Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	CS289	Title of the Course	Web Scripting Lab	L	T	P	C
Year	II	Semester	III	0	0	2	1
Pre-Requisite	None	Co-requisite	None				
Course Objectives		This course is to provide learners with a comprehensive understanding of JavaScript and React JS empowering them to develop dynamic and interactive web applications.					

Course Outcomes	
CO1	Understanding the role of JavaScript in web development
CO2	Syntax and structure of JavaScript code
CO3	JavaScript concepts to solve real-world problems
CO4	Utilize the concepts of JavaScript
CO5	React JS concepts to solve real-world problems

Experiment No.	Name of Experiment	Contact Hrs.	Mapped CO
1	Write a JavaScript program to display the current day and time in the following format. Sample Output: Today is: Tuesday. Current time is: 10 PM: 30:38.	2	1
2	Write a program to redirect, popup and print function in JavaScript.	2	1
3	Write a JavaScript program to change background color after 5 seconds of page load.	2	2
4	Write a JavaScript program to dynamically bold, italic and underline words and phrases based on user actions.	2	2
5	Write a JavaScript program to display a hidden div (e.g. showing stats of a player when user clicks on his name).	2	3
6	Write a JavaScript program to check the given number is mobile number or not using form.	2	3
7	Write a JavaScript program to test the first character of a string is uppercase or not.	2	4
8	Create a Simple Login form using React JS.	2	5
9	Write a program to create a simple calculator Application using React JS.	2	5
10	Write a program to create a voting application using React JS.	2	5

e-Learning Source:
https://www.udemy.com/courses/search/?q=javascript&src=sac&kw=java
https://www.udemy.com/courses/search/?src=ukw&q=React+JS

PO-PSO CO	Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	3	3	1			3	1	1		1	1	1	3		3
CO2	2	2	3	3	1		2	2	1		1	2		2	1	
CO3	1	1	1	2	1			2	2		2	1	1	3	1	2
CO4	2	2	1	2	3		2	1	3		3		3	1	1	1
CO5	1	2	1	3	2	3	1		2	3	2	1	2	2	3	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	BM225	Title of the Course	Principles of Management and Engineering Economics	L	T	P	C
Year	II	Semester	III	3	1	0	4
Pre-Requisite	None	Co-requisite	None				
Course Objectives	The course curriculum helps to understand the designing of the database models, understanding of the relationships between different records and databases. Its major objective is the storage, manipulation and working with the transactions. It helps in the connectivity of the large databases with the various webpages. It also introduces the concept of several technologies which helps in resolving the integrity, atomicity problems. It helps in the transformation of one type to different types. It removes multiple duplicacy, allows access to multiple users and helps in data protection.						

Course Outcomes	
CO1	Know about the concepts of database, their types, design concepts and ER-models
CO2	Know about the concepts of relational databases, working with SQL for frontend development
CO3	Know about the concepts of query optimization, transaction processing and concurrency control
CO4	Know about the concepts of database technologies, distributed database environment
CO5	Know about the concept of data warehouse, data cleaning and data integration

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1		Nature and Significance of Economics. Meaning of Science. Engineering and Technology and their Relationship with Economic Development.	8	1
2		The Concept of Demand and Supply. Elasticity of Demand and Supply, Indifference Curve Analysis, Price Effect. Income Effect and Substitution Effect.	8	2
3		Functions of Money, Value of Money, Inflation and Measures to Control it, Brief Idea of Functions of Banking System viz Commercial and Central Banking, Business Fluctuations.	8	3
4		Definition, Nature and Significance of Management, Evaluation of Management Thought, Contributions of Max Weber. Taylor and Fayol.	8	4
5		Factors of Individual Behavior, Perception. Learning and Personality Development Interpersonal Relationship and Group Behavior.	8	5

Reference Books:

1. Dewett, K.K. / Modern Economic Theory / S. Chand

2. Luthers Fred / OrganizaionalBehaviour

e-Learning Source:

Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO5	PSO6	PSO7
CO1	1	2	2	3	1	2	1	3	1	2	1	2	1	2	2			
CO2	3	2	1	1	1	2	3	2	2	2	3	1	3	2	2			
CO3	2	2	2	2	1	1	3	2	3	1	1	2	2	1	2			
CO4	3	2	1	2	3	1	1	3	2	2	3	3	2	3	1			
CO5	1	2	2	3	1	2	1	3	1	2	1	2	1	2	2			

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2016-17									
Course Code	BM226	Title of the Course	Human Values & Professional Ethics			L	T	P	C
Year	II	Semester	III			3	0	0	0
Pre-Requisite	None	Co-requisite	none						
Course Objectives	• To understand the moral values that ought to guide the Management profession, Resolve the moral issues in the profession, • To justify the moral judgment concerning the profession. • To create an awareness on Management Ethics and Human Values. • To inspire Moral and Social Values and Loyalty. Intended to develop a set of beliefs, attitudes, and habits that engineers should display concerning morality. • To create awareness about the important global issues: . Multinational corporations - Environmental ethics - computer ethics - weapons development								

Course Outcomes	
CO1	Development of moral and ethical values, right understanding and relationships
CO2	Knowledge of Moral Rights and Moral rules, Moral character and responsibilities. Privacy, Confidentiality, Intellectual Property rights and its laws.
CO3	Awareness about the Professional Responsibility of engineers, Responsibility of engineers related to risks, hazards and safety.
CO4	Development of Engineers Ethics. Understanding of variety of moral issues, moral judgment concerning the profession.
CO5	Understanding of various of global issues; Environmental ethics - computer ethics - weapons development.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Human Value Education	Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration. Its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly.	6	CO1
2	Introduction to Ethical Concept	Definition of industrial ethics and values, Ethical rules of industrial worker. Values and Value Judgments. Moral Rights and Moral rules, Moral character and responsibilities. Privacy, Confidentiality, Intellectual Property and the Law. Ethics as Law.	6	CO2
3	Professional Responsibility	The basis and scope of Professional Responsibility, Professions and Norms of Professional Conduct, Ethical Standards versus Profession, Culpable mistakes, the Autonomy of professions and codes of ethics. Employee status and Professionalism. Central Professional Responsibilities of Engineers: The emerging consensus on the Responsibility for safety among engineers, hazards and risks.	6	CO3
4	Engineers Ethics	Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry - moral dilemmas – moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles theories about right action – Self-interest - customs and religion - uses of ethical theories. Valuing Time – Cooperation – Commitment.	6	CO4
5	A Glimpse of Life Stories, Global Issues	Life story of Prophet Mohammad, Mahatma Gandhi, Swami Vivekanand, Marie Curie and Steve Jobs. Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers consulting engineers-engineers as expert witnesses and advisors -moral leadership.	6	CO5

Reference Books:

1. R.S. Naagarazan 2006, "A Textbook on Professional Ethics and Human values" New Age International Publisher.

2. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Value Education.

3. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 1996.

e-Learning Source:

1. Value Education website, http://www.uptu.ac.in . 2. Story of Stuff, http://www.storyofstuff.com

2. **https://www.youtube.com/watch?v=nlh9V5gd8hg&list=PLbMVogVj5nJQ20ZixllzM69agBq-m8ndV**

3. **https://www.youtube.com/watch?v=9LSEBK03CiY&list=PLysZquKdjuWSv87TaE7pByn5TE_e46O2C**

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	3			3		2		2	2	2	3
CO2	3	3	2	3	3			2					2	3	3
CO3	2	3	2	3	2			3		3			3	3	3

Integral University, Lucknow

Effective from Session: 2016-17								
Course Code	**CS200**		**Title of the Course Industrial Training/ internship/ Apprenticeship**					
Year		II	**Semester**	III	**L**	**T**	**P**	**C**
Pre-Requisite	None		**Co-requisite**	None	0	0	1	1

Course Objectives	Learn project management, technical skills, and teamwork. Apply advanced computer science knowledge for innovative solutions. Gain practical experience in software development. Improve communication and documentation skills.

Minor Project, students will work on exploring, experimenting, or analyzing technical problems in different areas of Computer Science and Engineering. This includes tasks like software development, algorithm design, system design, software testing, data analysis, cybersecurity, artificial intelligence, network systems, or computer applications. The assessment for the project will be done both within the department and externally, following the established procedures. Students will also need to submit a detailed project report by the end of the seventh semester

Course Outcomes	
CO 1	Develop practical skills relevant to the industry through hands-on training and exposure to real-world tasks and challenges.
CO 2	Enhance professional competencies such as communication, teamwork, problem-solving, and adaptability within an industrial setting.
CO 3	Apply theoretical concepts learned in academic studies to solve practical problems and contribute effectively to projects within the industry, bridging the gap between academic learning and real-world applications.
CO 4	Demonstrate Proficient Communication and documentation Skills in Reports and Presentations Throughout and Following Industrial Training / Internship.

S.No	Skill Set	Content	Mapped CO
1	**Practical Skill Development**	Develop practical skills relevant to the industry through hands-on training and exposure to real-world tasks and challenges.	CO-1
2	**Professional Growth**	Enhance professional competencies such as communication, teamwork, problem-solving, and adaptability within an industrial setting.	CO-2
3	**Application of Theoretical Knowledge**	Apply theoretical concepts learned in academic studies to solve practical problems and contribute effectively to projects within the industry, bridging the gap between academic learning and real-world applications.	CO-3
4	**Documentation Communication Proficiency**	Demonstrate Proficient Communication and documentation Skills in Reports and Presentations Throughout and Following Industrial Training / Internship.	CO-4

CO-PO Mapping																
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	2	3	1	3	1	0	1	2	3	0	1	3	3	3	2	2
CO 2	3	2	2	1	1	0	1	2	3	2	3	3	2	3	3	3
C03	2	2	1	2	2	1	1	2	2	3	2	3	3	3	3	3
C04	1	2	2	2	0	0	1	0	2	3	2	2	2	2	0	3

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CS203	**Title of the Course**	Cyber Law And Information Security	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	2	1	0	3
Pre-Requisite	NIL	**Co-requisite**	NIL				
Course Objectives	● Knowledge about cyber law, intellectual property and cyber crimes(internet security threats), trademarks and domain theft. ● Knowledge on the disciplines of technology, E-business and law to allow them to minimize the occurrence and severity of information security incidents. ● Knowledge about Information System and principles of Information Security (as confidentiality, integrity, and availability). ● Knowledge of cryptography and techniques used to detect and prevent network intrusions.						

Course Outcomes	
CO1	Understand key terms and concepts in cyber law, intellectual property and cybercrimes(internet security threats), trademarks and domain theft.
CO2	Keep an appropriate level of awareness, knowledge and skill on the disciplines of technology, E-business and law to allow them to minimize the occurrence and severity of information security incidents.
CO3	Understand about Information System and principles of Information Security (as confidentiality, integrity, and availability).
CO4	Understand about cryptography and techniques used to detect and prevent network intrusions.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Fundamentals of Cyber Law	Jurisprudence of Cyber Law, Object and Scope of the IT Act 2000, Introduction to Indian Cyber Law, Unicitral Model Law, ISP Guideline. Intellectual property issues and cyber space, Indian perspective, Overview of Intellectual property related legislation in India, Patent, Copy Right, Trademark law, Law related to semiconductor layout &design.	08	CO1
2	E - Commerce	Security Threats to E - Commerce, Virtual Organization, Business Transactions on Web, EGovernance and EDI, Concepts in Electronics payment systems, E-Cash, Credit/Debit Cards, E- Agreement, Legal recognition of electronic and digital records, E- Commerce Issues of privacy, Wireless Computing- Security challenges in Mobile devices. Digital Signatures - Technical issues, legal issues, Electronic Records, Digital Contracts, and Requirements of Digital Signature System.	07	CO2
3	Investigation and Ethics	Cyber Crime, Cyber jurisdiction, Cyber crime and evidence act, Treatment of different countries of cyber crime, Ethical issues in data and software privacy, Plagiarism, Pornography, Tampering computer documents, Data privacy and protection, Domain Name System, Software piracy, Issues in ethical hacking. Internet security threats: Hacking, Cracking, Sneaking, Viruses, Trojan horse, Malicious Code & logic bombs.Introduction to biometric security and its challenges, Finger prints.Cyber crime forensic: CASE STUDY in Cyber Crime.	09	CO3
4	Information security	Information Systems and its Importance, Role of Security in Internet and Web Services, Principles of Information Security, Classification of Threats and attacks, Security Challenges, Security Implication for organizations, Security services - Authentication, Confidentiality, Integrity, Availability and other terms in Information Security, Information Classification and their Roles. Introduction to Cryptography, Issues in Documents Security, Keys: Public Key, Private Key, Firewalls, Basic Concepts of Network Security, Perimeters of Network protection & Network attack, Need of Intrusion Monitoring and Detection.	09	CO4
Reference Books:				
Harish Chander "Cyber Law and IT Protection" , PHI Publication, New Delhi				
Merkov, Breithaupt," Information Security", Pearson Education				
"Cyber Law in India" - Farooq Ahmad-Pioneer books.				
K. K. Singh, Akansha Singh "Information Security and Cyber law", Umesh Publication, Delhi				

2	**Stacks & Ques**	Array Representation and Implementation of Stack, Operations on Stacks: Push & Pop, Linked Representation of Stack, Application of Stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of Postfix Expression using Stack. Recursion: Recursive Definition and Processes, Recursion in C, Example of Recursion, Tower of Hanoi Problem. **Queues:** Array and Linked Representation and Implementation of Queues, Operations on Queue: Create, Add, Delete, Full and Empty; Circular Queues, D-queues and Priority Queues**.**	9	2
		Header List, Polynomial Representation & Addition, Generalized Linked List, Garbage Collection and Compaction		
3	**Trees**	Basic Terminology, Binary Trees, Binary Tree Representation, Algebraic Expressions, Complete Binary Tree, Extended Binary Trees, Array and Linked Representation of Binary Trees, Traversing Binary Trees, Threaded Binary Trees, Traversing Threaded Binary Trees, Huffman Algorithm, Binary Search Tree (BST), Insertion and Deletion in BST, Path Length, AVL Trees, B-trees.	8	3
4	**Searching, Sorting and Hashing**	Sequential Search, Binary Search, Comparison and Analysis, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation. **Sorting:** Insertion Sort, Bubble Sort, Quick Sort, Two Way Merge Sort, Heap Sort.	7	4
5	**Graphs**	Terminology & Representations, Graphs & Multi-Graphs, Directed Graphs, Sequential Representations of Graphs, Adjacency Matrices, Traversal, Connected Component and Spanning Trees, Minimum Cost Spanning Trees. **File Handling:** Physical Storage Media File Organization, Organization of Records into Blocks, Sequential Files, Indexing and Hashing, Primary Indices, Secondary Indices	7	5

References:
1. M. Tannenbaum. "Data Structure Using C/C+"
2. Horowitz And Sahani "Fundamental of Data Structure", Galgotia Publication
3. A Lipschutz "Data Structure", Schaum series.
E-Learning Source:
https://nptel.ac.in/courses/106102064

CO-PO/PSO MAPPING

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1	2		1						1	1	2	1
CO2	3	3	2	2	2		1						1	3	3	1
CO3	3	3	3	2	2		1						1	3	3	2
CO4	3	3	3	2	3		2						2	3	3	2
CO5	3	3	3	3	3		2						2	3	3	2

Integral University, Lucknow

Effective from Session: 2020-21								
Course Code	CS206	**Title of the Course**	Discrete Structures	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	3	1	0	4
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	Explain the basic components of computers, their interconnection and data representation techniques in computer systems. To assess the working of CPU and become familiar with computer arithmetic's. Understand the control unit design using a hardwired and micro programmed approach. To study the memory organization and articulate design issues in each element of memory hierarchy						

Course Outcomes	
CO1	Perform the operations of union, intersection, complement, and difference on sets using proper notation. Be able to draw and interpret Venn diagrams of set relations and operations and use Venn diagrams to solve problems. Identify whether a mapping is one-to-one, many-to-one, or one-to-many and whether or not it is a function
CO2	Perform the operations of union, intersection, complement, and difference on sets using proper notation. Be able to draw and interpret Venn diagrams of set relations and operations and use Venn diagrams to solve problems. Identify whether a mapping is one-to-one, many-to-one, or one-to-many and whether or not it is a function
CO3	Learn about Ordered Set, Hasse Diagram of Poset, Well Ordered Set, Properties of Lattices, Bounded and Complemented Lattices. Boolean Algebra, Logic Gates and Karnaugh Maps, Properties of Trees
CO4	Learn about Proposition, First Order Logic, Truth Tables, Tautologies, Contradictions, Logical Implications, Logical Equivalence, Predicates
CO5	Identify and solve Recurrence Relations, Generating Functions, Bipartite, Regular, Connected Components in a Graph, Euler Graphs, Hamiltonian Path and Circuits, Chromatic Number

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1.	**Set Theory**	Definition of Sets, Countable and Uncountable Sets, Venn Diagrams, Proofs of Some General Identities on Sets Relation: Definition, Types of Relation, Composition of Relations, Pictorial Representation of Relation, Equivalence Relation, Partial Ordering Relation. Function: Definition, Type of Functions, One to One, Into and Onto Function, Inverse Function, of Functions, Recursively Defined Functions. Theorem Proving Techniques: Mathematical Induction Simple and Strong), Pigeonhole Principle, Prove by Contradiction.	9	1
2.	**Algebraic Structures**	Definition, Properties, Types: Semi Groups, Monoid, Groups, Abelian Group, Properties of Groups, Subgroup, Cyclic Groups, Cosets, Factor Group, Permutation Groups, Normal Subgroup, Homomorphism and Isomorphism of Groups, Example and Standard Results, Rings and Fields: Definition and Standard Results.	8	2
3.	**Posets, Hasse Diagram and Lattices**	Introduction, Ordered Set, Hasse Diagram of Partially, Ordered Set, Isomorphic Ordered Set, Well Ordered Set, Properties of Lattices, Bounded I and Complemented Lattices. Boolean Algebra: Basic Definitions, Sum of Products and Product of Sums, Form in Boolean Algebra, Logic Gates and Karnaugh Maps. Tree: Definition, Rooted Tree, Properties of Trees, Binary Search Tree, Tree Traversal.	9	3
4.	**Propositional Logic**	Proposition, First Order Logic, Basic Logical Operation, Truth Tables, Tautologies, Contradictions, Algebra of Proposition, Logical Implications, Logical Equivalence, Predicates, Universal And Existential Quantifiers.	7	4
5.	**Combinatorics & Graphs**	Recurrence Relation, Generating Function, Simple Graph, Multi Graph, Graph Terminology, Representation of Graphs, Bipartite, Regular, Planar and Connected Graphs, Connected Components in a Graph, Euler Graphs, Hamiltonian Path and Circuits, Graph Coloring, Chromatic Number, Isomorphism and Homomorphism of Graphs.	8	5

Reference Books:

1. Deo, Narsingh, "Graph Theory With application to Engineering and Computer.Science.", PHI.

2. Liptschutz, Seymour, "Discrete Mathematics", McGraw Hill.

3. Trembley, J.P & R. Manohar, "Discrete Mathematical Structure with Application to Computer Science", McGraw Hill.

4. Kenneth H. Rosen, "Discrete Mathematics and its applications", McGraw Hill.

5. Krishnamurthy, V., "Combinatorics Theory & Application", East-West Press Pvt. Ltd., New Delhi.

e-Learning Source:

https://onlinecourses.nptel.ac.in/noc20 cs82/preview

Integral University, Lucknow

Effective from Session: 2020-21									
Course Code	CS208	Title of the Course	DATA STRUCTURE USING C LAB		L	T	P	C
Year	II		III		0	0	2	
Pre-Requisite	None	Co-requisite	None					
Course Objectives		● To develop skills to design and analyze simple linear and non linear data structures ● To design and implement various data structure algorithms. ● To introduce various techniques for representation of the data in the real world ● To identify and apply the suitable data structure for the given real world problem ● To write algorithms for solving problems with the help of fundamental data structures							

Course Outcomes	
CO1	Able to handle operations like insertion, deletion, traversing mechanism etc. on various data structures
CO2	Able to implement the stack, Queue and their applications
CO3	Able to implement different types of trees and Binary Tree Traversal
CO4	Able to implement different Sorting and Search methods
CO5	Able to perform basic operations (creation and traversal) on graphs and determine minimum spanning tree

S. No.	List of Experiments	Contact Hrs.	Mapped CO
1	To implement traversing, insertion and deletion in arrays	2	1
2	To implement, addition, Multiplication of Two sparse Matrices	2	1
3	To implement insertion, deletion and pattern matching of a substring in a given string using linked list	2	2
4	To implement Insertion and deletion in Singly Linked List at Given Location as well as for a Given Item in sorted List.	2	2
5	To Implement Insertion and deletion in Circular Linked List	2	3
6	To implement insertion and Deletion in Stack and Queue using arrays and pointer	2	3
7	To implement Fibonacci Series and Tower of Hanoi Using Recursion	2	4
8	Creation of Trees and Tree Traversal Algorithms: Recursive and Non-Recursive	2	4
9	Creation of Graphs and Graph Traversal Algorithms. Sorting: Insertion Sort Quick Sort Merge Sort Bubble Sort Heap Sort Implementation of Sparse Matrix and Polynomial using Link list	2	5
10		2	5

Reference Books:

1. M. Tannenbaum. "Data Structure Using C/C+"

2. Horowitz and Sahani "Fundamental of Data Structure", Galgotia Publication

3. A Lipschutz "Data Structure", Schaum series.

e-Learning Source:

https://nptel.ac.in/courses/106102064

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO- PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1	2	1					2	1	1			
CO2	3	3	3	3	3	1					2	1	3			
CO3	3	3	3	3	3	1					2	1	3			
CO4	3	3	3	3	3	1					2	1	2		1	
CO5	3	3	3	3	3	1					2	1	1		2	

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session:2024-25							
Course Code	CS229	**Title of the Course**	Software Engineering	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	3	1	0	4
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	• Explain the basic understanding of software, its characteristics, and importance of following engineering principles to develop software. • Assess the applicability, strengths, and weaknesses of the different development life cycle models to provide real world software solutions. • To understand various processes of each phase of SDLC and make the students capable of preparing quality documentation for software development. • To develop effort estimation and risk management skills for developing software. • Study of CASE tools, Quality Assurance activities etc. for focusing on quality issues of software.						

Course Outcomes	
CO1	Identify the best suitable SDLC model for a given set of user requirements.
CO2	Estimate the total effort, to assess and manage the potential risks involved while developing the software.
CO3	Create a good quality SRS and design a highly cohesive and low coupled software
CO4	Follow the standard coding guidelines and practices and prepare best possible test cases to uncover errors.
CO5	Work on modern CASE tools and follow the international quality standards to produce good quality software.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction to Software Engineering**	Types of Software, Software Characteristics, Quality of a Good Software, Software Myths, Software Crisis, Software Engineering: Definition, Challenges, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes. Software Development Life Cycle Models: Waterfall Model, Prototyping Model, RAD Model Iterative Enhancement Model, Evolutionary Development Model and Spiral Model.	8	1
2	**Planning a Software**	Process Planning, Effort Estimation: Uncertainties in Effort Estimation, Building Effort Estimation Models, COCOMO Model, Project Scheduling & Staffing: Overall Scheduling, Detailed Scheduling, Team Structure, Software Configuration Management (SCM): - Baselines, Version Control, Change Control & Configuration Audit, Risk Management, Software Risks, Risk Analysis, Identification, Projection, Assessment, Monitoring and Managing the Risk, RMMM Plan.	8	2
3	**Software Requirements Analysis and Specification**	**Software Requirements**: Need for SRS, Requirement Process, Problem Analysis: Informal & formal Approaches, Data Flow Modeling, Prototyping, Requirements Specifications: Characteristics of an SRS, Components of SRS, Specification Language, Structure of Requirement Document: IEEE Standards for SRS. **Software Design**: Designing: Function Oriented Design: Design Principles: Problem Partitioning and Hierarchy, Abstraction, Modularity, Top Down and Bottom-Up Strategies, Module Level Concepts: Coupling, Cohesion; Introduction to Object Oriented Design, Software Measurement Metrics: Various Size Oriented Measures- Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.	8	3
4	**Coding & Testing**	**Coding**: Programming Principles and Guidelines: Common Coding Errors, Structured Programming, Information Hiding, Programming Practices, Coding Standards, Coding Process, Refactoring, Verification: Code Inspection. **Testing**: Testing Fundamentals: Error Fault and Failure, Test Oracles, Test Cases and Test Criteria, Unit Testing, Integration Testing: : Top Down and Bottom up, Acceptance Testing: Alpha and Beta Testing., Regression Testing, functional and non-functional testing. Testing Techniques: White Box: Logic Coverage, Path Coverage, Loop Coverage, Data Flow Testing. Black Box Testing: Boundary Value Analysis, Equivalence Class Testing.	8	4
5	**Computer Aided Software Engineering (CASE)**	CASE Tools, Scope, Benefits of CASE Tool, support in Software Life Cycle, Architecture of CASE Environment, Types of CASE Tools, Software Reliability and Quality Management: -Software Quality Management: Quality Concepts, Software Quality Assurance, Software Reviews, Formal Technical Reviews, Software Reliability, ISO 9000 Quality Standards, CMM Levels.	8	5

Reference Books:

1. Software Engineering: A Practitioner's Approach by Roger S. Pressman, McGraw-Hill International edition.

2. An Integrated Approach to Software Engineering, by Pankaj Jalote, Narosa Publishing House.

3. Software Engineering by K.K. Agarwal.

4. Software Engineering by Ian Sommerville, Addison-Wesley

PO-PSO / CO	Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2		1	1	2	2	3	2	1	3			
CO2	3	3	2	2	1		1		2	1	3	1		2	1	
CO3	3	3	3	2					3	3		2		3		
CO4	3	2	2	2	1	3		2	3	3		2	2	1	1	1
CO5	3	1	3	2	3	2	1	1	2	2	2	2			1	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2016-17								
Course Code	CS270	Title of the Course	Object Oriented Programming using Java	L	T	P	C	
Year	II	Semester	III	3	1	0	4	
Pre-Requisite	None	Co-requisite	None					

Course Objectives	- To provide students with a foundational understanding of programming language types, paradigms, and the computer programming hierarchy, with a specific emphasis on Java and its features, design goals, and industry relevance. - To equip students with a comprehensive understanding of object-oriented programming principles and advanced Java features, enabling them to proficiently design and develop robust, modular, and flexible Java applications. - To provide students with a comprehensive understanding of object-oriented programming principles, particularly focusing on class fundamentals, object manipulation, inheritance, and interface implementation in Java, along with the organizational benefits of packages - To provide students with a foundational understanding of threads and multi-threaded programming in Java, as well as input/output operations using the java.io package, including streams and file handling.

Course Outcomes	
CO1	Demonstrate practical skills in Java programming, including installation, development, source file structure, compilation, and execution.
CO2	Students will gain expertise in Java fundamentals, including object manipulation and memory management, constructor usage, method implementation, and advanced topics like static members and cloning, ensuring efficient and flexible Java program development.
CO3	Students will excel in Java programming by mastering class fundamentals, inheritance, and interfaces for efficient code organization and reusability, while understanding the benefits of package usage for access control and effective code management.
CO4	Students will become proficient in understanding and implementing exception handling, including different types of exceptions and their control flow, while also gaining skills in working with arrays and manipulating strings in Java programming.
CO5	Students will grasp the fundamentals of threads, synchronization, and multi-threaded programming in Java, alongside gaining expertise in input/output operations, including file handling and serialization.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction	Programming language Types and Paradigms, Computer Programming Hierarchy, Features of Java Language, JVM –The heart of Java, Java's Magic Bytecode **The Java Environment**: Installing Java, Java Program Development, Java Source File Structure, Compilation, Executions. **Basic Language Elements:** Lexical Tokens, Identifiers, Keywords, Literals, Comments, Primitive Data types, Operators Assignments.	9	1
2	Object Oriented Programming using Java	Class Fundamentals, Object & Object reference, Object Life time & Garbage Collection, Creating and Operating Objects, Constructor & initialization code block, Access Control, Modifiers, Methods Nested, Inner Class &Anonymous Classes, Abstract Class & Interfaces Defining methods, argument passing mechanism, method overloading, Recursion, Dealing with Static Members, Finalize () Method, Native Method., Use of "this" reference, Use of Modifiers with Classes & Methods	8	2
3	Extending Classes and Inheritances	Use and Benefits of Inheritance in OOP, Types of Inheritance in Java, Inheriting Data members and Methods, Role of Constructors in inheritance, Overriding Super Class Methods, Use of "super", Polymorphism in inheritance, Type Compatibility and Conversion Implementing interfaces. **Package:** Organizing Classes and Interfaces in Packages, Package as Access Protection, Defining Package, and Making JAR Files for Library Packages, Import and Static Import naming Convention for Package.	8	3
4	Exception Handling	Exceptions & Errors, Types of Exception, Control Flow in Exceptions, Use of try, catch, finally throw, throws in Exception Handling, In-built and User Defined Exceptions, Checked and Un-Checked Exceptions. **Array & String:** Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Operation on String, Mutable & Immutable String, Creating Strings using String Buffer.	8	4
5	Thread	Understanding Threads, Needs of Multi-Threaded Programming, Thread Life-Cycle, Thread Priorities and Synchronizing Threads, Inter Communication of Treads. **I/O Classes:** Input/output Operation in Java (java.io Package), Streams and the new I/O Capabilities, Understanding Streams, The Classes for Input and Output, The Standard Streams, Working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel	9	5

Reference Books:	
1.	T.Budd"An Introduction to OOP" Pearson Education
2.	Naughton, Schildt, "The Complete Refrence JAVA2",TMH
3.	Balagurusamy E, "Programming in Java", TMH
4.	"Head First Java" by Kathe Sierra

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	CS271	**Title of the Course**	Object Oriented concept using Java Lab	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	0	0	2	
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	• To learn the basic concepts and syntax of object-oriented programming. • To be able to develop logics which help them to create programs and applications using Java language. • To learn the use of exception handling. • To learn the use of methods and threads. • After learning object-oriented programming, they can easily create desktop-based projects.						

Course Outcomes	
CO1	Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.
CO2	Read and make elementary modifications to Java programs that solve real-world problems.
CO3	Validate input in a Java program.
CO4	Identify and fix defects and common security issues in code.
CO5	Document a Java program using Javadoc.

S. No.	List of Experiments	Contact Hrs.	Mapped CO
1	Create a class named 'Student' with String variable 'name' and integer variable 'roll_no'. Assign the value of roll_no as '2' and that of name as "John" by creating an object of the class Student.	2	1
2	Print the average of three numbers entered by user by creating a class named 'Average' which has a method to calculate and print the average.	2	1
3	Twin Prime are the prime numbers whose difference is 2 such as (3, 5), (5, 7), (11, 13). Write a program to display all twin prime numbers from 1 to n. Where n is the last range that is to be inputted by the user. Methods to be created are: • prime() – method which will check whether the number is prime or not. • show() – which will print the twin prime numbers and will call the prime() method. • main() – which will call the show() method	2	2
4	Write a program to print the area and perimeter of a triangle by creating a class named 'Triangle' with a parameterized constructor having the three sides as its parameters.	2	2
5	Write a program to print the volume of a Cube, Cuboid, and Sphere by using the concept of Method Overloading. Create a class named 'Volume'.	2	3
6	Write a Java program to calculate the average value of array elements where array elements are {20,30,25,25,-16,60,-100}	2	3
7	Write a Java program for exception handling using a try-catch block	2	4
8	Write a program to display the Fibonacci series from 1 to n using a recursive function. Where n is the last range that is to be inputted by the user.	2	4
9	Write a program to perform a single inheritance on two classes.	2	5
10	Write a Java program to perform employee payroll processing using packages. Create a package Employee. In the package create 2 files: 1. **Emp.java**: Declare the variables name, empid, category, bpay, hra, da, npay, pf, grosspay, incometax, and allowance. Calculate the values in methods. 2. **Emppay.java.**: Create an object e to call the methods to perform and print values. The salary is calculated according to the following rules: Salary = Basic pay+HRA+DA HRA = 30% of basic pay DA = 40% of basic pay	2	5

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2		3		3						2		1
CO2	1	1	1	2	1		3						2	1	1
CO3	1	2	2	2			3							1	1
CO4	1		2	2			3						2	1	1
CO5	1	2	1				3						2	1	

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlatio

Integral University, Lucknow

Effective from Session: 2024-25								
Course Code	CS272	**Title of the Course**	Python Programming Lab	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	3	1	0	4
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	To build a strong foundation of python and its IDEs and learn various object oriented programming constructs and data structures available in Python by Writing and using functions and modules. To Understand file handling application by exploring python libraries and developing real-world applications.						

Course Outcomes	
CO1	Install and configure python and its IDEs.
CO2	Write basic programs using the various data structures provided in python.
CO3	Develop small modules and components using object-oriented methodology.
CO4	Use the libraries and develop file handling applications.
CO5	Develop some working applications using python.

S. No.	List of Experiments	Contact Hrs.	Mapped CO
1	Understanding Python installation and its Integrated Development Environments (IDEs). Write a program to illustrate various data types & concepts of variables/Constant in Python.	2	1
2	Python program to implement Basic loops, functions, if -else and input -output function. Write a program in python to demonstrate the concept of "**Loop**" and print the following pattern of prime numbers if input is number of lines. e.g.; if n=3, output should be: 2 3, 5 7, 11, 13	2	1
3	Write a program to implement the concept of "**List**" (create, append, and remove lists in python).	1	2
4	Python Program to implement- **Strings**, **Tuple**, **Dictionary** and **Set**. Write a program to create, concatenate and print a "String" and accessing sub-string from a given string.	2	2
5	Write a program to illustrate the working of "**DICTIONARIES**" in python.	1	2
6	Create a Python program that incorporates the concept of "**FUNCTIONS**." Develop a Python Program that demonstrate the phenomena of **RECURSION**	2	3
7	Write a program to define a "**module**" and import a specific function in that module to another program. Python Program for file handling like - Working with different file formats (**CSV, JSON, XML**)	2	3
8	Python Programs for **Database Access**. Write a program that depicts the implementation of Python "**Class**" which reverse a string word by word	2	4
9	Write a program to implement the working of "**NumPy**" in python. Python Program for **Matplotlib**	2	5
10	Python Program for **Pandas**. **OOPS** in Python	2	5

Reference Books:

Guido van Rossum and Fred L. Drake Jr., ―An Introduction to Python – Revised andupdated for Python 3.2, Network Theory Ltd., 2011

Kenneth A. Lambert, ―Fundamentals of Python: First Programs, CENGAGE Learning,2012.

Timothy A. Budd, ―Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.

Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming inPython: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2				2	1	1	1			1		
CO2	1	1	2				3	1	1	2	1		2	1	
CO3	1	2	2				3	1	1	2	1		2	1	
CO4	2	3	3				3	1	1	3	1	1	2	2	1
CO5	3	3	3	1			3	2	2	3	2	1	3	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CS212	Title of the Course	Database Management System	L	T	P	C
Year	II	Semester	IV	3	1	0	4
Pre-Requisite	None	Co-requisite	None				
Course Objectives	● To describe a sound introduction to the discipline of database management systems and introduce concepts of the Entity-Relationship model. ● To build concepts of relational data model design by writing database queries using Relational Algebra and basic SQL as a universal database language ● To demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization. ● To provide an overview of the concept of transactions, serializability, recoverability, deadlock, and how to recover from deadlock. ● To understand database locks, timestamps and various concurrency control protocols.						

Course Outcomes	
CO1	*Demonstrate* the basic elements of a database management systems and *apply* the conceptual models of a database using ER modeling for real life applications.
CO2	*Create* and populate RDBMS for a real-life application, with constraints and keys using SQL. *Retrieve* any type of information from a database by formulating complex queries in SQL & Relational Algebra.
CO3	*Apply* concepts of normalization to *design* an optimal and efficient database.
CO4	*Understand* and *analyze* the concepts of indexing, hashing, database transactions, serializability, recoverability, deadlock, and ways to recover from deadlock.
CO5	*Analyze* the concepts of database locks, timestamps and various concurrency control protocols to manage concurrent database access.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to DBMS, Data Modeling Using the Entity Relationship Model	**Introduction to DBMS:** An Overview of Database Management System, Database System Vs File System, Database System Concepts and Architecture, Data Models Schema and Instances, Data Independence and Database Language and Interfaces, Data Definitions Language, DML, Overall Database Structure. **Data Modeling Using the Entity Relationship Model:** ER Model Concepts, Notation for ER Diagram, Examples based on E-R diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables, Extended ER Model, Relationships of Higher Degree.	8	1
2	Relational Data Model and Language, Introduction to SQL	**Relational Data Model and Language:** Relational Data Model Concepts, Integrity Constraints: Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. **Introduction to SQL:** Characteristics of SQL, Advantage of SQL. SQL Data Types and Literals. Types of SQL Commands. SQL Operators and Their Procedure. Tables, Views and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete Operations. Joins, Unions, Intersection, Minus, Cursors in SQL.	8	2
3	Data Base Design & Normalization, Storage and File Structure	**Data Base Design & Normalization:** Functional Dependencies, Normal Forms, First, Second, Third Normal Forms, BCNF, Inclusion Dependences, Loss Less Join Decompositions, Normalization using FD, MVD, and JDs, Alternative Approaches to Database Design. **Storage and File Structure:** Overview of Physical Storage Media, File Organization, Organization of Records in File, Data Dictionary Storage.	8	3
4	Indexing & Hashing, Transaction Processing Concepts	**Indexing & Hashing:** Basic Concepts, B+ Tree Index Files, B- Tree Index Files, Static Hashing, Dynamic Hashing. **Transaction Processing Concepts:** Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling.	8	4
5	Concurrency Control Techniques	**Concurrency Control Techniques:** Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Multi Version Schemes, Recovery with Concurrent Transaction.	8	5

Reference Books:
1. Korth, Silbertz, Sudarshan, "Data base concepts", McGraw-Hill
2. Elmasari, Navathe, "Fundamentals of Database Systems", Addison Wesley
3. Date C.J., "An Introduction to Database Systems", Addison Wesley

e-Learning Source:
https://onlinecourses.nptel.ac.in/noc22_cs51/preview

Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	CS220	**Title of the Course**	DBMS Lab	L	T	P	C
Year	II	**Semester**	IV	0	0	2	1
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	- To explain basic database concepts, applications, data models, schemas, and instances. - To describe the basics of SQL and construct queries using SQL. - To demonstrate the use of constraints and relational algebra operations. - To facilitate students in developing solutions for database applications. - To describe the concepts of ER-Model and normalization in databases						

Course Outcomes	
CO1	Able to understand the basics of SQL and construct queries using SQL in database creation.
CO2	Ability to formulate queries for DML/DDL/DCL commands.
CO3	Able to use aggregate functions, GROUP BY, HAVING, ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, MINUS.
CO4	Understand various advanced query execution such as relational constraints, joins, nested queries, VIEWS creation and dropping.
CO5	Able to design and implement a relational database system by taking up case studies.

S. No.	List of Experiments	Contact Hrs.	Mapped CO
1	Overview of using SQL, data types in SQL, concept of DDL, DML & DCL commands, creating tables (along with primary and foreign keys), altering tables, and dropping tables.	2	1
2	Practicing DML commands- Insert, Select, Update, Delete.	2	1
3	Write queries using Logical Operators (=, <, > etc).	2	2
4	Write queries using SQL operators (BETWEEN…AND, IN (list), LIKE, ISNULL and along with negation expressions).	2	2
5	Write queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING.	2	3
6	Write queries using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, MINUS, CONSTRAINTS etc.	2	3
7	Write queries for extracting data from more than one table (Equi-Join, Non-Equi Join, Inner Join, Outer Join).	2	4
8	Write queries for Sub queries, Nested queries, VIEWS Creation and Dropping.	2	4
9	CASE STUDY: Student should decide on a case study and formulate the problem statement, Database Design using ER Model (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.) **Note: Student is required to submit a document by drawing ER-Diagram to the Lab teacher.**	2	5
10	Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, represent attributes as columns, identifying keys), Create tables using SQL. **Note: Student is required to submit a document showing the database tables created from ER Model.**	2	5
11	Normalization -To remove the redundancies and anomalies in the above relational tables, Normalize up to Third Normal Form.	2	5

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	2						2	3	1	2		1
CO2	2	3	3	2	3						2	1	3	1		1
CO3	3	3	2	3	3						1	2	1	1		1
CO4	3	3	3	2	3	1					3	1	2	1	2	1
CO5	3	2	3	1	3	1			1	1	2	1	1	3	2	1

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2020-21								
Course Code	CS284	Title of the Course	Computer Organization and Architecture	L	T	P	C
Year	II	Semester	IV	3	1	0	4
Pre-Requisite	None	Co-requisite	None				
Course Objectives		Explain the basic components of computers, their interconnection and data representation techniques in computer systems. To assess the working of CPU and become familiar with computer arithmetic's. Understand the control unit design using a hardwired and micro programmed approach. To study the memory organization and articulate design issues in each element of memory hierarchy					

Course Outcomes	
CO1	Describe the basic organization of computer and data representation techniques used in computer systems.
CO2	Resolve the issues arising in the design of elements of memory hierarchy.
CO3	Explain and design the control unit using a hardwired and micro programmed approach.
CO4	Acquire the knowledge of advanced concepts of performance measure and parallel processing.
CO5	Explain and compare high performance processors.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1.	Introduction to Computer Organization & Architecture	Elements of Digital Computer, Bus Architecture and Bus Arbitration, Micro-operation, Register Transfer, Bus and Memory Transfer, Data Representation, Addition and Subtraction of Signed Numbers, Booth Algorithm	8	1
2.	Memory and Processor Organization	Memory: Main, Cache, Auxiliary and Virtual Memory, Concept of Address Mapping, Addressing Modes, Central Processing Unit (CPU): Single Accumulator, General Register, and Stack Organization. RISC and CISC Characteristics.	8	2
3.	Hardwired and Micro Programmed Control	Instruction Formats, Instruction and Interrupt Cycle, Timing and Control, Hardwired Control Design: Design of Computer Registers, Execution of a Computer Instruction, Micro Programmed Control Design: Basic Concept of Micro Programmed Control design, Microprogram Sequencer.	8	3
4.	Parallel and Pipeline Processing	Introduction to Parallel Processing, Parallel Architecture Classification, Performance of Parallel Processors, Pipelining: Introduction, Arithmetic Pipeline, Instruction Pipeline, Introduction to different types of available computers.	8	4
5.	High Performance Processors	Superscalar, Vector, and VLIW Architecture, Cache Architecture: Cache Coherence and Synchronization Mechanism, Interconnection Network for Parallel Computers.	8	5

Reference Books:
1. "Computer System Arch." By- Morris Mano, Prentice Hall India, New Delhi.
2. "Computer Organization." By- Vranesic&Hamacher, Tata Mgraw Hill, New Delhi
3. "Kai Hwang", Advanced Computer Architecture, McGraw Hill International.
4. "Moreshwar R. Bhujade", Parallel Computing, New Age International.

e-Learning Source:
https://nptel.ac.in/courses/106105163

Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	2	1		2			1	1			3		2	
CO2	3	3				2	2		2	1	2		3	2	2	1
CO3	2	3	3	2	2	1				2	1	2	3	3	1	2
CO4	3	3	2	2	1	3	2		2	2	3	3		3	3	1
CO5	3		3	3	3	2	1			2	2	2	3			2

1- **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

Integral University, Lucknow

Effective from Session: 2023-24							
Course Code	CS290	Title of the Course	Full Stack Development- Front End	L	T	P	C
Year	II	Semester	IV	3	1	0	4
Pre-Requisite	CS131, CS270	Co-requisite	CS336				
Course Objectives		The learners understand the methodical approach for MERN Full Stack Software Development, with an emphasis on frontend (using React.js) components.					

Course Outcomes	
CO1	Comprehensive understanding of the role and importance of frontend development in web applications
CO2	Basics of JavaScript as a programming language. Integrating JavaScript with HTML and CSS.
CO3	Comprehensive understanding of React routing and state management, covering both fundamental and advanced concepts.
CO4	Apply acquired knowledge and skills to build a web project that consumes APIs and incorporates effective styling.
CO5	Handle various aspects of full stack development, ensuring they can build robust and scalable web applications.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction	Basic of frontend development: Introduction to HTML5, Document Structure, Elements and Semantic Tags, Introduction to CSS3: Styling, Layouts, and Responsive Design, Basic of JavaScript: Variables, Data types, and Control Structures, DOM manipulation with JavaScript.	8	1
2	Getting Started with React	React Components, JSX, and basic concepts, State and Props in React, Handling events, Conditional Rendering, Setting up a react development Environment, Building a simple React Application.	8	2
3	React Routing and State Management	Introduction to React Hooks: useState and useEffect, React Router for client-side routing, Context API For global state management, Managing state in React applications, Handling user input with forms in react.	8	3
4	Consuming APIs and styling	Introduction to styling in React: CSS in JS libraries, Theming and styling, Optimizing Performance with React.memo and useMemo, Making API calls in React applications (fetch, Axios).	8	4
5	Full Stack Integration and Handling	Implementing basic user authentication on the frontend, Handling basic data interaction between frontend and backend, connecting the react frontend to the MERN backend, Basic error handling and debugging in a full-stack application, Building a simple MERN stack application.	8	5

Reference Books:
1. Nabendu Biswas, Mern Projects for beginners
2. Vasan Subramanian, Pro Mern Stack
3. Eddy Wilson Iriarte Koroliova, MERN Quick Start Guide
4. Shama Hoque, Full-Stack React Projects
5. Vishal Kamal, Beginner's Guide to MERN Technology

e-Learning Source:
https://www.udemy.com/course/fullstack-web-development-course-projects-base/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	3	3	1	3		3	1	1			1	1	3		3
CO2	2	2	3	3	1	1	2	2	1			2	2	2	1	
CO3	1	1	1	2	3	1		2	2			1		3	1	2
CO4	2	2	1	2	2	1	2	1	3		1		2	1	1	1
CO5	1	2	1	3	1		1		2	3	1	1	1	2	3	1

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2023-24							
Course Code	CS291	**Title of the Course**	Full Stack Development- Front End Lab	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	0	0	2	0
Pre-Requisite	CS271	**Co-requisite**	CS337				
Course Objectives	The aim of the course is to equip students with the comprehensive skills and knowledge needed to become skilled front-end developers in the full-stack development.						

Course Outcomes	
CO1	Design and implement user interfaces that prioritize usability and provide an enhanced user experience.
CO2	Implement dynamic and interactive features on web pages using JavaScript Front-End Frameworks.
CO3	Demonstrate the ability to create well-structured and styled web pages using HTML and CSS.
CO4	Apply fundamental JavaScript concepts to solve programming challenges.
CO5	Handle various aspects of full stack development, ensuring they can build robust and scalable web applications.

Experiment No.	Name of Experiment	Contact Hrs.	Mapped CO
1	Create a simple webpage using HTML.	2	1
2	Create a simple webpage using CSS styling Elements.	2	1
3	Create a program using Java Script for Web page to display browser information.	2	2
4	Create a favicon.ico image using HTML.	2	2
5	Create a simple Application using React JS.	2	3
6	Create a list in react JS.	2	3
7	Create and build a new element with append () and prepend () using jQuery.	2	4
8	Create a calculator application using React JS.	2	4
9	Create a Simple Login form using React JS.	2	5
10	Create a website using HTML CSS and JavaScript.	2	5

e-Learning Source:	
1. https://www.udemy.com/course/fullstack-web-development-course-projects-base/	
2.https://www.udemy.com/course/full-stack-crash-course/learn/lecture/35198512#overview	

PO-PSO CO	Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	3	3	1	3		3	1	1		1	1	1	3		3
CO2	2	2	3	3	1		2	2	1		1	2	2	2	1	
CO3	1	1	1	2	3			2	2		2	1		3	1	2
CO4	2	2	1	2	2		2	1	3		3		2	1	1	1
CO5	1	2	1	3	1	3	1		2	3	2	1	1	2	3	1

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	CS282	**Title of the Course**	Advance Java Programming Lab	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	0	0	2	1
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	● To learn the basic concepts and syntax of advance java programming. ● To be able to develop logics which help them to create applications using applets. ● To learn the use of JDBC-ODBC. ● To learn the use of JSP and servlet. ● To create web projects.						

Course Outcomes	
CO1	To understand the basic concepts of Applets & AWT package.
CO2	To design and develop client server application and JDBC package.
CO3	To analyse and develop programs on Servlet and JAVA Beans
CO4	To develop programs on different project using Swing.
CO5	To analyse and develop programs on Servlet and JSP.

S. No.	List of Experiments	Contact Hrs.	Mapped CO
1	Create GUI application using AWT & Applet classes: A) To show a simple message along with background and foreground colours. B) To create an applet that scrolls a message from left to right? C) To create an applet that receives an integer in one text field, and computes its factorial value and returns it in another text field, when the button named "Compute" is clicked.	4	1
2	Design & develop the client-server application using NET package.	2	1
3	Create client server Application using RMI.	2	2
4	Implement database application using JDBC package.	2	2
5	A) Write a java program to create a bean that counts the number of mouse clicks? B) Write a java program to create a bean that counts the number of button clicks?	4	3
6	Describe & develop Java Servlet, HTTP request and response program	2	3
7	Create a Servlet program for cookies	2	4
8	Create application using Java Swing package.	2	4
9	A) Write a java Program to create a JSP page to display a simple message along with current Date? B) Write a java Program to create a JSP page to display the random number?	4	5
10	Design program for JSP by using JSP Exception and JSP Action Elements	2	5

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2		3		3						2		1	1
CO2	1	1	1	2	1								2	1	1	
CO3	1	2	2	2			3							1	1	2
CO4	1		2	2									2	1	1	
CO5	1	2	1				3						2	1		

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2020-2021								
Course Code	CS285	**Title of the Course**	Computer Organization & Architecture Lab	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	0	0	2	1
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	To learn the basic concepts of flip flops. To learn about adders and registers. To learn the working of counters and multipliers. To learn the working of associative memory cell. To learn the working of multiplexer and demultiplexer.							

Course Outcomes	
CO1	Design & Implement Output of the basic logic gates for different combinations of input
CO2	Design & Implement various flip flop SR, JK, D and T
CO3	Design & Implement half adder and full adder circuit.
CO4	Design & Implement counter and register.
CO5	Design & Implement multiplexer and demultiplexer

S. No.	List of Experiments	Contact Hrs.	Mapped CO
1	Design & Implementation of various flip flop SR, JK, D and T.	2	1
2	Design & Implementation of Half adder and Full adder circuit.	2	1
3	Design & Implementation of Half Subtractor and Full Subtractor circuit.	2	2
4	Design & Implementation counters.	2	2
5	Design & Implementation Registers.	2	3
6	Register level design of 2 bit magnitude comparator.	2	3
7	Design & Implementation of 2*2 bit unsigned multiplier.	2	4
8	Design & Implementation of associative memory cell.	2	4
9	Design & Implementation of MUX & DEMUX.	2	5
10	Design & Implementation of ADC & DAC circuit	2	5

Reference Books:
1. "Computer System Arch." By- Morris Mano, Prentice Hall India, New Delhi.
3. "Kai Hwang", Advanced Computer Architecture, McGraw Hill International.

e-Learning Source:
http://vlabs.iitkgp.ernet.in/vlabs/vlab12/comp.html
https://elearning.icar.gov.in/eLearning_ContentDisplay.aspx

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2					2				2						
CO2	3		3	3			2		2					2		2	1
CO3	1	1								3					2		2
CO4		2	2	3		1			1					1		3	1
CO5	1		1			3			1								2

3- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2023-24							
Course Code	CS292	Title of the Course	Theory of Computation	L	T	P	C
Year	II	Semester	IV	3	1	0	4
Pre-Requisite	None	Co-requisite	None				
Course Objectives	The primary objective of this course is to introduce students to the foundations of computability theory. Other objectives include the application of mathematical techniques and logical reasoning to important problems, and to develop a strong background in reasoning about finite state automata and formal languages.						

Course Outcomes	
CO1	To demonstrate computational mathematical models for problem solving and describe how they relate to formal languages.
CO2	To analyze the relationship among language classes and grammars with the help of Chomsky Hierarchy.
CO3	To apply rigorous formal mathematical model for proving different properties of grammars, languages, and automata.
CO4	To apply mathematical foundations, algorithmic principles and computer science theory to the modelling and design of computer based systems in a way that demonstrates.
CO5	Have an overview of how the theoretical study in this course is applicable to and engineering application like designing the compilers.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction**	Finite state machine, definitions, Finite automaton model, acceptance of strings and languages Deterministic Finite Automata (DFA), Nondeterministic Finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.	8	1
2	**Regular expression & Languages**	Chomsky Hierarchy, Regular Grammars, Unrestricted Grammars, Context Sensitive Language, Regular expression (RE); Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non-Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma.	8	2
3	**Context free grammar (CFG) and Context Free Languages (CFL)**	Context free grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF.	8	3
4	**Push Down Automata (PDA)**	Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stacks PDA, Non-Deterministic Push Down Automata.	8	4
5	**Turing machines (TM)**	Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Halting problem of Turing machines	8	5

Reference Books:

1 K. L. P. Mishra, N. Chandra Sekaran,"Theory of Computer Science: Automata, Languages and Computation" PHI Publication.

2 John E. Hopcroft, Rajeev Motwani, Jaffrey D.Ullman, "Introduction to Automata Theory, Languages, and Computation" 3e Paperback – 1 January 2008.

3 C. K. Nagpal, "Formal Languages and Automata Theory" 2012, Oxford Publication.

e-Learning Source:

https://nptel.ac.in/courses/106105196

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
CO1	2	2	2	2		1		1		1		2	1		3	
CO2	3	2	3	2	2	1						2		3		2
CO3	3	3	3	2	1	2		2				2	2		3	
CO4	3	2	2	2	3	3	1	2		1	1	2	2			1
CO5	3	2	1	1		2				2		2		1	2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow
B.Tech Computer Science and Engineering, B.Tech –, CSE

Effective from Session:								
Course Code	ES202	Title of the Course	Disasters, Management	L	T	P	C	
Year	II	Semester	III	2	1	-	3	
Pre-Requisite	10+2 having a minimum of 45 % marks in the aggregate from a recognized Board/University	Co-requisite						
Course Objectives	• To Study the types of Disasters and its profile in India. • Knowledge of causes and impacts of Disasters, and Case studies of National and Global Disasters. • To learn about risk reduction approaches of Disasters with safety issues in mitigating Industrial disasters. • Basic concepts of Disaster Management Cycle and its Risk Reduction Measures. • To know the National Acts and policies for mitigating disasters. Role of Army, Police, Community, Corporate, Media etc. for post Disaster Management.							
Course Outcomes								
CO1	Students are able to learn types of disasters and its profile in India							
CO2	Students are able to understand the causes and impacts of disasters on environment							
CO3	Students are able to learn about risk reduction approaches of disasters with safety issues in mitigating industrial disasters.							
CO4	To understand the concept of Disaster Management Cycle and its Risk Reduction							
CO5	To understand the concept of Disaster Management Cycle and its Risk Reduction							

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to disaster	Introduction to Disasters, Concepts, Definition and types (Natural and Man-made), Disaster profile of India.	8	CO1
2	Impact of Disaster	Causes and Impacts of Disasters, Global and National Perspective, Case studies from Disasters, Large Hydro projects and its risks for Disasters	8	CO2
3	Disaster Risk Reduction	Approaches to Disaster risk Reduction, Safety issues in mitigating Industrial disasters, Case studies, EHS etc.	8	CO4
4	Disaster Management	Disaster Management Cycle, Risk Reduction Measures (Preparedness, Mitigation, Response	8	CO3
5	Disaster Act. and Policies	National Acts and policies for mitigating Disasters (Disaster Management Act 2005, NDRF,	8	CO3

Reference Books:

(1) Gupta Harsh K., Disaster Management, Hyderabad University Press. Publications-Meerut.

(2) Sethi, V.K., Disaster Management, New Delhi Maxford Books

(3) Bhattacharya, Tushar, Disaster Science and Management, New Delhi Tata Mc Graw Hill.

(4) Nidhi Gauba, Dhawan/ Ambrina Sardar Khan, Disaster Management and Preparedness, CBS

e-Learning Source:

https://www.youtube.com/watch?v=9WIwlljva_s

https://www.youtube.com/watch?v=uA_OLKfQpYA

Course Articulation Matrix: (Mapping of COs with POs and PSOs)																		
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	1	1	1	1	1	3	2	1	1	2	1	1	1	1	-	-	-
CO2	2	2	2	1	2	3	3	2	2	2	2	2	1	1	1	-	-	-
CO3	3	2	2	1	2	2	3	2	2	2	1	2	1	1	1	-	-	-
CO4	3	2	2	1	2	2	3	2	2	1	1	2	1	1	1	-	-	-
CO5	3	1	3	2	2	2	2	2	3	2	1	2	1	1	1	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

1. Name of the Department: Mathematics & Statistics						

2. Course Name	Mathematical Analysis for Computer Science & Engineering EEEngineeringEngineeringEngineering	L	T	P
3. Course Code	MT238	3	1	0

4. Type of Course (use tick mark)		Core (✔)	DSE ()	AEC ()	SEC ()	OE ()
5. Pre-requisite (if any)	10+2 with PCM	6. Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials

Lectures = 30	Tutorials = 10	Practical = Nil

8. COURSE OBJECTIVES: The purpose of this undergraduate course is to impart basic and key knowledge of numerical analysis, complex analysis, probability and probability distribution. The content of course has various applications. After successfully completion of course, the student will able explore subject into their respective dimensions.

9. COURSE OUTCOMES (CO):
After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Students will be able to understand solution of different types of equations using various methods and their convergence such as bisection method, Regula-Falsi method, Iteration method, Newton-Raphson method and LU decomposition method.
CO2	Students will gain an understanding of interpolation of data by various methods.
CO3	Students will be able to learn and implement different numerical methods of differentiation and integration.
CO4	Student able to find numerical solution of ordinary differential equations by means of various techniques.
CO5	Students will create the own understanding of complex analysis. They learn to check analyticity of functions and also to evaluate definite integral by simpler techniques. They also know about mapping and its types.

10. Unit wise detailed content

Unit-1	Number of lectures = 08	Title of the unit: Differential Equations

Algebraic & Transcendental Equations: Bisection Method, Iteration Method, False Position Method, Newton-Raphson Method. Rate of Convergence of Methods. Solution of system of linear equations by LU decomposition method.

Unit-2	Number of lectures =08	Title of the unit: Laplace Transform

Interpolation: Finite differences, Newton's forward & backward formula, Gauss forward and backward formula for equal intervals. Lagrange's and Newton's divided difference formula for unequal intervals,

Unit-3	Number of lectures = 09	Title of the unit: Fourier Series and Partial Differential Equations

Numerical differentiation and Numerical Integration: Numerical differentiation, Quadrature formula, Numerical Integration by Trapezoidal Rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule, Boole's & Weddle's Rule,

Unit-4	Number of lectures = 08	Title of the unit: Applications of Partial Differential Equations

Solution of Ordinary Differential Equations: Numerical solution of ordinary differential equations by Euler's Method, Modified Euler's Method and Runge-Kutta Method, Picard's and Taylor's Methods.

Unit-5	Number of lectures = 07	Title of the unit: Basic Statistics and curve fitting

Complex Analysis: Analytic functions, C-R equations, Cauchy's integral theorem, Cauchy's integral formula for derivatives of analytic functions, Conformal mapping, Bilinear transformation.

11. CO-PO mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	1	-	-	-	-	-	-	-	3	-	1	2	-
CO2	3	2	2	1	-	-	-	-	-	-	-	3	-	1	1	-
CO3	3	2	3	1	-	-	-	-	-	-	-	3	-	2	2	-
CO4	3	2	3	1	-	-	-	-	-	-	-	3	-	1	1	-
CO5	2	1	2	1	-	-	-	-	-	-	-	2	-	-	-	-
3 Strong contribution, 2 Average contribution , 1 Low contribution																