complexity analysis of searching and sorting algorithms **[7 Lectures]**; Implementation of Multi List, Binary Tree, K-ary Tree, Tree traversals, Threaded Binary Tree, Priority Queue using Binary Heap, Binomial Heap, and Fibonacci Heap, Heap Sort **[10 Lectures]**; Binary Search Tree (BST), Balanced BST: AVL Tree and RB Tree; Multiway Tree: B Tree and B+ Tree **[10 Lectures]**; Fundamentals of Graph, Adjacency Matrix and List; Graph Traversal using DFS and BFS, Basic Algorithms – Shortest Path and Minimum Spanning Tree **[6 Lectures]**; Interval Tree, Segment Tree, and String Data Structures: Suffix Tree, Tries, Suffix Array **[6 Lectures]**

Total: 42 Lectures

7. 15B17CI371 - Data Structures Lab (0-0-1)

Implementation of linear data structures like, array, linked lists, stack, queue and related operations, multi linked list for sparse matrix representation **[2 Labs]**; Implementation of searching and sorting algorithms like, linear search, binary Search, interpolation search, median Search; Hashing – Hash Table, Chaining, Probing; Sorting – Merge, Quick, Radix, Bucket, and Count **[2 Labs]**; Implementation of Binary Tree, K-ary Tree, Threaded Tree, Priority Queue using Binary Heap and Fibonacci Heap, Heap Sort **[3 Labs]**; Implementation of Binary Search Tree (BST), Balanced BST: AVL Tree & RB Tree; Multiway Tree: B Tree & B+ Tree **[3 Labs]**; Writing programs to traverse graph using DFS & BFS and implement the algorithms for Shortest Path and Minimum Spanning Tree **[2 Labs]**; Implementation of Interval Tree, Segment Tree, and Tries **[2 Labs]**

Total: 14 Labs

8. 24B11CS213 - Database Management Systems (3-0-0)

Fundamentals of Database and Database Management System, Physical Level of Data Storage, Structure of Relational Database, Table, Attributes, Records **[3 Lectures]**; Introduction to SQL, Data types in SQL, Operations on single table like create, insert, delete, update, alter, etc., SQL queries on single table using select statement with or without where and group by clause, etc., Overview of NoSQL databases **[9 Lectures]**; Database Design and ER Model, Entity type, Attributes, Relation types, Notations, Constraints, Extended ER Features **[4 Lectures]**; Relational Model and Structured Query Language, Data Definition and Data Manipulation, Relational Algebra **[9 Lectures]**; Procedural Language, PL/SQL, Stored Procedures, Functions, Cursors, Triggers **[4 Lectures]**; Functional Dependency & Normalization, Data Dependencies, 2NF, 3NF, BCNF, building normalized databases **[5 Lectures]**; Transaction Management, ACID properties of Transactions, Need of Concurrency, Concurrency Control Techniques, Deadlocks, Database Recovery System, Database Security and Authorization **[9 Lectures]**

Total: 42 Lectures

9. 24B15CS213 - Database Management Systems Lab (0-0-1)

Design simple SQL queries using MYSQL to apply various operations on single table like create, insert, delete, update, alter, etc., Queries on single table using select statement with or without where/ group by clause, etc. **[3 Labs]**; Simple queries, sorting results (order by clause), SQL aggregate functions, grouping results (group by clause), Subqueries, any and all, multi-table queries, exists and not exists, Combining Result Tables (union, intersect, except), database updates **[4 Labs]**; Implement the ER Diagram modelled for different problems **[2 Labs]**; Write the PL/SQL program for storing data using procedures, stored functions, cursors and Triggers **[3 Labs]**; Create databases involving different concepts of DBMS like normalization, concurrency control, security, and authorization, etc. **[3 Labs]**

Total: 14 Labs

10. 24B15CS214 - Unix Programming Lab (1-0-1)

Introduction to Unix Operating System and overview to Open Source Software, Writing C program in Unix environment using GCC compiler **[1 Lecture + 1 Lab]**; working with vi editor, vi editor and basic UNIX commands **[2 Lectures + 2 Labs]**; The UNIX file system, working with directories, input-output redirection, Pipes, Processes **[2 Lectures + 2 Labs]**; Using the Shell; Working with filters: grep, sed and awk, UNIX Shell Programming: customizing the cal command, while and until loops, traps, zap, pick and news command, get and put **[4 Lectures + 4 Labs]**; Programming with standard I/O **[3 Lectures + 3 Labs]**; UNIX System Calls: low level I/O, File system- directories, inodes, process, signals and interrupts **[2 Lectures + 2 Labs]**.

Total: 14 Lectures and 14 Labs

11. 24B15CS215 - Object Oriented Programming using Java (0-0-1)

Introduction to Java and its features, Functioning of JVM and JDK, Structure of class and primitive data types in Java **[1 Lab]**; Implementation of class in Java involving tokens, variables, methods, operators, control statements, array, static variables and methods, reference data types, variables and methods, constructors **[1 Labs]**; Implementation of Inheritance and other relationships like Association, Aggregation and Composition in Java **[2 Labs]**; Implementation of abstract class and methods, interface, packages, and garbage collection in Java **[2 Labs]**; Writing programs in Java to handle strings **[1 Labs]**; Java programs involving exception handling, exception propagation, and user defined checked & unchecked exceptions **[1 Lab]**; Writing Java programs involving Collections framework, Collection interfaces, Collection classes, Iterators, Comparators, User defined classes in Collections, etc. **[2 Labs]**; Implementing Multithreading in Java and Java programs involving Generic classes and methods, Wild cards, Metadata & Reflection **[2 Labs]**; Writing Java programs to implement Applet fundamentals, applet class, HTML Applet tag, passing parameters to applets **[2 Labs]**

Total: 14 Labs

Core Courses offered by Dept. of CS&E and IT in Fourth Semester of BTech-CSE

12. 24B11CS221 - Design and Analysis of Algorithms (3-1-0)

Need to analyse the performance of algorithms; Asymptotic analysis and notations- big O, big omega, big theta, little o, Growth of Functions; Recurrence and Solving Recurrences using different approaches; Empirical analysis of sorting and searching algorithms **[9 Lectures]**; Fundamentals of Divide and Conquer (D&C) approach,

designing the D&C based algorithms for binary search, quick sort, merge sort, matrix multiplication, closest pair, etc. **[5 Lectures]**; Fundamentals of greedy algorithms and designing solutions for graph problems like Shortest Path, MST, Coloring, Covering, etc., fractional Knapsack, Coinage problem, Bin packing, Job scheduling, Text compression using Huffman coding & Shannon-Fanon coding, etc. **[7 Lectures]**; Review of recursive algorithms for N-queen, Rat in a maze, etc. problems and designing backtracking based solutions for M-coloring problem, Hamiltonian Cycle detection, Travelling salesman problem, Network flow, etc **[7 Lectures]**; Fundamentals of Dynamic Programming (DP) and designing DP based solutions for 0/1 Knapsack, Shortest path, Coinage problem, Matrix Chain Multiplication, Longest common subsequence, Longest increasing sequence, String editing, etc. **[7 Lectures]**; String matching algorithms using Naïve String Matching, Finite Automata Matcher, Rabin Karp matching algorithm, Knuth Morris Pratt, etc. **[5 Lectures]**; Efficiency and Tractability, P, NP, NP-Complete, NP-Hard problems **[2 Lectures]**

Total: 42 Lectures

13. 24B15CS221 - Design and Analysis of Algorithms Lab (0-0-1)

Implementation of searching algorithms, like linear, binary, and interpolation and analyzing their performances with Hash function-based searching **[1 Lab]**; Implementation of sorting algorithms, like bubble, selection, insertion, quick, merge, count, radix, bucket, and heap sort and analyze their performances for different test cases **[2 Labs]**; Implement D&C based solutions for the problems, matrix multiplication, closest pair, etc. **[2 Labs]**; Write greedy algorithms based programs for different problems like, shortest path, MST, graph coloring, fractional Knapsack, coinage problem, bin packing, job scheduling, text compression using Huffman coding & Shannon-Fanon coding, etc. **[2 Labs]**; Implement recursive and backtrack based solutions for different problems like M-coloring problem, Hamiltonian Cycle detection, Travelling salesman problem, Network flow, etc. **[2 Labs]**; Designing and implementing DP based solutions for 0/1 Knapsack, Shortest path, Coinage problem, Matrix Chain Multiplication, Longest common subsequence, Longest increasing sequence, String editing, etc. **[3 Labs]**; Implement and analyse the performances of string matching algorithms, like, Naïve String Matching, Finite Automata Matcher, Rabin Karp matching algorithm, Knuth Morris Pratt, etc. **[2 Labs]**

Total: 14 Labs

14. 24B11CS222 - Artificial Intelligence and Machine Learning (3-0-0)

Fundamentals of AI: Introduction to AI, Problems of AI, AI technique, Tic – Tac – Toe Problem. Intelligent Agents, Agents &Environment, Nature of Environment, Structure of Agents, Goal-based agents, Utility-based agents, learning agents **[6 Lectures]**; Search Techniques Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search. Heuristic search strategies Greedy best -first search, A* search, AO* search **[9 Lectures]**; Introduction to Machine learning: Fundamentals of Machine learning, Types of Machine Learning: Supervised, unsupervised, reinforcement, Machine perception - feature extraction - classification, clustering, linear and logistic regression **[9 Lectures]**; Classification Algorithms Concept of ANN (Artificial Neural Network): Perceptron and backpropagation neural network - k-nearest neighbor rule. Support vector machine: Decision trees: and random forest **[9 Lectures]**; Deep Neural Network: Introduction to Deep learning, Convolutional neural networks, CNN Architectures LeNet, AlexNet, GooleNet, VGG Net, ResNet: Comparative analysis **[9 Lectures]**

Total: 42 Lectures

15. 24B15CS222 - Artificial Intelligence and Machine Learning Lab (0-0-1)

Python fundamentals: Data Types, Basic programming, Conditional Statements, List, Tuples, Sets, Dictionary, Loops, String Manipulation, Functions, Strings **[3 Labs]**; Python Libraries: Array and matrix processing using NumPy, Data Analysis using Pandas, Image manipulation using SciPy, Deep learning implementation using TensorFlow, Designing Neural Network using Keras, Matplotlib **[4 Labs]**; Machine Learning using Python: Data preparation, creating training and testing sets, building a model, Model evaluation, Supervised learning: Decision trees, Linear regression, Logistic regression, SVM, Random Forest, ANN, Unsupervised learning: k-means clustering **[5 Labs]**; Mini Project using AI&ML: identify broad topic based on the AI&ML, identify the research problem, design the architecture for the proposed problem, implement and propose your novelty/improvement, perform the experimental analysis **[2 Labs]**

Total: 14 Labs

16. 24B11CS223 - Software Engineering (3-0-0)

Introduction to software engineering principles, software process models (build and fix model, waterfall model, Incremental process model, Evolutionary- Prototype and Spiral models, Agile Models (tools study). Project planning, Project Scheduling: network diagram, Gant Chart, CPM and PERT **[7 Lectures]**; Requirement Engineering, types of requirement, requirement elicitation, analysis, specification, SRS, requirement verification and validation **[4 Lectures]**; Software design, Use case diagram, State diagram, Activity Diagram, Class Diagram, Sequence diagram, Collaboration diagram, Deployment Diagram, Component Diagram and Package diagram. Design Modularity, Coupling Cohesion **[7 Lectures]**; Software Construction, Coding standards and guidelines, Code checklist, Code Reviews, Code Refactoring, Code optimization, Design pattern, Modern programming environments (Code search, Programming using library components and their APIs), Program comprehension; Program correctness, Defensive programming **[8 Lectures]**; Software Metrics, Size-Oriented Metric, Function-oriented Metric, Halstead's Software Metric, Information Flow Metric, Object-oriented Metric, Class-Oriented Metric, COCOMO Model **[7 Lectures]**; Software Testing, White-Box Testing, Basis Path Testing, Control Structure Testing: Condition Testing, Data Flow Testing, Loop Testing, Black-Box Testing: Equivalence class partitioning, Boundary Value Analysis, Decision table testing, Cause effect graphing, Mutation Testing and regression Testing, formal methods **[9 Lectures]**

Total: 42 Lectures

17. 24B15CS224 - Competitive Programming Lab (1-0-1)

Introduction to Competitive Programming, Online Judge and online competitive programming portals, TLE, Test Cases, overview of various programming contests like, ACM ICPC, IOI, Long and short challenges of CodeChef, etc., Forming problems for contests and creation of the test cases with setting of time limits and leader board **[1 Lecture + 1 Lab]**; Formation of problems and test cases based on greedy algorithms (like shortest path, minimum spanning tree, etc.) and solving them **[2 Lectures + 2 Labs]**; Formation of problems and test cases based on dynamic programming (like string editing, longest common subsequence, longest increasing subsequence, etc.) and solving them **[3 Lectures + 3 Labs]**; Formation of problems and test cases based on graph algorithms (like network flow, graph traversals, shortest path, etc.) and solving them **[3 Lectures + 3 Labs]**; Formation of problems and test cases based on divide and conquer (like sorting, searching, closest pair, etc.) and solving them **[2 Lectures + 2 Labs]**; Formation of problems and test cases based on bit manipulation, number theory and combinatorics and solving them **[3 Lectures + 3 Labs]**

Total: 14 Lectures and 14 Labs

Core Courses offered by Dept. of CS&E and IT in Fifth Semester of BTech-CSE

18. 24B11CS312 - Operating Systems (3-0-0)

Introduction and Historical context of Operating Systems, Operating Structure and Architecture **[4 Lectures]**; Process Concepts, Threads & Concurrency, Scheduling Concurrency & Synchronization issues, IPC, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Process synchronization: Critical section problems, Semaphores, Synchronization hardware and monitors **[12 Lectures]**; Deadlock, System model, Characterization, Methods for handling deadlocks. Deadlock prevention, Avoidance and detection, Recovery from deadlock **[6 Lectures]**; Memory Management, Background, Swapping, Contiguous memory allocation, Paging, Segmentation, Segmentation with Paging, Virtual Memory, Background, Swapping, Contiguous memory allocation, Paging, Segmentation, Segmentation with Paging, Virtual Memory **[8 Lectures]**; Secondary Storage Management, Fault and Security Issues **[6 Lectures];** Case studies of OS: Windows, Linux, IBM, Tizen Operating System, Distributed O.S: Introduction to distributed operating systems, synchronization and deadlock in distributed systems **[6 Lectures].**

Total: 42 Lectures

19. 24B15CS312 - Operating Systems Lab (0-0-2)

Unix Commands, Process creation/Inter-process communication (IPC), Process creation using pthread library under Linux environment **[3 Labs]**, Scheduling Concurrency & Synchronization issues, IPC, Scheduling criteria,

Scheduling algorithms like semaphores, binary semaphores and monitors via different classical test suites **[4 Labs]**, Resource management task like CPU scheduling algorithms, deadlock handling **[4 Labs]**, Disk-scheduling algorithms, memory management schemes, file management systems **[3 Labs]**.

Total: 14 Labs

20. 24B11CS313 - Computer Networks (3-1-0)

Overview of Computer Networks, Network Hardware, Network Software, Networks Topologies, Layering and Protocols: OSI, TCP/IP Reference Models, ARPANET, Internet **[4 Lectures];** Physical Layer: Guided Transmission Media: Twisted Pairs, Fiber Optics, etc., Errors in Transmission: Attenuation, Noise, Repeaters, Encoding (NRZ, NRZI, etc.), Wireless Transmission **[6 Lectures];** Data link layer: Design issues, framing, Error detection (Parity, CRC) and correction, Elementary data link protocols: simplex protocol, stop and wait protocols for error-free channel and noisy channel, Sliding Window Protocols, Medium Access sub layer: The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols. Wireless LANs, Data link layer switching **[9 Lectures];** Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Broadcast, Multicast, Distance vector, Inter-domain routing, etc., Congestion Control Algorithms, Quality of Service, Internetworking, The Network layer in the internet, Internet Protocol, IPv6, ARP, DHCP, ICMP, Network Address Translation **[9 Lectures];** Transport Layer: Transport Services, Elements of Transport protocols, Connection management: establishment and termination, TCP and UDP protocols, flow and congestion control, timers, retransmission, TCP extensions, etc. **[8 Lectures];** Application Layer –Domain name system, SNMP, Electronic Mail; the World WEB, HTTP, Streaming audio and video, Session, Presentation, and Application Layers Examples: DNS, SMTP, IMAP, etc. **[6 Lectures].**

Total: 42 Lectures

21. 24B15CS313 - Computer Networks Lab (0-0-1)

Overview of NS2 and other network simulators, Hands-on on NS2 simulator **[3 Labs]**; Write programs to compute CRC code for the polynomials CRC-12, CRC-16 and CRC CCIP, Implement the data link layer framing methods, Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism **[3 Labs]**; Implement Dijsktra's algorithm to compute the shortest path through a network, Implement distance vector routing algorithm for obtaining routing tables at each node, for given subnet of hosts obtain the broadcast tree for the subnet, Implement data encryption and data decryption, Write programs for congestion control and frame sorting technique used in buffers **[4 Labs]**; Use NS2 Simulator to perform following: Find the Number of Packets Dropped, Find the Number of Packets Dropped by TCP/UDP, Find the Number of Packets Dropped due to Congestion, Compare Data Rate & Throughput, Plot Congestion for Different Source/Destination, Determine the Performance with respect to Transmission of Packets **[4 Labs]**.

Total: 14 Labs

22. 24B15CS314 - Full Stack Development Lab (0-0-2)

Introduction to python, Django and VS code, Creation of virtual environment Django Project and App **[1 Lab]**; Display Current Date and Time four hours ahead and four hours before in server **[1 Lab]**; Develop a Django app that displays an unordered list of fruits and ordered list of selected students for an event **[2 Labs];** Develop a website including multiple pages and inherit the design layout with proper connection between pages **[2 Labs]**; Develop a Django app that performs student registration to a course. It should also display list of students registered for any selected course. Create students and course as models with enrolment as Many To Many field **[2 Labs]**; Extend the student course registration process with the inclusion of the admin pages, creating user accounts, and validation for the specific fields **[2 Labs]**; Develop example Django app that performs CSV and PDF generation for any models created in previous laboratory component **[2 Labs]**; Develop a search application in Django using AJAX that displays courses enrolled by a student being searched **[2 Labs].**

Total 14 Labs

Core Courses offered by Dept. of CS&E and IT in Sixth Semester of BTech-CSE

23. 24B11CS321 - Web Technology (3-0-0)

Introduction to HTML: HTML Common tags- Block Level and Inline Elements, Lists, Tables, Images, Forms, Frames; Cascading Style sheets, CSS Properties; Java Script: Introduction to Java Script, Objects in Java Script, Dynamic HTML with Java Script **[9 Lectures]**; JDBC: Data Base, Database Schema, A Brief Overview of The JDBC Process, JDBC Driver Types, JDBC Packages, Database Connection, Associating The JDBC-ODBC Bridge with Database, Creating, Inserting, Updating and Deleting Data In Database Tables, Result, Set, Metadata **[9 Lectures]**; Web Servers and Servlets: Tomcat web server, Introduction to Servlets: Servlets, the advantage of Servlets over "Traditional" CGI, Basic Servlet Structure, Simple Servlet, Generating Plain Text, Compiling and Installing the Servlet, Invoking the Servlet, Lifecycle of a Servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Context Parameters, Handling HTTP Request & Responses, Using Cookies-Session Tracking, Servlet with JDBC **[10 Lectures]**; Introduction to JSP: The Problem with Servlet. The Anatomy of a JSP Page, JSP Processing, JSP Application Development: Generating Dynamic Content, Using Scripting, Elements, Implicit JSP Objects, Declaring Variables and Methods, Sharing Data Between JSP pages, Users Passing Control and Data between Pages, JSP application design with JDBC, JSP Application Design with MVC **[8 Lectures]**; Introduction to PHP: Basics of PHP, Functions, Error Handling, Interaction between PHP and MySQL, Database using Forms, Using PHP to manipulate and Retrieve Data in MySQL **[6 Lectures]**

Total: 42 Lectures

24. 24B15CS321 - Web Technology Lab (0-0-1)

HTML Common tags- Block Level and Inline Elements, Lists, Tables, Images, Forms, Frames, Cascading Style sheets, Java Script, Objects in Java Script, Dynamic HTML with Java Script **[3 Labs]**; JDBC: Data Base, Database Schema, JDBC Process, JDBC Driver, JDBC Packages, Database Connection, JDBC-ODBC Bridge with Database, Creating, Inserting, Updating and Deleting Data In Database Tables, Result, Set, Metadata **[3 Labs]**; Web Servers and Servlets: Tomcat web server, Basic Servlet Structure, Simple Servlet, Generating Plain Text, Compiling and Installing the Servlet, Invoking the Servlet, Servlet API, Reading Servlet parameters, Reading Initialization parameters, Context Parameters, Handling HTTP Request & Responses, Using Cookies-Session Tracking, Servlet with JDBC **[3 Labs]**; Introduction to JSP, JSP Page, JSP Processing, JSP Application Development: Generating Dynamic Content, Using Scripting, Elements, Implicit JSP Objects, Declaring Variables and Methods, Sharing Data Between JSP pages, Users Passing Control and Data between Pages, JSP application design with JDBC, JSP Application Design with MVC **[3 Labs]**; Basics of PHP, Functions, Error Handling, Interaction between PHP and MySQL, Database using Forms, Using PHP to manipulate and Retrieve Data in MySQL **[2 Labs].**

Total: 14 Labs

25. 24B11CS322 - Advanced Data Structures and Algorithms (3-0-0)

Review of Linear and Non-linear Data Structures: Stack, Queue, Tree, and Graph **[4 Lectures]**; Advanced Data Structures: Splay Tree, Scape Goat Tree and Treap, Disjoint Set, Interval Tree, Segment Tree with Lazy Propagation Operations, Priority Search Tree, Binary Indexed Tree, Range Tree and Range Queries, etc. **[10 Lectures]**; Introduction to Multi-Dimensional Data Structures: K-Dimensional Tree, Quad Tree, Octree, Binary Search Partitioning Trees, R-trees, Multidimensional B-trees, etc. **[10 Lectures]**; Review of algorithm design techniques: greedy method, divide-and-conquer, dynamic programming with advanced applications, Algorithms for maximum flow **[4 Lectures]**; Approximation Algorithms for Steiner Tree, Vertex Cover, Set Cover, max-SAT, Subset Sum, Knapsack, Bin Packing, Scheduling, Traveling Salesman Problem, K-center, etc. **[10 Lectures]**; Randomized Algorithms for Quick Sort, Binary Search, Minimum Cut (Karger's Algorithm), Random Number Generator, Strong Password Suggester, Shuffle the Array, etc. **[4 Lectures].**

Total: 42 Lectures

26. 24B15CS322 - Advanced Data Structures and Algorithms Lab (0-0-1)

Implementation of Stack, Queue, Tree, Graph, etc. **[2 Labs]**; Implementation of Advanced Data Structures: Splay Tree, Scape Goat Tree, Treap, Disjoint Set, Interval Tree, Segment Tree with Lazy Propagation Operations, Priority Search Tree, Binary Indexed Tree, Range Tree and Range Queries, etc. **[3 Labs]**; Implementation of Multi-Dimensional Data Structures: K-Dimensional Tree, Quad Tree, Octree, Binary Search Partitioning Trees, R-trees, Multidimensional B-trees, etc. **[3 Labs]**; Implementation of problems solvable using design techniques of greedy method, divide-and-conquer, dynamic programming **[1 Lab]**; Implementation of Approximation Algorithms for

Steiner Tree, Vertex Cover, Set Cover, max-SAT, Subset Sum, Knapsack, Bin Packing, Scheduling, Traveling Salesman Problem, K-center, etc. **[3 Labs]**; Implementation of Randomized Algorithms for Quick Sort, Binary Search, Minimum Cut (Karger's Algorithm), Random Number Generator, Strong Password Suggester, Shuffle the Array, etc. **[2 Labs].**

Total: 14 Labs

27. 24B11CS323 - Distributed and Cloud Computing (3-0-0)

Review of operating systems principles, Theoretical foundations to Distributed Systems. Synchronization mechanisms in Distributed Systems, Resource models. Clock synchronization. Event ordering. Timestamps recording. Global state collection mechanisms **[6 Lectures]**; Election Algorithms and Termination Detections, Distributed mutual exclusion. Token and non-token-based algorithms. Comparative performance analysis. Distributed Deadlock Detection Algorithms, Process deadlocks in DS. Deadlock handling techniques **[8 Lectures]**; Agreement Protocols, System Model, Classification, Byzantine Problems and Solutions, Consistency and Replication Issues, Data-centric consistencies, Client-centric consistencies. Epidemic Protocols, Fault Tolerance, Reliability, Fault Tolerance, Reliability in Distributed Systems, Group Communications, and Distributed commit. Failure Recovery **[10 Lectures]**; Introduction to cloud computing, Correlation between Distributed and Cloud Models, Deployment Models, Service Models, SaaS, PaaS, IaaS. Essential Characteristics, Foundational Elements, Enabling Technologies for Cloud, Virtualization Technology, Virtualization Techniques, Virtual Machines, Virtual Machine Monitors, Live Migrations, Virtual Clusters, Containers and overview of Dockers, Data and Network security in cloud, Access control and authentication in cloud computing **[14 Lectures]**; Case Study: Amazon Web Services-Elastic Compute Cloud, Simple Storage Service, Relational Database Services **[4 Lectures]**.

Total: 42 Lectures

28. 24B11CS324 - Information Security and Cryptography (3-0-0)

Overview of e-security - Threats, risks, consequences; Sources of threats; Attacks classification **[3 Lectures];** Cryptography for e-security covering topics Stream ciphers, block ciphers, Keys and key management, Key exchange (peer to peer, peer - keyserver - peer), Diffie Helman key sharing scheme, Symmetric key cryptography, asymmetric key cryptography **[4 Lectures]**; Introduction to Hash digests including properties of cryptographic hash functions, Merkle Damgard construction, md family, sha family, Digital signatures , sha3 **[6 Lectures];** Basics of the GPG, Commands and CLI, GPG trust model, GUI – KGPG, Seahorse; Frontends – Kleopatra, enigmail **[5 Lectures];** Block ciphers –principles, Feistel networks, S boxes and P boxes, Block cipher modes of operation, DES, 3DES, AES **[8 Lectures]**; Elementary number theory - Prime numbers, Factoring, Modular arithmetic, Fermat's & Euler's theorems, gcd, Euclid's algorithm, Discrete logarithm problem **[8 Lectures]**; Public key encryption - Public key crypto systems, RSA algorithm, Elliptic Curve cryptography **[4 Lectures];** Security Aspects - PKI, CA. X509 certificates, SSL/TLS, HTTPS, IPV6 and IPSEC, Proxies and Firewalls **[4 Lectures].**

Total 42 Lectures