

**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA, G.B. NAGAR
(AN AUTONOMOUS INSTITUTE)**



Affiliated to

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, UTTAR PRADESH LUCKNOW

Evaluation Scheme & Syllabus



For

B.Tech. in Computer Science (CS)

Second Year

(Effective from the Session: 2026-27)

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA, G.B. NAGAR
(AN AUTONOMOUS INSTITUTE)

**COMPUTER SCIENCE
EVALUATION SCHEME
SEMESTER III**

S. NO	SUBJECT CODES	SUBJECT NAME	TYPE OF SUBJECT	PERIODS			EVALUATION SCHEMES				END SEMESTER		TOTAL	CREDIT
				L	T	P	CT	TA	TOTAL	PS	TE	PE		
1 WEEK'S COMPULSORY INDUCTION PROGRAM														
1	CCSCC0301	Employability Skill Development-I	Mandatory	2	0	0	60	40	100				100	2
2	CAS0301	Statistics and Probability	Mandatory	3	1	0	30	20	50		100		150	4
3	CCSE0303A	Operating Systems	Mandatory	2	0	0	30	20	50		50		100	2
4	CCSE0301	Data Structures and Algorithm-II	Mandatory	3	0	0	30	20	50		100		150	3
5	CCS0301	Cloud Virtualization Technologies	Mandatory	2	0	0	30	20	50		50		100	2
6	CCSAI0302	High Performance Computing	Mandatory	3	0	0	30	20	50		100		150	3
7	CCSE0353A	Operating Systems Lab	Mandatory	0	0	4				50		50	100	2
8	CCSE0351	Data Structures and Algorithm-II Lab	Mandatory	0	0	4				50		50	100	2
9	CCS0351	Cloud Virtualization Technologies Lab	Mandatory	0	0	2				25		25	50	1
10	CCSE0355	Object Oriented Techniques using Java	Mandatory	0	0	6				50		100	150	3
11	CCSE0359	Internship-I	Mandatory	0	0	2				50			50	1
12	CNC0301 / CNC0302	Artificial Intelligence and Cyber Ethics / Environmental Science	Compulsory Audit	2	0	0	30	20	50				50	NA
13		MOOCs (For B.Tech. Hons. Degree)	*MOOCs											
		TOTAL		17	1	18	210	140	350	225	400	225	1200	25

*** List of MOOCs Based Recommended Courses for Second year B. Tech Students**

S. No.	Subject Code	Course Name	University/ Industry Partner Name	N. of Hours	Credits
1.	CMC0044	Getting Started with Linux Fundamentals 9.1	RedHat	16h	1
2.	CMC0035	Data Structures and Algorithms using Python - Part 2	Infosys Wingspan (Infosys Springboard)	37h 41m	3
3.	CMC0027	Object Oriented Programming Using Python	Infosys Wingspan (Infosys Springboard)	46h 13m	3.5

PLEASE NOTE:

A 3-4 weeks Internship shall be conducted during summer break after semester-II and will be assessed during semester-III

Compulsory Audit (CA) Courses (Non-Credit - CNC0301/CNC0302)

- All Compulsory Audit Courses (a qualifying exam) do not require any credit.
- The total and obtained marks are not added in the grand total.

Abbreviation Used:

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam.
 CE: Core Elective, OE: Open Elective, DE: Departmental Elective, PE: Practical End Semester Exam, CA: Compulsory Audit,
 MOOCs: Massive Open Online Courses.

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
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**COMPUTER SCIENCE
EVALUATION SCHEME
SEMESTER IV**

S.NO	SUBJECT CODES	SUBJECT NAME	TYPE OF SUBJECT	PERIODS			EVALUATION SCHEMES				END SEMESTER		TOTAL	CREDIT
				L	T	P	CT	TA	TOTAL	PS	TE	PE		
1	CASCC0401	Employability Skill Development – II	Mandatory	2	0	0	60	40	100				100	2
2	CCSE0401	Database Management Systems	Mandatory	2	0	0	30	20	50		50		100	2
3	CCSML0402A	Machine Learning Algorithms	Mandatory	3	0	0	30	20	50		100		150	3
4	CCS0401	Modern Data Engineering Concepts	Mandatory	3	0	0	30	20	50		100		150	3
5		Departmental Elective-I	Departmental Elective	3	0	0	30	20	50		100		150	3
6	CASL0401	Technical Communication	Mandatory	2	0	0	30	20	50		50		100	2
7	CCSE0451	Database Management Systems Lab	Mandatory	0	0	4				50		50	100	2
8	CCSML0452A	Machine Learning Algorithms Lab	Mandatory	0	0	2				25		25	50	1
9	CCSE0455	Web Technologies	Mandatory	0	0	6				50		100	150	3
10	CCSE00459	Mini Project	Mandatory	0	0	2				50			50	1
11	CCSCC0452	Problem Solving Approaches	Mandatory	0	0	2				50			50	1
12	CNC0402 / CN C0401	Environmental Science / Artificial Intelligence And Cyber Ethics	Compulsory Audit	2	0	0	30	20	50				50	NA
13		MOOCs (For B.Tech. Hons. Degree)	*MOOCs											
		TOTAL		17	0	16	210	140	350	225	400	175	1150	23

*** List of MOOCs Based Recommended Courses for Second year B. Tech Students**

S. No.	Subject Code	Course Name	University/ Industry Partner Name	N. of Hours	Credits
1	CMC0071	Database Management System	Infosys Wingspan (Infosys Springboard)	16h	1
2	CMC0072	Fundamentals of Data Networking	Infosys Wingspan (Infosys Springboard)	35h 42m	2.5

PLEASE NOTE:

A 3-4 weeks Internship shall be conducted during summer break after semester-II and will be assessed during semester-III

Compulsory Audit (CA) Courses (Non-Credit - CNC0402/CNC0401)

- All Compulsory Audit Courses (a qualifying exam) do not require any credit.
- The total and obtained marks are not added in the grand total.

Abbreviation Used:

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam.
CE: Core Elective, OE: Open Elective, DE: Departmental Elective, PE: Practical End Semester Exam, CA: Compulsory Audit,
MOOCs: Massive Open Online Courses.

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List of Department Elective: -

S. No.	Subject Code	Subject Name	Type of Subject	Bucket Name	Semester
1	CCSAI0411	Data Analytics	Departmental Elective- I	AI Driven Analytics	IV
2	CCSAI0412	CRM: Fundamentals	Departmental Elective- I	CRM-RPA	IV
3	CCSCY0411	Fundamentals Of Cyber Security	Departmental Elective- I	Cyber Security- I	IV
4	CCSE0411	Python Web Development With Django	Departmental Elective- I	Full Stack Development	IV

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AICTE Guidelines in Model Curriculum:

A student will be eligible to get Under Graduate degree with Honours only, if he/she completes the additional MOOCs courses such as Infosys Springboard/NASSCOM/CISCO (as applicable) certifications, or any other online courses recommended by the Institute (Equivalent to 20 credits). During Complete B.Tech. Program Guidelines for credit calculations are as follows.

1. For 6 to 12 Hours =0.5 Credit
2. For 13 to 18 =1 Credit
3. For 19 to 24 =1.5 Credit
4. For 25 to 30 =2 Credit
5. For 31 to 35 =2.5 Credit
6. For 36 to 41 =3 Credit
7. For 42 to 47 =3.5 Credit
8. For 48 and above =4 Credit

For registration to MOOCs Courses, the students shall follow Infosys Springboard/NASSCOM/CISCO (as applicable) registration details as per the assigned login and password by the Institute these courses may be cleared during the B. Tech degree program (as per the list provided). After successful completion of these MOOCs courses, the students shall provide their successful completion status/certificates to the Controller of Examination (COE) of the Institute through their coordinators/Mentors only.

The students shall be awarded Honours Degree as per following criterion.

- i. If he / she secures 7.50 as above CGPA.
- ii. Passed each subject of that degree program in the single attempt without any grace.
- iii. Successful completion of MOOCs based 20 credits



Course Code: CCSCC0301				Course Name: EMPLOYABILITY SKILL DEVELOPMENT - I							L	T	P	C
Course Offered in:											2	0	0	2
Pre-requisite: Students should have successfully completed communication skills courses in the first year.														
Course Objectives:														
SECTION A: Develop understanding of computer systems, mathematical foundations, and programming concepts while applying structured problem-solving techniques to design logical solutions effectively.														
SECTION B: Enhance numerical ability and logical reasoning skills through speed mathematics, number systems, and analytical problem-solving techniques for competitive aptitude development.														
SECTION C: To develop the ability to communicate effectively and empathetically in workplace situations while strengthening active listening, adaptability, and cross-cultural awareness for navigating complex professional environments.														
Course Outcome												Bloom's Knowledge Level (KL)		
CO1	Apply fundamental concepts of computer systems, mathematical foundations, and programming constructs to analyze and solve basic computational problems.											K3		
CO2	Design and develop structured solutions for problem statements by applying SDLC principles, logical thinking, and flowchart/pseudocode techniques.											K6		
CO3	Apply number theory and logical reasoning concepts to solve quantitative and analytical problems efficiently.											K3		
CO4	Apply spoken English skills to participate effectively in standard workplace routines, including daily stand-ups, reporting, and collaborative problem-solving.											K3		
CO5	Evaluate and adapt communication styles to suit dynamic workplace communication situations and deliver context-sensitive, and logically structured verbal responses under time constraints.											K6		
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)														
CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	2	3	1	-	3	2	2	2	1	1	2
CO2	3	3	3	3	3	2	1	3	2	2	2	2	2	2
CO3	3	3	2	1	-	-	-	1	2	2	2	3	2	2
CO4	-	-	-	-	1	2	-	3	2	2	-	-	-	-
CO5	-	2	1	-	1	2	-	3	2	2	1	-	-	-

Course Contents / Syllabus		
Section-A		
UNIT 1	FOUNDATIONS OF COMPUTER SYSTEMS AND MATHEMATICAL CONCEPTS	8 hours
Computer System Fundamentals: Introduction to Assembler, Compiler, Interpreter, Role of Loader and Linker in program execution. Mathematical Foundations for Computing: Sets, Relations, and Functions: definitions and applications, Principle of Mathematical Induction and its use in proofs. Basic Concepts of Programming Language: Memory model of C/C++ Program, Activation Record of a function, L-Value/ R-Value concept. Operators, Precedence, Order of Evaluation and Associativity. Pointers and Dynamics Memory Concept, Functions (argument passing, concept of scope), Understanding Recursion, Bitwise Operations.		
UNIT 2	DESIGN AND DEVELOP STRUCTURED SOLUTIONS FOR PROBLEM STATEMENTS	8 hours
Introduction to Software Development Life Cycle, Step-by-step solution to simple problems, Developing logic/flowchart/pseudocode. Stepwise refinement and Procedural Abstraction. Case Study*: Understand the problem statement, identify a feasible solution, and develop the logic along with a flowchart for the proposed solution.		
SECTION-B		
UNIT 3	SPEED MATH AND NUMBER SYSTEM	16 hours
Classification of number, Divisibility Rule, Factorization, HCF & LCM, It's Application, Unit digit (Cyclicity), Last two digit, Remainder theorem, Factorial and Number of zeroes, Highest power. Analytical and Logical Reasoning: Direction and Sense, Blood Relation, Number Series and Letter Series, Coding Decoding		
SECTION-C		
UNIT 4	WORKPLACE INTERACTION ESSENTIALS	12 hours
The Professional Shift: Navigating the transition from academic to professional tone. Using appropriate register when addressing peers vs. supervisors. Active Listening & The Feedback Loop: Moving beyond passive hearing. Practicing the SBI (Situation-Behaviour-Impact) model for peer feedback and clarifying multi-step technical instructions. Structured Micro-Speaking: The art of the concise update. Delivering 1-2 minute "Stand-up" reports (What I did, What I will do, Blockers) and explaining basic technical processes to laymen. Guided Interpersonal Simulations: Role-playing everyday scenarios: politely interrupting a meeting, seeking assistance on a delayed task, and confirming understanding of complex briefs using paraphrasing techniques. Digital & Hybrid Nuances: Verbal signaling in virtual meetings, managing "overtalk," and translating concise written chat messages into spoken professional updates.		
UNIT 5	WORKPLACE COMMUNICATION IN ACTION	12 hours
Dynamic Problem-Based Communication: Simulating the "War Room." Explaining sudden technical failures, proposing immediate solutions, and negotiating revised deadlines with stakeholders. Listening Under Pressure & Global Adaptability: Interpreting fast, accented, or incomplete instructions (incorporating CEFR-level listening benchmarks). Decoding tone, urgency, and indirect cultural communication styles. Collaborative Conflict Resolution: Managing disagreements in team settings using "I-statements" and the "Yes, and..." technique to build consensus without escalating tension. The Persuasive Professional: Delivering evidence-based arguments using the PREP (Point, Reason, Example, Point) framework to justify a technical choice or resource allocation. Real-Time "Crisis" Simulation (Capstone): A comprehensive role-play where student groups are given a sudden project change or client issue. They must conduct an emergency meeting, delegate tasks verbally, and present a united response to the "client."		
Total Lecture		56 Hours

**A list of problem statements will be provided by the mentor; you may choose anyone.*
Note: Students may choose an alternative problem statement with prior approval from the mentor.

REFERENCE BOOKS:

BOOK TITLE	AUTHOR
A Project-Based Introduction to Programming	Access Point Publishing
Programming: Principles and Practice Using C++	Bjarne Stroustrup
Effective Modern C++	Scott Meyers
Quantitative Aptitude	R S Aggarwal

Verbal & Non-Verbal Reasoning	R S Aggarwal
<i>Crucial Conversations Tools</i>	Kerry Patterson et al.
<i>HBR Guide to Persuasive Presentations</i>	Nancy Duarte

SELF-STUDY CONTENT LINKS:		DURATION (IN HRS)
MOOCs	https://swayam-plus.swayam2.ac.in/courses/course-details?id=F_WADHW_042	105 hours
Video Lectures	Employability Skills Training Session - YouTube	1 hour
Web References	https://dde.manuu.edu.in/sites/default/files/DDE/DDE-Assignments/Diploma-Sem1-2024/Employability-Skills-1.pdf	

Course Code: CAS0301					Course Name: Statistics and Probability								L	T	P	C
Course Offered in: B. Tech. Second Year: Semester-III/IV AI/AIML/AI (TWIN)/AIML(TWIN)/CYS/DS/CS/CSE/CSE(TWIN)/CSE R/IT/ IT- Twin/ M. Tech. (Int.)/MCT													3	1	0	4
Pre-requisite: B. Tech. First Year Syllabus																
Course Objectives:																
1. The objective of this course is to familiarize the students with concepts of Probability and statistical techniques.																
2. It aims to equip the students with adequate Knowledge of statistics that will enable them in formulating Problems and solving problems analytically																
Course Outcome: After completion of the course, the student will be able to													Bloom's Knowledge Level (KL)			
CO1	Apply the concept of moments, skewness and kurtosis in relevant field.												K3			
CO2	Apply the concept of correlation, regression and curve fitting with real world problems.												K3			
CO3	Apply the concept of probability and random variable.												K3			
CO4	Apply the concept of Mathematical Expectations and Probability Distribution in real life problems.												K3			
CO5	Apply the concept of hypothesis testing and statistical quality control to create control charts.												K3			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)																
CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3		
CO1	3	2	2	3	1	1	-	1	2	2	2	3	1	1		
CO2	3	2	2	3	1	1	-	1	2	2	2	3	2	2		
CO3	3	2	1	2	-	-	-	-	1	2	2	2	1	1		
CO4	3	2	2	3	1	1	-	1	2	2	2	3	2	2		
CO5	3	2	2	3	1	1	-	1	2	2	2	3	2	2		
Course Contents / Syllabus																
Module 1			Statistical Techniques-I											9 hours		
Introduction: Measures of central tendency: Mean, Median, Mode, Standard deviation, Quartile deviation, Moments, Skewness, Kurtosis.																
Module 2			Statistical Techniques-II											9 hours		
Curve Fitting: Straight line, Second-degree parabola, Exponential curve by method of least squares, Correlation and Rank correlation, Linear regression, nonlinear regression and multiple linear regression.																
Module 3			Probability and Random Variable											9 hours		
Random Variable: Definition of a Random Variable, Discrete Random Variable, Continuous Random Variable, Probability mass function, Probability Density Function, Distribution functions.																
Bivariate Random Variables: Joint probability mass function, joint density and distribution Function, Properties of Joint Distribution function, Marginal Probability mass function, Marginal density Functions, Conditional Distribution for Bivariate Random Variables, Statistical Independence, Central Limit Theorem (Proof not expected)																
Module 4			Expectation and Probability Distributions											9 hours		
Expectations of single Random Variable, Mean, Variance, Moment Generating Function, Binomial, Poisson.																

Normal, Exponential distribution.		
Module 5	Hypothesis Testing and Control Charts	9 hours
Testing a Hypothesis, Null hypothesis, Alternative hypothesis, Level of significance, Confidence limits, Test of significance of means by Z-test and t-test, Chi-square test, F-test, One way ANOVA. Statistical Quality Control (SQC), Control Charts, Control Charts for variables (Mean and Range Charts), Control Charts (p, np and C charts)		
Total Lecture Hours		45hours
Textbook: 1. Textbook of Engineering Mathematics- IV Bali, N.P. 2. Advanced engineering mathematics Jain, R.K. 3. Higher engineering mathematics Grewal, B.S. 4. Statistical methods Gupta, S.P. 5. Advanced engineering mathematics ZILL, DENNIS G.		
Reference Books: 1. Introduction to Probability Models Ross, Sheldon M 2. Probability, Random Variables and Stochastic Processes Papoulis, Athanasios 3. Advanced engineering mathematics Kreyszig, E		
Self-Study Content Links:		Duration (in Hrs)
MOOCs	https://www.futureskillsprime.in/course/probability-and-statistics/	30 hrs
Video Lectures	https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_ma74 https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_ma77 https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_mg10	13 hrs
Web Reference	https://www.geeksforgeeks.org/maths/probability-and-statistics/	3 hrs
	https://www.geeksforgeeks.org/machine-learning/statistics-for-machine-learning/	2 hrs

Course Code: CCSE0303A					Course Name: OPERATING SYSTEMS							L	T	P	C
Course Offered in: CSE/CSE-R/IT/CS/CSE (AI)/CSE (AIML)/ IOT/DS/CYS/M.Tech.Int.												2	0	0	2
Pre-requisite: Basic knowledge of computer fundamentals, C programming, Data structures and Computer organization.															
Course Objectives:															
The objective of the course is to provide a foundational understanding of operating system concepts, including system architecture, process and thread management, concurrency, deadlock, resource management, memory and file systems, Linux shell scripting, and an introduction to virtualization and distributed systems.															
Course Outcome: After completion of the course, the student will be able to												Bloom’s Knowledge Level (KL)			
CO1		Understand operating system architecture and types and use the Linux CLI for basic Operations.										K2			
CO2		Implement the CPU scheduling algorithms including uses of multithreading models.										K3			
CO3		Implement concurrency control, process synchronization techniques, and deadlock handling techniques.										K3			
CO4		Implement memory management strategies to optimize system performance and analyze file systems and configure virtual machines in modern operating systems.										K3			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)															
CO - PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	3	2	2	1	2	-	-	-	-	1	1	2	1	2	
CO2	3	3	3	2	2	-	-	-	-	1	1	2	2	1	
CO3	3	3	3	2	2	-	-	-	-	1	1	2	3	3	
CO4	3	3	3	2	2	-	-	-	-	1	2	2	2	2	
Course Contents / Syllabus															
UNIT 1		FUNDAMENTALS & SHELL SCRIPTING										8 HOURS			
Fundamentals of Operating Systems: Overview of Operating Systems, Generations of OS, Operating system architecture, Interrupt handling, System call and kernel, Types of Operating System: Batch OS, Multi-programming OS, Multitasking OS, Multiprocessor OS, Real time OS.															

Shell Scripting in Linux: Introduction to Linux Operating System & Architecture, Basic Command Line Interface (CLI) Operations in Linux, Shell Scripting Basics: Variables, Control Structures, Functions. Case study: Automating system administration tasks using shell scripts in Linux.		
UNIT 2	PROCESS & THREAD MANAGEMENT	8 HOURS
Process Management: Process, Transition Diagram, Process Control Block (PCB), Types of Schedulers: Long Term, Mid Term, Short Term Scheduler, CPU Scheduling: Pre-emptive and Non-Pre-emptive Algorithm (FCFS, SJF, SRTF, Non-Pre-emptive Priority, Pre-emptive Priority, Round Robin, Multilevel Queue Scheduling and Multilevel Feedback Queue Scheduling) Thread: Processes Vs Threads, Thread states, Benefits of threads, Types of threads, Multithreading Models, Concept of Hyper-Threading. Case study: Analyse and implement CPU Scheduling in Real-Time Embedded Systems and RTOS.		
UNIT 3	CONCURRENCY AND DEADLOCK MANAGEMENT	8 HOURS
Concurrency: Introduction of Concurrency, Types of Process, Race Condition, Critical Section, Inter Process Communication, Producer consumer problem. Process Synchronization: Lock variable, Peterson's Solution, Strict alternation, Lamport Bakery Solution, Test and set lock, Semaphore- counting, binary and monitor Classical Problem of Synchronization: Bound Buffer, Dining Philosopher, Reader writer, Sleeping barber. Deadlock: Deadlock, Deadlock characterization, Deadlock Prevention, Deadlock Avoidance: Bankers Algorithms, Deadlock Detection, Recovery from Deadlock. Case study: Deadlock avoidance in database transaction management systems like Oracle or MySQL.		
UNIT 4	MEMORY MANAGEMENT	8 HOURS
Memory Management: Memory Management function, Loading and linking Address Binding, Memory management techniques, Contiguous technique- Fixed Partitions, variable partitions, Memory Allocation: Allocation Strategies (First Fit, Best Fit, and Worst Fit), Non-contiguous, Paging, Segmentation, Segmented paging, Virtual Memory: Virtual Memory Concepts, Demand Paging, Performance of Demand Paging, Page Replacement Algorithms: FIFO, LRU, Optimal and LFU, Belady's Anomaly, Thrashing File and Disk Management: File Access Mechanism, File Allocation Method, Disk Scheduling Algorithms Modern Operating System: Virtual machines – hypervisor, Introduction to GPU. Introduction of CUDA Programming. Case study: Virtual memory management in modern OS like Windows 10 and how paging impacts performance.		
Total Lecture Hours		32 HOURS
Textbook:		
Book Details		Authors Name
Operating System Concepts Essentials , Willey Publication,10th Edition,2018.		Abraham Silberschatz, Peter Baer Galvin and Greg Gagne

A practical guide to Linux: Commands, Editors and Shell Programming, CreateSpace Independent Publishing Platform, 4th Edition,2017.		Marks G. Sobell
LINUX for beginners, 1stEdition,2014.		Jason Cannon
Reference Books:		
Book Details		Authors Name
Operating Systems: Internals and Design Principles, Pearson Education , 9th Edition, 2019.		William Stallings
Operating System: A Design-oriented Approach , McGraw Hill Education,2017.		Charles Patrick Crowley
Learning Linux Shell Scripting, Packt Publishing ,2nd Edition 2018.		Ganesh Naik
Self-Study Content Links:		Duration (in Hrs)
MOOC'S	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384325804798771234443_shared/overview	29 hrs
Video Lectures	https://www.youtube.com/watch?v=dTl9QkH4j8o&list=PL6CdojO56mZ3SeRfpzMBMObsnTziA0gfE https://www.youtube.com/watch?v=Q35sMYHalvQ https://www.youtube.com/watch?v=rnGVincwk30 https://www.youtube.com/watch?v=akU1Ji8Vzdk&list=PLbMVogVj5nJRa3VKt_eyZdJ_DitCz1cvQ https://www.youtube.com/watch?v=pPAKs7tT8sw https://www.youtube.com/watch?v=hBPYP0ZEvS8 https://www.youtube.com/watch?v=UeVQxzlgd10 https://www.youtube.com/watch?v=9cuwgiHQyol https://www.youtube.com/watch?v=-NONm-Jq34Y&t=25s https://www.youtube.com/watch?v=5uyGn147rr0 https://www.youtube.com/watch?v=utYC2tKDdoQ https://www.youtube.com/watch?v=Cuo8	30 hrs

	GtKlgoE https://www.youtube.com/watch?v=Y14b7_T3AEw https://www.youtube.com/watch?v=bK-VhQA512c https://www.youtube.com/watch?v=o2_iCzS9-ZQ https://www.youtube.com/watch?v=SnKgEuUfV4k https://www.youtube.com/watch?v=86FAWCzIe_4	
Web References	https://www.geeksforgeeks.org/operating-systems/operating-systems/ https://studyhubzone.com/operating-systems-notes/	4 hrs



NIET
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Noida Institute of Engineering & Technology, Greater Noida

नोएडा अभियांत्रिकी एवं प्रौद्योगिकी संस्थान, ग्रेटर नोएडा

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Approved by AICTE, Affiliated to Dr. A.P.J. Abdul Kalam Technical University, Lucknow Uttar Pradesh, (Formerly Uttar Pradesh Technical University)



Course Code: CCSE0301				Course Name: DATA STRUCTURES AND ALGORITHMS-II								L	T	P	C
Course Offered in: CSE/CSE-R/CS/IT/CSE(AI)/CSE(AIML)/CSE(DS)/CS/CSE(IOT)/M.tech.Int												3	0	0	3
Pre-requisite: C, Python															
Course Objectives:															
The objective of the course is to learn the basic concepts of algorithm analysis, along with the implementation of non-linear data structures.															
Course Outcome: After completion of the course, the student will be able to												Bloom’s Knowledge Level (KL)			
CO1	Apply tree structures to solve specific problems using various tree operations and algorithms.											K3			
CO2	Analyse the graph data structure and evaluate the efficiency of its operations for problem solving.											K4			
CO3	Evaluate dynamic programming solutions for efficient problem-solving across diverse contexts.											K4			
CO4	Apply efficient backtracking and branch –and –bound techniques across diverse problem-solving scenarios.											K3			
CO5	Understand principles of advanced data structures, including their implementation and applications.											K2			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)															
CO-PO MAPPING	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	3	3	2	1	1	2	1	1	2	1	-	2	1	2	
CO2	3	3	2	1	1	2	1	1	2	1	-	2	1	2	
CO3	3	3	2	2	2	2	1	1	2	2	-	2	1	2	
CO4	3	3	3	2	2	2	1	1	2	1	-	2	1	2	
CO5	3	3	3	2	2	2	1	1	2	2	-	2	1	2	
Course Contents / Syllabus															
UNIT 1	DESIGN AND ANALYSIS OF ALGORITHMS: TREE											9 HOURS			
Trees: Terminology used with Trees, Binary Tree, Memory representation of Tree, Traversal Algorithms: In-order, Pre-order, and post-order. Constructing Binary Tree from given Tree Traversal, Operation of Insertion, Deletion, Searching & Modification of data in Binary Search tree, Binary Heaps, Threaded Binary trees, Traversing Threaded Binary trees, AVL Tree. Application of Trees: Priority Queue, Heap Sort															
UNIT 2	DESIGN AND ANALYSIS OF ALGORITHMS: GRAPH											10 HOURS			

Graphs: Terminology used with Graph, Data Structure for Graph Representations: Adjacency matrices, Adjacency List. Graph Traversal: Depth First Search and Breadth First Search. Connected Component, Spanning Trees. Algorithms on Graphs: Minimum Cost Spanning Trees: Prim's and Kruskal's algorithm, Transitive Closure and Shortest Path algorithms: Dijkstra Algorithm, Bellman Ford Algorithm, Floyd Warshall's Algorithm.		
UNIT 3	DYNAMIC PROGRAMMING	9 HOURS
Dynamic Programming: Dynamic Programming concepts 0/1 Knapsack, Longest Common Sub Sequence, Matrix Chain Multiplication, Resource Allocation Problem.		
UNIT 4	BACKTRACKING, BRANCH AND BOUND	9 HOURS
Backtracking: Backtracking, Branch, and Bound with Examples Such as Travelling Salesman Problem, Graph Colouring, n-Queen Problem, Hamiltonian Cycles, and Sum of Subsets.		
UNIT 5	ADVANCED- DATA STRUCTURES	8 HOURS
Red-Black Trees, B – Trees, B+ Trees, Binomial Heaps, Fibonacci Heaps		
Total Lecture Hours		45 HOURS
Textbook:		
Book Details		Authors Name
<i>Data Structures and Algorithms in Python: An Indian Adaptation, 1st Edition, 2021</i>		<i>Michael T. Goodrich, Roberto Tamassia</i>
<i>Data Structures Schaum's Outline Series, Tata McGraw-hill Education (India) Pvt. Ltd, 2nd Edition, 2017.</i>		<i>Lipschutz</i>
<i>Introduction to Algorithms, Printice Hall of India, 4th Edition, 2022</i>		<i>Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest,</i>
Reference Books:		
Book Details		Authors Name
<i>Data Structure Using C, Oxford University Press, 2nd Edition, 2014.</i>		<i>Reema Thareja</i>
<i>Data Structure Using C, Pearson Education India, 2nd Edition, 2011.</i>		<i>AK Sharma</i>
<i>C and Data structure, Wiley Dreamtech Publication, 1st Edition, 2004.</i>		<i>P. S. Deshpandey</i>
Self-Study Content Links:		Duration (in Hrs)

MOOC'S	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384203240484864010470_shared/overview https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130944399140945922584_shared/overview	18 hrs 3 hrs
VIDEO LECTURES	https://www.youtube.com/watch?v=zWg7U0OEAOE&list=PLBF3763AF2E1C572F https://www.youtube.com/watch?v=LQx9E2--p5c&pp=ygUMYXJyYXlzIG5wdGVs https://www.youtube.com/watch?v=K7VIKIUdo20&pp=ygUPbGluayBsaXN0IG5wdGVs https://www.youtube.com/watch?v=g1USSZVWDsY&list=PLB3CD0BBB95C1BF09&index=2&pp=iAQB https://www.youtube.com/watch?v=THMyk2_p530&pp=ygUccXVldWUgZGF0YSBzdHJ1Y3R1cmUgICBucHRlbA%3D%3D https://www.youtube.com/watch?v=_VV9v41FIq0&pp=ygUZZGI2aWRIIGFuZCBjb25xdWVvICBucHRlbA%3D%3D https://www.youtube.com/watch?v=ARvQcqJ_-NY&list=PLfFeAJ-vQopt_S5XlavyvDFL_mi2pGJE3	40 hrs
WEB REFERENCES	https://www.msajce-edu.in/academics/it/LectureNote/CD3291-LN.pdf	

Course Code: CCS0301				Course Name: CLOUD VIRTUALIZATION TECHNOLOGIES									L	T	P	C
Course Offered in: B. Tech. 2nd Year (3rd Semester) Computer Science													2	0	0	2
Pre-requisite: Fundamentals of Cloud Computing																
Course Objectives:																
The objective of this course is to provide virtualization concepts to design, deploy, and manage open-source virtualized environments and cloud infrastructure.																
Learn different types of virtualization techniques, including server virtualization, storage virtualization, network virtualization, and desktop virtualization.																
Develop the ability to install, configure, and manage virtual machines using virtualization tools and platforms.																
Analyze the performance, resource allocation, security, and scalability aspects of virtualized environments.																
Gain practical knowledge of deploying and managing virtualization solutions for efficient utilization of hardware and cloud infrastructure resources.																
Course Outcome: After completion of the course, the student will be able to														Bloom's Knowledge Level (KL)		
CO1	Understand the fundamentals of virtualization technologies, hypervisors, and their role in cloud computing environments													K2		
CO2	Analyze server and desktop virtualization platforms, virtual machines, and resource allocation mechanisms.													K4		
CO3	Apply network virtualization concepts and Software-Defined Networking (SDN) techniques in virtualized environments.													K3		
CO4	Apply storage virtualization models and cloud-based storage solutions for efficient data management.													K3		
CO5	Examine virtualization platforms and architectures for selecting suitable virtualization solutions in cloud environments.													K4		
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)																
CO-PO MAPPING	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	2	1	–	3	–	–	–	1	–	–	2	3	2	1	
CO2	2	3	2	1	3	–	–	–	2	–	–	2	3	3	2	
CO3	2	3	1	1	3	–	–	–	1	–	–	2	3	2	1	
CO4	2	3	3	2	3	–	–	1	2	–	–	2	3	3	2	
CO5	2	3	3	3	3	–	1	2	2	–	–	3	3	3	3	
Course Contents / Syllabus																
UNIT 1	INTRODUCTION TO VIRTUALIZATION TECHNOLOGIES AND HYPERVISORS											7 HOURS				
Virtualization and cloud computing: Evolution of virtualization technologies, Limitations and challenges, Need of virtualization,																

benefits, limitations, Level of Virtualization, Types of Virtualizations, Session-based virtualization, Guest OS and host OS. Hardware virtualization: Full virtualization, Partial virtualization, Paravirtualization, Hardware assisted Virtualization. Software virtualization: Hypervisor, role of hypervisors, Hypervisor Architecture, Types of Hypervisors (Type-1, Type-2), Virtualization Architecture, Virtual Box, VMware.		
UNIT 2	SERVER AND DESKTOP VIRTUALIZATION	8 HOURS
Virtual Machine: Introduction, Types of virtual machines, Server Virtualization, types of server virtualization, Physical vs virtual servers, Resource allocation (CPU, memory, storage and I/O). Business Cases for Server Virtualization, Uses of Virtual Server Consolidation, Selecting Server Virtualization, Platform-Desktop Virtualization, Remote access protocols (RDP, ICA), Centralized vs distributed desktop environments. Types of Desktop Virtualization: VDI, EC2. VMware ESXi, Microsoft Hyper-V, KVM, QEMU, XenServer Installation and configuration.		
UNIT 3	NETWORK VIRTUALIZATION	8 HOURS
Network Virtualization: Concept and Evolution of network virtualization Types, Overlay and underlay networks, VLAN Vs. VXLAN, VMware NSX, Virtual Network Interface Cards (vNICs), Software-Defined Networking (SDN): SDN architecture and control plane/data plane, Virtual switches, Virtual Routing, OpenFlow protocol, SDN controllers (e.g., ONOS, OpenDaylight), Virtual Private Cloud (Public, Private).		
UNIT 4	STORAGE VIRTUALIZATION	7 HOURS
Storage Virtualization: Introduction, Benefits, Types of Storage: Direct Attached Storage, Storage Area Network, Network Attached Storage, RAID), Virtualization-Block, File-Address space Remapping, Risks of Storage, Types of Storage Virtualization: Block-level virtualization, File-level virtualization, Object storage virtualization. Storage Provisioning Techniques: Thick provisioning vs thin provisioning, Storage tiering (hot, warm, cold data). Data Management Techniques: Data deduplication, Data compression, Data replication (synchronous and asynchronous), Data migration, Backup and Recovery. Storing data in the cloud: S3 and Glacier, EBS and EFS, Using Relational Database Service: RDS, NoSQL Database Service: DynamoDB.		
Total Lecture Hours		30 HOURS
Textbook:		
Book Details		Authors Name
Virtualization Essentials, Wiley India Pvt. Ltd., 2nd Edition, 2016		Matthew Portnoy
Virtual Machines: Versatile Platforms for Systems and Processes, Morgan Kaufmann Publishers, 1st Edition, 2005		James E. Smith and Ravi Nair
Professional Xen Virtualization, Wiley Publishing Inc., 1st Edition, 2008		William von Hagen

Reference Books:		
Book Details		Authors Name
Virtualization: From the Desktop to the Enterprise, Apress Publications, 1st Edition, 2005		Chris Wolf, Erick M. Halter
Cloud Native Security, O'Reilly Media, 1st Edition, 2021		Mike Ryan
Cloud Computing Security: Concepts and Practice, Emereo Publishing, 1st Edition, 2013,		Ivanka Menken
Self-Study Content Links:		Duration (in Hrs)
MOOC'S	Mastering VMware vSphere 6.5	16 hrs 08 min
VIDEO LECTURES	https://www.youtube.com/watch?v=7m3f-P-WWbg (Edureka)	00Hrs 25Min
	https://www.youtube.com/watch?v=wOBA6Wri0Fg	01Hrs 51Min
	https://www.youtube.com/watch?v=b_krXFeOEDU	03Hrs 48Min
	youtube.com/watch?v=2LaAJq1lB1Q&t=147s&pp=0gcJCQYLAYcqIYzv	10Hrs 17Min
WEB REFERENCES	https://awsacademy.instructure.com/courses/ https://www.getyoureducation.net/course/virtualization-sharing-cloud-resources?utm_source=chatgpt.com	

Course Code: CCSAI0302		Course Name: HIGH-PERFORMANCE COMPUTING										L	T	P	C
Course Offered in: CSE/CS/IT/CSIT/CSE(AI)/CSE(AIML)/ECE/EEE/ELCE/ME												3	0	0	3
Pre-requisite: Fundamentals of Cloud Computing															
Course Objectives:															
This course introduces the fundamentals of High-Performance Computing (HPC) and modern computing paradigms like cloud, grid, cluster, and quantum computing. It covers computing architecture, parallelism concepts, distributed memory models, and message-passing techniques. Students will also develop parallel applications using OpenMP and explore fault-tolerant mechanisms in cluster systems.															
Course Outcome: After completion of the course, the student will be able to												Bloom’s Knowledge Level (KL)			
CO1	Identify the need and applications of High-Performance Computing.											K2			
CO2	Analyze computing architectures and parallelism concepts to assess HPC system performance.											K4			
CO3	Implement distributed memory techniques and message passing for parallel algorithm design.											K3			
CO4	Evaluate clustering models and fault tolerance methods in cluster computing systems.											K4			
CO5	High-Throughput Computing (HTC) in Cloud Environments											K3			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)															
CO-PO MAPPING	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	3	2	1	-	1	1	-	-	-	-	1	3	2	1	
CO2	3	3	2	2	2	-	-	-	-	-	1	3	2	1	
CO3	3	3	3	2	3	-	-	-	1	1	1	3	3	2	
CO4	2	3	2	3	2	1	-	-	1	-	2	3	2	2	
CO5	3	3	2	2	3	2	-	-	-	-	2	3	3	2	
Course Contents / Syllabus															
UNIT 1	INTRODUCTION TO HIGH-PERFORMANCE COMPUTING										9 HOURS				
Computational Thinking, Computing, Need of High-Performance Computing, Applications of High-Performance Computing, Parallel programming Software Platforms and its significance, Cloud computing, Application areas of HPC: Grid computing, Cluster															

computing and Quantum Computing, Multi-core CPUs, Graphical Processing Units.		
UNIT 2	COMPUTING ARCHITECTURES	10 HOURS
Instruction Type: Single Instruction Single Data (SISD), Single Instruction Multiple Data (SIMD), Multiple Instruction Single Data (MISD), Multiple Instruction Multiple Data (MIMD), Memory Hierarchy, Data parallelism, Task parallelism, Bit-level parallelism, Instruction-level parallelism, Concurrency, Decomposition, Mapping, Parallel Random-Access Machine (PRAM), Non-Uniform Memory Access (NUMA), Multithreading vs Multiprocessing, shared memory model, Open MP, distributed memory model, Message passing interface. Performance measures: Speedup, efficiency and scalability.		
UNIT 3	DISTRIBUTED MEMORY	10 HOURS
Distributed memory and Message passing networks, Broadcast, Reduction, Parallel Prefix Sum, Scatter, Gather, Network topologies for parallel computing, Network optimization. Distributed Breadth-First Search (BFS), Graphs and adjacency matrix, Matrix based Breadth-First Search (BFS), Compute Unified Device Architecture (CUDA) programming, Parallel matrix operations, Sparse vs Dense matrices.		
UNIT 4	CLUSTER COMPUTING	10 HOURS
Basic Linear Algebra Subprograms (BLAS), Linear Algebra Package, Cluster Computing, Clustering Models, Clustering Architectures, Clustering Architectures key factors, types of clusters, Mission critical Vs Business Critical Applications, Fault Detection and Masking Algorithms, Check pointing, Heartbeats, Watchdog Timers, Fault recovery through Failover and Failback Concepts.		
UNIT 5	HPC IN CLOUD	9 HOURS
High-Throughput Computing: Task Computing and Task-based Application Models, Market-Based Management of Clouds, Energy-Efficient and Green Cloud Computing Architecture, Resource Allocation, Leases, Task Scheduling: RR, Cloud List Scheduling and Cloud Min-Min Scheduling, Workflow Scheduling, Montage, Epigenomics, Signal and Image Processing in High Throughput, Laser Interferometer Gravitational-Wave Observatory, Cyber Shake, Task Consolidation, sIntroduction to CloudSim, Cloudlet, Virtual Machine and its Provisioning, Time and Space-shared Provisioning		
Total Lecture Hours		48 HOURS
Textbook:		
Book Details		Authors Name
The Sourcebook of Parallel Computing		Jack Dongarra, Geoffrey Fox, and Ken Kennedy
Petascale Computing: Algorithms and Applications		David A. Bader (Ed.)
Parallel and High-Performance Computing		Robert Robey and Yuliana Zamora

High Performance Computing: Modern Systems and Practices		Thomas Sterling, Maciej Brodowicz, and Matthew Anderson
Reference Books:		
Book Details		Authors Name
Virtualization: From the Desktop to the Enterprise, Apress Publications, 1st Edition, 2005		Chris Wolf, Erick M. Halter
Cloud Native Security, O'Reilly Media, 1st Edition, 2021		Mike Ryan
Cloud Computing Security: Concepts and Practice, Emereo Publishing, 1st Edition, 2013,		Ivanka Menken
Self-Study Content Links:		Duration (in Hrs)
VIDEO LECTURES	https://www.youtube.com/watch?v=zJ_D6AiGIV8	1 hrs 29 min
	https://www.youtube.com/watch?v=FTXikoQr46U	31 min 31 sec
	https://www.youtube.com/watch?v=gE8KgD9D69k	53 min 29 sec
	https://www.youtube.com/watch?v=kHV6wmG35po	11 min 20 sec

LAB Course Code: CCSE0353A					LAB Course Name: OPERATING SYSTEMS LAB							L	T	P	C
Course Offered in: CSE/CSE-R/IT/CS/AI/AIML/ IOT/DS/CYS												0	0	4	2
Pre-requisite: Basic knowledge of computer fundamentals, C programming, Data structures and Computer organization.															
Course Objectives:															
This course introduces the fundamentals of High-Performance Computing (HPC) and modern computing paradigms like cloud, grid, cluster, and quantum computing. It covers computing architecture, parallelism concepts, distributed memory models, and message-passing techniques. Students will also develop parallel applications using OpenMP and explore fault-tolerant mechanisms in cluster systems.															
Course Outcome: After completion of the course, the student will be able to												Bloom’s Knowledge Level (KL)			
CO1		Execute basic Linux commands and shell scripts to automate file management and system administration tasks.										K3			
CO2		Implement and compare various CPU scheduling algorithms, process synchronization solutions using semaphores and deadlock handling algorithms.										K4			
CO3		Simulate memory allocation techniques and page replacement algorithms, disk management strategies and explore modern OS features including virtualization and distributed computing.										K5			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)															
CO-PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	2	1	1	1	3	-	-	2	2	-	3	2	1	2	
CO2	3	3	3	2	2	-	-	2	2	-	2	2	2	3	
CO3	3	2	3	2	3	-	-	2	2	-	3	2	3	3	
List Of Practical’s (Indicative & Not Limited To)															
S.No		Experiment								CO Mapping					
1		Installation of Linux Operating system.								CO1					
2		Implementation of Linux Commands i. Display system information using uname, hostname, and date etc. ii. File operations using cat, touch, cp, mv, rm, and chmod ,umask etc. iii. Create, view, and navigate directories using mkdir, rmdir, cd, pwd, ls etc. iv. Disk Commands df,du,mount,unmount,mkfs,fsck etc.								CO1					

3	Implementation of Linux Commands (continued) - Use redirection and piping in commands. - File compression and archiving using tar, gzip, zip, unzip etc. - Process commands ps,kill, killall,nice, pgrep, top,htop etc. - Network commands ifconfig, ping, netstat, host,ip route etc. - Administrator Commands Adduser,Passwd, deluser, usermod, groupadd etc	CO1
4	Shell Scripting Programming - Write a shell script to ask your name, program name and enrollment number and print it on the screen. - Write a shell script to find the sum, the average and the product of the four integers entered. - write shell script to find average of numbers given at command line - Write a shell program to exchange the values of two variables. - Write a shell program to Print Numbers 1 to 10 using while & do while loop. - Write a shell program to Print Numbers 1 to 10 using for loop.	CO1
5	Shell Scripting Programming (continued) - Write a shell script to display the digits which are in odd position in a given 5-digit number. - Write a shell program to search for a given number from the list of numbers provided using binary search method. - Write a shell program to concatenate two strings and find the length of the resultant string. - Write a shell script to find the smallest of three numbers. - Write a shell program to count number of words, characters, white spaces and special symbols in a given text.	CO1
6	Implement FCFS CPU Scheduling algorithm.	CO2
7	Implement the SJF CPU Scheduling algorithm (For both pre-emptive and non-pre-emptive).	CO2
8	Implement PRIORITY CPU Scheduling Algorithm (For both pre-emptive and non-pre-emptive).	CO2

9	Implement Round-Robin CPU Scheduling Algorithm.	CO2
10	Implement Multi-Level Queue CPU Scheduling algorithm.	CO2
11	Implement Multilevel Feedback Queue CPU Scheduling Algorithm.	CO2
12	Execute the RACE Condition of Process Synchronization.	CO3
13	Implement the Producer–consumer problem using semaphores.	CO3
14	Design a code and implement the Dining Philosopher problem.	CO3
15	Implement Banker’s algorithm of Deadlock Avoidance.	CO3
16	Execute an algorithm for Deadlock Detection.	CO3
17	Implement Contiguous memory variable size partition scheme.	CO3
18	Simulate the First-Fit contiguous memory allocation technique.	CO3
TEACHING HOURS		48 HOURS



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151-200 Rank Band in Overall



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LAB Course Code: CCSE0351				LAB Course Name: Data structure and Algorithms lab-II								L	T	P	C
Course Offered in: CSE/CS/CSR-R/M.TECH(INT) /IT//CSE(AI)/CSE(AIML)/CSE(DS)/CSE(CS)												0	0	4	2
Pre-requisite: C, Python															
Course Objectives:															
Learn to implement linear data structures															
Course Outcome: After completion of the course, the student will be able to												Bloom’s Knowledge Level (KL)			
CO1		Implementation of tree data structures for basic operations like insertion, deletion, searching and traversal										K3			
CO2		Implementation of algorithms based on graph data structures for solving real world problems.										K3			
CO3		Implementing Dynamic Programming, Backtracking, Branch and Bound algorithms to solve complex data efficiently and effectively.										K3			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)															
CO-PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	3	3	2	1	1	2	1	1	2	1	-	2	1	2	
CO2	3	3	2	1	1	2	1	1	2	1	-	2	1	2	
CO3	3	3	2	2	2	2	1	1	2	2	-	2	1	2	
List Of Practical’s (Indicative & Not Limited To)															
S.No	Experiment									CO Mapping					
1	Write a program to implement an in-order traversal of a binary tree and print the nodes.									CO1					
2	Write a program to implement a pre-order traversal of a binary tree and print the nodes.									CO1					
3	Write a program to implement a post-order traversal of a binary tree and print the nodes.									CO1					
4	Write a program to count the number of nodes in a binary tree.									CO1					
5	Write a program to find the height of the tree.									CO1					

6	Write a program to check if the binary tree is balanced or not.	CO1
7	Write a program to search a number in a Binary Search Tree (BST).	CO1
8	Write a program to insert a node in a Binary Search Tree (BST).	CO1
9	Write a program to delete a node from a Binary Search Tree (BST).	CO1
10	Write a program to implement a max-heap and perform heap sort on an array of integers.	CO1
11	Write a program to implement a priority queue using a max heap.	CO1
12	Write a program to create a graph using an adjacency matrix.	CO2
13	Write a program to create a graph using an adjacency list.	CO2
14	Write a program to perform Depth-First Search (DFS) on a graph.	CO2
15	Write a program to perform Breadth-First Search (BFS) on a graph.	CO2
16	Write a program to check if there is a path between two nodes in a graph using DFS.	CO2
17	Write a program to find all the vertices reachable from a given vertex in a graph.	CO2
18	Write a program to detect a cycle in an undirected graph using DFS.	CO2
19	Write a program to detect a cycle in a directed graph using DFS.	CO2
20	Write a program to find the degree of each vertex in an undirected graph.	CO2
21	Write a program to count the number of connected components in an undirected graph.	CO2
22	Write a program to implement Dijkstra's Algorithm.	CO3

23	Write a program to implement Prim's Algorithm.	CO3
24	Write a program to implement Kruskal's Algorithm.	CO3
25	Write a program to implement Floyd–Warshall's all-pairs shortest path algorithm.	CO3
26	Write a program to implement Bellman–Ford Algorithm.	CO3
27	Write a program to implement Longest Common Subsequence (LCS) using Dynamic Programming.	CO3
28	Write a program to implement 0/1 Knapsack using Dynamic Programming.	CO3
29	Write a program for Matrix Chain Multiplication using Dynamic Programming.	CO3
30	Write a program to implement Sum of Subsets problem using backtracking.	CO3
TEACHING HOURS		30 HOURS



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LAB Course Code: CCS0351				Lab Course Name: CLOUD VIRTUALIZATION TECHNOLOGIES LAB								L	T	P	C
Course Offered in: B. Tech. Computer Science												0	0	2	1
Pre-requisite: Fundamentals of Cloud Computing															
Course Objectives:															
Learn to provide students with practical experience in using cloud services and tools. This involves setting up virtual machines, storage solutions, databases, networking configurations.															
Understand and implement different virtualization techniques including server, storage, and network virtualization.															
Gain hands-on experience in creating and managing virtualized cloud environments and resource allocation.															
Analyse the performance, scalability, and security aspects of virtualization in cloud computing environments.															
Apply virtualization technologies to optimize hardware utilization, system management, and cloud infrastructure deployment.															
Course Outcome: After completion of the course, the student will be able to												Bloom’s Knowledge Level (KL)			
CO1		Configuration of virtualization platforms such as VirtualBox, VMware ESXi, and Hyper-V										K3			
CO2		Analyze virtual networking and storage using tools like VPC and cloud services (S3, EBS, RDS).										K4			
CO3		Apply security features like firewalls and IAM along with auto-scaling and its policies.										K3			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)															
CO-PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	3	1	2	1	3	–	–	–	1	–	–	3	2	1	
CO2	3	3	2	2	3	–	–	–	1	–	1	3	3	1	
CO3	2	2	3	2	3	–	–	1	–	–	1	2	3	2	
List Of Practical’s (Indicative & Not Limited To)															
S.NO	EXPERIMENT									CO MAPPING					
1	Write a program to implement an in-order traversal of a binary tree and print the nodes.									CO1					
2	Write a program to implement a pre-order traversal of a binary tree and print the nodes.									CO1					
3	Write a program to implement a post-order traversal of a binary tree and print the nodes.									CO1					

4	Write a program to count the number of nodes in a binary tree.	CO1
5	Write a program to find the height of the tree.	CO1
6	Write a program to check if the binary tree is balanced or not.	CO1
7	Write a program to search a number in a Binary Search Tree (BST).	CO1
8	Write a program to insert a node in a Binary Search Tree (BST).	CO1
9	Write a program to delete a node from a Binary Search Tree (BST).	CO1
10	Write a program to implement a max-heap and perform heap sort on an array of integers.	CO1
11	Write a program to implement a priority queue using a max heap.	CO1
12	Write a program to create a graph using an adjacency matrix.	CO2
TEACHING HOURS		30 HOURS

Course Code: CCSE0355		Course Name: OBJECT ORIENTED TECHNIQUES USING JAVA											L	T	P	C
Course Offered in: CSE/CS/IT/CSE(AI)/CSE(AIML)/CSE(IOT)/CSE(AI)/CSE(DS)/CSE-R/M.Tech int													0	0	6	3
Pre-requisite: Basic Programming Knowledge, Knowledge of any programming language (e.g., C, C++, Python)																
Course Objectives:																
The objective of this course is to understand the object-oriented methodology, and its techniques to design stand alone and GUI applications using hands-on engaging activities.																
Course Outcome: After completion of the course, the student will be able to												Bloom’s Knowledge Level (KL)				
CO1	Understand the concepts of object-oriented programming and relationships among them needed in modeling.											K2				
CO2	Demonstrate the Java programs using OOP principles and also implement the concepts of lambda expressions											K3				
CO3	Analyze packages with different protection level resolving namespace collision and implement the error handling concepts for uninterrupted execution of Java program.											K4				
CO4	Analyze Concurrency control, I/O Streams and Java Socket Programming Concepts.											K4				
CO5	Design and develop the GUI based application, Generics and Collections in Java programming language to solve the real-world problem											K6				
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)																
CO-PO MAPPING	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	3	3	3	2	2	1	-	1	-	2	3	3	2	3	
CO2	3	3	3	3	2	2	1	-	1	1	2	3	2	2	3	
CO3	3	3	3	3	3	2	2	-	2	1	2	3	3	1	3	
CO4	3	3	3	3	3	2	2	1	2	1	2	3	2	2	3	
CO5	3	3	3	3	3	2	2	1	2	1	2	3	3	2	3	
Course Contents / Syllabus																
UNIT 1	BASICS OF JAVA PROGRAMMING											16 HOURS				
Object Oriented Programming: Introduction and Pillars of OOP with real life example, jvm architecture and its components																

Modelling Concepts: Introduction, Class Diagram and Object Diagram, UML concepts: Association, Composition, aggregation, realization, and Generalization. Control Statements: Decision Making, Looping and Branching, Argument Passing Mechanism: Command Line Argument, Console Input. Class and Object: Object Reference, Constructor, Abstraction: Abstract Class, Interface and its uses, Defining Methods, Use of “this” and “super” keyword, Garbage Collection and finalize () Method etc.		
UNIT 2	OOPS FEATURES, ARRAYS AND LAMBDA EXPRESSIONS	16 HOURS
Inheritance: Introduction and Types of Inheritance in Java, Access Modifiers, Constructors and super constructor in Inheritance. Polymorphism: Introduction and Types, Overloading and Overriding. Lambda expression: Introduction and Working with Lambda Variables. Arrays: Introduction and its Types. Jagged Array with example		
UNIT 3	PACKAGES, EXCEPTION HANDLING AND STRING HANDLING	16 HOURS
Packages: Introduction and Types, Access Protection in Packages, Import and Execution of Packages. Exception Handling, Assertions and Localizations: Introduction and Types, Exceptions vs. Errors, Handling of Exception. Finally, Throws and Throw keyword, Multiple Catch Block, Nested Try and Finally Block, Customized Exceptions, Tokenizer. Assertions and Localizations Concepts and its working. String Handling: Introduction and Types, Operations, Immutable String, Method of String class, String Buffer and String Builder class.		
UNIT 4	CONCURRENCY IN JAVA AND I/O STREAM	16 HOURS
Threads: Introduction and Types, Creating Threads, Thread Lifecycle, Thread Priorities, Daemon Thread, Runnable Class, Synchronizing Threads etc. I/O Stream: Introduction and Types, Common I/O Stream Operations, Interaction with I/O Streams Classes. character and byte-oriented stream classes with example Java Socket Programming: Introduction and types(TCP, UDP), java socket program with server-side and client-side by using connection.		
UNIT 5	GUI PROGRAMMING, GENERICS AND COLLECTIONS	16 HOURS
GUI Programming: Introduction and Types, Swing, AWT, Components and Containers, Layout Managers and User-Defined Layout and Event Handling. Generics: Introduction to Generic Classes, types of generic defined in brief, bounded type parameter(Upper and Lower bound), Initializing a Generic Object, Classes, Methods and Interfaces Use enumerated type. Collections: Introduction, main interfaces of collections(Collection, List Set, Map, Queue), classes of collections(ArrayList, Linked list, HashSet, HashMap and TreeSet) and methods(List, Set Map) Collection using Iterators.		
Total Lecture Hours		80 HOURS
Textbook:		

Book Details		Authors Name
” Java: A Beginner’s Guide”, McGraw-Hill Education 2nd edition		Herbert Schildt
“Programming with Java A Primer”, TMH, 4th edition.		E Balagurusamy,
Reference Books:		
Book Details		Authors Name
“Core Java Volume I – Fundamentals”, Prentice Hall		Cay S. Horstmann
” Effective Java”, Addison Wesley		Joshua Bloch
Java - The Complete Reference”, McGraw Hill Education 12th edition		Herbert Schildt
Self-Study Content Links:		Duration (in Hrs)
MOOC’S	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0125409722749255681063_shared/overview	46h 13m
VIDEO LECTURES	https://www.youtube.com/watch?v=iw1Xf_33YM0&list=PLQEaRBV9gAFujcBWJhBT2XXsuMlIfETBy	30h
WEB REFERENCES	https://www.geeksforgeeks.org/dsa/introduction-of-object-oriented-programming/	20 m
	https://en.wikipedia.org/wiki/Object-oriented_programming	58 m
LIST OF PRACTICAL		
S.N.	List Of Practical’s (Indicative & Not Limited To)	CO
1	Understanding Text Editors to Write Programs Compile and run first java file Byte Code and class file	CO1
2	Sketch a class and object diagram describing the sales order system of restaurant	CO1
3	Sketch a class diagram describing the circle and rectangle class	CO1

4	Sketch a class diagram for a college platform including, classroom, playground, chair, table, smart board, teaching staff etc.	CO1
5	Sketch a class diagram containing class called Employee, which models an employee with an ID, name and salary. Add method raiseSalary(percent) that increases the salary by the given percentage.	CO1
6	Program to display default value of all Primitive data types	CO1
7	Implement the code using main() method to calculate and print the Total and Average marks scored by a student from the input given through the command line arguments. Assume that four command line arguments name, marks1, marks2, marks3 will be passed to the main() method in the below class with name TotalAndAvgMarks.	CO1
8	Write code which uses if-then-else statement to check if a given account balance is greater or lesser than the minimum balance. Write a class BalanceCheck with public method checkBalance that takes one parameter balance of type double. Use if-then-else statement and print Balance is low if balance is less than 1000. Otherwise, print Sufficient balance.	CO1
9	A class Number Palindrome with a public method isNumberPalindrome that takes one parameter number of type int. Write a code to check whether the given number is palindrome or not. For example, Cmd Args : 333 333 is a palindrome	CO1
10	Write a class FibonacciSeries with a main method. The method receives one command line argument. Write a program to display Fibonacci series i.e. 0 1 1 2 3 5 8 13 21	CO1
11	Write a Java Program to find the Factorial of a given number.	CO1
12	Java Program to create a class, methods and invoke them inside main method.	CO1

13	Write a Java program to illustrate the abstract class concept. Create an abstract class Shape, which contains an empty method numberOfSides(). Define three classes named Trapezoid, Triangle and Hexagon extends the class Shape, such that each one of the classes contains only the method numberOfSides(), that contains the number of sides in the given geometrical figure. Write a class AbstractExample with the main() method, declare an object to the class Shape, create instances of each class and call numberOfSides() methods of each class.	CO1
14	Java program to illustrate the static field in the class.	CO1
15	Java Program to illustrate static class.	CO1
16	Write a java program to access the class members using super keyword	CO1
17	Java program to access the class members using this keyword	CO1
18	Implement an interface named MountainParts that has a constant named TERRAIN that will store the String value "off_road". The interface will define two methods that accept a String argument name newValue and two that will return the current value of an instance field. The methods are to be named: getSuspension, setSuspension, getType , setType.	CO1
19	Java program to demonstrate nested interface inside a interface.	CO1
20	Java program to demonstrate nested interface inside a class.	CO1
21	Java program to explicit implementation of garbage collection by using finalize() method	CO1
22	Java program to implement Single Inheritance	CO1

23	Java program to implement multi- level Inheritance	CO1
24	Java program to implement constructor and constructor overloading.	CO1
25	Java program implement method overloading.	CO1
26	Java program to implement method overriding.	CO1
27	.Java program to implement lambda expression without parameter.	CO1
28	Java program to implement lambda expression with single parameter.	CO1
29	Java program to implement lambda expression with multi parameter.	CO1
30	Java program to implement lambda expression that iterate list of objects	CO2
31	.Java program to define lambda expressions as method parameters	CO2
32	Write a class CountOfTwoNumbers with a public method compareCountOf that takes three parameters one is arr of type int[] and other two are arg1 and arg2 are of type int and returns true if count of arg1 is greater than arg2 in arr. The return type of compareCountOf should be boolean. Assumptions: 1. arr is never null 2. arg1 and arg2 may be same	CO2
33	Java program to show the multiplication of two matrices using arrays.	CO2

34	Java Program to search an element using Linear Search	CO2
35	.Java program to search an element using Binary Search	CO2
36	Java Program to sort element using Insertion Sort	CO2
37	Java Program to sort element using Selection Sort Largest element Method	CO2
38	Java program to Sort elements using Bubble Sort	CO2
39	Java program to create user defined package.	CO3
40	Java Program to create a sub- classing of package	CO3
41	Implement the following: 1. Import package.*; 2. import package.classname; Using fully qualified name.	CO3
42	Implement and demonstrate package names collision in java	CO3
43	Java program to handle and Arithmetic Exception Divided by zero	CO3
44	.Java Program to implement User Defined Exception in Java	CO3
45	Java program to illustrate finally block	CO3

46	Java program to illustrate Multiple catch blocks	CO3
47	Java program for creation of illustrating throw in exception handling.	CO3
48	Implement the concept of Assertion in Java Programming Language	CO3
49	Implement the concept of Localization in Java Programming Language.	CO3
50	Java program to print the output by appending all the capital letters in the input string.	CO3
51	Java program that prints the duplicate characters from the string with its count.	CO3
52	Java program to check if two strings are anagrams of each other	CO3
53	Java Program to count the total number of characters in a string	CO3
54	.Java Program to count the total number of punctuation characters exists in a String	CO3
55	Java Program to count the total number of vowels and consonants in a string	CO3
56	Java Program to show .equals method and == in java	CO3
57	Given a string, return a new string made of n copies of the first 2 chars of the original string where n is the length of the string. The string may be any length. If there are fewer than 2 chars, use whatever is there. If input is "Wipped" then output should be "WiWiWiWiWi".	CO3

58	Given two strings, a and b, create a bigger string made of the first char of a, the first char of b, the second char of a, the second char of b, and so on. Any leftover chars go at the end of the result. If the inputs are "Hello" and "World", then the output is "HWeolrllod".	CO3
59	Java program to show the usage of string builder.	CO3
60	Java program to show the usage of string buffer.	CO3
61	Creating and Running a Thread	CO3
62	Implementing Runnable Interface	CO3
63	Synchronizing Threads with lock	CO3
64	Synchronizing Threads without lock	CO3
65	Java program to implement even and odd threads by using Thread class .	CO4
66	Java program to implement even and odd threads by using Runnable interface.	CO4
67	Java program to synchronize the threads by using Synchronize statements and Synchronize block.	CO4
68	.Write a program where the client sends a message to the server, and the server prints it by using TCP	CO4
69	Implement a server that can handle multiple clients simultaneously using UDP	CO4

70	Write a client-server application where the client uploads a file and the server saves it by using TCP/UDP.	CO4
71	Java program to implement that read a character stream from input file and print it into output file.	CO4
72	.Java program to implement that merge the content of two files (file1.txt, file2.txt) into file3.txt.	CO4
73	Write a Java program that reads the contents of one file and copies them to another file.	CO4
74	Write a Java program that reads a text file and counts the number of words in it.	CO4
75	Write a Java program that reads a text file and counts the frequency of each word in it.	CO4
76	Write a Java program that reads a text file and adds line numbers to each line. The program should create a new file with the line numbers added to the beginning of each line.	CO4
77	Write a Java program that reads two binary files and compares them byte by byte to determine if they are identical. Display a message indicating whether the files are the same or different.	CO4
78	Program to create a frame with three button in AWT and swing	CO4
79	Program to display message with radio buttons in swing	CO4
80	Program to display "All The Best" in 5 different colors on screen. (Using AWT/Swing)	CO5
81	Program to implement handling in a button "OK"	CO5

82	Java Program to implement BorderLayout	CO5
83	.Java Program to implement GridLayout	CO5
84	Java Program to implement BoxLayout	CO5
85	Java Program to implement CardLayout	CO5
86	Java program to implement Generic class	CO5
87	Java program to illustrate Generic methods	CO5
88	Java program to implement wildcard in generics	CO5
89	Java program to implement of methods of HashSet	CO5
90	Java Program to implement methods available in HashMap class	CO5
91	Program to add, retrieve, and remove element from ArrayList	CO5
92	Create a method which can accept a collection of country names and add it to ArrayList with generic defined as String and return the List.	CO5
93	Create a method which can create a HashSet containing values 1-10.The Set should be declared with the generic type Integer.The method should return the Set.	CO5

94	ava program to implement autoboxing	CO5
95	Java program to implement unboxing	CO5
96	Develop a java class with a method <i>storeEvenNumbers(int N)</i> using ArrayList to store even numbers from 2 to N, where N is a integer which is passed as a parameter to the method <i>storeEvenNumbers()</i> . The method should return the ArrayList (A1) created.	CO5
97	Create a method that accepts the names of five countries and loads them to an array list and returns the list.	CO5
98	Create a method which can accept a collection of country names and add it to ArrayList with generic defined as String and return the List.	CO5



NIET
Greater Noida
Autonomous Institute

Noida Institute of Engineering & Technology, Greater Noida

नोएडा अभियांत्रिकी एवं प्रौद्योगिकी संस्थान, ग्रेटर नोएडा

Approved by AICTE, Affiliated to Dr. A.P.J. Abdul Kalam Technical University, Lucknow Uttar Pradesh, (Formerly Uttar Pradesh Technical University)



Course Code: CASCC0401				Course Name: EMPLOYABILITY SKILL DEVELOPMENT - II							L	T	P	C
Course Offered in: IV Semester											2	0	0	2
Note: Section C - offered in B.Tech. III/IV SEM														
Pre-requisite: Students should have successfully completed communication skills courses in the first year.														
Course Objectives:														
Section A: Develop proficiency in C++ programming, data management, and project development by applying concepts, teamwork, and problem-solving to build practical applications.														
Section B: Enhance quantitative aptitude skills through business mathematics concepts, enabling accurate problem-solving in financial calculations, ratios, and real-world numerical applications.														
Section C: To develop the ability to communicate effectively and empathetically in workplace situations while strengthening active listening, adaptability, and cross-cultural awareness for navigating complex professional environments.														
Course Outcome											Bloom’s Knowledge Level (KL)			
CO1		Apply C++ programming concepts, file handling, and STL techniques to develop efficient programs for data storage and manipulation.									K3			
CO2		Design and implement a C++ -based project by applying planning, teamwork, and problem-solving skills.									K6			
CO3		Solve real-life business math problems involving percentages, profit and loss, discounts, interest, averages, mixtures, and ratios using appropriate mathematical methods.									K3			
CO4		Apply spoken English skills to participate effectively in standard workplace routines, including daily stand-ups, reporting, and collaborative problem-solving.									K3			
CO5		Evaluate and adapt communication styles to suit dynamic workplace communication situations and deliver context-sensitive, and logically structured verbal responses under time constraints.									K6			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)														
CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	2	3	1	-	3	2	2	2	-	-	-
CO2	3	3	3	3	3	2	1	3	2	2	2	-	-	-

Guided Interpersonal Simulations: Role-playing everyday scenarios: politely interrupting a meeting, seeking assistance on a delayed task, and confirming understanding of complex briefs using paraphrasing techniques. Digital & Hybrid Nuances: Verbal signalling in virtual meetings, managing “overtalk,” and translating concise written chat messages into spoken professional updates.		
UNIT 5	WORKPLACE COMMUNICATION IN ACTION	12 hours
Dynamic Problem-Based Communication: Simulating the “War Room.” Explaining sudden technical failures, proposing immediate solutions, and negotiating revised deadlines with stakeholders. Listening Under Pressure & Global Adaptability: Interpreting fast, accented, or incomplete instructions (incorporating CEFR-level listening benchmarks). Decoding tone, urgency, and indirect cultural communication styles. Collaborative Conflict Resolution: Managing disagreements in team settings using “I-statements” and the “Yes, and…” technique to build consensus without escalating tension. The Persuasive Professional: Delivering evidence-based arguments using the PREP (Point, Reason, Example, Point) framework to justify a technical choice or resource allocation. Real-Time “Crisis” Simulation (Capstone): A comprehensive role-play where student groups are given a sudden project change or client issue. They must conduct an emergency meeting, delegate tasks verbally, and present a united response to the “client.”		
Total: 56 Hours		
<i>*A list of problem statements will be provided by the mentor; you may choose anyone.</i> <i>Note: Students may choose an alternative problem statement with prior approval from the mentor.</i>		
REFERENCE BOOKS:		
BOOK TITLE	AUTHOR	
A Project-Based Introduction to Programming	Access Point Publishing	
Programming: Principles and Practice Using C++	Bjarne Stroustrup	
Effective Modern C++	Scott Meyers	
Quantitative Aptitude	R S Aggarwal	
Verbal & Non-Verbal Reasoning	R S Aggarwal	
<i>Crucial Conversations Tools</i>	Kerry Patterson et al.	
<i>HBR Guide to Persuasive Presentations</i>	Nancy Duarte	
SELF-STUDY CONTENT LINKS:		DURATION (IN HRS)

MOOCs	nptel.ac.in/courses/109104107	8 Weeks
Video Lectures	Employability Skills Training Session - YouTube	1 hour
Web References	https://www.scribd.com/document/690580893/EMPLOYABILITY-SKILLS-NOTES-full-1	-

Course Code: CNC0302/CNC0402				Course Name: Environmental Science								L	T	P	C
Course Offered in: CSE/CS/IT/CSE(AI)/CSE(AIML)/CSE(IOT)/CSE(AI)/CSE(DS)/CSE-R/M.Tech (Int) / MCT / CSE (CYS)												2	0	0	NA
Pre-requisite: Basic knowledge of biology, chemistry, ecology, geology, mathematics, and understanding of human impacts on natural systems.															
Course Objectives:															
To help the students in realizing the inter-relationship between man and environment and help the students in acquiring basic knowledge about environment.															
Course Outcome: After completion of the course, the student will be able to														Bloom's Knowledge Level (KL)	
CO1	Understand the basic principles of ecology and the environment. Ecosystem: Basic concepts, components of ecosystems, food chains and food webs. Ecological pyramids													K2	
CO2	Understand the different types of natural resources like food, forest, Minerals and energy and their conservation													K2	
CO3	Understand the different types of pollution, pollutants, their sources, effects, and their control methods.													K2	
CO4	Understand the basic concepts of sustainable development, Environmental Impact Assessment (EIA) and different acts related to environment													K2	
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)															
CO-PO MAPPING		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1		3	3	2	2	-	3	3	2	2	-	2	2	2	
CO2		3	3	2	2	-	3	3	2	2	-	2	2	2	
CO3		3	3	2	2	-	3	3	2	2	-	2	2	2	
CO4		3	3	2	2	-	3	3	3	2	-	2	2	2	
Course Contents / Syllabus															
UNIT 1	Basic Principle of Ecology and Biodiversity													5 HOURS	
Definition, Scope and basic principles of ecology and environment. Ecosystem: Basic concepts, components of ecosystem. Food chains and food. Webs. Ecological pyramids, Energy flow in ecological systems, Characteristics of different ecosystems. Biogeochemical Cycles: Importance, gaseous and sedimentary cycles. Carbon, Nitrogen, Phosphorus and Sulphur Cycles. Biodiversity and their importance, Threats to biodiversity, major causes, extinction's, vulnerability of species to extinction, IUCN threat categories, Red data book. Strategies for biodiversity conservation, principles of biodiversity conservation in-situ and ex-situ conservation strategies Mega diversity zones and Hot spots, concepts, distribution and importance.															
UNIT 2	Natural Resources and Ecological succession													5 HOURS	
Natural resources and associated problems. Forest resources: Use and over- exploitation, deforestation. Timber extraction, mining, dams and their effects on forest and tribal people. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Food resources: World food problems, changes caused by agriculture and over- grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, and salinity. Land resources: Land as a resource, land degradation, man induced landslides. Equitable use of resources for sustainable lifestyles. Non-Renewable Energy Resources: Fossil fuels and their reserves, Nuclear energy, types, uses and effects, Renewable Energy Resources: hydropower, Solar energy, geothermal, tidal and wind energy, Biomass energy, biogas and its advantages. Ecological succession-Types, stages, examples of ecological succession															
UNIT 3	Pollution and Waste Management													5 HOURS	
Air pollution: sources of air pollution, Primary and secondary air pollutants. Origin and effects of SOX, NOX, CO, CFC, Hydrocarbon, control of air pollution. Water pollution: sources and types of water pollution, Effects of water pollution, Eutrophication, Soil pollution: Causes of soil pollution, Effects of soil pollution, Major sources of and effects of noise pollution on health, Radioactive and thermal pollution sources and their effects on surrounding environment. Solid waste disposal and its effects on surrounding environment, Introduction to E- Waste, Types and classification of E- Waste, Impacts of E- Waste on environment and human health,E-Waste management and recycling., Climate change, global warming, acid rain, ozone layer depletion.															
UNIT 4	Environmental Assessment and Legislation													5 HOURS	
Women education, Role of NGOs regarding environmental protection, Bio indicators and their role, Natural disasters and disasters management, Aims and objectives of Environmental Impact Assessment (EIA). Salient features of following Acts: Environmental Protection Act, 1986, Wildlife (Protection) Act, 1972.Water (Prevention and control of pollution) Act, 1974. Forest (Conserving) Act, 1980. Definition and concept of sustainability, impacted areas of sustainable development, Global initiative, and issues on sustainable development UN SDGs, System Thinking and Sustainability.															
Total Lecture Hours													20 HOURS		
Textbook:															

S.No	Book Title with publication agency & year	Author
1	Brady, N.C. 1990. The nature and properties of Soils, Tenth Edition. Mac Millan Publishing Co., New York	Brady, N.C
2	Sodhi G.S. 2005, Fundamentals of Environmental Chemistry: Narosa Publishing House, New Delhi.	Sodhi G.S
3	Dash, M.C. (1994), Fundamentals of Ecology, Tata Mc Graw Hill, New Delhi.	Dash, M.C
Reference Books:		
1	Rao M.N. and H.V.N. Rao, 1989 : Air Pollution, Tata McGraw Hill Publishing Co. Ltd., New Delhi	Rao M.N. and H.V.N. Rao
2	A Text Book of environmental Science By Shashi Chawla	Shashi Chawla
Self-Study Content Links:		
MOOC'S		
VIDEO LECTURES	https://www.youtube.com/watch?v=T21OO0sBBfc	7 min 42 sec
	https://www.youtube.com/watch?v=qt8AMjKKPD0	15 min
	https://www.youtube.com/watch?v=brF0RWJyx9w	3 min 25 sec
	https://www.youtube.com/watch?v=GK_vRtHJZu4	4 min 25 sec
WEB REFERENCES	https://www.youtube.com/watch?v=yqev1G2iy20 ,	28 min
	https://www.youtube.com/watch?v=_74S3z3IO_I ,	31 min 35 sec
	https://www.youtube.com/watch?v=jXVw6M6m2g0	11 min



Course Code: CCSE0401				Course Name: DATABASE MANAGEMENT SYSTEMS								L	T	P	C
Course Offered in: CSE/CSE-R/IT/M.Tech Int./CSE (Twin)/IT (Twin)/CSE(Prof)/IT (Prof)/M&C/AI/AI (TWIN)/AIML/AIML (TWIN)/CS/CYS/DS/IOT												2	0	0	2
Pre-requisite: Basic understanding of computer fundamentals such as architecture, storage and hardware. In addition, familiarity with data structures, algorithms, and basic programming concepts will be beneficial.															
Course Objectives: The objective of the course is to introduce about database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information in relational & non-relational databases.															
Course Outcome												Bloom’s Knowledge Level (KL)			
CO1		Apply ER model for conceptual design of the database.										K3			
CO2		Execute SQL and apply the normalization to improve the database design.										K3			
CO3		Implement complex queries in database with different applications.										K3			
CO4		Understand transaction and concurrency control and execute the concept of PL/SQL.										K3			
CO5		Analyze and implement effective Relational and Non-Relational database for real-world problems.										K4			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)															
CO-PO Mapping		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1		3	3	3	3	2	1	1	1	2	1	2	3	1	2
CO2		3	2	3	3	2	2	1	2	1	2	2	3	2	2
CO3		3	3	2	3	3	2	-	2	1	-	2	3	3	2
CO4		3	2	2	2	2	2	1	-	1	1	1	3	3	2
CO5		2	2	2	2	3	2	1	-	1	2	2	3	3	2
Course Contents / Syllabus															

UNIT 1	INTRODUCTION ABOUT THE DATABASE CONCEPTUAL DESIGNING	9 hours
Basic Concept: Database system concept, architecture, History of Database, Data Independence, Database system Vs File system, Data models & Types of Data Models, schema and instances. Data Modelling using the Entity Relationship Model: ER model concepts, Degree of relationship, Notation for ER diagram, mapping constraints, Generalization, Aggregation, Reduction of an ER diagrams to tables. Extended ER Diagram & reduction of EER. Codd Rules. Introduction on SQL: Types of SQL commands: -DDL, DML, DCL, TCL. Basic of Relation Algebra & Operations, Query Optimization.		
UNIT 2	BASIC OF SQL & NORMALIZATION	9 hours
Keys & Types of Keys: Super key, Candidate Key, Primary Key, Alternative Key, Foreign Key, unique. Constraints and Types of Constraints. Use of Functions and Clause: Aggregate Functions, Scalar Functions, Where Group by, Having and Order by. Use of Predicates: SQL Operators. Like, Between, Aliases, distinct, limit. Functional Dependencies, attribute Closure, Normalization & Types of Normalization, Candidate Key, FD Preservation, Lossy and Lossless decomposition, Canonical Cover of FD's, Denormalization.		
UNIT 3	INTRODUCTION OF COMPLEX QUERIES	9 hours
Use of Operators: Union, Intersect, Minus, Cartesian Product, Joins: Inner Join: Natural Join, Equi Join & Non Equi Join, Outer Join: Left Outer Join, Right Outer Join and Full Outer Join, Division Operator. Nested Query or Sub Query: IN, NOT IN, Exists, Not Exists, All and Any. Managing Indexes, Synonyms and Sequences, Managing Views. Introduction of PL/SQL: Implementation of PL/SQL Function, Stored Procedure, Cursor, Trigger, Exception Handling. Database connectivity: Database Connectivity with any of the Programming Languages.		
UNIT 4	TRANSACTION AND CONCURRENCY CONTROL	9 hours
Transaction system: Life cycle of transaction, ACID Properties Schedule & Types of Schedule, Serializability, Recoverability, Deadlock Handling. Concurrency Control Techniques: Concurrency Control, Concurrency control Techniques: Locking Techniques, Timestamping, Validation Based Protocol, Transaction & Data Control: -Grant, Revoke, commit & Rollback.		
UNIT 5	INTRODUCTION OF NOSQL WITH MONGODB	9 hours
Introduction to NoSQL: NoSQL Data Models, Overview of NoSQL Databases with their Types, Uses & Features of NoSQL Document Databases, CAP theorem, BASE Vs ACID, Comparison of relational databases to NoSQL stores, uses and deployment: MongoDB, Cassandra, HBASE, Neo4j, Redis and Riak.		

Introduction to MongoDB: Introduction and Features of MongoDB, MongoDB Operators, MongoDB Collection & Document, MongoDB Shell & their commands, CRUD operations. Introduction of Cloud Database. MongoDB Cloud product : Stitch, Atlas & Cloud Manager.		
Total: 45 Hours		
TEXTBOOK		
BOOK TITLE		AUTHOR
Database Concepts, McGraw Hill, 7th Edition, 2020		Avi Silberschatz Henry F. Korth S. Sudarshan
Fundamentals of Database Systems, Addison Wesley, 7th edition, 2016		R. Elmasri and S. B. Navathe
REFERENCE BOOKS:		
BOOK TITLE		AUTHOR
Database Systems: A practical Approach to Design, Implementation and Management. Pearson Education,3rd Edition, 2007.		Thomas Connolly , Carolyn Begg
NoSQL and SQL Data Modeling: Bringing Together Data, Semantics, and Software, Ted Hills, 1st Edition,2016.		Ted Hills
SELF-STUDY CONTENT LINKS:		DURATION (IN HRS)
MOOCS	nptel.ac.in/courses/106105175	16 HOURS
VIDEO LECTURES	DBMS L1 Inauguration & Introduction DBMS L2 Introduction to Relational Model DBMS L8C Entity Relationship Model DBMS L8D Entity Relationship Model (Problem Solving and Discussion) DBMS L4A Joins, Set Operations and Aggregate Functions DBMS L4B Joins, Set Operations and Aggregate Functions DBMS L9B Relational Database Design DBMS L9C Relational Database Design DBMS L5A Nested Subqueris DBMS L15 Transactions DBMS L16A Concurrency Control	30 HOURS

	DBMS L16B Concurrency Control DBMS L16C Concurrency Control L64: Non-relational database management systems nosql & cap theorem DBMS L19 Distributed Data Stores and NoSQL Databases	
WEB REFERENCES	https://www.geeksforgeeks.org/dbms/dbms/ https://www.scribd.com/document/666843210/Database-Management-System-DBMS-HandWritten-Notes	2 HOURS



Course Code: CCSML0402A	Course Name: MACHINE LEARNING ALGORITHMS	L	T	P	C
Course Offered in: B. Tech. 2nd year (4th Semester) Computer Science		3	0	0	3

Pre-requisite: Basic knowledge of Python programming and Statistics fundamentals.

Course Objectives:

To present the fundamental concepts of machine learning, including supervised, unsupervised, and ensemble techniques. To explain data preprocessing methods such as feature selection, normalization, and data cleaning. To discuss key algorithms like regression, classification, clustering, and decision trees in the context of real-world problems. To outline model performance metrics, validation methods, and parameter tuning techniques. To offer hands-on exposure to programming tools and libraries used for machine learning.

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain Machine Learning concepts, feature engineering, preprocessing techniques, and PCA for data analysis.	K2
CO2	Apply regression models, Gradient Descent, Evaluation Metrics, and regularization techniques in Machine Learning	K3
CO3	Implement classification algorithms for solving binary and multiclass Machine Learning problems effectively.	K3
CO4	Analyze probabilistic learning methods and ensemble techniques for robust predictive model development	K4
CO5	Evaluate clustering and anomaly detection algorithms for unsupervised learning and pattern discovery.	K5

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	1	3	–	–	2	1	1	–	2	2	2
CO2	2	3	3	–	3	–	–	3	–	1	–	2	2	3
CO3	3	3	3	3	2	1	–	3	–	1	1	2	3	3
CO4	3	3	2	3	2	1	–	3	1	2	–	3	3	3
CO5	2	2	2	2	3	2	1	–	1	2	2	3	3	2

Course Contents / Syllabus		
UNIT 1	INTRODUCTION TO MACHINE LEARNING AND FEATURE ENGINEERING	8 hours
Introduction to Machine Learning: Motivation, Definition, Applications of Machine Learning Types of Machine Learning: Supervised, Unsupervised and Reinforcement Learning Datasets and Features: Features and their types, handling missing data, Dealing with categorical features, Feature Scaling, Feature selection, outlier detection and removal, Principal Component Analysis (PCA) Algorithm		
UNIT 2	REGRESSION AND REGULARIZATION	9 hours
Introduction to Regression: Regression Problem, Linear regression model (Simple, Multiple and Polynomial) Errors Measures: Mean Squared Error (MSE), Root Mean Squared Error (RMSE), Mean Absolute Error (MAE) Cost function: Formula, intuition and visualization Gradient Descent: Algorithm, intuition, learning rate and Gradient Descent for linear regression. Evaluating the Accuracy of Linear Regression Model: R2 and Adjusted R2 Regularization: Bias and Variance, Overfitting and Underfitting, L1 and L2 Regularization, Regularized cost function, Regularized Linear Regression		
UNIT 3	CLASSIFICATION ALGORITHMS	11 hours
Classification: Classification problem, Binary and Multiclass Classification, Decision Boundary, Logistic regression model for binary classification, Cost function of logistic regression model, Regularized logistic regression, One Vs. All strategy for multiclass classification using logistic regression. Measuring Performance of Classification Model: Accuracy, Precision, Recall, F1-Score, Confusion matrix Decision Trees: Decision Tree Classification Algorithm, Attribute Selection Measures, Variants of Decision Trees (ID3, C4.5, CART) Large Margin Classifier: Support Vector Machines Instance Based Learning: K Nearest Neighbor Algorithm		
UNIT 4	PROBABILISTIC MODELS AND ENSEMBLES	8 hours
Probabilistic Methods for Classification: Bayesian Learning, Naive Bayes Classifier, Bayesian belief networks Tree Ensembles: Using multiple decision trees, Bagging Vs. Boosting, Sampling with replacement, Random Forest Algorithm, Adda boost, Gradient Boosting, XGBoost Algorithm.		
UNIT 5	CLUSTERING ALGORITHMS AND ANOMALY DETECTION	9 hours
Unsupervised Learning & Clustering: The problem of clustering, Distance measures		

Partition Based Methods: K-Means Clustering (Intuition, Algorithm, Optimization objective, Initializing K-Means, Choosing number of clusters) K-Medoids and K-Mode clustering algorithms. Hierarchical Clustering (Single Linkage, Complete Linkage, Agglomerative Nesting (AGNES), Divisive Analysis (DIANA). Density-based Clustering: DBSCAN Algorithm Anomaly Detection: Finding unusual events, Gaussian Distribution and Gaussian Mixture Model, Anomaly Detection Algorithm, Developing and evaluating anomaly detection system.		
Total: 45 Hours		
TEXTBOOK		
BOOK TITLE		AUTHOR
Machine Learning, McGraw-Hill Education, 1997		Tom M. Mitchell
Machine Learning with Python, Wiley India, 2019		Manaranjan Pradhan & U. Dinesh Kumar
Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition, O'Reilly Media, 2022		Aurélien Géron
Machine Learning with PyTorch and Scikit-Learn, 2nd Edition, Packt Publishing, 2022		Sebastian Raschka, Yuxi Liu, Vahid Mirjalili
REFERENCE BOOKS:		
BOOK TITLE		AUTHOR
Pattern Recognition and Machine Learning, 1st Edition, Springer, 2006		Christopher M. Bishop
Introduction to Machine Learning, 4th Edition, MIT Press, 2020		Ethem Alpaydin
SELF-STUDY CONTENT LINKS:		DURATION (IN HRS)
MOOCS	Explore Machine Learning with TensorFlow	14Hrs 09Min
VIDEO LECTURES	https://www.youtube.com/watch?v=GwIo3gDZCVQ (Edureka) https://www.youtube.com/watch?v=JxgmHe2NyeY&t=476s https://www.youtube.com/watch?v=53mqteI5TS0 https://www.youtube.com/watch?v=ZftI2fEz0Fw&list=PLKnIA16_	9Hrs 36Min 6Hrs 36Min 23Hrs 26Min 25Hrs 05Hrs 35Min

	Rmvbr7zKYQuBfsVkjoLcJgxHH https://www.youtube.com/watch?v=k9V3DapHEDA	
WEB REFERENCES	https://www.kaggle.com/learn/intro-to-machine-learning https://openlearninglibrary.mit.edu/courses/course-v1:MITx+6.036+1T2019/about https://developers.google.com/machine-learning/crash-course	



Course Code: CCS0401				Course Name: MODERN DATA ENGINEERING CONCEPTS								L	T	P	C
Course Offered in: B. Tech. 2nd year (4th Semester) Computer Science												3	0	0	3
Pre-requisite: Fundamental of Cloud Computing															
Course Objectives:															
To equip learners with the skills to design, build, and optimize scalable big data pipelines and analytics solutions using distributed systems and cloud-based data engineering technologies. Learn the foundations of data engineering, including data pipelines, ETL/ELT processes, data storage, and distributed systems. Develop the ability to create reliable, scalable, and automated data workflows using modern tools and cloud platforms. Gain hands-on experience with big data ecosystems such as Apache Spark, Apache Kafka, and cloud-based data warehouses. Understand data quality, privacy, governance, and security techniques to ensure trustworthy and compliant data systems.															
Course Outcome												Bloom’s Knowledge Level (KL)			
CO1	Infer data engineering fundamentals, big data characteristics, data formats, and storage platforms.											K2			
CO2	Apply data ingestion, transformation, and streaming techniques to build scalable data pipelines.											K3			
CO3	Analyze distributed storage and processing frameworks including HDFS, MapReduce, and cloud-based solutions.											K4			
CO4	Analyze big data analytics, visualization, and security mechanisms for large-scale data systems.											K4			
CO5	Build scalable data engineering solutions leveraging serverless, orchestration, and emerging technologies.											K3			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)															
CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	3	2	-	-	2	-	-	-	-	-	-	2	1	-	
CO2	3	2	2	-	3	-	-	-	-	-	-	3	2	1	
CO3	3	3	2	2	3	-	-	-	-	-	-	3	2	1	
CO4	2	2	3	2	3	2	-	2	-	2	-	2	3	1	
CO5	2	2	3	2	3	-	-	-	2	2	2	3	3	2	

Course Contents / Syllabus		
UNIT 1	INTRODUCTION TO DATA ENGINEERING	9 hours
Introduction to Data Engineering: Data Lifecycle, Types of Data: Structured, Semi-Structured, Unstructured, Data Formats (CSV, JSON, Parquet, Avro). Big Data fundamentals: 5Vs (Volume, Velocity, Variety, Veracity, Value), Data Sources & Semantics, Cloud Storage Options (Object Storage, Data Lakes, Data Warehouses), Introduction to distributed storage and processing (Batch vs real-time data processing), Introduction to Data governance, metadata, and catalog concepts.		
UNIT 2	DATA INGESTION, INTEGRATION AND STREAMING	9 hours
Data ingestion patterns: batch, micro-batch, real-time streaming, ETL vs ELT in Big Data environments, Data pipelines and orchestration, Streaming architectures and event-driven systems, AWS ingestion services: Kinesis, Glue, Database Migration Service. Message broker concepts (Kafka basics), Schema evolution and serialization (Avro, JSON), Data cleansing and transformation, High-throughput ingestion and fault tolerance.		
UNIT 3	BIG DATA STORAGE AND DISTRIBUTED PROCESSING	9 hours
Data lake architecture using Amazon S3, Data partitioning, bucketing, indexing. Hadoop Distributed File System (HDFS): Architecture (NameNode, DataNode, Secondary NameNode), Block storage and replication mechanism, Fault tolerance and data locality. MapReduce Programming Model: Map, Shuffle, reduce phases, Execution flow and job scheduling. Hadoop Ecosystem Components (overview): Yarn Hive, Pig, HBase, Distributed processing frameworks: Hadoop vs Spark, Big Data processing using Amazon EMR, In-memory processing and parallelism concepts, Data warehousing using Amazon Redshift, Query engines like Amazon Athena.		
UNIT 4	BIG DATA ANALYTICS, VISUALIZATION, AND SECURITY	9 hours
Analytical systems: OLAP vs OLTP, Real-time analytics and stream processing, Data exploration and query optimization, Visualization using Amazon QuickSight, Data governance and metadata management. Security in Big Data systems: encryption, IAM, fine-grained access, Privacy and compliance in large-scale systems, Monitoring pipelines using Amazon CloudWatch, Data Visualization Tools (BigQuery, Tableau basics), Data quality, validation, and anomaly detection Apache Kafka Architecture, Spark Streaming Basics, Real-Time vs Batch Processing, Lambda & Kappa Architecture.		
UNIT 5	CLUSTERING ALGORITHMS AND ANOMALY DETECTION	9 hours

Serverless data processing: using AWS Lambda, Workflow orchestration using AWS Step Functions, Data pipeline automation and scheduling, Data lineage and metadata tracking, High availability and fault tolerance in distributed systems, Scalability strategies in Big Data pipelines, Cost optimization for large-scale data workloads, Integration with machine learning pipelines. Emerging trends: Data mesh, lakehouse architecture, real-time analytics, AI-driven data engineering.		
Total: 45 Hours		
TEXTBOOK		
BOOK TITLE		AUTHOR
Data Engineering with AWS: Learn how to design and build cloud-based data transformation pipelines using AWS, Packt Publishing; 1st edition, 2021.		Gareth Eagar
Data Engineering with AWS: A Practical Guide to Building Scalable and Secure Enterprise Data Platforms, BPB Publications; 1st edition, 2025.		Sanjiv Kumar Jha
Ultimate AWS Data Engineering: Design, Implement and Optimize Scalable Data Solutions on AWS, Orange Education Pvt. Ltd.; 1st edition, 2025		Rathish Mohan, Shekhar Agrawal, Srinivasa Sunil Chippada
REFERENCE BOOKS:		
BOOK TITLE		AUTHOR
Fundamentals of Data Engineering: Plan and Build Robust Data Systems, O'Reilly Media; 1st edition, 2022		Joe Reis, Matt Housley
Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable System, O'Reilly Media; 1st edition, 2017.		Martin Kleppmann
Hadoop: The Definitive Guide, O'Reilly Media; 4th edition, 2015.		Tom White
SELF-STUDY CONTENT LINKS:		DURATION (IN HRS)
MOOCS	https://www.coursera.org/professional-certificates/gcp-data-engineering	40 HRS
	https://www.udacity.com/course/data-engineering-with-aws--nd027	18 HRS

VIDEO LECTURES	https://www.youtube.com/watch?v=hf2go3E2m8g https://www.youtube.com/watch?v=ckQ7d6ca2J0 https://www.youtube.com/watch?v=QMWXcyuYzD4 https://www.youtube.com/watch?v=o4rF4hSf9D8	03Hrs 02Min 01Hrs 31Min 21Hrs 31Min 011Hrs 54Min
WEB REFERENCES	https://www.geeksforgeeks.org/data-engineering/what-is-data-engineering/ https://www.ibm.com/think/topics/data-engineering https://learn.microsoft.com/en-us/fabric/data-engineering/data-engineering-overview https://www.databricks.com/blog/what-is-data-engineering	



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Course Code: CCSAI0411				Course Name: DATA ANALYTICS								L	T	P	C
Course Offered in: CSE/CS/IT/CSE(AI)/CSE(AI ML)/CSE(IOT)/CSE(AI)/CSE(DS)/CSE-R/M.Tech int												3	0	0	3
Pre-requisite: Basic Knowledge of Statistics and Probability															
Course Objectives:															
The objective of this course is to understand the fundamental concepts of Data analytics and learn about various types of data formats and their manipulations. It helps students to learn exploratory data analysis and visualization techniques in addition to R/Python/Tableau programming language.															
Course Outcome												Bloom’s Knowledge Level (KL)			
CO1		Understand the fundamental concepts of data analytics in the areas that plays major role within the realm of data science.										K1			
CO2		Explain and exemplify the most common forms of data and its representations.										K2			
CO3		Understand and apply data pre-processing techniques.										K3			
CO4		Analyze data using exploratory data analysis.										K4			
CO5		Illustrate various visualization methods for different types of data sets and application scenarios.										K3			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)															
CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	3	2	-		1	-	-		-	2	-	3	1	2	
CO2	2	3	-	1	2	-	-	1	-	1	-	2	1	1	
CO3	3	3	2	2	3	-	-		-	2	-	3	2	2	
CO4	2	3	2	3	3	-	-	1	-	2	1	3	2	2	
CO5	2	2	2	2	3	-	-	2	-	1	1	3	2	2	

Course Contents / Syllabus		
UNIT 1	INTRODUCTION TO DATA SCIENCE	8 hours
Introduction to Data Science, Big Data, the 5 V's, Evolution of Data Science, Datafication, Skillsets needed, Data Science Lifecycle, types of Data Analysis, Data Science Tools and technologies, Need for Data Science, Analysis Vs Analytics Vs Reporting, Big Data Ecosystem, Future of Data Science, Applications of Data Science in various fields, Use cases of Data science-Facebook, Netflix, Amazon, Uber, AirBnB.		
UNIT 2	DATA HANDLING	9 hours
Types of Data: structured, semi-structured, unstructured data, Numeric, Categorical, Graphical, High Dimensional Data, Transactional Data, Spatial Data, Social Network Data, standard datasets, Data Classification, Sources of Data, Data manipulation in various formats, for example, CSV file, pdf file, XML file, HTML file, text file, JSON, image files etc. import and export data in R/Python		
UNIT 3	DATA PRE-PROCESSING	9 hours
Form of Data Pre-processing, data Attribute and its types, understanding and extracting useful variables, KDD process, Data Cleaning: Missing Values, Noisy Data, Discretization and Concept hierarchy generation (Binning, Clustering, Histogram), Inconsistent Data, Data Integration and Transformation. Data Reduction: Data Cube Aggregation, Data Compression, Numerosity Reduction.		
UNIT 4	EXPLORATORY DATA ANALYSIS	9 hours
Handling Missing data, Removing Redundant variables, variable Selection, identifying outliers, Removing Outliers, Time series Analysis, Data transformation and dimensionality reduction techniques such as Principal Component Analysis (PCA), Factor Analysis (FA) and Linear Discriminant Analysis (LDA), Univariate and Multivariate Exploratory Data Analysis. Data Munging, Data Wrangling- APIs and other tools for scrapping data from the web/ internet using R/Python.		
UNIT 5	DATA VISUALIZATION	10 hours
Introductions and overview, Debug and troubleshoot installation and configuration of the Tableau. Creating Your First visualization: Getting started with Tableau Software, Using Data file formats, connecting your Data to Tableau, creating basic charts (line, bar charts, Tree maps), Using the Show me panel. Tableau Calculations: Overview of SUM, AVG, and Aggregate features Creating custom calculations and fields, Applying new data calculations to your visualization. Manipulating Data in Tableau: Cleaning-up the data with the Data Interpreter, structuring your data, Sorting, and filtering Tableau data, Pivoting Tableau data. Advanced Visualization Tools: Using Filters, Using the Detail panel Using the Size panels, customizing filters, Using and Customizing tooltips, formatting your data with colours, Creating Dashboards & Stories, Distributing & Publishing Your Visualization		
Total: 45 Hours		

TEXTBOOK		
BOOK TITLE		AUTHOR
<i>Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining</i> . 2nd Edition, John Wiley & Sons, 2014.		Myatt, G. J., & Johnson, W. P.
<i>Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data</i> . John Wiley & Sons, 2015.		Dietrich, D., Heller, B., & Yang, B
REFERENCE BOOKS:		
BOOK TITLE		AUTHOR
<i>An Introduction to Statistical Learning with Applications in Python</i> . Springer, 2023.		James, G., Witten, D., Hastie, T., & Tibshirani, R.
<i>R for Data Science</i> . 2nd Edition, O'Reilly, 2023.		Wickham, H., & Grolemund, G.
SELF-STUDY CONTENT LINKS:		DURATION (IN HRS)
MOOCS	https://www.netacad.com/courses/dataanalyticsessentials?courseLang=en-US	30Hrs
VIDEO LECTURES	https://www.youtube.com/watch?v=r-uOLxNrNk8	12Hrs
WEB REFERENCES	https://jakevdp.github.io/PythonDataScienceHandbook/	3Hrs



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Course Code: CCSAI0412				Course Name: CRM- FUNDAMENTALS								L	T	P	C
Course Offered in: CSE/CS/IT/CSE(AI)/CSE(AI ML)/CSE(IOT)/CSE(AI)/CSE(DS)/CSE-R/M.Tech int												3	0	0	3
Pre-requisite: None															
Course Objectives:															
To provide an understanding of CRM fundamentals, customer relationship strategies, e-CRM technologies, and the organizational, technological, and human aspects of CRM implementation.															
Course Outcome												Bloom’s Knowledge Level (KL)			
CO1		Understand the fundamental concepts of Customer Relationship Management (CRM).										K1, K2			
CO2		Explain the strategies and framework of Customer Relationship Management.										K2			
CO3		Describe the fundamentals of Cloud-Based Customer Relationship Management.										K1			
CO4		Apply CRM concepts to business use cases and customer-centric solutions.										K3			
CO5		Demonstrate the basics of Customer Relationship Management implementation.										K3			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)															
CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	3	2	–	–	2	–	–	–	–	–	1	1	2	1	
CO2	2	3	1	–	2	1	–	–	–	–	2	2	2	2	
CO3	2	2	2	1	3	–	–	–	–	–	2	3	2	3	
CO4	2	3	3	2	2	2	–	1	2	1	2	2	3	2	
CO5	2	3	3	2	3	2	–	2	2	2	3	3	2	3	

Course Contents / Syllabus		
UNIT 1	INTRODUCTION	9 hours
CRM- definition, history, goals. Sources of CRM value. Components of CRM: people, process, technology. Evolution of CRM: marketing and its principles, customer relations to CRM. Dynamics of Customer Supplier Relationships, Nature and context of CRM, Strategy and Organization of CRM: strategy, The relationship-oriented organization: Mission, Culture, Structure, People, Communication & Information Systems.		
UNIT 2	CRM STRATEGY AND FRAMEWORK	9 hours
Developing a CRM strategy. Customer oriented (C in CRM), Relationship driven, 360-degree view of customer. CRM system features- functions, application, benefits and solutions. Importance of loyalty- active, passive, split, shifting and switchers, customer profiling, customer segmentation model, Customer Experience, relationship marketing and journey, Case study.		
UNIT 3	SOLUTION DESIGN AND ARCHITECTURE	9 hours
CRM system solution-specifications. Data Analysis, Solution Requirements. Types of CRM- On-Premises, cloud based. Pros and Cons of each. Integration CRM with other enterprise applications. The Technology of CRM: Data warehouses and customer relationships, creating data mart model, components of operational data warehouse.		
UNIT 4	CRM FOR BUSINESS	9 hours
CRM in Sales, Service, Marketing, E-commerce. Social Customer Relationship Management. Analytical CRM: Predictive Analytics Vs Operational Analytics. Channel Partner Relationship management, Collaborative CRM (using data pooling), Business Benefits of Cloud Based System, SLAs, Practical Challenges.		
UNIT 5	CRM IMPLEMENTATION	9 hours
Building CRM roadmaps: current processes, customers, strategic goals, technology issues, pilot and proof of concept projects. Preliminary Roadmap and its template, developing roadmap midstream. Design stage, custom development, integration, reporting, data migration, and implementation, testing, launching and application management. Introduction to following CRM tools: ZOHO, Pega, Microsoft Dynamics 365, Sales force.		
Total: 45 Hours		
TEXTBOOK		
BOOK TITLE		AUTHOR
CRM Fundamentals		<i>Scott Kostojohn, Mathew Johnson, Brian Paulen</i>

Customer Relationship Management: How to Develop and Execute a CRM Strategy		Michael Pearce	
REFERENCE BOOKS:			
BOOK TITLE		AUTHOR	
The CRM Handbook: A Business Guide to Customer Relationship Management		Jill Dyché	
Customer Relationship Management Systems Handbook		Duane E. Sharp	
SELF-STUDY CONTENT LINKS:			DURATION (IN HRS)
VIDEO LECTURES	https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_mg57		7 min
WEB REFERENCES	https://www.geeksforgeeks.org/software-engineering/customer-relationship-management-crm/		



Course Code: CCSCY0411				Course Name: Fundamentals of Cyber Security								L	T	P	C
Course Offered in: CSE/CS/IT/CSE(AI)/CSE(AI ML)/CSE(IOT)/CSE(AI)/CSE(DS)/CSE-R/M.Tech int												3	0	0	3
Pre-requisite: Basic knowledge of Computer Systems, Familiarity with Internet Usage and Web Browsing, Understanding of basic Networking Terms (e.g., IP, LAN, Router), Awareness of Digital Tools (Email, Cloud, Antivirus), Fundamental Logical Thinking.															
Course Objectives:															
Basic knowledge of Computer Systems, Familiarity with Internet Usage and Web Browsing, Understanding of basic Networking Terms (e.g., IP, LAN, Router), Awareness of Digital Tools (Email, Cloud, Antivirus), Fundamental Logical Thinking.															
Course Outcome												Bloom’s Knowledge Level (KL)			
CO1		Understand the basic principles and terminology of cyber security.										K1			
CO2		Recognize common cyber threats and attack vectors.										K2			
CO3		Demonstrate knowledge of basic cyber defense tools and techniques.										K2			
CO4		Adopt safe online behavior and promote cyber hygiene.										K2			
CO5		Interpret and apply basic cyber laws and ethical principles.										K3			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)															
CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	3	2	1	1	1	-	1	-	1	-	2	-	3	1	
CO2	3	3	2	2	2	-	2	-	2	-	2	2	3	2	
CO3	3	3	3	2	3	-	3	2	2	1	3	3	3	3	
CO4	2	2	2	1	2	1	3	2	2	-	3	-	3	3	
CO5	2	2	2	2	1	1	3	2	2	1	3	-	2	3	

Course Contents / Syllabus		
UNIT 1	INTRODUCTION TO CYBER SECURITY	9 hours
Definition, Evolution, and Need of Cyber Security, Difference between Information Security and Cyber Security, Cyber Forensics, The CIA Triad (Confidentiality, Integrity and Availability), Basic Terminologies: Threats, Vulnerabilities, Exploits, Risks, Cyber Security Objectives: Prevention, Detection, Response and Recovery, Cyber Security Domains: Network Security, Information Security, Application Security, Cloud Security and IoT Security, Security Goals, Roles of Security Policies, Procedures, and Awareness.		
UNIT 2	CYBER THREATS AND ATTACKS	9 hours
Introduction to cyber-attacks, Malware Types: Virus, Worm, Trojan Horse, Ransomware, Spyware, Adware, Social Engineering Attacks: Phishing, Baiting, Pretexting, Tailgating, Web-Based Attacks: SQL Injection, Cross-Site Scripting (XSS), Clickjacking, Network Attacks: Denial-of- Service (DoS), DDoS, Spoofing, Sniffing, Insider threats and APTs (Advanced Persistent Threats), Emerging Threats: IoT Vulnerabilities, Mobile Threats. Application security (design, development and testing), operations security, monitoring, identifying threats, and remediating them.		
UNIT 3	CYBER DEFENSE MECHANISM	9 hours
Authentication Mechanisms: Passwords, OTPs, Biometrics, Access Control Models: DAC, MAC, RBAC, Firewalls: Types, Configurations, Limitations, Intrusion Detection and Prevention Systems (IDS/IPS), Cryptography: Basic Idea of Encryption and Decryption, Endpoint Protection: Antivirus, Anti-Malware, Backup Types: Full, Incremental, Differential, Incident Response Basics.		
UNIT 4	NETWORK AND SYSTEM SECURITY BASICS	9 hours
Networking basics (home network and large-scale business networks), Networking concepts (CIDR, subnets), and protocols (DNS, DHCP, IP). Basic Network Security Concepts: Security of protocols, IP, MAC, Ports, Protocols (HTTP, HTTPS, FTP), Working of World Wide Web (www), the Internet and the HTTP protocol, security of browser to web server interaction, Network Security Devices: Routers, Switches, Firewalls, Proxies, Secure System Configuration: OS Hardening, User Privileges, Patch Management and Software Updates, Secure Coding Principles and Common Software Flaws, Safe Browsing Habits, Secure Downloads, Email Security.		
UNIT 5	CYBER ETHICS LAW AND DATA HYGIENE	9 hours
Cyber Ethics: Responsible use of Technology, Netiquette, Importance of Cyber Laws and Data Protection Regulations (GDPR), Overview of Indian IT Act 2000 and Amendments (Sections 43, 66, 67, etc.), Data Privacy and Data Protection Principles, Intellectual Property Rights (IPR) in Cyberspace, Digital Footprint, Identity Protection, Password Hygiene, Cyber Bullying, Trolling, Online Frauds, Fake News Awareness.		
		Total: 45 Hours
TEXTBOOK		

BOOK TITLE		AUTHOR
Cybersecurity: Principles and Practice (5th Edition)		William Stallings
Computer Security Fundamentals (4th Edition)		Chuck Easttom
REFERENCE BOOKS:		
BOOK TITLE		AUTHOR
Fundamentals of Cyber Security (1st Edition)		Kutub Thakur, Al-Sakib Khan Pathan
Cyber Security (1st Edition)		Nina Godbole, Sunit Belapure
SELF-STUDY CONTENT LINKS:		DURATION (IN HRS)
MOOCS	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0136382610228674561182_shared/overview	1h
	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130752807862845445_shared/overview	11h 5m
	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_3388902307073574000_shared/overview	7h 3m
	https://infyspringboard.onwingspan.com/web/en/page/lex_auth_014234794236551168189	1h
VIDEO LECTURES	https://www.youtube.com/watch?v=z5nc9MDbvkW	38 Min 19 Sec
	https://nptel.ac.in/courses/106106129	8 Min 15 Sec
	https://www.youtube.com/watch?v=BdluJhRaAMA	12 Min 34 Sec
	https://www.youtube.com/watch?v=uqvn2vRBOqk&list=PLm3g0kXO2llm8Qd6EpKQc2gUiCz-bf3f2 https://nptel.ac.in/courses/106105183	4 Min 12 Min
WEB REFERENCES	https://www.geeksforgeeks.org/cybersecurity/what-is-cyber-security/ https://www.geeksforgeeks.org/types-of-cyber-attacks/ https://www.ironnet.com/topics/what-is-cyber-defense https://www.geeksforgeeks.org/computer-networks/types-of-security-mechanism/	24 Hrs



Course Code: CCSE0411				Course Name: PYTHON WEB DEVELOPMENT WITH DJANGO								L	T	P	C
Course Offered in: CSE/CS/IT/CSE(AI)/CSE(AI ML)/CSE(IOT)/CSE(AI)/CSE(DS)/CSE-R/M.Tech int												3	0	0	3
Pre-requisite: Students should have good knowledge of Python Programming and Python coding experience.															
Course Objectives:															
This course focuses on how to design and build statistics as well as dynamic webpages and interactive web-based applications. These courses mainly focus on how Python operates within web development using the increasingly popular Django framework.															
Course Outcome												Bloom’s Knowledge Level (KL)			
CO1		Apply Python programming concepts and client-side technologies to develop Django-based web applications.										K3			
CO2		Demonstrate the use of the Django web framework to design and implement dynamic web pages and interactive web-based applications.										K3			
CO3		Analyze and implement account management and authentication mechanisms in Django applications.										K4			
CO4		Analyze the role of database connectivity using SQLite in web application development and its impact on modern e-commerce and social platforms.										K4			
CO5		Design, develop, and deploy a functional Django web application on a cloud platform by integrating web technologies, databases, and authentication services.										K6			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)															
CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	2	2	3	1	3	-	1	3	-	3	3	3	3	3	
CO2	2	2	3	1	3	-	1	-	-	2	3	3	3	3	
CO3	2	2	2	2	2	-	-	2	-	2	2	2	2	2	
CO4	2	1	2	1	2	-	-	1	1	2	2	3	3	3	
CO5	2	1	3	2	3	-	-	3	2	3	3	2	2	2	

Course Contents / Syllabus		
UNIT 1	PYTHON LIBRARIES FOR WEB DEVELOPMENT	9 hours
Collections-Container datatypes, Tkinter-GUI applications, Requests-HTTP requests, BeautifulSoup4-web scraping, Scrapy, Zappa, Dash, CherryPy, Turbo Gears, Flask, Web2Py, Bottle, Falcon, Cubic Web, Quixote, Pyramid.		
UNIT 2	INTRODUCTION TO DJANGO FRAMEWORK	9 hours
Understanding Django environment, Features of Django and Django architecture, MVC and MTV, URL's and Views, Mapping the views to URLs, Django Template, Template inheritance Django Models, Creating model for site, Converting the model into a table, Fields in Models, Integrating Bootstrap into Django, creating tables, Creating grids, Creating carousels.		
UNIT 3	INTEGRATING ACCOUNTS & AUTHENTICATION ON DJANGO	9 hours
Introduction to Django Authentication System, Security Problem & Solution with Django Creating Registration Form using Django, Adding Email Field in Forms, configuring email settings, Sending emails with Django, Adding Grid Layout On Registration Page, Adding Page Restrictions, Login Functionality Test and Logout.		
UNIT 4	CONNECTING SQLITE WITH DJANGO	9 hours
Database Migrations, Fetch Data From Database, Displaying Data On Templates, Adding Condition On Data, Sending data from url to view, Sending data from view to template, Saving objects into database, Sorting objects, Filtering objects, Deleting objects, Difference between session and cookie, Creating sessions and cookies in Django.		
UNIT 5	DEPLOYING DJANGO WEB APPLICATION ON CLOUD	9 hours
Creating a functional website in Django, Four Important Pillars to Deploy, registering on Heroku and GitHub, Push project from Local System to GitHub, Working with Django Heroku, Working with Static Root, Handling WSGI with gunicorn, Setting up Database & adding users.		
Total: 45 Hours		
TEXTBOOK		
BOOK TITLE		AUTHOR
<i>"Python: The Complete Reference Paperback", 4th Edition 2018, McGraw Hill Education Publication.</i>		<i>Martin C. Brown</i>
<i>"Python Programming: Using Problem Solving Approach", 3rd Edition 2017, Oxford University Press Publication.</i>		<i>Reema Thareja</i>

” Beginning Django Web Application Development and Deployment with Python”, 2nd Edition 2017, Apress Publication.		Daniel Rubio, Apress	
“Python Django Web Development: The Ultimate Django web framework guide for Beginners”, 2nd Edition 2019, Kindl e Edition.		William Jordon,	
REFERENCE BOOKS:			
BOOK TITLE		AUTHOR	
“Building Django 2.0 Web Applications: Create enterprise-grade, scalable Python web applications easily with Django 2.0”, 2nd Edition 2018, and Packt Publishing.		Tom Aratyn,	
“Build a website with Django”, 1st Edition 2019, GNW Independent Publishing Edition.		Nigel George	
” Django in 8 Hours: For Beginners, Learn Coding Fast! 2nd Edition 2020, independently published Edition.		Ray Yao	
“Test-Driven Development with Python: Obey the Testing Goat: Using Django, Selenium, and JavaScript”, 2nd Edition 2019, Kindle Edition.		Harry Percival	
SELF-STUDY CONTENT LINKS:			DURATION (IN HRS)
MOOCS	https://online.codingblocks.com/courses/python-django		4 WEEKS
VIDEO LECTURES	https://youtu.be/QXeEoD0pB3E?list=PLsyeobzWxl7poL9JTVyndKe62ieoN-MZ3		1 HRS 03 MIN
	https://youtu.be/9MmC_uGjBsM?list=PL3pGy4HtqwD02GVgM96-V0sq4_DSinqvf		27 MIN 29 SEC
WEB REFERENCES	https://www.geeksforgeeks.org/python/python-web-development-django/		



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Course Code: CASL0401				Course Name: TECHNICAL COMMUNICATION								L	T	P	C
Course Offered in: B. Tech. All branches (except CSBS)												2	0	0	2
Pre-requisite: Intermediate level (CEFR) and above															
Course Objectives:															
Demonstrate effective verbal and non-verbal communication skills in diverse professional settings, including meetings, presentations, and interpersonal interactions. Develop and apply clear, concise, and audience-appropriate written communication, such as emails, letters, memos, resume’, using correct grammar, tone, and format. Adapt communication style based on cultural, organizational, and situational contexts to foster inclusive and respectful professional relationships. Employ digital communication tools and platforms (e.g., video conferencing, business messaging apps) responsibly and effectively in remote or hybrid work environments.															
Course Outcome												Bloom’s Knowledge Level (KL)			
CO1		Comprehend the principles and functions of technical communication.										K2			
CO2		Write for specific audience and purpose to fulfil the provided brief										K3			
CO3		Recognize and produce different kinds of technical documents.										K3			
CO4		Apply effective speaking skills to efficiently carry out official discourses.										K3			
CO5		Demonstrate their understanding of communication through digital media.										K3			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)															
CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	1	1	1	1	1	2	1	2	3	1	1	-	-	-	
CO2	1	1	1	1	1	1	1	2	3	1	1	1	-	1	
CO3	1	1	1	1	1	1	1	2	3	1	1	2	1	2	
CO4	1	1	1	1	1	1	1	2	3	1	1	1	1	2	
CO5	1	1	1	1	1	1	1	2	3	1	1	1	1	1	

Course Contents / Syllabus		
UNIT 1	INTRODUCTION TO TECHNICAL COMMUNICATION	4 hours
Technical Communication: Definition, Process, Types, Levels, and Flow; Barriers to Technical Communication: emphasis on gender neutral language and cultural sensitivity; Significance of audience in technical communication		
UNIT 2	TECHNICAL WRITING 1	5 hours
Technical writing skill: characteristics, examples; Business letters/emails: Content organization, Tone and intent; Agenda & Minutes of Meetings		
UNIT 3	TECHNICAL WRITING 2	5 hours
Job application, Resume’; Report, proposal; Technical paper: Abstract; Ethical Writing: Copy Editing, Referencing and Plagiarism		
UNIT 4	PUBLIC SPEAKING	6 hours
Components of effective speaking: Simplicity, order, balance in arranging ideas. Importance of <i>KOPPACT</i> ; Appearing for a job interview: FAQs; Telephonic & Online Interviews		
UNIT 5	VIRTUAL/REMOTE COMMUNICATION	4 hours
Remote work: online platforms; Video conferencing; Virtual etiquette: email ids, usernames; Writing Blogs & creating Vlogs		
Total: 24 Hours		
TEXTBOOK		
BOOK TITLE		AUTHOR
Technical Communication – Principles and Practices, 4 th Edition , Oxford Univ. Press, 2022, New Delhi.		Meenakshi Raman & Sangeeta Sharma
REFERENCE BOOKS:		
BOOK TITLE		AUTHOR
Technical Communication, 15th Edition , Pearson, 2021		John M. Lannon & Laura J. Gurak
Spoken English- A Manual of Speech and Phonetics (5th Edition) by , 2024, New Delhi.		R K Bansal & J B Harrison, Orient Blackswan

Business Correspondence and Report Writing (6 Edition), Tata McGraw Hill & Co. Ltd., 2020, New Delhi.		Prof. R C Sharma, Krishna Mohan, and Virendra Singh Nirban
Intercultural Communication in Virtual Exchange , Cambridge Univ. Press, 2024.		Francesca Helm
SELF-STUDY CONTENT LINKS:		DURATION (IN HRS)
MOOCS	https://onlinecourses.nptel.ac.in/noc24_ge37/preview https://archive.nptel.ac.in/courses/109/106/109106094/	4 WEEKS 4 WEEKS
VIDEO LECTURES	https://www.youtube.com/watch?v=kOJlwMJxEG0&t=8s https://www.youtube.com/watch?v=Sg7Q_dC_fW U&list=PLPuC5CMHiqmuzq_KQ4aw0V9Q7xJY6aezb https://www.youtube.com/watch?v=ymLFJDpjc&list=PLPuC5CMHiqmuzq_KQ4aw0V9Q7xJY6aezb&index=6	2.5 HRS
WEB REFERENCES	Technical Communication And Soft Skills For Engineers	2.5 HRS



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LAB Course Code: CCSE0451				Lab Course Name: DATABASE MANAGEMENT SYSTEMS LAB								L	T	P	C
Course Offered in:CSE/CSE-R/IT/M.Tech Int./CSE (Twin)/IT (Twin)/M&C/AI/AI (TWIN)/AIML/AIML (TWIN)/CS/CYS/DS/IOT												0	0	4	2
Pre-requisite: Basic knowledge of computer fundamentals, programming, data structures, relational database concepts.															
Course Objectives:															
To familiarize the students to the basics of database design and implementation.															
Course Outcome: After completion of the course, the student will be able to												Bloom’s Knowledge Level (KL)			
CO1		Design and implement ER/EER models to solve real-world problems and transform them into relational schemas using appropriate database tools.										K3			
CO2		Apply SQL and PL/SQL to create complex data queries, and procedural operations including triggers and functions, along with database connectivity.										K3			
CO3		Analyze and ensure database integrity using constraints and implement unstructured databases using MongoDB with appropriate query operations.										K4			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)															
CO-PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	3	3	3	3	2	1	-	1	2	1	2	3	1	2	
CO2	3	3	3	3	2	2	-	2	1	2	2	3	3	2	
CO3	2	2	2	2	3	2	-	-	1	2	2	3	3	2	
List Of Practical’s (Indicative & Not Limited To)															
S.NO		EXPERIMENT									CO MAPPING				
1		Understand and implement the different ER diagram notation with their relationship and cardinalities.									CO1				
2		Choose a case study on different domains I. E-commerce Platform II. Inventory Management III. Railway System IV. Hospital Data Management V. Company System Banking System									CO1				
3		Create an ER diagram for the above chosen case-study (Program-2). Identify the suitable entities and find the relationship and cardinalities between the entities with their relevant attributes.									CO1				

4	Implement DDL, DML, DCL & TCL commands.	CO2
5	Implementation of I/O Constraints: Primary Key, Composite primary Key, Foreign Key, Unique Key.	CO2
6	Implementation of Business Constraints: Null, Not Null, Default, Check.	CO2
7	Practicing Queries using Like, Between, Aliases, distinct Operator & Predicate and Implement Aggregate functions.	CO2
8	Implementation of Queries using Where, Group by, Having and Order by Clause.	CO2
9	Create a table EMPLOYEE with following schema:-(Emp_no, E_name, E_address, E_ph_no, Dept_no, Dept_name, Job_id, Designation, Salary) Write SQL statements for the following query. - List the E_no, E name, Salary of all employees working for MANAGER. - Display all the details of the employee whose salary is more than the Sal of any IT PROFF. - List the employees in the ascending order of Designations of those joined after 1981. - List the employees along with their Experience and daily. - List the employee who are either 'CLERK' or 'ANALYST'. - List the employees who joined on 1-MAY-81, 3-DEC-81, 17-DEC-81. - List the e_name those are starting with 'S'. - Display total salary spent for each job category. - Display lowest paid employee details under each manager. - Display number of employees working in each department and their department name. - Display the details of employees sorting the salary in increasing	CO2

	order. xii. Show the record of employee earning salary greater than 16000 in each department. xiii. Add constraints to check, while entering the empno value (i.e) empno > 100. xiv. Define the field DEPTNO as unique. Create a primary key constraint for the column (EMPNO).	
10	Implementation of Queries using set theory operators UNION, INTERSECT, MINUS.	CO2
11	Implementation of Queries using Inner Join and Outer Join along with their types.	CO2
12	Implementation of Queries ,nested Queries or Sub Queries: IN, NOT IN, Exists, Not Exists, All and Any.	CO2
13	Apply the set theory operators, joins and nested queries on the chosen above case-study(Program-2)	CO2
14	Understand & implement the Database Connectivity with any programming language.	CO2
15	Implementation of Indexing, Views and sequence.	CO2
16	I. Write a PL/SQL Program to Add Two Numbers II. Write PL/SQL Program for Fibonacci Series Write PL/SQL Program to Find Greatest of Three Numbers	CO2
17	Write a PL/SQL code block to calculate the area of a circle for a value of radius varying from 3 to 7. Store the radius and the corresponding values of calculated area in an empty table named Areas, consisting of two columns Radius and Area.	CO2
18	Write a PL/SQL code block that will accept an account number from the user, check if the users balance is less than the minimum balance, only then deduct Rs.100/- from the balance.	CO2
19	Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old values and new values.	CO2

20	Implementation of commit and rollback statement with amount transfer example.	CO2
21	Study of Open Source NOSQL Database and installation of MongoDB.	CO3
22	Implementation of the MongoDB Shell commands.	CO3
23	Implementation of the CRUD Operations in MongoDB.	CO3
24	Implementation of Aggregate Functions in MongoDB.	CO3
TEACHING HOURS		48 HOURS

LAB Course Code: CCSML0452A				Lab Course Name: MACHINE LEARNING ALGORITHMS LAB								L	T	P	C
Course Offered in: B. Tech. 2nd year (4th Semester) Computer Science												0	0	2	1
Pre-requisite: Basic knowledge of Python programming and Statistics fundamentals															
Course Objectives:															
The course aims to develop practical skills in designing, training, evaluating, and deploying deep learning models for computer vision, natural language processing, object detection, sequence modeling, and generative AI applications using modern cloud-enabled AI frameworks.															
Perform data preprocessing, feature extraction, visualization, and dataset handling for machine learning applications.															
Implement supervised and unsupervised learning techniques such as regression, classification, and clustering on real-world datasets.															
Evaluate the performance of machine learning models using appropriate metrics, validation methods, and parameter tuning techniques.															
Gain hands-on experience in designing, testing, and deploying machine learning models to solve practical problems.															
Course Outcome: After completion of the course, the student will be able to												Bloom’s Knowledge Level (KL)			
CO1		Apply basic data exploration and preprocessing techniques to identify dataset characteristics, missing values, duplicate records, and outliers.										K3			
CO2		Analyze the dataset to determine appropriate strategies for handling missing values, categorical data imputation, and data inconsistencies.										K4			
CO3		Evaluate and implement suitable data cleaning methods, including row removal, value imputation, duplicate elimination, and outlier treatment, to prepare a high-quality dataset for analysis.										K5			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)															
CO-PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	3	2	2	2	3	1	-	3	1	-	2	3	2	3	
CO2	3	2	3	3	3	1	-	3	1	1	2	3	2	3	
CO3	3	3	3	3	3	1	-	3	1	1	3	3	3	3	
List Of Practical’s (Indicative & Not Limited To)															
S.NO		EXPERIMENT									CO MAPPING				
1		Perform the following on a dataset: i. Basic data exploration, check for missing values, remove rows with missing values, Fill missing numerical values with mean or median, fill in categorical values with mode or a specific value, Handling duplicate rows, Removing outliers.									CO1				

	ii. Dealing with categorical Variables: one-hot encoding, label encoding, ordinal encoding, and target encoding iii. Feature Scaling: MinMaxScaler, StandardScaler, MaxAbsScaler, RobustScaler, Normalizer iv. Correlation Analysis Implement Principal Component Analysis (PCA) algorithm for dimensionality reduction.	
2	Implement a class having functions for Mean Absolute Error, Root Mean Square Error, Log loss, R-square and Adjusted R Square Fit a linear regression model to predict housing prices based on the size of the house. Forecasting Stock Closing Prices with Polynomial Regression and Bias-Variance Trade-off Analysis. Implement Gradient Descent algorithm and analyse the effect of learning rate and derivatives. Demonstrate effect of underfitting and overfitting in already implemented regression algorithms.	CO2
3	Implement logistic regression for binary classification on a dataset. Implement logistic regression model for Handwritten digit classification. Implement K-Nearest Neighbor regression from scratch for classification. Use the ID3 algorithm to build a decision tree to predict whether a customer will purchase a product based on their browsing behaviour on an e-commerce website. Use a support vector machine (SVM) to classify images into different categories using the CIFAR-10 dataset.	CO2
4	Implement Email Spam Classifier using Naïve Bayes Algorithm. Implement Random Forest algorithm and Xgboost algorithm for Telco Customer Churn Prediction and compare the performance of both the algorithms.	CO3
5	Customer Segmentation for a Retail Store Using K-Means Clustering. Document Clustering Using Hierarchical Clustering and Dendrograms. Fraud Pattern Detection in Transactions Using DBSCAN Clustering. Clustering City Temperature Patterns Using Gaussian Mixture Models. Implementation of anomaly detection system.	CO3
TEACHING HOURS		30 HOURS

Course Code: CCSE0455		Course Name: WEB TECHNOLOGIES											L	T	P	C
Course Offered in: CSE/CS/IT/CSE(AI)/CSE(AIML)/CSE(IOT)/CSE(AI)/CSE(DS)/CSE-R/M.Tech int													0	0	6	3
Pre-requisite: Basic Programming Knowledge, Knowledge of any programming language (e.g., C, C++, Python/Java), Familiarity with basic concepts of Internet.																
Course Objectives:																
This course covers different aspect of web technology such as HTML, CSS, Java Script and provide fundamental concepts of Internet, Web Technology and Web Programming. Students will be able to build a proper responsive website.																
Course Outcome: After completion of the course, the student will be able to													Bloom’s Knowledge Level (KL)			
CO1	Identify the basic facts and explaining the basic ideas of Web technology and internet.												K2			
CO2	Applying and creating various HTML5 semantic elements and application with working on HTML forms for user input.												K6			
CO3	Understanding and applying the concepts of Creating Style Sheet CSS3 and bootstrap.												K3			
CO4	Analysing and implementing concept of JavaScript and its applications.												K6			
CO5	Creating and evaluating dynamic web pages using the concept of PHP.												K6			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)																
CO-PO MAPPING	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	3	2	-	2	-	-	-	2	2	-	3	1	1	3	
CO2	3	2	3	2	3	-	-	-	2	1	2	1	2	3	3	
CO3	3	2	3	-	3	-	-	-	2	2	2	2	3	2	3	
CO4	3	3	3	2	3	-	1	-	2	2	2	3	2	3	3	
CO5	3	3	3	2	3	-	-	-	2	2	2	2	1	2	3	
Course Contents / Syllabus																
UNIT 1	BASICS OF WEB TECHNOLOGY & TESTING											16 HOURS				
Introduction: Introduction to Web Technology, History of Web and Internet, Connecting to Internet, Introduction to Internet services and tools, Client-Server Computing, Protocols Governing Web, Basic principles involved in developing a web site, Planning process,																

Types of Websites, Web Standards and W3C recommendations.		
Web Hosting: Web Hosting Basics, Types of Hosting Packages, registering domains, Defining Name Servers, Using Control Panel, Creating Emails in Cpanel, Using FTP Client, Maintaining a website.		
UNIT 2	INTRODUCTION TO HTML & XML	16 HOURS
HTML: What is HTML, DOM- Introduction to Document Object Model, Basic structure of an HTML document, Mark up Tags, Heading-Paragraphs, Line Breaks, Understand the structure of HTML tables. Lists, Working with Hyperlinks, Image Handling, Understanding Frames and their needs, HTML forms for User inputs. New form Elements- date, number, range, email, search and data list, Understanding audio, video and article tags. XML: Introduction, Tree, Syntax, Elements, Attributes, Namespaces, Display, HTTP request, Parser, DOM, XPath, XSLT, XQuery, XLink, Validator, DTD, Schema, Server.		
UNIT 3	CONCEPT OF CSS3 AND BOOTSTRAP	16 HOURS
Concept of CSS 3: Creating Style Sheet, CSS Properties , CSS Styling(Background, Text Format, Controlling Fonts) , Working with block elements and objects , Working with Lists and Tables , CSS Id and Class, Box Model(Introduction, Border properties, Padding Properties, Margin properties) CSS Advanced(Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute selector) , CSS Color, Creating page Layout and Site. Bootstrap: Introduction, Bootstrap grid system, Bootstrap Components.		
UNIT 4	JAVASCRIPT AND ES6	16 HOURS
JavaScript Essentials: Introduction to Java Script , JavaScript Types , Var, Let and Const Keywords, Operators in JS , Conditions Statements , Java Script Loops, JS Popup Boxes , JS Events , JS Arrays, Working with Arrays, JS Objects ,JS Functions , Using Java Script in Real time , Validation of Forms, Arrow functions and default arguments, Template Strings, Strings methods, Callback functions, Object de-structuring, Spread and Rest. Operator, Typescript fundamentals, Typescript OOPs- Classes, Interfaces, Constructor etc. Decorator and Spread Operator Difference == & ===, Asynchronous Programming in ES6, Promise Constructor, Promise with Chain, Promise Race.		
UNIT 5	INTRODUCTION TO PHP	16 HOURS
Introduction to PHP, Basic Syntax, Variables & Constants, Data Type, Operator & Expressions, Control flow and Decision making statements, Functions, Strings, Arrays. Working with files and directories: Understanding file& directory, Opening and closing, a file, Coping, renaming and deleting a file, working with directories, Creating and deleting folder, File Uploading & Downloading. Session & Cookies: Introduction to Session Control, Session Functionality What is a Cookie, Setting Cookies with PHP. Using Cookies with Sessions, Deleting Cookies, Registering Session variables, Destroying the variables and Session.		
Total Lecture Hours		80 HOURS
Textbook:		
Book Details		Authors Name

“Web Technology and Design”, 1st Edition 2003, New Age International.		C Xavier
“Internet and Web Technologies”, 2nd Edition 2017, Mc Graw Hill Education.		Raj Kamal
“Beginning PHP Laravel”, 2nd Edition 2020, kindle Publication.		Oluwafemi Alofe,
Reference Books:		
Book Details		Authors Name
“Collaborative Web Development” 5th Edition 1999, Addison Wesley Publication.		Burdman, Jessica
“Fundamentals of Web Development”, 3rd Edition 2016		Randy Connolly
“HTML, DHTML, Java Script, Perl & CGI”, 4th Edition 2010 BPB Publication		Ivan Bayross
Self-Study Content Links:		Duration (in Hrs)
MOOC’S	https://onlinecourses.swayam2.ac.in/e-learning/preview/nou24_cs09	12 WEEKS
VIDEO LECTURES	https://youtu.be/96xF9phMsWA https://youtu.be/Zopo5C79m2k https://youtu.be/ZliIs7jHi1s https://youtu.be/htbY9-yggB0 https://youtu.be/vHmUVQKXIVo https://youtu.be/qz0aGYrrlhU https://youtu.be/a8W952NBZUE https://youtu.be/BsDoLVMnmZs https://youtu.be/1Rs2ND1ryYc https://youtu.be/vpAJ0s5S2t0 https://youtu.be/GBOK1-nvdU4 https://youtu.be/Eu7G0jV0ImY https://youtu.be/-qfEOE4vtxE https://youtu.be/PkZNo7MFNFg https://youtu.be/W6NZfCO5SIk https://youtu.be/DqaTKBU9TZk https://youtu.be/_GMEqhUyyFM https://youtu.be/ImtZ5yENzgE https://youtu.be/xIApzP4mWyA	17 MIN 8.50 MIN

	https://youtu.be/qKR5V9rdht0	
WEB REFERENCES	<u>Web Development Technologies - GeeksforGeeks</u>	
LIST OF PRACTICAL		
S.N.	List Of Practical's (Indicative & Not Limited To)	CO
1	A. Overview and Installation of various code editors.	CO1
2	B. Overview and Installation of various servers	CO1
3	Implementing HTML program that represent in the document as a start tag, which gives the name and attributes	CO2
4	Implementing HTML program that represents a document	CO2
5	Implementing HTML program to display your simple CV	CO2
6	Creating html document that represents document object model	CO2
7	To Create a table to show your class time table.	CO2
8	Apply various colors to suitably distinguish keywords , also apply font styling like italics, underline and two other fonts to words you find appropriate , also use header tags.	CO2
9	Create a webpage with HTML describing your department use paragraph and list tags	CO2
10	Implementing HTML program that for Heading	CO2
11	Implementing program that implement paragraph and line-break	CO2

12	Use tables to provide layout to your HTML page describing your college infrastructure.	CO2
13	Use and <div> tags to provide a layout to the above page instead of a table layout	CO2
14	Create links on the words e.g. —Wi-Fi and —LAN to link them to Wikipedia pages	CO2
15	Insert an image and create a link such that clicking on image takes user to other page	CO2
16	Change the background color of the page; At the bottom create a link to take user to the top of the page.	CO2
17	Creating HTML program to implement three articles with independent, self-contained content.	CO2
18	Creating a XML document that defines the self-descriptive tags	CO2
19	Designing XML document that store various book data such as: book category, title, author, year and price	CO2
20	To Describe the various types of XML key components	CO2
21	Design XML DTD to define the structure and legal element and attribute of XML document	CO2
22	To implement internal and external DTD	CO2
23	Use frames such that page is divided into 3 frames 20% on left to show contents of pages, 60% in center to show body of page, remaining on right to show remarks.	CO2

24	Design a HTML registration form that takes user name, user password and mobile number with submit button control	CO2
25	Design a HTML5 document that implement of date, number, range, email, search and data list.	CO2
26	Implementation in HTML5 that include native audio and video support without the need for Flash.	CO2
27	Create a simple form to submit user input like his name, age, address and favourite subject, movie and singer.	CO2
28	Add few form elements such as radio buttons, check boxes and password field. Add a submit button at last.	CO2
29	Design a XML Schema that describes the structure of an XML document.	CO2
30	Design a XML document that describe the well-formed XML document	CO2
31	Design a XML document of CD Catalog through each <CD> element, and displays the values of the <ARTIST> and the <TITLE> elements in an HTML table	CO2
32	3. Create a XSL document for and taken xml document by you.	CO2
33	Create a XSLT document for and taken xml document by you with all steps	CO2
34	Design a web page by applying CSS grouping and dimensions property.	CO3
35	Demonstrating the CSS Box model with consists of: borders, padding, margins, and the actual content.	CO3

36	Add CSS property assign a style or behavior to an HTML element such as: color, border, margin and font-style.	CO3
37	Add To Style Text Elements with Font, Size, and Color in CSS	CO3
38	Applying a block element in CSS acquires up the full width available for that content.	CO3
39	Design a web page by applying CSS Display and Positioning property.	CO3
40	Design a web page by applying CSS Display and Positioning property .	CO3
41	Design a web page by applying CSS pseudo classes.	CO3
42	Creating a Java Script code to implement all data types.	CO4
43	Design a basic structure of Bootstrap Grid system.	CO4
44	Design All Bootstrap Components with example.	CO4
45	Implementing a program in Java script to implement augmented function.	CO4
46	Implementing a program to implement calculator application as real time.	CO4
47	Design a HTML form validation using Java Script.	CO4

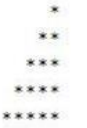
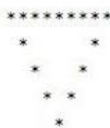
48	Write a program to implement Arrow function with default argument in ES6	CO4
49	Implementing a program in ES6 to implement Template string concepts	CO4
50	Implementing a program in ES6 to implement all string methods.	CO4
51	Creating a Java Script program to implement Dialog, Confirm and Message Popup Boxes.	CO4
52	Implementing a Java Script program to implement onClick and onSubmit event	CO4
53	Creating a java script code to implement 'let' keyword	CO4
54	Creating a java script code to implement 'const' keyword	CO4
55	Implementing a program to implement call back functions in ES6.	CO4
56	Implementing a program for de-structuring of an array in ES6	CO4
57	Javascript code to implement object and class concepts in Typescript.	CO4
58	Write a Typescript program that implement interface and constructor	CO4
59	Write a code in typescript that implement decorator and spread operator	CO4

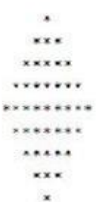
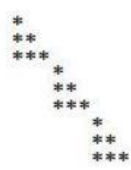
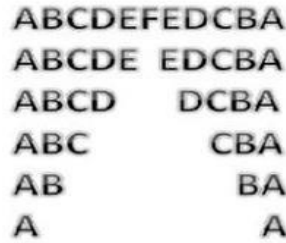
60	Create a constant by using define() function with its proper syntax	CO4
61	Creating PHP script that return any data types whatever you use.	CO4
62	Implementing a code in Java Script to implement Spread and rest operator	CO4
63	Javascript code that should compile by Typescript compiler as'tsc'	CO4
64	Write a code in typescript that implement Asynchronous Programming concepts.	CO4
65	Write a program in Typescript that implement promise constructor	CO4
66	Implementing promise and chain concepts in Typescript	CO4
67	Write a code in typescript that implement Promise.race() static method.	CO4
68	Crating a program that implement control flow and decision making statement.	CO4
69	Creating PHP to implements parameterized function	CO4
70	Creating program in PHP to store multiple string and concatenate these string and print it.	CO5
71	Write a PHP script to create and delete directory structure	CO5

72	Program to upload and download a file in PHP	CO5
73	Implements single dimension array in PHP	CO5
74	Write a PHP code to open and close a file in a proper manner	CO5
75	Write a PHP script to copying, renaming and deleting a file.	CO5
76	PHP program to create and destroy a session.	CO5
77	PHP program to set and delete a cookie.	CO5
78	PHP program to manually register the session variable	CO5
79	PHP program to manually destroy the session variable	CO5
80	PHP program to store the session data on one page and would be available on second page.	CO5



Course Code: CCSCC0452				Course Name: PROBLEM SOLVING APPROACHES								L	T	P	C
Course Offered in: CSE/CS/IT/CSE(AI)/CSE(AIML)/CSE(IOT)/CSE(AI)/CSE(DS)/CSE-R/M.Tech int												0	0	2	1
Pre-requisite: Programming Language C/C++ or Java or Python															
Course Objectives:															
Problem-solving in computer programming involves a structured approach to identifying, analyzing, and resolving coding challenges. The process typically includes thoroughly understanding the problem, decomposing it into smaller, manageable parts, designing an appropriate algorithm, implementing the solution through code, and performing testing and debugging to ensure correctness and efficiency.															
Course Outcome												Bloom’s Knowledge Level (KL)			
CO1		Develop logic-based solutions using control statements, recursion and bit manipulation to solve basic and intermediate computational problems.										K6			
CO2		Implement and manipulate arrays and strings using fundamental and advanced searching sorting techniques.										K3			
CO3		Analyze and debug code for logical errors and improve the efficiency of the solution using appropriate data structures and algorithmic patterns.										K4			
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)															
CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	3	3	3	2	2	1	2	2	-	-	2	3	3	2	
CO2	3	3	2	2	2	-	2	-	-	-	2	2	2	2	
CO3	3	3	2	2	3	1	2	2	-	-	3	3	3	2	
LIST OF PRACTICAL’S															
S.NO	PRACTICAL											CO			
1	Secure Password Generator A company wants to create a secure password generator for their employees. The password must be based on specific numeric properties to enhance its complexity and security. Write a program to validate and generate a secure password according to the following rules: <i>1. Prime Number Validation:</i> The user must input a 3-digit number. The program should first check if the number is a														

	prime number. - If it is not a prime number, the user should be prompted to enter another number until a valid prime number is provided. 2. Sum of Digits Check: - Once a valid prime number is entered, calculate the sum of its digits. If the sum of the digits is not divisible by 3, ask the user to enter another prime number until a valid one is found. 3. Armstrong Number Check: - Check entered prime number is Armstrong or not? If Armstrong are found, prompt the user to enter another prime number and repeat the process. Password Generation: Concatenate the 1 if entered prime number is Armstrong otherwise 2 with the sum of the digits of the valid prime number to form the secure password. Example Scenario: Sample Input Enter a 3-digit prime number: 153 Sum of digits of 153 = 9	
2	Write a function to input electricity unit charges and calculate total electricity bill according to the given condition: For first 50 units Rs. 0.50/unit For next 100 units Rs. 0.75/unit For next 100 units Rs. 1.20/unit For unit above 250 Rs. 1.50/unit An additional surcharge of 20% is added to the bill	
3	Write a method to generate a secure code which the sum of all possible palindrome numbers between given two numbers. For Example: Input: 10, 80 Output: 308 Explanation: All palindrome numbers between 10 & 80 are: 11,22,33,44,55,66,77 Password= 11+22+33+44+55+66+77 = 308	
4	Draw the following Patterns for N=5     Right Triangle Star Pattern Hollow Right Triangle Star Pattern Pyramid Star Pattern Hollow Pyramid Star Pattern     Mirrored Right Triangle Star Pattern Hollow Mirrored Right Triangle Star Pattern Inverted Pyramid Star Pattern Hollow Inverted Pyramid Star Pattern	

	    Diamond Star Pattern Hollow Diamond Star Pattern Number pattern 18 For N=3 print above pattern    Right Arrow Star Pattern Left Arrow Star Pattern Alphabetical pattern	
5	Write a program that takes an integer n as input and prints the multiplication table of n from n * 1 to n * 10. The output should clearly show each multiplication step.	
6	Write a program to calculate the sum of all integers from 1 to a given number N. The program should take N as input and output the total sum using iteration or recursion.	
7	Find the GCD of Two Numbers Using Recursion: Write a recursive function to calculate the Greatest Common Divisor (GCD) of two numbers using Euclid's algorithm. The function should take two integers as input and return their GCD.	
8	Find the LCM of Two Numbers Using Recursion: Write a program to compute the Least Common Multiple (LCM) of two numbers using recursion. You may use the relationship $LCM(a, b) = a * b / GCD(a, b)$ and a recursive function for GCD.	
9	Write a program to count the number of set bits (1s) in the binary representation of a given integer. The program should efficiently use bitwise operations to perform the task without converting the number to a string.	
10	Write a program that takes a number and a bit position as input and checks whether the bit at that position is set (1) or clear (0). Use bitwise operators to perform the check	
11	Given a number and a position, write a program to toggle (invert) the bit at the given position using bitwise operations. The result should reflect the updated value of the number after flipping the bit.	
12	Write a program to compute the XOR of all numbers from 1 to n using a mathematical pattern (not a loop). Use bitwise XOR properties to achieve an efficient solution.	
13	Given an array of size n-1 containing unique elements from 1 to n, find the missing number using bit manipulation (preferably XOR approach) without sorting or using extra space.	

14	Given an array where all elements repeat twice except two elements that appear only once, write a program to find the two non-repeating elements using bitwise operations in linear time and constant space.	
15	Write a program to check if a given number is a power of two using bit manipulation. A number is a power of two if it has exactly one set bit in its binary representation.	
16	Given two integers A and B, write a program to count how many bits need to be flipped to convert A to B. Use XOR to find differing bits and count the number of set bits.	
17	Write an efficient program to count the total number of set bits in binary representations of all numbers from 1 to n. Optimize the approach using bitwise logic and recursion.	
18	Write a program to calculate the square of a number using only bitwise operations and addition. Do not use multiplication, division, or any power functions.	
19	Write a function to add two integers using bitwise operations only. Avoid using the + or - operators. Implement logic using XOR and AND operations for binary addition.	
20	Write a program to generate the power set (all subsets) of a given set using bitwise representation. Each subset can be represented by a binary number where each bit indicates inclusion of the corresponding element.	
21	Sarah is assisting the "MathMinds Club" in creating passwords for their online platform. They have a list of numbers, some stable and some unstable. Define a function that can help Sarah calculate the password according to the given scenario. Scenario: - There are N numbers provided. - A number is stable if each digit appears the same number of times. - A number is unstable if the frequency of its digits is not the same. - The password is computed as the sum of all stable numbers minus the sum of all unstable numbers. - Consider only those numbers in the list that have more than equal to three digits. For example: Input: N=5 List: 12, 1313, 122, 678, 898 Output: Password: 971	
22	Given an array of integers, including possible negative values, you are allowed to modify at most one element by doubling its value. The goal is to find the maximum possible sum of any subarray after making this modification. Input: arr = [-2, 1, -3, 4, -1, 2, 1, -5, 4] Expected Output: Original Maximum Subarray Sum: 6 (achieved from [4, -1, 2, 1]) Maximum Sum After Modification: 10(achieved from [8, -1, 2, 1], where the value 4 is doubled to 8).	

23	For a given string, generate a pattern based on the following rules: Input: A string of characters (e.g., "HAT"). Output: Generate patterns by replacing characters with the numeric value 1 and process the patterns as described below: 1. Replace one character at a time with 1: - o For each character in the string, replace it with 1, keeping the other characters unchanged. - o Example for "HAT": 1AT, H1T, HA1 2. Replace two characters at a time with 1: - o Replace every combination of two characters with 1, keeping the remaining character unchanged. - o If 1s are consecutive, replace them with their sum (e.g., 11T becomes 2T). - o Example for "HAT": 11T → 2T, H11 → H2, 1A1 3. Replace all characters with 1: - o Replace all characters in the string with 1. - o If there are consecutive 1s, sum them up (e.g., 111 becomes 3). - o Example for "HAT": 111 → 3 Final Output For the string "HAT", the output should be: 1AT, H1T, HA1, 2T, H2, 1A1, 3.	
24	Given a sorted array arr [] and a target value, the task is to count triplets (i, j, k) of valid indices, such that arr[i] + arr[j] + arr[k] = target and i < j < k. Examples: Input: arr[] = [-3, -1, -1, 0, 1, 2], target = -2 Output: 4	
25	You are given an array prices[] where prices[i] represents the price of a given stock on day i. You want to maximize your profit by choosing a single day to buy one stock and choosing a different day in the future to sell that stock. Write a program to return the maximum profit you can achieve from this transaction. If no profit is possible, return 0.	
26	Find the "Kth" max and min element of an array: Given k, find the k-th smallest and k-th largest element in the array. Input: arr = [7, 10, 4, 3, 20, 15], k = 3 Output: Kth Smallest: 7, Kth Largest: 10	

27	7. Sort a binary array Input: [0, 2, 1, 2, 0] Output: [0, 0, 1, 2, 2] with values 0, 1, and 2 using constant space and one pass (Dutch National Flag algorithm).		
28	Find longest consecutive subsequence: Return the length of the longest consecutive elements sequence. Input: [1, 9, 3, 10, 4, 20, 2] Output: 4 (Sequence: 1, 2, 3, 4)		
29	Given a number of bits and a number K. In one flip you can toggle exactly K consecutive bits. With only this flip operation available, convert the string into all 1. Input String: 0000110000 and K=3 Following are four flip operations by using which all bits converted into 1's. Flip1- 1110110000 Flip2- 1110110111 Flip3-1111000111 Flip4- 1111111111 If it is not possible to convert all bits into one's then print "IMPOSSIBLE".		
30	10. Given a list of non-negative integers, arrange them in such a way that they form the largest possible number. Since the result can be very large, return it as a string in $O(N \log N)$ time complexity.		
	Example-1 Input: N = 5 Arr[] = {3, 30, 34, 5, 9} Output: 9534330	Example-2 Input: N = 4 Arr[] = {54, 546, 548, 60} Output: 6054854654	
31	11. Given an array arr[] of size n containing distinct integers within the range [1, n+2], find the two missing numbers from the first n+2 natural numbers. Constraints: - The solution must run in $O(N)$ time and use $O(1)$ extra space. - The array does not contain duplicate values. Examples: Input: arr[] = [1, 2, 4, 6, 3, 8], n = 6 Output: 5, 7		
32	Given a string str of lowercase alphabets and a number k, the task is to print the minimum value of the string after removal of k characters. The value of a string is defined as the sum of squares of the count of each distinct character present in the string. Return the minimum possible required value. Examples: Input: str = "abccc", k = 1 Output: 6		

	Input: str = “aabcbbcabcc”, k = 3 Output: 27 Expected Time Complexity: O(n+klog(p)) Note: Here n is the length of string and p is number of distinct alphabets and k number of alphabets to be removed.		
33	13. Given a non-negative integer S represented as a string, remove K digits from the number so that the new number is the smallest possible. Note : The given <i>num</i> does not contain any leading zero. Expected Time Complexity: O(S).		
	Example 1: Input: S = "149811", K = 3 Output: 111	Example 2: Input: S = "1002991", K = 3 Output: 21	
34	You are given a two-dimensional grid board[][] of size n * m consisting of English letters and a string target. Your task is to determine whether the target word can be formed by sequentially connecting letters from the grid. You may move to adjacent cells horizontally or vertically (not diagonally), and a cell may not be reused once it is part of the current path. Examples: Input: board[][] = [['C', 'A', 'T'], ['R', 'A', 'K'], ['T', 'O', 'N']], target = "CART" Output: true Explanation: You can trace the word "CART" through the path: C → A → R → T (moving horizontally and vertically, without repeating cells).		
35	15. Given an encoded string s, the task is to decode it. The encoding rule is: k[encodedString], where the encodedString inside the square brackets is being repeated exactly k times. Note that k is guaranteed to be a positive integer, and encodedString contains only lowercase english alphabets. Note: The test cases are generated so that the length of the output string will never exceed 10^5. Examples: Input: s = "1[b]" Output: "b" Input: s = "3[b2[ca]]" Output: "bcacabacabcaca"		
TEACHING HOURS			30 HRS

Course Code: CNC0401		Course Name: ARTIFICIAL INTELLIGENCE AND CYBER ETHICS											L	T	P	C
Course Offered in: All B.Tech Branches													2	0	0	0
Pre-requisite: Basic understanding of AI, Cybercrime, Computer System and Ethics																
Course Objectives:																
The course aims to foster critical thinking about ethical issues, promote responsible use of technology, and ensure students can identify, analyze, and address ethical dilemmas in Artificial Intelligence and cyber domains.																
Course Outcome: After completion of the course, the student will be able to												Bloom’s Knowledge Level (KL)				
CO1	Learn key principles of AI ethics, summarizing ethical considerations and applications in AI development and deployment.											K2				
CO2	Apply policies and framework for Fairness in AI and Machine Learning.											K3				
CO3	Apply privacy and security concepts, risk management and regulatory compliance in the field of AI and Cyber Security.											K3				
CO4	Understand the nature of cybercrimes, the principles of intellectual property rights (IPR), and the legal measures necessary to address and prevent these issues.											K2				
CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)																
CO-PO MAPPING	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	-	1	-	-		1	2	-	-	-	2	1	1	1	-	
CO2	2	3	2	-	2	1	2	-	2	1	2	2	1	1	2	
CO3	2	3	2	1	2	3	3	-	2	2	2	2	2	1	2	
CO4	2	2	-	-	1	3	3	-	2	2	2	2	1	1	2	
Course Contents / Syllabus																
UNIT 1	AN OVERVIEW TO AI ETHICS											6 HOURS				
Definition of AI Ethical principles in AI, Sources of AI data, Legal implications of AI Security Breaches, Privacy and AI Regulations, Key Principles of Responsible AI, Transparency and Accountability, Dual-Use Dilemma, Human-Centric Design, Introduction to Cyber Laws and Ethics, Historical Development of Cyberlaws, Legal frameworks.																
UNIT 2	FAIRNESS AND FAVORITISM IN MACHINE LEARNING											8 HOURS				
Introduction to Fairness and Bias in AI, Types of Fairness and Bias, Impact of Bias and Fairness in AI, Techniques for Measuring Fairness and Bias, Techniques for Mitigating Bias, Current Policies and Frameworks for Fairness in AI, Bias in Data Collection,																

Fairness in Data Processing, Generative AI, Types of Bias in Generative AI.		
UNIT 3	AI ETHICS AND CYBERSECURITY PRINCIPLES	8 HOURS
Importance of Privacy and Security in AI, AI specific Security Tools and Software, Privacy-Preserving Machine Learning (PPML) and Privacy-Preserving Data Mining (PPDM), Risk Management: Risk Assessment and Incident Response, Regulatory Compliance: GDPR, HIPAA, Case Studies: Implementation of AI Ethics guidelines and best practices in engineering projects.		
UNIT 4	CYBERCRIMES, IPR AND LEGAL MEASURES	8 HOURS
Types of Cybercrimes and their Impact, Legal measures for Cybercrime Prevention and Prosecution, IPR: Copyrights, Trademarks, Patents, and Trade Secrets, Ethical Implications of Intellectual Property, Cyber Security and Privacy Issues, Cyber Crime Investigations and Digital Evidence Handling, Overview of Indian Cyber Laws (IT Act 2000 and Amendments), Comparative Overview: Indian vs Global Cyber Laws, Case Study: The ATM Heist – Cosmos Bank Cyber Attack (India, 2018).		
Total Lecture Hours		30 HOURS
Textbook:		
Book Details		Authors Name
Artificial Intelligence: A Guide for Thinking Humans , Penguin Books, 2019.		Melanie Mitchell
Cyber Ethics: Morality and Law in Cyberspace ,7th Edition (2023).		Richard Spinello, Jones & Bartlett Learning
Reference Books:		
Book Details		Authors Name
Artificial Intelligence and Ethics , BPB Publications, 2023.		S. B. Kishor, Debajit Biswas
Cyber Security and Cyber Laws ,Cengage India, 2022.		Alfred Basta, Nadine Basta, Sattwik Panda,
Self-Study Content Links:		Duration (in Hrs)
MOOC'S	https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_INTEL_02	64 HRS
VIDEO LECTURES	https://www.youtube.com/watch?v=hVJqHgqF59A https://www.youtube.com/watch?v=VqFqWlqOB1g https://www.youtube.com/watch?v=O5RX_T4Tg24 https://www.youtube.com/watch?v=RJZ0pxcZsSQ	5.2m 6.52m 45m 5.02m
WEB REFERENCES	CCS345 Ethics and AI Lecture Notes PDF Artificial Intelligence Intelligence (AI) & Semantics	