Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**CS 515**	**Title of the Course**	**Data Communication and Computer Networks Lab**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	I	**3**	**1**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	**None**				
Course Objectives	Genetic algorithms, its applications and advances						

Course Outcomes	
CO1	Simulation of ALOHA, CSMA and CSMA/CD
CO2	Simulation of Data Link Layer Protocols
CO3	Simulation of Application Layer Protocols
CO4	Experiments related to LAN and MAN
CO5	Implementation of ALOHA, CSMA and CSMA/CD in C.

Sr. No.	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Simulate ALOHA protocol for packet transmission between a no. of Nodes connected to a commonbus.	2	1
2	Simulate CSMA protocol for packet transmission between a no. of Nodes connected to a commonbus.	2	1
3	SimulateCSMA/CDprotocolforpackettransmissionbetweenano.ofNodesconnectedtoacommonbus.	2	1
4	SimulateTOKENBUSforbusLAN.	2	2
5	SimulateTOKENBUSforringLAN	2	2
6	Simulate PACKET TRANMISION from one Node to anotherNode.	2	2
7	Simulate SLIDING WINDOW protocol to provide reliable data transfer between two nodes over an unreliableNetwork.	2	2
8	Simulate STOP & WAIT protocol for packet transmission between a no. ofnodes.	2	1
9	Simulate FILE TRANSFER protocol to check transfer of file and deceiving of file between two nodes.	2	1
10	Simulation of network based on Pure Aloha protocol usingnetsim.	2	3
11	Simulation of network based on Slotted Aloha protocol usingnetsim.	2	3
12	Simulation of network based on Ethernet protocol usingnetsim.	2	3
13	Simulation of network based on Token Bus protocol usingnetsim.	2	3
14	Simulation of network based on Token Ring protocol usingnetsim.	2	3
15	Simulation of network based on Router usingnetsim.	2	2
16	Simulation of network based on Frame relay usingnetsim.	2	2
17	SimulationofnetworkbasedonX.25usingnetsim.	2	2
18	Simulation of network based on TCP (Transfer Control Protocol) usingnetsim.	2	4
19	Simulation of network based on UDP (User Datagram Protocol) usingnetsim.	2	4
20	Simulation of network based on ATM (Asynchronous Transfer Mode) usingnetsim	2	4
21	WAP to implement TOKEN RINGprotocol.	2	5
22	WAP to implement ALOHAprotocol.	2	5
23	WAP to implement CSMA/CD protocol for a singlechannel.	2	5

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

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

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**CS-514**	**Title of the Course**	**Data Communication & Computer Network**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	I	**4**	**0**	**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	To understand the transmission media and type of switching.
CO2	To analyze different networking functions and features of data link protocols and sliding window protocol.
CO3	To apply different networking concepts for implementing network solution.
CO4	To evaluate and implement routing algorithms for implanting solution for the real-life problems.
CO5	To implement model of fault tolerant computer networks.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Network Models (ISO-OSI and TCP/IP):**	Need & Comparison of network models (ISO-OSI and TCP/IP), Transmission Impairments: Attenuation, Distortion, Noise. Data Rate: NBR, Shannon Capacity. Network Performance: Bandwidth, Throughput, Delay, Jitter. Switching: Circuit switching, Packet switching, Virtual Circuit. Introduction to flow control, Error Control, Error detection and correction, multiplexing. HDLC-Configurations and transfer modes, frames, Control Field, Segment format	8	1
2	**Network Layer:**	Network layer - connection devices, IP Addressing, Classful addressing, classless addressing. Features & comparison of IPv4 and IPv6. Routing algorithms and protocols, direct versus indirect delivery, forwarding techniques, Unicast routing protocols - optimization, intra and inter domain routing, distance vector routing, link state routing, path vector routing. Multicast routing protocols – Unicast, multicast and broadcast, Applications Multicast routing. Network layer protocol: ARP, RARP.	8	2
3	**Transport Layer:**	Transport layer-User datagram protocol (UDP)-segment format, Well-known port for UDP, checksum, UDP Operation, Use of UDP. TCP - TCP Segment format, TCP Services, TCP features, TCP connection Establishment & release, TCP half close, TCP simultaneous close, TCP timers, TCP data flow, TCP timeout and retransmission	8	3
4	**Congestion Control:**	Congestion control - data traffic descriptor, traffic profile, congestion - network performance, open-loop & close loop congestion control. Quality of services - flow characteristics, flow classes, techniques to improve QoS-Scheduling, Traffic Shaping, Resource reservation Admission control. Security-services - message confidentiality, message authentication, message non-repudiation, message confidentiality: confidentiality with symmetric key cryptography, Confidentiality with asymmetric key cryptography, message and message digest.	8	4
5	**Application Layer:**	Application layer- Domain name system: Name space, Domain name space, Distribution of domain name space, Resolution of Domain names. Segment format and working of DNS, FTP, TELNET, TFTP. Electronic mail: SMTP, IMAP and POP3 protocols	8	5

Reference Books:

1. Forouzen, “Data Communication and Networking”, TMH 4th Edition
2. A.S.Tanenbaum,”Computer Networks”,3rd Edition,Prentice Hall India,1997.
3. W.Stallings,”Data and Computer Communication”,Macmillan Press,1989.
4. W. Richard stevens, “TCP/IP Illustrated Vol 1 “, Addition Wesley

e-Learning Source:

https://archive.nptel.ac.in/courses/106/105/106105082/

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		3	2		
CO2	3	3	3	2	1	1		1				2		3	3
CO3	3	2	1	1	2	2	3		2			3	1		
CO4	3	2	2	2	3	3				1		2	4		3
CO5	3	1	1	1	1	2	1					2		3	

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

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**CS-516**	**Title of the Course**	**Advance Data Structure and Algorithm**	**L**	**T**	**P**	**C**
Year	**1**	**Semester**	1	**3**	**1**	**0**	**4**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	The course curriculum helps to understand the various data structures and various relationships between different types of data structures. Its major objective is the analysis of algorithms, trees, graphs, traversal techniques, solutions of recursive equations, NP class problems and parallel algorithms.						

Course Outcomes	
CO1	Know about the concepts of data structures, their types, design concepts
CO2	Know about the concepts of recursive equations, working with recursive programs., algorithm analysis.
CO3	Know about the concepts of graphs and trees and their various traversals and properties.
CO4	Know about the concepts of approximation algorithms and NP class problems
CO5	Know about the concept of parallel algorithms and pipelines.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Data Structures	Overview of data structures Review of Arrays, sparse matrices, Stacks, Queues, linked lists, doubly linked lists, Applications, dynamic storage management Overview of Advance Data structure Red-Black Trees, AVL Trees and B-Trees	8	1
2	Analysis of Algorithms	Algorithms and various analysis models, Analyzing Recursive Programs using various strategies Divide and Conquer Paradigm: Divide and conquer recurrence equations and their solutions, Review of various examples Binary search, Quick sort, merge sort.	8	2
3	Graphs & Trees	Basic traversal and search techniques: Game Tree, traversal techniques of graph, connected component and spanning tree, Bi-connected components, AND/OR graph, LOWER BOUND THEORY comparison tree and lower bound through reduction.	8	3
4	Approximation Algorithms	Introduction, absolute approximation, - Approximation, Polynomial time approximation scheme, fully Polynomial time approximation scheme, NP Hard and NP Complete problem basic concept, Cook Theorem, NP Hard graph problems, NP Hard scheduling problems, NP Hard code generating problems.	8	4
5	Parallel Algortihms	PRAM Algorithms: Introduction, computational model, fundamental techniques and algorithms, merging and lower bounds MESH Algorithms: computational model, packet routing fundamental algorithm, merging computing the convex hull.	8	5

Reference Books:

Fundamental of computer algorithms-Ellis Horowits, Sartaj Sahani,Saguthevar Rajasejaran (Universities press) second Edition

The design and analysis of Computer algorithms- Aho, hopcraft &ulman (Pearson Education)

Introduction to Algorithms- Thomas H. Coremen, Charles S. Lieserson, Ronald L Rivest and Clifford Stein (PHI)-2 nd edition

Randomized Algorithms- Rajiv Motwani and Prabhakar Raghavan (Cambridge University Press)

e-Learning Source:

https://nptel.ac.in/courses/106106130

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

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	CS-517	**Title of the Course**	Advance Software Engineering and Project Management	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	**3**	**1**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	The course curriculum helps to understand the various data structures and various relationships between different types of data structures. Its major objective is the analysis of algorithms, trees, graphs, traversal techniques, solutions of recursive equations, NP class problems and parallel algorithms.						

Course Outcomes	
CO1	Overview of Basic and Advance Software Engineering.
CO2	Have knowledge of Design Principles and Advance Software Design.
CO3	Apply, analyze and compare effort estimation and different network planning models.
CO4	Analysis of Software Testing and Quality Assurance and K-Metrics.
CO5	Comparison and analysis of Advance Concepts of Software Development.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction	Process models and their evolution- NATO 1968, Waterfall model, Spiral model, Agile Manifesto, Agile Process and Principles, Extreme programming, Scrum, Rational Unified Process, CMM,CMM-I, PCMM,ISO12207, Critical Analysis of Process models.	8	1
2	Software Design	Software Design – Design principles, Software architecture, Design Patterns, User Interface Design, Object Oriented Design with UML, Universal design applied to software engineering, Design for Reuse	8	2
3	Programming Paradigms	Programming Paradigms – Imperative programming, Functional programming, Logical programming, Object oriented programming, Global Software Development- tools and practices, Coding Standards, Aspect Oriented Software Engineering.	8	3
4	Software Testing and Quality Assurance	Software Testing and Quality Assurance – Testing processes, Testing tools, ISO Quality Models- ISO 9001 and ISO 9126, Usability Testing, Test Driven Software Development, Object Oriented Testing with C and K-Metrics, Software Configuration Management.	8	4
5	Introduction,Contract&TechnicalprojectManagement	Introduction,Contract&TechnicalprojectManagement,Activities,Plans,Methods,Methodologies,objectives,business case, Success, failure, Management control, Traditional vs Modern project management, Project portfolio management, Project evaluation, Cost-benefit evaluation Techniques, Risk Evaluation, Resource allocation, Strategic management, Benefits, Step Wise Project Planning.	8	5

Reference Books:

RogerSPressman,SoftwareEngineering,7thedition,TMHpublication

IanSommerville,SoftwareEngineering,9thedition,PearsonEducation

Rumbaugh, Object–Oriented Modeling and Design, Pearson Education

Jeff Tain, Software Quality Engineering, IEEE publication

e-Learning Source:

https://nptel.ac.in/courses/106105087

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

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

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	CS-518	**Title of the Course**	Soft Computing	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	**3**	**1**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	The course curriculum helps to understand the concepts of fuzzy rule, fuzzy data, crisp rule, crisp data, fuzzy relation, implication, and elaborates the concepts of particle intelligence, swarm intelligence, evolutionary computing, optimalization theory, different kind of neural network, learning theory by neural network, algorithm based computing, probabilistic computing, hybrid system concepts, etc						

Course Outcomes	
CO1	Know about the concepts of fuzzy logic, crisp logic, fuzzy relation, fuzzy implication rule
CO2	Know about the concepts of optimization theory genetic computing, and evolutionary computing.
CO3	Know about the concepts of the neural network,Single Layer, Multilayer, classifications, Implementation, and training
CO4	Know about the concepts of classifications, Implementation, and training
CO5	Know about the concept of hybrid systems, like neuro-fuzzy systems, fuzzy genetic systems, and particle intelligence.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction of soft computing:	Introduction of soft computing: [8] What is Soft Computing, soft computing vs. hard computing, soft computing paradigms, and applications of soft computing. Basics of Machine Learning. Dealing with Imprecision and Uncertainty- Probabilistic Reasoning- Bayesian network, Pearl's Scheme for Evidential Reasoning, Dempster-Shafer Theory for Uncertainty Management, Certainty Factor Based Reasoning	8	1
2	Neural Networks	Neural Networks: Basics of Neural Networks- Neural Network Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, characteristics and applications of ANN, McCulloch Pitt model, different activation functions, Supervised Learning algorithms- Perceptron (Single Layer, Multi layer), Linear separability, ADALINE, MADALINE, RBF networks , Widrow Hoff, learning rule, Delta learning rule, Back Propagation algorithm, Un-Supervised Learning algorithms- Hebbian Learning, Winner take all, Self Organizing Maps, Adaptive Resonance Theory: Architecture, classifications, Implementation and training. Associative Memory	8	2
3	Fuzzy Logic:	Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions, Fuzzy rule base system : fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, Mamdani Fuzzy Models – Sugeno Fuzzy Models, Adaptive Neuro-Fuzzy Inference Systems Architecture	8	3
4	Optimization	Derivative-based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton's Method, Simulated Annealing, Random Search, Downhill Simplex Search Derivative-free Optimization- Genetic algorithm Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, mutation operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional methods.	8	4
5	Evolutionary Computing	Evolutionary Computing: Genetic programming (GP), Ant colony optimization (ACO), Particle swarm optimization (PSO), Artificial Immune System (AIS).	8	5

Reference Books:

1. S, Rajasekaran& G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications", PHI Publication.
2. S.N. Sivanandam& S.N. Deepa, "Principles of Soft Computing", Wiley Publications.
3. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India.
4. SAndries P Engelbrecht, Computational Intelligence: An Introduction, Wiley Publications.

e-Learning Source:

https://onlinecourses.nptel.ac.in/noc22_cs54/preview

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	3	1	2	1	3	1	2	1	2	1	2	2
CO2	3	2		1	1	2	3	2	2	2	3		3	2	2
CO3	2	2		2	1	1		2	3	1	1		2	1	2
CO4	3	2		2	3	1	1	3	2		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: 2019-20							
Course Code	**CS 519**	**Title of the Course**	**SOFT COMPUTING LAB**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	I	**0**	**0**	**2**	**2**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	• Artificial Intelligence, Various types of production systems, characteristics of production systems. • Neural Networks, architecture, functions and various algorithms involved. • Fuzzy Logic, Various fuzzy systems and their functions. • Genetic algorithms, its applications and advances.						

Course Outcomes	
CO1	1. Learn about soft computing techniques and their applications
CO2	2. Analyze various neural network architectures
CO3	3. Understand perceptrons and counter propagation networks.
CO4	4. Define the fuzzy systems
CO5	5. Analyze the genetic algorithms and their applications.

Sr. No.	List of Experiments	Contact Hrs.	Mapped CO
1	Exposure to Scilab Script &Functions.	2	1
2	Write a program for Recursion inScilab.	2	1
3	Write a program in Scilab for decision control andloops.	2	2
4	Write a program in Scilab for surfaceplots	2	2
5	Write a program in Scilab for FileHandling.	2	2
6	Find whether the given matrix is (a) reflexive (b) tolerance and (c) transitivity matrix or not by writing a Scilabprogram.	2	3
7	Find whether the given matrix is symmetry or not by writing a Scilabprogram.	2	3
8	Write aprograminScilab tocalculateunion,intersection,complement anddifferenceoftwo fuzzysets	2	3
9	Find the fuzzy relation between two vectors R and S, Using max–product and max-min method by writing aScilabprogram.	2	4
10	Illustrate different types of generalized bell membership functions using Scilabprogram	2	4
11	DesignnetworksofMcCullochPittsneuronsthatimplementlogicalNOT,AND and OR gates. Draweachnetwork and label all the weight and thresholdvalues	2	4
12	WriteaprogramofPerceptronTrainingAlgorithm.	2	5
13	Write a program to implement deltarule.	2	5
14	WriteaScilabprogramforHebbnettoclassifytwodimensionalinputpatternsbipolarwiththeirtargetsgiven „*“ indicates a „+1“ and „.“ Indicates „-1“.	2	5
15	Implement Classical Genetic Algorithm inScilab	2	5
16	Write a Scilab program for Linear & Quadraticoptimization.	2	5

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

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

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**CS 521**	**Title of the Course**	**Advance Distributed Operating Systems Lab**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	II	**0**	**0**	**2**	**2**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	To understand the challenges of the system software in modern era computing like cloud computing, Big-data analytics and IoT						

Course Outcomes	
CO1	Elucidate the foundations and issues of distributed systems
CO2	Understand the various synchronization issues and global state for distributed systems.
CO3	Understand the Mutual Exclusion and Deadlock detection algorithms in distributed systems.
CO4	Describe the agreement protocols and fault tolerance mechanisms in distributed systems.
CO5	Describe the features of peer-to-peer and distributed shared memory systems

Sr. No.	**Experiment**	**Contact Hrs.**	**Mapped CO**
1	ulate the functioning of Lamport's Logical Clock in"C"	2	1
2	Simulate the Distributed Mutual Exclusion in"C	2	1
3	lement a Distributed Chat Server using TCP Sockets in"C".	2	2
4	lement "Java RMI" mechanism for accessing methods of remote systems.	2	2
5	lement concurrent client serverapplication.	2	2
6	lement concurrent daytime client serverapplication	2	3
7	te a program to increment counter in sharedmemory.	2	3
8	ign a Distributed Application using RMI for remotecomputation	2	4
9	ign a Distributed Application using Message passing Interface for remote computation	2	4
10	ign a Distributed application using socket. Application consists of a server which takes an integer rvalue from the client, calculates factorial and returns the result to the Client program	2	5

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO4
CO1	3	3	2	3	3					2	1	2	2	3	4
CO2	1	3	4	2	1	4		1	1	2	2	1			3
CO3	3	3	3	1	1	1				2	2	2	2	2	3
CO4	1	2	1	2	4	2	2	3	2	2			1	2	1
CO5	3	1	1	2	1	2	1	3	1	2	1	2	1	2	2

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS 522**	**Title of the Course**	advanced computer architecture	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	II	**3**	**1**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	The objective of this course is to analyze parallel computing and parallelism at various levels of the job, identify the various conditions of parallelism, and elaborated the various interconnection network. It also focuses on identifying the pipeline hazards,latency in pipeline collision vector.						

Course Outcomes	
CO1	Know about the concepts of computer architecture, computer design, high-performance computer
CO2	Know about the concepts of performance metrices parallel computer, and advanced processor technology.
CO3	Know about the concepts of memory, memory hierarchy, network memory,
CO4	Know about the concepts of RAID, various interconnection network
CO5	Know about the concept of pipeline, pipeline designing, linear and non linear pipilene

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Fundamentals of Computer design	Fundamentals of Computer design, state of computing, parallel computing, parallel computing model, multiprocessor and multi computer. Parallel architecture classification scheme, Performance metrics and measures, scalability analysis and approach, speedup performance law, parallel processing application, quantitative principles of computer design	8	1
2	Advanced processor technology	Advanced processor technology, superscalar and vector processor, Instruction level parallelism (ILP)- over coming data hazards- reducing branch costs – high performance instruction delivery hardware-based speculation- limitation of ILP, ILP software approach- compiler techniques static branch prediction- VLIW approach- H.W support for more ILP at compile time- H.W verses S.W solutions.	8	2
3	Memory hierarchy design	Memory hierarchy design- cache memory organization, cache performance, reducing cache misses' penalty and miss rate, virtual memory technology, protection and examples of VM. Backplane bus system, symmetric shared memory architectures- distributed shared memory Synchronization- multi threading	8	3
4	Storage systems- Types	Storage systems- Types – Buses - RAID- errors and failures- bench marking a storage device designing an I/O system. Inter connection networks and clusters, network properties and routing, static connection network, dynamic connection network	8	4
5	Introduction to High Performance Computing	Introduction to High Performance Computing: Overview, Pipeline v/s Parallel Processing Parallel Architectures Performance. Pipeline Processing: Pipeline performance, design of arithmetic pipelines, multifunction pipes, concept of reservation table, collision vector and hazards. Instruction Processing Pipes: Instruction and data hazard, hazard detection and resolution	8	5

Reference Books:

1. Computer Architecture A quantitative approach 3rd edition John L. Hennessy & David A. Patterson Morgan Kufmann (An Imprint of Elsevier)
2. Computer Architecture and parallel Processing" Kai Hwang and A. Briggs International Edition McGraw-Hill
3. . Advanced Computer Architectures, Dezso Sima, Terence Fountain, Peter Kacsuk, Pear son
4. Advance computer architecture ,Kai Hwang, Tata Mc Graw hill Prerequisite – None Corequisite – None

e-Learning Source:

https://onlinecourses.nptel.ac.in/noc22_cs10/preview

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	4
CO2	1	3	4	2	1	4		1	1	2	2	1			3
CO3	3	3	3	1	1	1				2	2	2	2	2	3
CO4	1	2	1	2	4	2	2	3	2	2			1	2	1
CO5	3	1	1	2	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	CS 523	**Title of the Course**	Pattern Recognition	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	**3**	**1**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	1. To implement pattern recognition and machine learning theories. 2.To design and implement certain important pattern recognition techniques. 3. To apply the pattern recognition theories to applications of interest. 4. To implement the entropy minimization, clustering transformation and feature ordering. 5. To introduce the curse of dimensionality and various methods of dimensions reduction						

Course Outcomes	
CO1	Implementation of pattern recognition and machine learning theories.
CO2	Designing and implementing certain important pattern recognition techniques.
CO3	Applying the pattern recognition theories to applications of interest.
CO4	Implementation of the entropy minimization, clustering transformation and feature ordering
CO5	Knowledge about the curse of dimensionality and various methods of dimensions reduction

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	INTRODUCTION	Basic concepts, Applications, Fundamental problems in pattern Recognition system design, Design concepts and methodologies, Examples of Automatic Pattern recognition systems, Simple pattern recognition model. DECISION AND DISTANCE FUNCTIONS -Linear and generalized decision functions, Pattern space and weight space, Geometrical properties, implementations of decision functions, Minimum-distance pattern classifications.	8	1
2	PROBABILITY	Probability of events: Random variables, Joint distributions and densities, Movements of random variables, Estimation of parameter from samples. STATISTICAL DECISION MAKING- Introduction, Baye's theorem, Multiple features, Conditionally independent features, Decision boundaries, Unequal cost of error, estimation of error rates, the leaving -one-out-techniques, characteristic curves, estimating the composition of populations. Baye's classifier for normal patterns.	8	2
3	NON PARAMETRIC DECISION MAKING	Introduction, histogram, kernel and window estimation, nearest neighbour classification techniques. Adaptive decision boundaries, adaptive discriminate functions, Minimum squared error discriminate functions, choosing a decision making techniques. CLUSTERING AND PARTITIONING- Hierarchical Clustering: Introduction, agglomerative clustering algorithm, the single -linkage, complete-linkage and average -linkage algorithm. Ward's method Partition clustering-Forg's algorithm, K-means's algorithm, Isodata algorithm.	8	3
4	PATTERN PREPROCESSING AND FEATURE SELECTION	Introduction, distance measures, clustering transformation and feature ordering, clustering in feature selection through entropy minimization, features selection through orthogonal expansion, binary feature selection.	8	4
5	SYNTACTIC PATTERN RECOGNITION & APPLICATION OF PATTERN RECOGNITION	Introduction, concepts from formal language theory, formulation of syntactic pattern recognition problem, syntactic pattern description, recognition grammars, automata as pattern recognizers, Application of pattern recognition techniques in bio-metric, facial recognition, IRIS scon, Finger prints, etc.	8	5

Reference Books:

Richard duda, Hart, David Strok, "Pattern Classification", John Wiley.

2. Digital Image Processing, M.Anji Reddy, Y.Hari Shankar, BS Publications.

e-Learning Source:

https://onlinecourses.nptel.ac.in/noc19_ee56/preview

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

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

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	CS-520	**Title of the Course**	Advanced Distributed Operating System	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	**3**	**1**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	To understand the foundations of distributed systems. To learn issues related to clock Synchronization and the need for global state in distributed systems. To learn distributed mutual exclusion and deadlock detection algorithms. To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems. To learn the characteristics of peer-to-peer and distributed shared memory systems						

Course Outcomes	
CO1	Elucidate the foundations and issues of distributed systems
CO2	Understand the various synchronization issues and global state for distributed systems.
CO3	Understand the Mutual Exclusion and Deadlock detection algorithms in distributed systems.
CO4	Describe the agreement protocols and fault tolerance mechanisms in distributed systems.
CO5	Describe the features of peer-to-peer and distributed shared memory systems

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Advanced Operating Systems:	Overview and architecture, Distributed computing models and their comparison, Client Server Models: addressing, architecture, implementation. Case Study.' World Wide Web 1.0 Interprocess Communication: API for internet protocol, Marshalling. Client server communication, group communication Case Study.' CBCAST protocol in ISIS.	9	1
2	Distributed objects and remote invocation:	-communication between Distributed objects, RPC, events and notification Case Study: Java RMI Operating System Support: Operating System layer. Protection , processes ands threads, operating system architecture Distributed clock synchronization: physical clock , logical clock.	8	2
3	Distributed File System:	Models, service interface and directory interface design, DFS system structure, Case Study: Google file system. Security in distributed systems: problems and design issues, Faulttolerance and recovery: basic concepts, faultmodels, agreement problems andits applications, commit protocols, voting protocols, checkpointing and recovery	8	3
4	Distributed Multimedia systems:	Characteristics of multimedia, multimedia data. Quality of service management, resorce management, stream adaptation. Case Study: Tiger video file server. Distributed shared memory: design and implementation issues, sequential consistency and Ivy. Case Study: Munin.	8	4
5	Real time distributed operating system:	Design issues, distributed communicatins in LAN and WAN, scheduling: static and dynamic, scheduling algorithms, Case Study: MARS. Emerging trends in distributed computing: Introduction, Grid computing-architeture application, SOA overview, design, service oriented grid, advantages and future scope, Cloud computing- feature and architecture.	9	5

Reference Books:

1. Distributed Systems — Coulouris [Pearson Education]
2. Distributed Operating Systems- Tannenbaum [Pearson Education]
3. Distributed Systems:Principles andParadigms —Tannenbaum[Pearson

e-Learning Source:

https://onlinecourses.nptel.ac.in/noc21_cs87/preview

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

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	CS-524	**Title of the Course**	Software Testing & Quality Management	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	**4**	**0**	**0**	**4**
Pre-Requisite	1. None	**Co-requisite**	None				
Course Objectives	1. To understand and describe software testing in general. 2. To understand various testing techniques. 3. To understand various software testing strategies. **4.** To identify the role of software testing in software quality improvement.						

Course Outcomes	
CO1	Develop and manage test plan as per the software testing guidelines.
CO2	Apply software testing techniques to uncover errors.
CO3	Develop test cases on the basis of different testing strategies.
CO4	Plan, assess and improve the quality of software.
CO5	Work on standard quality models.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Software Testing	Evolution, Myths, Facts, Goals, Psychology, Models, Principles, Axiom of Testing, Study of Bugs: Classification, Priority, Severity and their tracking. Software Testing: Terminology, Life cycle, Methodology, Types of Testing, Test planning: Test Plan Specification, Leveled Test Plan, Development of Test Plan ,Master Test plan ,Phase Wise Test Plan, Test management, Software Testing Guidelines, Defect Management, Analyzing & Reporting Test.	8	1
2	Testing Technique	Static Testing: Inspection, Structured Walkthrough, Technical reviews, Automated Techniques ,Black box testing, Types of Black box Testing: Requirement based Testing, Positive & Negative Testing, Boundary Value Analysis, Compatibility Testing, Domain Testing, Graph Based Testing, Robustness Testing , Syntax Testing, Finite State Testing, CauseEffect Graphing Based Testing. White Box Testing, Types of White box Testing: Basis Path Testing, Control Structure Testing, Mutation Testing, and Gray Box Testing. Software Testability, Software Test Automation, Test Metrics and its Measurements.	8	2
3	Software Testing Strategies	Model for Software Testing, Unit Testing, Integration, System & Acceptance Testing: Alpha Testing, Beta Testing, Stress testing, Load testing, Reliability Testing, Scalability Testing . Performance Testing, Regression Testing, Ad-hoc Testing, Usability and Accessibility Testing, Object Oriented Testing: Object-Oriented Testing Model, Object-oriented Software Test Strategy.	8	3
4	Introduction to Software Quality	Concepts of quality, perspectives and expectations, Quality Framework, Quality engineering: Activity and process, Quality planning, Quality assessment and improvement. Quality assurance: Classification, Q.A activities, Q.A. Techniques, Defect prevention and process improvement, Software Inspection, Formal Verification, Introduction to Software Reliability Engineering, Software Quality Measurement & Metrics.	8	4
5	Quality Models	McCall's model, Bohem's model, Dromey's model, FURPS Model,ISO-9126 Model, Cost Of Quality, Software Quality Factors, Quality Control , CMMI-Framework : Process Area Components, Capability & Maturity Levels, Relationship Among Process Areas.	8	5

Reference Books:

1. Software Testing : K.Mustafa,R.A. Khan ,Narosa
2. Software Testing : Srinivasan Desikan,Pearson
3. Software Testing : Naresh Chauhan , Oxford
4. Software Quality Engineering : Jeff Tian ,Wiley
5. Software Testing Fundamentals: Marnie L.Hutcheson,Wiley
6. Software Testing : Ron Patton, Pearson

e-Learning Source:

https://onlinecourses.nptel.ac.in/noc19_cs71/preview

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

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

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**CS-525**	**Title of the Course**	Advance Concepts of Database Design	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	II	**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 and how the underlying queries compute. • To give the knowledge about database tuning and object oriented database concepts • To give knowledge and understandings of distributed databases. • Explain basic issues of database security and how to built secure databases. • To give the knowledge about the working of emerging databases.						

Course Outcomes	
CO1	Know about the concepts of indexing, query processing & query optimization. Evaluation of expressions and cost estimation.
CO2	Have knowledge about database tuning and concept building of object-oriented database systems and the terminologies used.
CO3	Know about the distributed database systems, their types, data fragmentation, data replication, deadlock handling and concurrency control techniques used in distributed databases.
CO4	Know about database security threats, issues, role of DBA, database audits and discretionary access control.
CO5	Have knowledge about enhanced data models (active databases, temporal databases, statistical databases, & multimedia databases) for advanced applications.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Indexing	Indexing – Primary & Secondary Index, Multilevel Indexing, B tree Indexing, B+ tree indexing, Hashing- Static & dynamic. Query Processing- Measures of query cost, selection operations, Join operations, Evaluation of expressions-Materialization, Pipelining. Query Optimization- Introduction, generating equivalence relation, Transformation of relational expression- equivalence rules, Choice of evaluation plans, Cost estimation- cost based optimization, Heuristic optimization, Statistical Information for Cost Estimation.	8	1
2	Database Tuning-& Object Oriented Database System	Database Tuning- Database workload, Physical design and tuning decisions, Need for database tuning, Index selection, Tuning Indexes, Tuning the conceptual schema, Tuning queries and views, DBMS Benchmarks. Object Oriented Database System- properties, need for OODBMS, Structured types, Inheritance, Multiple Inheritance, Object identity, Object containment, Nested Relational Model.	8	2
3	Distributed Database System	Distributed Database System- Heterogeneous and Homogeneous Databases, Distributed Data Storage –Data replication, Data fragmentation, Distributed Transactions, Concurrency Control in Distributed Databases Commit Protocols –Two-Phase commit, Three- Phase commit, Deadlock handling, Distributed Query Processing In R * System .	8	3
4	Database Security	Database Security- Database Security and Authorization, Introduction to Database Security Issues, Types of Security, Database Security and DBA, Access Protection, User Accounts, and Database Audits Access Control and Grant & Revoke on Views and Integrity Constraints, Discretionary Access Control, Role of DBA, Security in Statistical Databases.	7	4
5	Enhanced Data Model for Advanced Applications	Enhanced Data Model for Advanced Applications- Active database concept and triggers and their design and implementation issues, Temporal data base concepts, Spatial and multimedia databases, Introduction to deductive databases, introduction to expert database system.	8	5

Reference Books:

1. Korth, Silberchatz, Sudarshan, "Database Concepts", Addison Wesley.
2. Majumdar & Bhattacharya, "Database Management System", TMH.
3. Elmastri, Navathe, "Fundamentals of Database Systems", Addison Wesley.
4. Date C.J., "An Introduction to Database System", Addison Wesley.
5. Ramakrishnan, Hadzilacous, Goodman, "Concurrency Control & Recovery", Addiosn Wesley.
6. Ceri & Palgatti, "Distributed Databases", McGraw Hill.

e-Learning Source:

https://nptel.ac.in/courses/106105175

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

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS-528**	**Title of the Course**	Forensic & Cyber Crime	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	II	**4**	**0**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	To understand underlying principles and many of the techniques associated with the digital forensic practices and cyber-crime. To explore practical knowledge about ethical hacking methods. To learn the importance of evidence handling and storage for various devices. To develop an excellent understanding of current cyber security issues (Computer Security Incident) and analyzed the ways that exploits in securities. To investigate attacks, IDS. technical exploits and router attacks and "Trap and Trace" computer networks. To apply digital forensic knowledge to use computer forensic tools and investigation report writing						

Course Outcomes	
CO1	Demonstrate competency in the principles of crime scene investigation, including the recognition, collection, identification, preservation, and documentation of physical evidence.
CO2	Underline the need of digital forensic and role of digital evidences. List the method to generate legal evidence and supporting investigation reports and will also be able to use various digital forensic tools.
CO3	Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection
CO4	Demonstrate the ability to document and orally describe crime scenes, physical evidence, and scientific processes.
CO5	Identify and examine current and emerging concepts and practices within the forensic science field.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Cyber Forensic Basics	Introduction to Cyber Forensics, Storage Fundamentals, File System Concepts, Operating System Software and Basic Terminology, Introduction to Encase Forensic Edition, Analysis and Advanced Forensic Tool Kit. Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics.	8	1
2	Cyber Crimes and Cyber Laws-Introduction	Introduction to IT laws & Cyber Crimes – Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Mail Bombs, Exploitation, Stalking and Obscenity in Internet. Information Technology Act, 2000. Intellectual Property Right, Penalties Under IT Act Offences, Digital Signature and Electronic Signature Under IT Act Statutory Provisions Establishment of Authorities and their functions, Certifying Authorities & Cyber Regulation Appellate	8	2
3	Cyber Forensics Investigation-	Introduction to Cyber Forensic Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Encryption and Decryption methods, Search and Seizure of Computers, Recovering deleted evidences, Password Cracking.	8	3
4	Data and Evidence Recovery:	Data Recovery, Introduction to Deleted File Recovery, Formatted Partition Recovery, Data Recovery Tools, Data Recovery Procedures and Ethics, Preserve and safely handle original media, Document a "Chain of Custody", Complete time line analysis of computer files based on file creation, file modification and file access.	7	4
5	Cyber Security-	Cyber Security- Introduction to Cyber Security, Implementing Hardware Based Security, Software Based Firewalls, Security Standards, Assessing Threat Levels, Forming an Incident Response Team, Reporting Cyber crime, Operating System Attacks, Application Attacks, Reverse Engineering & Cracking Techniques and Financial Frauds.	10	5

Reference Books:

1. 1. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics ", Tata McGraw -Hill, New Delhi, 2006.
2. Robert M Slade," Software Forensics", Tata McGraw - Hill, New Delhi, 2005.
3. Faiyaz Ahmad, "Cyber law and Information Security", Dreamtech, New Delhi, 2013.

http://www.ifs.edu.in/cyber-forensics-cyber-crimes-cyber-security-cyber-law/

e-Learning Source:

https://onlinecourses.nptel.ac.in/noc22_cs117/preview

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

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	CS-530	**Title of the Course**	Applied Data Mining and Warehousing	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	**4**	**0**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives							

Course Outcomes	
CO1	Develop a strong foundation of knowledge about data warehouse and related techniques.
CO2	Design and build a data warehouse from the available historical data and perform OLAP operations to discover knowledge.
CO3	Preprocess the data using cleaning, integration, transformation and reduction and find associations and correlations among that data.
CO4	Classify the given dataset by using statistical and probabilistic models to predict the class labels of new data.
CO5	Perform cluster analysis by using some major clustering methods and work on the recent advancements on text and web mining.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Overview & Concepts-	Introduction to Data Warehousing, Data Warehousing Features, Data Warehouses and Data Marts; Difference between Operational Database Systems and Data Warehouses; Data Warehouse Implementation; Multidimensional Data Model, Data Warehouse Implementation, Further Development of Data Cube Technology, Architecture: Understanding Data Warehouse Architecture, Architectural Framework.	8	1
2	Technical Architecture	Introduction to Principles of Dimensional Modeling; Data Extraction, Transformation, and Loading, OLAP in the Data Warehouse: Demand for Online Analytical Processing, Major Features and Functions, OLAP Models; From Data Warehousing to Data Mining, Data Preprocessing: Needs Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, iscretization and Concept Hierarchy Generation.	8	2
3	Data Mining	Introduction, Data Mining Functionalities, Classification of Data Mining System; Data Mining Primitives, Languages, and System Architectures: Data Mining Primitives, Data Mining Query Languages, Designing Graphical User Interfaces Based on a Data Mining Query Language Architectures of Data Mining Systems Concepts Description: Characterization and Comparison: Data Generalization and Summarization-Based Characterization, Analytical Characterization: Analysis of Attribute Relevance, Mining Class Comparisons: Discriminating between Different Classes, Mining Descriptive Statistical Measures in Large Databases.	8	3
4	Mining Association Rules in Large Databases	Association Rule Mining, Mining Single-Dimensional Boolean Association Rules from Transactional Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses Classification and Prediction: Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification Based on Concepts from Association Rule Mining	8	4
5	Cluster Analysis Introduction	Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Outlier Analysis. Mining Complex Types of Data: Multidimensional Analysis and Descriptive Mining of Complex, Data Objects, Mining Spatial Databases, Mining Multimedia Databases, Mining Time-Ser ies and Sequence Data, Mining Text Databases, Mining the World Wide Web	8	5

Reference Books:

2. Jiawei Han, Micheline Kamber, "Data Mining Concepts & Techniques" Elsevier.
2. Mallach,"Data Warehousing System",McGraw –Hill.
3. H.Dunham,"Data Mining:Introductory and Advanced Topics" Pearson Education.
4. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World : A Practical Guide for Building Decision Support Systems, . Pearson Education
5. Data Mining: The Textbook Springer;2015th Edition

e-Learning Source:

https://onlinecourses-archive.nptel.ac.in/noc17_mg24/preview

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	4
CO2	1	3	4	2	1	4		1	1	2	2	1			3
CO3	3	3	3	1	1	1				2	2	2	2	2	3
CO4	1	2	1	2	4	2	2	3	2	2			1	2	1
CO5	3	1	1	2	1	2	1	3	1	2	1	2	1	2	2

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

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	**CS-529**	**Title of the Course**	**Digital image Processing**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	II	**4**	**0**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	1. To explain basics of digital signal processing such as Fourier analysis 2. To expose students to different low level image processing tasks such as filtering, edge detection etc. 3. To impart knowledge of image compression as well as various image Segmentation techniques. 4 . To introduce advanced image processing algorithms for face detection and recognition						

Course Outcomes	
CO1	After the completion of the course the student should be able to
CO2	Apply image processing techniques for solving problems in computer science
CO3	Explain basic image processing techniques for solving real problems
CO4	Apply image processing techniques for solving problems in computer science
CO5	Evaluate algorithms for higher level image processing.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Digital Image Fundamentals	Image Sensing, and Acquisition, Image Sampling and Quantization, Basic Relationship between Pixels. Sensor and Imaging: Imaging Optics, Radiometry of Imaging, illumination sources andtechniques, Camera Principles,Color Imaging, Single Sensor ColorImaging ndColorDemosaicing,RangeImages,3DImaging.	8	1
2	SignalRepresentation	VectorSpaceandUnitaryTrasnsforms,Multi- ResolutionalSignalRepresentation, Wavelet Decomposition,Scalespaceanddiffusion,Representationofcolor,RetinexProcessing,MarkovRandomFieldModellingsofImages	10	2
3	Non-linear Image Processing	Median and Order Statistics Filters, Rank-Ordered-Mean Filtersand Signal Dependent Rank-Ordered-Mean Filters, Two Dimensional Teager Filters, Applications of nonlinear filters in image enhancement,edge detections, noise removal etc.	8	3
4	ImageProcessinginBiometricSecurity	Introduction, Fingerprint Recognition,Face Recognition, Iris Recognition,Vein Pattern Recognition, Multimodal Biometrics Techniques. Biometric System Architeture, Extraction Algorithm,Matching Algorithm, Authentication, Biometric System Evaluation, Privacyissues.	8	4
5	Image Processing in Medical Field	Image Processing in Medical Field: Introduction, CT scan images, MRI, Seeded segmentation methods : Desirableproperties, Pixel Based Methods, Contour Based Methods,Geodesic Active Contours, level set method, deformablemodel, graph based method, Image analysis of retinal images :acquisition,preprocessing	10	5

Reference Books:

3. R.C Gonzalez and R.E. Woods, " Digital Image Pr ocessing" , Addison Wesley, 1992.
2. A.K.J ain, " Fundamentals of Digital Image Pr ocessing" , Pr entice Hall of India.
3. Digital Image Processing–M. Anji Reddy, BSPublications.

e-Learning Source:

https://archive.nptel.ac.in/content/storage2/courses/117104069/chapter_1/1_4.html

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

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