Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS-301**	**Title of the Course**	**Design and Analysis of Algorithm**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	**V**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	To analyze the problem and design an efficient algorithm to solve it by using & modifying classical design techniques or creating a new solution technique						

Course Outcomes	
CO1	Would be able to analyze the problem and design an efficient algorithm to solve it by using & modifying classical design techniques or creating a new solution technique.
CO2	For an algorithm given all the required parameters, would be able to analyze the algorithm and evaluate its utility in the given situation, able to apply the approach where problem can be solved by smaller input then apply for larger perspective.
CO3	Given more than one solutions for the problem, would be able to evaluate and compare those using standard mathematical techniques and select the best solution.
CO4	For a design problem given, would be able to compare and evaluate different Data Structures available and modify or create new them for the same.
CO5	For given different problems, would be able to categorize the different kind of complexities and develop non deterministic solution to problems having large complexities.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction:**	Introduction: Algorithms, Analysis of Algorithms, Growth of Functions: Asymptotic Notations, Standard Notations and Common Functions; Recurrence Methods: Substitution Method, Iteration Method, Recursion Tree Method, Master's Method.	8	1
2	**Designing of Algorithms and Advanced Data Structure**	Divide & Conquer: Heap Sort, Quick Sort, Sorting in Linear Time, Medians and Order Statistics. Red-Black Trees, Augmenting Data Structure, Binomial Heaps, Fibonacci Heaps.	8	2
3	**Advanced Design and Analysis Techniques**	Greedy Algorithms: Knapsack Problem, Travelling Salesperson Problem, Minimum Cost Spanning Trees: Kruskal's Algorithm, Prim's Algorithm. Dynamic Programming: Longest Common Subsequence, Matrix Chain Multiplication, 0/1 Knapsack Problem, Single Source Shortest Path: Dijkstra's Algorithm, Bellman Ford Algorithm.	8	3
4	**Amortized Analysis, Back Tracking: and Branch & Bound**	Accounting Method, Aggregate Method, Potential Method, Introduction, Subset Sum Problem, n-Queens problem and Introduction, 0/1 Knapsack, 15 Puzzle problem.	8	4
5	**String Matching and Complexity Theory**	Algorithm, The Rabin-Karp Algorithm, The Knuth-Morris Pratt Algorithm. Class P and NP, NP-hard Problems, NP-Complete Problems, Polynomial Reduction, Approximation Algorithm	8	5

Reference Books:

1. Coremen, Rivest, Lisserson, "Algorithms", PHI.
2. Horwitz & Sahani, Fundamental of Computer Algorithm, Galgotia.
3. Michael T. Goodrich and Roberto Tamassia, Algorithm Design: Foundation, Analysis and Internet Examples, John Wiley Publications.

e-Learning Source:

https://nptel.ac.in/courses/106106131

	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	1	3	3	1	3		3	1	1			1	1	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
CO4	2	2	1	2	2	1	2	1	3		1		2	1	1
CO5	1	2	1	3	1		1		2	3	1	1	1	2	3

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS-303**	**Title of the Course**	**Principles of Operating System**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	**V**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	To introduce students with basic concepts of Operating System, its functions and services. To critique how memory management is implemented by the operating system, including concepts of paging, segmentation, paged segmentation etc. To introduce the concepts of Processes in Operating System and various algorithms to schedule these processes. To provide the knowledge of basic concepts towards process synchronization, deadlock and related issues. To gain insight on file management, disk management etc and to become familiar with the protection and security mechanisms taken by operating system.						

Course Outcomes	
CO1	The basic concepts of Operating System, its functions and services.
CO2	Design and effective memory management scheme for the operating system where there is less wastage and the response time is quick.
CO3	The basic concepts of Processes in Operating System and the application of various CPU scheduling algorithms.
CO4	Analyse the basic concepts of process synchronization, deadlock and related issues.
CO5	The basic components of file management, disk management etc and will become familiar with the protection and security mechanisms taken by operating system.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Desktop OS and Mobile OS**	Importance of Operating Systems; Basic Concepts and Terminology; Evolution of Operating Systems: Batch, Interactive, Time Sharing & Real Time Systems. Operating System Structure: Simple Structure, Layered Approach; System Calls; Kernels: overview, objectives of kernel, types of kernels. Architecture, Android OS, iOS, Virtual OS, Cloud OS and their design.	8	1
2	**Process, Threads, CPU Scheduling and Real Time Scheduling**	Introduction, Process Model, Process State, Process Control Block. Overview, benefits of threads, types of threads. Basic Concepts, Scheduling Criteria, And Types of Scheduling, Scheduling Algorithms: FCFS, SJF, Round Robin, Priority Scheduling, Multilevel Queue Scheduling, Multilevel, Feedback Scheduling. Introduction, Uniprocessor scheduling, Multiprocessor Scheduling.	8	2
3	**Process Synchronization and Deadlock**	Principles of Concurrency, Race Condition, Critical Section, Critical Section Problem, Synchronization Mechanism, Semaphores and Classical Problems of Synchronization: Bounded Buffer Problem, Readers Writers Problem.Principles, System Model, Deadlock Characterization, Methods of Deadlock Handling: Prevention, Avoidance, Detection & Recovery from Deadlock	8	3
4	**Memory Management and Virtual Memory Management**	Introduction, logical vs. physical address space, swapping, contiguous memoryallocation, paging, segmentation, segmentation with paging. Introduction, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU, Optimal), allocation of frames, thrashing.Other Memory Management Schemes: Swapping, Overlays.	8	4
5	**Device Management, Disk Scheduling and Protection & Security**	Introduction, types of devices, FCFS, SSTF, SCAN, CSCAN, LOOK, C-LOOK Scheduling File Systems: file concept, Access Mechanism, directory structure, file system structure, allocation methods (Contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), Directory implementation (linear list, hash table), efficiency & performance.	8	5

Reference Books:

1. Galvin, Silberchatz “Operating Systems Principles”, Addision Wesley.
2. Milenekovie, “Operating System Concept”, McGraw Hill.
3. Dietal, “An Introduction to Operating System”, Addion Wesley.
4. Tannenbaum, “Operating System Design And Implementation”, PHI.
5. Galvin, Silberchatz “Operating Systems Principles”, Addision Wesley.

e-Learning Source:

https://nptel.ac.in/courses/106105214

	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	1	1	3	2	3				1		3		1	
CO2	3	3	3	2	1	1		1				2			
CO3	3	2	1	1	2	2	3		2			3			3
CO4	3	2	2	2	3	3				1		2		2	
CO5	3	1	1	1	1	2	1					2			

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS-304**	**Title of the Course**	**Theory of Automata & Formal Languages**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	**V**	**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, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non-Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages	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, Closure properties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.	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, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory	8	5

e-Learning Source:

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

	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	2	2	2	2		1		1		1		2	1		3
CO2	3	2	3	2	2	1						2		3	
CO3	3	3	3	2	1	2			2			2	2		3
CO4	3	2	2	2	3	3	1	2		1	1	2	2		
CO5	3	2	1	1		2				2		2		1	2

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

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	**CS-334**	**Title of the Course**	**Cloud Computing**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	**V**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	**1.** To study the the various paradigm of cloud computing and computing techniques. **2.** To study the concepts ,key technologies, strength and limitation of cloud computing and possible application **3.** To understand the architecture and infrastructure of cloud computing including SaaS, PaaS,Iaas, public cloud, private cloud and hybrid cloud. **4.** To study Interpretation of various data, scalability and cloud services to acquire efficient database for cloud storage.						

Course Outcomes	
CO1	Explain the various paradigm of cloud computing and computing techniques.
CO2	Articulate the concepts ,key technologies, strength and limitation of cloud computing and possible application
CO3	Identify the architecture and infrastructure of cloud computing including SaaS, PaaS, Iaas, public cloud, private cloud and hybrid cloud.
CO4	Interpret various data, scalability and cloud services to acquire efficient database for cloud storage.
CO5	Describe the appropriate cloud computing solutions and recommendations according to application used.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction:**	Historical development, Vision of Cloud Computing, Characteristics of cloud computing as per NIST, Cloud computing reference model, Cloud computing environments, Cloud services requirements, Cloud and dynamic infrastructure. Overview of cloud applications: ECG Analysis in the cloud, Protein structure prediction, Gene Expression Data Analysis, Satellite Image Processing, CRM and ERP ,Social networking.	8	1
2	**Cloud Computing Architecture:**	Cloud Reference Model, Types of Clouds, Cloud Interoperability & Standards, Scalability and Fault Tolerance; Cloud Solutions: Cloud Ecosystem, Cloud Business Process Management, Cloud Service Management. Cloud Offerings: Cloud Analytics, Virtual Desktop Infrastructure.	8	2
3	**Cloud Management & Virtualization Technology:**	Resiliency, Provisioning, Asset management, Concepts of Map reduce, Cloud Governance, High Availability and Disaster Recovery. Virtualization: Fundamental concepts of compute ,storage, networking, desktop and application virtualization .Virtualization benefits, server virtualization, Block and file level storage virtualization Hypervisor management software, Infrastructure Requirements , Virtual LAN(VLAN) and Virtual SAN(VSAN) and their benefits.	8	3
4	**Cloud Security:**	Cloud Information security fundamentals, Cloud security services, Design principles, Secure Cloud Software Requirements, Policy Implementation, Cloud Computing Security Challenges, Virtualization security Management, Cloud Computing Security Architecture.	8	4
5	**Market Based Management of Clouds, Federated Clouds/Inter Cloud:**	Characterization & Definition, Cloud Federation Stack, Third Party Cloud Services. Case study: Google App Engine, Microsoft Azure, Hadoop, Amazon.	8	5

Reference Books:

1. Buyya, Selvi ," Mastering Cloud Computing ",TMH Pub.
2. Kumar Saurabh, "Cloud Computing" , Wiley Pub.
3. Krutz , Vines, "Cloud Security " , Wiley Pub.
4. Velte, "Cloud Computing- A Practical Approach" ,TMH Pub.
5. Sosinsky, "Cloud Computing" , Wiley Pub.

e-Learning Source:

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

	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	–	–	–	–	–	–	–	–	–	–	–	–	3
CO2	3	3	–	–	–	–	–	–	–	–	–	–	–	–	3
CO3	3	3	3	3	–	–	–	–	–	–	–	–	2	3	3
CO4	3	3	3	3	–	–	–	–	–	–	–	–	2	3	3
CO5	3	3	3	3	–	–	–	–	–	–	–	–	2	3	3

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

Integral University, Lucknow

Effective from Session: 2021-22							
Course Code	**CS-341**	**Title of the Course**	**Introduction to Internet of Things**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	**V**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	**1.** To understand the concepts of Internet of Things. **2.** To introduce the concept of M2M (machine to machine) with necessary protocols **3.** To illustrate diverse methods of deploying smart objects and connect them to network. **4.** To introduce the Raspberry PI platform, that is widely used in IoT applications **5.** To Infer the role of Data Analytics and Security in IoT						

Course Outcomes	
CO1	Understand the concepts of Internet of Things and can able to build IoT applications.
CO2	Understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules
CO3	Student must be able to understand the specialized aspects of IoT Devices
CO4	Elaborate the need for Data Analytics and Security in IoT
CO5	Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction to IoT**	Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Comparing IoT Architectures , Functional blocks of IoT, Communication models & APIs, IoT Challenges.	8	1
2	**Communication Protocols**	Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensors, Actuators and Smart Objects, Sensor Networks, Connecting Smart Objects, IoT Access Technologies.	8	2
3	**IoT and M2M**	Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMPNETOPEER	8	3
4	**IoT Physical Devices and Endpoints**	Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI focusing on interfacing external gadgets, controlling output, reading input from pins.	8	4
5	**IoT Physical Servers and Advanced Topics**	Introduction to Cloud Storage models and communication APIs, Web server – Web server for IoT, Cloud for IoT, An Introduction to Data Analytics for IoT, Big Data Analytics Tools and Technology, Securing IoT, Common Challenges in OT Security,	8	5

Reference Books:

1. Raj Kamal, “Internet of Things: Architecture and Design Principles”, 1st Edition,McGraw Hill Education, 2017. (ISBN: 978-9352605224)
2. Internet of Things - A Hands-on Approach, ArshdeepBahga and Vijay Madisetti, Universities Press, 2015, ISBN: 978817371954
3. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT

e-Learning Source:

https://nptel.ac.in/courses/106105166

	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	2		3	1		3	2				1	2	1	2	2
CO2			2	3	3				2	3	1	1	1	1	3	2
CO3	1	3			2	1		2	3				1	2	1	2
CO4			1	2			3			3	2	1	2	3	2	1
CO5	1	2	3		1	2		3					2	1	1	3

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

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	**CS-342**	**Title of the Course**	**DATA COMPRESSION**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	**V**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	1. Basic knowledge of Data compression 2. Types of data compression 3. Various techniques o f Data compression 4. Application of data compression						

Course Outcomes	
CO1	Understand the importance of compressions, and different compression models
CO2	Solve the various problems based on lossless compression approach such as Huffman, adaptive Huffman models
CO3	Solve problems using arithmetic and dictionary based compression techniques.
CO4	Apply partial prediction matching, and learn to transformation of source based on Transform algorithms
CO5	Represent the various dynamic model in the form of structured vector representation

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction**	Compression Techniques: Loss Less Compression, Lossy Compression, Measures of Performance, Modeling and Coding. Mathematical Preliminaries for Lossless Compression: A Brief Introduction to Information Theory: - Models: Physical Models, Probability Models, Markov Models, Composite Source Model, Coding:-Uniquely Decodable Codes, Prefix Codes	8	1
2	**Huffman Coding**	The Huffman Coding Algorithm: Minimum Variance Huffman Codes, Adaptive Huffman Coding: Update procedure, Encoding procedure, decoding procedure. Golomb Codes, Rice Codes, Tunstall codes. Application of Huffman Coding. Text compression, Audio Compression.	8	2
3	**Arithmetic Coding**	Coding a Sequence, Generating a Binary Code, Comparison of Binary and Huffman Coding, Applications: Bi-Level Image Compression-JBIG and JBIG2 Standards. Dictionary Techniques: Introduction, Static Dictionary: - Diagram Coding, Adaptive Dictionary: The LZ77 Approach, The LZ78 Approach Applications. Image Compression: The Graphics Interchange Format (GIF), Compression over Modem.	8	3
4	**Prediction with Partial Match**	The Basic Algorithm, The ESCAPE SYMBOL, Length of Context, The Exclusion Principle, The Burrows-Wheeler Transform, Move-to- Front Coding, CALlC, JPEG-LS, Multi-resolution Approaches, Facsimile Encoding, Dynamic Markov Compression.	8	4
5	**Quantization**	Introduction of Scalar and Vector Quantization, Advantages of Vector Quantization Over Scalar Quantization, The Linde-Buzo-Gray Algorithm, Tree Structured Vector Quantizes, Structured Vector Quantizes.	8	5

Reference Books:

1.Introduction to Data Compression, Second Edition, Khalid Sayood, The Morgan Kaufmann Series

2. Data Compression: The Complete Reference 4th Edition by David Salomon, Springer

3. Text Compression1st Edition by Timothy C. Bell Prentice Hall

4. Elements of Data Compression, Drozdek, Cengage Learning

e-Learning Source:

https://nptel.ac.in/courses/106105166

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

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS343**	**Title of the Course**	**Visual Programming Lab**	**L**	**T**	**P**	**C**
Year	III	**Semester**	V	**0**	**0**	**2**	**1**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	This course introduces computer programming using the Visual BASIC programming language with object-oriented programming principles. Emphasis is on event-driven programming methods, including creating and manipulating objects, classes, and using object-oriented tools.						

Course Outcomes	
CO1	Design, create, build, and debug Visual Basic applications.
CO2	Explore Visual Basic's Integrated Development Environment (IDE).
CO3	Write and apply decision structures for determining different operations
CO4	Write and apply procedures, sub-procedures, and functions to create manageable code.
CO5	Write Visual Basic programs using object-oriented programming techniques including classes, objects, methods, instance variables, composition, and inheritance, and polymorphism.

S. No.	**List of Experiments**	**Contact Hrs.**	**Mapped CO**
1	Program for a running traffic light application using Visual Basic	2	1
2	Program for design a user friendly menu File Edit Utilities Quit	2	1
3	Program to add two numbers and then transfer the result into INITIAL NO. Text box and then add another number to the initial no. do this process 5 times.	2	2
4	Program to calculate the Compound Interest.	2	2
5	Design a simple webpage using HTML and DHML to Implement all type of List	2	3
6	Design a simple webpage using HTML5	2	3
7	Write inline, internal and external CSS for a Web Page	2	4
8	Design a Navigation Menu using HTML and CSS	2	4
9	Crete Frame for Separate Web Page	2	5
10	Write a Program to Create Table for Student Cross-List	2	5

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

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS 302**	**Title of the Course**	**Designing and Analysis of Algorithm Lab**	**L**	**T**	**P**	**C**
Year	III	**Semester**	V	**0**	**0**	**2**	**1**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	• To learn the basic concepts of divide and conquers with help of various examples. • To be able to develop logics which help to find the optimal solution. • To learn the Dynamic approach to through various problems. • To learn the uses of augmented data structure and their implementation. • Learning Backtracking and its implementation.						

Course Outcomes	
CO1	Able to understand the basic concepts of Divide and conquer their implementation.
CO2	Able to understand and develop solution to optimization problem(Greedy algorithm)
CO3	Able to analyze and develop dynamic solution and implementation
CO4	Develop understanding of Backtracking problems and their implementation
CO5	Understanding and develop the logic to implementation of different augmenting data structures (RB Tree)

S. No.	**List of Experiments**	**Contact Hrs.**	**Mapped CO**
1	Introduction	2	1
2	Implement Merge Sort	2	1
3	Implement Quick Sort(Divide & Conquer)	2	2
4	Implement Heap Sort	2	2
5	Implement Knapsack problem (Greedy ALGO.)	2	3
6	Implement of directed and undirected graph	2	3
7	Implement Shortest path by Dijkstra Algorithm	2	4
8	Implement 8- Queen problem(Back Tracking)	2	4
9	Implement Minimal spanning tree by	2	5
10	Kruskal's Algorithm	2	5

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

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS-313**	**Title of the Course**	**Microprocessor and its Applications**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	**VI**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	This course deals with the systematic study of the Architecture and programming issues of 8 bit 8085-microprocessor and interfacing with other peripheral ICs and co-processor. In addition, a 16-bit microprocessors and other chips (8255, 8251, 8253 and 8257) are introduced. The aim of this course is to give the students basic knowledge of the microprocessors (8085 and 8086) needed to develop the systems using it.						

Course Outcomes	
CO1	Understand the basic architecture of 8085 and 8086.
CO2	Impart the knowledge about the instruction set.
CO3	Understand the basic idea about the data transfer schemes and its applications
CO4	Develop skill in simple program writing for INTEL 8085 and INTEL 8086.
CO5	Understand advance microprocessor, microcontroller and Embedded System.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1		Category of Memory, Microprocessor, Microcontroller, Buses, machine Language, Assembly Language, High Level Language, Assembly Language Program Development Tool. 8085 Microprocessor: Architecture, Pin diagram, Instruction Type, Instruction Cycle, Timing Diagram, Addressing Modes, Instruction Set. Assembly Programming based on 8085, Interrupt and Interrupt Service Routine.	8	1
2		8086 Microprocessor: Architecture, Pin Diagram, Timing Diagram, Addressing Modes, Instruction Set, Instruction Templates, Assembly Language Programming: Based on Procedure, Macros, Number conversion, String operation.	8	2
3		Interfacing with Peripheral Devices and Memory: Types of Transmission, 8257(DMA), 8255(PPI), Serial Data Transfer (USART 8251), Keyboard- Display Controller (8279), Priority Interrupt Controller(8259)	8	3
4		Interfacing with Timers and its Applications: Programmable Interval Timer/Counter (8253/8254): Introduction, Modes, Interfacing of 8253, Applications, ADC: Introduction, ADC Converters, ADC IC (0808/0809), Interfacing and Application of ADC.	8	4
5		Advanced Microprocessors and Micro-Controller: Introduction to Intel 80186, 80286, 80386 and 80486 Microprocessor. Introduction to Embedded System and Microcontrollers, 8051 Micro-controller: Introduction, Architecture.	8	5

Reference Books:

1- R.S. Gaonkar: "Microprocessor architecture, Programming and Applications with 8085/8080", Penram Publication.

2- B.Ram : " Fundamental of Microprocessor and Microcomputer", DhanpatRai Publication, 4th edition.

3- R. Singh and B.P. Singh: " Microprocessor Interfacing and its application", New Age International Publishers, 2nd Edition.

4- D.V. Hall: " Microprocessor Interfacing", TMH (Revised 2nd Edition).

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

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS- 315**	**Title of the Course**	**COMPILER DESIGN**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	**VI**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	The course curriculum helps to understand the concepts of compiler and phases, various translation schemes, the complexity of the input program, machine dependent code and machine independent code, optimization theory, syntax directed translation scheme of the input jobs, role and responsibility of pre-processor in compiler designing and compiling of the input jobs.						

Course Outcomes	
CO1	Know about the concepts of a preprocessor, translation rule, cross compiler, assembler loader and linker.
CO2	To know about the basic principles of the compiler, and its constituent parts, algorithms, and data structures required to be used in the compiler.
CO3	Know about the concepts of the function and complexity of modern compilers.
CO4	Know about the concepts of code generation algorithms to get the machine code for the optimized code
CO5	Know about the concept flow graph, machine-dependent, and machine-independent optimization, intermediate code ,.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction	Introduction to Compiler, Phases and Passes, Bootstrapping, Finite State Machines and Regular Expressions and their Applications to Lexical Analysis, Implementation of Lexical Analysers, Lexical analyser Generator, LEX-compiler, Formal Grammars and their Application to Syntax Analysis, BNF Notation, Ambiguity, YACC.	8	1
2	Context Free Grammars	The Syntactic Specification of Programming Languages: Context Free Grammars, Derivation and Parse Trees, Capabilities of CFG. Basic Parsing Techniques: Parsers, Top Down Parsing, Predictive Parsers, LL(1), Shift Reduce Parsing, Operator Precedence Parsing, Elimination of left recursion	8	2
3	Parsing	Automatic Construction of Efficient Parsers: LR Parsers, the Canonical Collection of LR(O) Items, Constructing SLR Parsing Tables, Constructing Canonical LR Parsing Tables, Constructing LALR Parsing Tables, using Ambiguous Grammars, an Automatic Parser Generator, Implementation of LR Parsing Tables, Constructing LALR Sets of Items.	8	3
4	Syntax-Directed Translation	Syntax-Directed Translation: Syntax-Directed Translation Schemes, Implementation of Syntax-Directed Translators, Intermediate Code, Postfix Notation, Parse Trees & Syntax Trees, Three Address Code, Quadruple & Triples, Translation of Assignment Statements, Boolean Expressions, Statements that Alter the Flow of Control, Postfix Translation, Translation with a Top Down Parser. More About Translation: Array References in Arithmetic Expressions, Procedures Call, Declarations, Case Statements.	8	4
5	Symbol Tables	Symbol Tables: Data Structure for Symbols Tables, Representing Scope Information. Run-Time Administration: Implementation of Simple Stack Allocation Scheme, Storage Allocation in Block Structured Language. Introduction to Code Optimization: Loop Optimization, the DAG Representation of Basic Blocks, Value Numbers and Algebraic Laws, Global Data-Flow Analysis. Introduction to Code Generation.	8	5

Reference Books:

1- Aho, Sethi & Ullman, “Compiler Design”, Addison Wesley.

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	2	1	1			1	1	1	2	1	2	2
CO2	2	3	1	1	1	2	3	2		2			3	2	
CO3	1	2	2	2					1	1	1	2	2	1	2
CO4	1	2	2	3	4	1				2		3	2		
CO5	1	1	2	3	5			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	**CS316**	**Title of the Course**	**COMPILER DESIGN LAB**	**L**	**T**	**P**	**C**
Year	III	**Semester**	V	**0**	**0**	**2**	**1**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	the purpose of this undergraduate course is to impart practical knowledge of the concepts through different experiments related to its theoretical course.						

Course Outcomes	
CO1	Able to understand the basic concepts TOKEN and lexeme, the flow of control
CO2	Able to design and develop various programming concepts, like case statements, and procedure calls.
CO3	Able to analyze and compute first and follow, and used the concept first and follow, to implement various parsing algorithms.
CO4	Able to develop programs on the different parser.
CO5	Able to implement programs on various SDT.

S. No.	**List of Experiments**	**Contact Hrs.**	**Mapped CO**
1	Write a program to implement TOKENIZER.	2	1
2	Write a program using call statement and CASE statement.	2	1
3	Write a program to find out FIRST / FOLLOW of grammar.	2	2
4	Evaluate POSTFIX and PREFIX expression with the help of stack.	2	2
5	Write a program to implement OPERATOR PRECEDENCE PARSER.	2	3
6	Design a parser like RECURSIVE DESCENT PARSER.	2	3
7	Design PREDICTIVE PARSER.	2	4
8	Design I.R(0) PARSER..	2	4
9	Write a program to implement TOKENIZER.	2	5
10	Write a program using call statement and CASE statement.	2	5

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1		2		2						2	2	1
CO2	3	1	2	2	2		3						1	2	1
CO3	4	2	2	2			2						3	2	2
CO4	3	2	3	3			3						3	1	1
CO5	1	2	1				3						2	1	1

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	CS306	**Title of the Course**	COMPUTER NETWORKS LAB	**L**	**T**	**P**	**C**
Year	III	**Semester**	V	0	0	2	**1**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	Resource sharing is the main objective of the computer network Lab. The objective of this lab course is to get practical knowledge of working principles of various communication protocols. Analyze structure and formats of TCP/IP layer protocols using network tools such as and network simulators (NS2). This lab provides a practical approach to Ethernet/Internet networking.						

Course Outcomes	
CO1	Understand the practical approach to network communication protocols.
CO2	Understand network layers, structure/format and role of each network layer.
CO3	Able to design and implement various network application such as data transmission between client and server, file transfer, real-time multimedia transmission.
CO4	Understand the various Routing Protocols/Algorithms and Internetworking.
CO5	Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers.

S. No.	**List of Experiments**	**Contact Hrs.**	**Mapped CO**
1	Simulation of Basic Router Configuration in cisco packet tracer	2	1
2	Simulation of Router Name and Password in cisco packet tracer	2	1
3	Simulation of Banner motd and login in Cisco packet tracer	2	2
4	Simulation of telnet in Cisco packet tracer	2	2
5	Simulation of DHCP in Cisco packet tracer	2	3
6	Simulation of RIP in cisco packet tracer	2	3
7	.Simulation of OSPF in cisco packet tracer	2	4
8	Simulation of crate and add VLAN in cisco packet tracer	2	4
9	Simulation of STP in cisco packet tracer	2	5
10	Simulation of two router communication in cisco packet Tracer	2	5

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

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS314**	**Title of the Course**	**Microprocessor Lab**	**L**	**T**	**P**	**C**
Year	III	**Semester**	V	**0**	**0**	**2**	**1**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	To expose students to the operation of typical microprocessor (8086) trainer kit. To prepare the students to be able to solve different problems by developing different programs. To develop the quality of assessing and analysing the obtained data						

Course Outcomes	
CO1	Identify relevant information to supplement to the Microprocessor and Microcontroller course6.
CO2	Set up programming strategies and select proper mnemonics and run their program on the training boards.
CO3	Practice different types of programming keeping in mind technical issues and evaluate possible causes of discrepancy in practical experimental observations in comparison
CO4	Develop testing and experimental procedures on Microprocessor and Microcontroller analyse their operation under different cases.
CO5	Prepare professional quality textual and computational results, incorporating accepted data analysis and synthesis methods, simulation software, and word- processing tools.

S. No.	**List of Experiments**	**Contact Hrs.**	**Mapped CO**
1	Write a program to two add 16 bit Hexadecimal numbers without carry.	2	1
2	Write a program to two add 16 bit Hexadecimal numbers with carry.	2	1
3	Write a program to find the greatest number from an array of 10 numbers.	2	2
4	Write a program to calculate the factorial of a number.	2	2
5	Write a program to multiply two 16-bit numbers result should be greater than 16 bit.	2	3
6	Write a program to input 5 numbers and arrange them in descending order.	2	3
7	Write a program to convert the string data it's Two's complement form.	2	4
8	Write a program to multiply two 8-bit signed - numbers.	2	4
9	Write a program to read 8 bit data from Port B. Complement this data & send it back to Port A.	2	5
10	Write a program to move a block of data from one memory location to another.	2	5

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

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS306**	**Title of the Course**	**COMPUTER NETWORKS LAB**	**L**	**T**	**P**	**C**
Year	III	**Semester**	V	**0**	**0**	**2**	**1**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	Resource sharing is the main objective of the computer network Lab. The objective of this lab course is to get practical knowledge of working principles of various communication protocols. Analyse structure and formats of TCP/IP layer protocols using network tools such as and network simulators (NS2). This lab provides a practical approach to Ethernet/Internet networking.						

Course Outcomes	
CO1	Understand the practical approach to network communication protocols.
CO2	Understand network layers, structure/format and role of each network layer.
CO3	Able to design and implement various network application such as data transmission between client and server, file transfer, real-time multimedia transmission.
CO4	Understand the various Routing Protocols/Algorithms and Internetworking.
CO5	Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers.

S. No.	**List of Experiments**	**Contact Hrs.**	**Mapped CO**
1	Simulation of Basic Router Configuration in cisco packet tracer	2	1
2	Simulation of Router Name and Password in cisco packet tracer	2	1
3	Simulation of Banner motd and login in Cisco packet tracer	2	2
4	Simulation of telnet in Cisco packet tracer	2	2
5	Simulation of DHCP in Cisco packet tracer	2	3
6	Simulation of RIP in cisco packet tracer	2	3
7	.Simulation of OSPF in cisco packet tracer	2	4
8	Simulation of crate and add VLAN in cisco packet tracer	2	4
9	Simulation of STP in cisco packet tracer	2	5
10	Simulation of two router communication in cisco packet Tracer	2	5

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

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

Integral University, Lucknow

Effective from Session: 2021-22							
Course Code	**CS-345**	**Title of the Course**	**Advance Computer Architecture**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	**VI**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	The main aim of the course is to help students understand the effect of modern computer architectures on software and program performance, and the new developments in computer architecture and how it affects algorithm design. Main themes include: memory hierarchy, caching, pipelining, parallelism and multiprocessors						

Course Outcomes	
CO1	Registers, bus as well as memory and its hierarchy and input/output devices.
CO2	Division based algorithms for different representation of data and discuss I/O interfaces, ports and Data Transfer modes
CO3	Register and stack organization and construct different control units.
CO4	Types of memory and memory mapping of one type with other
CO5	Knowledge about Interconnection Network, non-blocking network, cross bar network, and shuffle exchange network.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction**	Introduction to Computer Architecture, Evolution of Computer Architecture, Parallel Computing, Parallel Architectural Classification Schemes: Flynn's, Shores, Feng's Classification; Performance of Parallel Processors: Speedup Performance Laws, Amdahl Law, and Gustafson Law, Performance Metrics and Measures.	8	1
2	**Pipeline Processing:**	Pipeline Processing: Introduction to Pipeline Processing, Arithmetic Pipelines, Pipelined Instruction Processing, Instruction Level Parallelism. Interlocks, Hazards, and Hazards Detentions & Resolution, Scheduling of Pipelines	8	2
3	**Processor Architectures:**	Processor Architectures: Superscalar Architecture, Vector Architecture and VLIW Architecture, Super pipeline design, Memory Technology: Cache Architecture; Cache Coherence and Synchronization Mechanisms, Shared-Memory Organizations	10	3
4	**Synchronous parallel processing**	Synchronous parallel processing, SIMD Architecture and programming principals, SIMD parallel algorithm, Data mapping and memory in Array Processor	10	4
5	**Interconnection Network**	Interconnection Network, introduction to permutations, group of mapping, decomposition of a permutation into cycles, elementary permutation used in interconnection network, complete non-blocking network, cross bar network, clos network, Benes's network, shuffle exchange network	8	5

Reference Books:

1. Peterson & Heresy, "Quantitative approach to computer Architecture"
2. Kai Hwang, "Advanced Computer Architecture", McGraw Hill International.
3. "Morgan Kaufman". Quin, "Parallel computing, Theory & Practices", McGraw Hill
4. Bhujde, "Parallel Computing", New Age International Hwang, "Advance ComputerArchitecture

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

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS-320**	**Title of the Course**	**Real Time System**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	**VI**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	To give knowledge and understandings of Real time databases and their applications						

Course Outcomes	
CO1	Apply the knowledge of operating system concepts to understand real time system concepts like tasks and scheduling.
CO2	Analyze the various parameters related to the different types of scheduling in single processor and multiprocessor environments.
CO3	The basic concepts of real time databases and their applications.
CO4	Apply the basic concepts of fault tolerance and clocks to design an effective real time system.
CO5	Identify the various protocols for effective resource sharing.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction**	Introduction to Real Time Systems, Structure of Real Time System, Various Classification of Real Time Systems, Embedded System, Characterizing Real Time System & Task, Various Issues in Real Time System	8	1
2	**Task Assignment & Scheduling**	Classical Uniprocessor Scheduling Algo- Rate Monotonic, EDF. Uniprocessor Scheduling of IRIS Tasks, Identical and Nononidentical Linear & Concave Reward Function, 0/1 Reward Function. Task Assignment Algorithms- Utilization Balancing, A Next-Fit Algorithm for RM Scheduling, A Myopic Offline Scheduling FAB Algorithm & Buddy Strategy	8	2
3	**Real Time Database**	Real Time vs. General purpose Database, Main Memory database, Concurrency Control Issues, Real Time OS- Threads and Tasks, Kernel, Case Study of QNX, VRTX, Vx Works.	8	3
4	**Fault Tolerance Techniques**	Introduction Fault, Fault Detection and Error Containment, Redundancy Data Diversity, Reversal Checks, Malicious & Integrated Failure Handling. Clock Synchronization: Introduction Clocks, A Nonfault Tolerant Synchronization Algorithms, Impact of Fault, Fault Tolerant Synchronization in H/Wand S/W	8	4
5	**Real Time Communication**	Introduction, N/W Topologies, Protocols: Internet & Resource Reservation Protocols, Real Time Protocol, Contention-Based Protocol.	8	5

Reference Books:

1. C.M. Krishna & Shin, "Real Time Systems", Mc Graw Hill 1985.
2. Jane W.S. LIU, "Real Time Systems", Pearson Education".
3. Levi & Agarwal, "Real Time System", McGraw Hill.

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

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

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	**CS-346**	**Title of the Course**	**Concepts in Advanced Database System**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	**VI**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	To give the knowledge of Advance SQL Queries , which help the student to learn the working of Internal processing of DBMS, when the query imputed. To give knowledge and understandings of Distributed database . To give the knowledge about database tuning and Explain basic issues of Database security. To give the knowledge of database tuning and database security. To give the knowledge about data warehouse , connectivity and different types of emerging databases.						

Course Outcomes	
CO1	Have knowledge about advance SQL queries and its applications.
CO2	Have knowledge and understanding of distributed database.
CO3	Have knowledge about database tuning and Explain basic issues related to Database security.
CO4	HaveknowledgeaboutPL/SQLanditsimplementationinvariousqueryprocess.
CO5	Have knowledge and understanding of Advanced data bases and data warehouse.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Query Processing and Optimization**	Clustering & Indexing, Query Processing, Estimations for Query Processing Cost Algorithms for executing selection Operations, Algorithms for executing Join Operations, Algorithm for executing Project Operations. Query Optimization: Heuristics for Query Optimizations, Query Evaluation Plans, Pipelined Evaluations, System Catalogue in RDBMS	8	1
2	**Object Oriented databases**	Database Tuning: Database Workloads, Tuning Decisions, DBMS Benchmarks, Multiple Attribute Search Keys, Extended Relational Model & Object Oriented Database System: Requirement, Properties, Structured Types, Object Identity, Containment, and Class Hierarchy, Logic Based Data Model, and Nested Relational model.	8	2
3	**Distributed databases**	Distributed Database System: Structure of Distributed Database, Data Fragmentation, Data Model, Query Processing, Semi Join, Parallel & Pipeline Join, Concurrency Control in Distributed Database System, Recovery in Distributed Database System, Distributed Deadlock Detection and Resolution, Commit Protocols	8	3
4	**Database Security**	Database Securities: Database Security, Access Control and Grant & Revoke on Views and Integrity Constraints, Mandatory & Discretionary Access Control, Role of DBA, Security in Statistical Databases	8	4
5	**Enhanced databases**	Enhanced Data Model for Advanced Applications: Database Operating System, Introduction to Temporal Database Concepts, Introduction to Spatial and Multimedia Databases, Introduction to Data Mining, Introduction to Active Database System & Deductive Databases, Database Machines, Web Databases.	8	5

Reference Books:

1- Majumdar & Bhattacharya, "Database Management System", TMH.

2- Korth, Silberchatz, Sudarshan, "Database Concepts", Addison Wesley

3- Elmastri, Navathe, "Fundamentals of Database Systems", Addison Wesley

4- Date C.J., "An Introduction to Database System", Addison Wesley.

PO-PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	**1**	**2**		**1**	**1**		**3**	**2**				**1**	**2**	**1**	**2**	**2**
CO 2			**3**	**1**	**3**				**2**	**3**	**3**	**1**	**1**	**2**	**3**	**2**
CO 3	**1**	**1**			**2**	**1**		**3**	**3**				**1**	**1**	**1**	**2**
CO 4			**1**	**2**			**1**			**3**	**2**	**1**	**2**	**1**	**2**	**1**
CO 5	**1**	**2**	**3**		**1**	**2**		**3**					**2**	**2**	**1**	**3**

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS-311**	**Title of the Course**	**Software Project & Quality Management**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	**VI**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	1. Explain the basic understanding of software, its characteristics, and importance of following engineering principles to develop software. 2. Assess the applicability, strengths, and weaknesses of the different development life cycle models to provide real world software solutions. 3. To understand various processes of each phase of SDLC and make the students capable to prepare quality documentation for software development.						

Course Outcomes	
CO1	Analyze the systematically stepwise project planning.
CO2	Have knowledge of strategic program management, analysis of technical assessment of projects and study and analysis of different Cost-Benefit Evaluation Techniques.
CO3	Apply, analyze and compare effort estimation and different network planning models.
CO4	Evaluation and analysis of different resources and Critical Path, monitoring and control, Prioritizing monitoring and change control.
CO5	Compare and analyze modern project management, contract management, ISO Standards, CMM, Six Sigma Approach.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction to Wireless Communication:**	Overview of Software Project Planning Software Project, Categorization of Software Project, Introduction to Stepwise Project Planning: Identify Project Scope and objectives, Identify Project Infrastructure, Project Products and Activities, Activity risks, Resource Allocation, Project Plan Execution	8	1
2	**Channel Allocation:**	Project Evaluation: Strategic Program Management, Technical Assessment, Cost Benefit Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques: Net profit, Payback Period, Return on Investment, Net Present Value, Internal Rate of Return, Risk Evaluation, Selection of Technologies, overview of software development models.	8	2
3	**Telecommunications Systems:**	Software Effort Estimation an Overview, Project Schedules, Network Planning Models, Activity Duration Estimation, and Risk Management: Identification, Analysis and Abatement of Risk	8	3
4	**Wireless LAN:**	Resource Allocation: Nature of resources, Identifying Resource Requirements, Scheduling Resources, Creating Critical Path, Counting the Cost, Cost Schedules. Monitoring and Control: Visualizing progress, Cost Monitoring, Prioritizing Monitoring, Getting Project Back to Target, Change Control	8	4
5	**Mobile network layer:**	Contract Management, Human Resource Management, Software Quality Definition, Software Quality Assurance, Quality Assurance Plan, Quality Matrices, ISO Standards, CMM, Six Sigma Approach	8	5

Reference Books:

1. Software Project Management by Bob Hughes and Mike Cotterell, Third Edition, TMH.
2. Information Technology Project Management by Kathy Schwalbe, International Student Edition, THOMSON Course Technology, 2003.
3. Software Quality by Mordechai Ben-Menachem/Garry S Marliss. Thomson Learning Publication
4. Software Project Management A Unified Framework by Walker Royce. Pearson Education.

	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	2	1	1	3	1	1	1	1	1	3	1	2	2	
CO2	3	3	3	2	1		1	1	1	1	1			2	1	
CO3	3	2	1	1	2	3	1	1	1	1	1	3	2	1	2	
CO4	3	2	2	2		1		1			1	2	3		3	
CO5	1	2	3		1	2		3					2	1	1	3

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

Integral University, Lucknow

Effective from Session: 2021-22							
Course Code	**CS-347**	**Title of the Course**	**Green Computing**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	**VI**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	To understand various processes of each phase of SDLC and make the students capable to prepare quality documentation for software development.						

Course Outcomes	
CO1	Obtain the fundamentals of green computing and its IT strategies
CO2	Learn about green assets, modeling and information systems
CO3	Acquire knowledge on grid framework
CO4	Understand the concept of green compliance
CO5	Work with case studies

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction**	Green IT Fundamentals: Business, IT, and the Environment –Environmental Impacts of IT, Green IT, Holistic Approach to Greening IT, Greening IT, Applying IT for enhancing. Environmental sustainability, Green IT Standards and Eco-Labelling of IT, Enterprise Green, IT strategy, Green IT: Burden or Opportunity?	8	1
2	**Green Devices and Hardware with Green Software**	Green Devices Hardware/Software: Introduction, Life Cycle of a device or hardware, Reuse, Recycle and Dispose, Energy-saving software techniques, Evaluating and measuring software Impact to platform power	8	2
3	**Green Assets and Modeling and Grid Framework**	Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration –Green Information Systems: Design and Development Models. Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework	8	3
4	**Green Compliance and Social Aspects**	Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future. Introduction, Strategizing Green Initiatives, Implementation of Green IT, Information Assurance, Communication and Social media	8	4
5	**Regulating the Green IT and CASE STUDIES**	Introduction, The regulatory environment and IT manufacturers, Non regulatory government initiatives, Industry associations and standards bodies, Green building standards, Green data centers, Social movements and Greenpeace. Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.	8	5

Reference Books:

1- BhuvanUnhelkar, ―Green IT Strategies and Applications-Using Environmental Intelligence‖, CRC Press, June 2014.

2- Woody Leonhard, Katherine Murray, ―Green Home computing for dummies‖, August 2012.

3- Harnessing Green IT Principles and Practices , San Murugesan, G.R. Gangadharan, Wiley Publication, ISBN:9788126539680

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

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

Integral University, Lucknow

Effective from Session: 2021-22							
Course Code	**CS-348**	**Title of the Course**	**Human Computer Interaction**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	**VI**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	To give the knowledge of TCP/IP protocol. To give the knowledge of packet switching and message switching. To give the knowledge of sliding window protocol. To give the knowledge of the CDMA. To give the knowledge of network layer protocols viz. Ipv4, ARP, RARP. To give the knowledge of routing. To give the knowledge of TCP & UDP. To give the knowledge of congestion control. To give the knowledge of quality of service. To give the knowledge of DNS, FTP, TELNET and remote logging.						

Course Outcomes	
CO1	Acquire fundamental concepts of computer components functions regarding interaction with human and vice versa
CO2	Analyze interface problems to recognize what design approach and interaction styles are required in the light of usability standards and guidelines.
CO3	Utilize basic concepts to construct a user-interaction strategy for a given problem its usability evaluation and to meet desired needs within realistic constraints such as social, political and ethical norms.
CO4	Ability to design and develop an interface by using appropriate HCI techniques that are preferred by the user.
CO5	Ability to apply different evaluation technique with case studies.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction to user-centric design**	Introduction to user-centric design – case studies, historical evolution, issues and challenges and current trend, Engineering user-centric systems – relation with software engineering, iterative life-cycle, prototyping, guidelines, case studies	8	1
2	**User-centric computing**	User-centric computing – framework, introduction to models, model taxonomy, Computational user models (classical) – GOMS, KLM, Fitts' law, Hick-Hymans law.	8	2
3	**Computational user models**	Computational user models (contemporary) 2D and 3D pointing, constrained navigation, mobile typing, touch interaction, Formal models – case study with matrix algebra, specification and verification of properties, formal dialog modeling.	8	3
4	**Empirical research**	Empirical research – research question formulation, experiment design, data analysis, statistical significance test. Case Study 1- Multi-Key press Hindi Text Input Method on a Mobile Phone.	8	4
5	**User-centric design evaluation**	User-centric design evaluation – overview of evaluation techniques, expert evaluation, user evaluation, model-based evaluation with case studies. Case Study 2 – GUI design for a mobile phone based Matrimonial application.	8	5

Reference Books:

1- Samit Bhattacharya (July, 2019). Human-Computer Interaction: User-Centric Computing for Design, McGraw-Hill India, Print Edition: ISBN-13: 978-93-5316-804-9; ISBN-10: 93-5316-804-X, E-book Edition: ISBN-13: 978-93-5316-805-6; ISBN-10: 93-5316-805-8.

2- Dix A., Finlay J.,Abowd G. D. and Beale R. Human Computer Interaction, 3rd edition, Pearson Education, 2005.

3- Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T. Human Computer Interaction,Addison-Wesley, 1994.

4- B. Shneiderman; Designing the User Interface,Addison Wesley 2000 (Indian Reprint).

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

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS-340**	**Title of the Course**	**Software Engineering**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	**V**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	4. Explain the basic understanding of software, its characteristics, and importance of following engineering principles to develop software. 5. Assess the applicability, strengths, and weaknesses of the different development life cycle models to provide real world software solutions. 6. To understand various processes of each phase of SDLC and make the students capable to prepare quality documentation for software development. 7. To develop effort estimation and risk management skills for developing software. 8. 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 Components, Software Crisis, Software Engineering: Definition, Challenges, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes. Software Development Life Cycle Models: Build and Fix Models, Waterfall Model, Prototyping Model, RAD Model Iterative Enhancement Model, Evolutionary Development Model and Spiral Model, WINWIN Spiral Model, Fourth Generation Techniques.	8	1
2	**Planning a Software**	Process Planning, Effort Estimation: Uncertainities in Effort Estimation, Building Effort Estimation Models, A Bottom-Up Estimation Approach, COCOMO Model, Project Scheduling & Staffing: Overall Scheduling, Detailed Scheduling, Team Structure, Software Configuration Management(SCM): - Baselines, Version Control, Change Control & Configuration Audit, Risk Management: Reactive and Proactive Risk Strategies, 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, Object Oriented Modeling, Prototyping, Requirements Specifications: Characteristics of an SRS, Components of SRS, Specification Language, Structure of Requirement Document: IEEE Standards for SRS, Validation, Metrics. **Designing and Coding:** Designing: Function Oriented Design: Design Principles: Problem Partitioning and Hierarchy, Abstraction, Modularity, Top Down and Bottom-Up Strategies, Module Level Concepts: Coupling, Cohesion; Structure Design Methodology, Verification, Introduction to Object Oriented Design & User Interface 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, Static Analysis, Proving Correctness, Combining Different Techniques, Metrics. **Testing:** **Testing Fundamentals:** Error Fault and Failure, Test Oracles, Test Cases and Test Criteria, Test Case Execution and Analysis, 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, state Table Based Testing, Decision Table Based 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, and Statistical Quality Assurance. 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.

	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	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		
CO5	3	1	3	2	3	2	1	2	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	**CS-312**	**Title of the Course**	**Digital Image Processing**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	**V**	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	To explain basics of digital signal processing such as Fourier analysis To expose students to different low level image processing tasks such as filtering, edge detection etc. To impart knowledge of image compression as well as various image Segmentation techniques. To introduce advanced image processing algorithms for face detection and recognition.						

Course Outcomes	
CO1	Explain basic image processing techniques for solving real problems
CO2	Apply image processing techniques for solving problems in computer science
CO3	Evaluate algorithms for higher level image processing.
CO4	Develop understanding for object registration and recognition
CO5	Develop an application using existing image processing algorithms

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction and Fundamentals**	Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization.	8	1
2	**Image Enhancement in Spatial Domain**	Introduction; Basic Gray Level Functions – Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening – The Laplacian.	8	2
3	**Color Image Processing**	Color Fundamentals, Color Models,Converting Colors to different models, Color Transformation, Smoothing and Sharpening, Color Segmentation. **Morphological Image Processing** Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening.	8	3
4	**Registration**	Introduction, Geometric Transformation – Plane to Plane transformation, Mapping, Stereo Imaging – Algorithms to Establish Correspondence, Algorithms to Recover Depth Segmentation Introduction, Region Extraction, Pixel-Based Approach, Multi-level Thresholding, Local Thresholding, Region-based Approach, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by Thresholding, Edge Detector Performance, Line Detection, Corner Detection.	8	4
5	**Feature Extraction**	Representation, Topological Attributes, Geometric Attributes. Description Boundary-based Description, Region based Description, Relationship. **Object Recognition** Deterministic Methods, Clustering, Statistical Classification, Syntactic Recognition, Tree Search, Graph Matching	8	5

Reference Books:

1. Digital Image Processing 2nd Edition, Rafael C. Gonzalez and Richard E. Woods. Published by: Pearson Education.
2. Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: John Wiley and Sons, NY.
1. Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall, Upper Saddle River, NJ.

e-Learning Source:

https://nptel.ac.in/courses/106106131

	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	2	1	3	1	1	3	1	2	1	1	2	3	2			2
CO2	3	2	3	2	1	1			2		2	1	3			3
CO3	2	2	1	1	2	2	3		1		3			3		2
CO4	3	2	2	2	3	3					2			3		3
CO5	3	1	1	1	1	2	1				2				3	3

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS310**	**Title of the Course**	**OPEN SOURCE SOFTWARE TECHNOLOGIES LAB**	**L**	**T**	**P**	**C**
Year	III	**Semester**	V	**0**	**0**	**2**	**1**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	To motivate students to use open source operating systems. To teach students to setup their own Linux server . To teach students to setup their own web server and commands To learn using MySql as an open source database system. To learn PHP as open source development programming language.						

Course Outcomes	
CO1	Explain common open source licenses and the impact of choosing a license to explain open- source project structure and how to successfully set up a project
CO2	Competent with Linux in their systems Install different useful packages in Linux using RPM can Schedule task automatically and run administrative commands.
CO3	Able to understand web server easily how to store, process and deliver web pages to the users. How intercommunication is done using by variety of available Protocols.
CO4	Analyze the existing design of a database schema and apply concepts of normalization to design an optimal database by formulating complex queries in MySQL.
CO5	Design and develop Client Server applications using open source scripting language. Able how to design GUI Applications in open source scripting language to evaluate different processes.

S. No.	**List of Experiments**	**Contact Hrs.**	**Mapped CO**
1	Overview of FOSS & Basic Command interface on Linux	2	1
2	Usage of Basic Linux Commands, File and Folder Management Commands	2	1
3	Learning Network related Command and Administrative Commands	2	2
4	Learning Vi Editor & its Modes And GUI Tools	2	2
5	Learning Shell Script, A Shell Script to demonstrate various control Constructs	2	3
6	A Script to check for a file and directory existence in the file system	2	3
7	A Script to execute different command to demonstrate Switch cases statement	2	4
8	A Script to handle command line argument and other Special symbols	2	4
9	Learn how to Compile, Debug & Execute C, C++ & Java Programming Codes without IDEs.	2	5
10	Learning about LAMP STACK its Installation And Configuration on Linux (Ubuntu) and Perform Post Installation Exercises	2	5

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

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

Name & Sign of Program Coordinator	**Sign & Seal of HoD**