INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: Big Data
COURSE CODE: CS-609

COURSE OBJECTIVES:

1. To study the basic technologies that forms the foundations of Big Data. .
2. To study the programming aspects of cloud computing with a view to rapid prototyping of complex applications.
3. To understand the specialized aspects of big data including big data application, and big data analytics.
4. To study different types Case studies on the current research and applications of the Hadoop and big data in industry

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Student must be Able to understand the building blocks of Big Data
CO2	Student must be able to articulate the programming aspects of cloud computing(map Reduce etc)
CO3	Student must be able to understand the specialized aspects of big data with the help of different big data applications
CO4	Student must be able to represent the analytical aspects of Big Data
CO5	Student must be know the recent research trends related to Hadoop File System, MapReduce and Google File System etc

CO-PO MAPPING:

↓CO\PO→	PO1: Ability to apply knowledge of science, computing and mathematics to deal with	PO2: Ability to analyze the computer engineering problems, formulate them in order to	PO3: Ability to develop and design solutions based on analysis to solve engineering	PO4: Ability to handle complex and interdisciplinary engineering problems by using	PO5: Ability to apply state of the art tools and techniques in order to achieve economic	PO6: Ability of being aware about the existing social problems and keen to find their	PO7: Ability to provide environment friendly and sustainable solutions.	PO8: Ability to understand their professional and ethical responsibility.	PO9: Ability to work as an individual as well as in teams.	PO10: Ability to communicate with the stake holders by applying their soft skills.	PO11: Ability to manage the day to day challenges by optimizing the project resources.	PO12: Ability to engage and encourage themselves in continuous learning process in
CO1:Student must be Able to understand the building blocks of Big Data	1	2		3	1		3	2				1
CO2:Student must be able to articulate the programming aspects of cloud computing(map Reduce etc)			2	3	3				2	3	1	1
CO3:Student must be able to understand the specialized aspects of big data with the help of different big data applications	1	3			2	1		2	3			
CO4:Student must be able to represent the analytical aspects of Big Data			1	2			3			3	2	1
CO5:Student must be know the recent research trends related to Hadoop File System, MapReduce and Google File System etc	1	2	3		1	2		3				
3: Strong Association, 2: Average Association, 1: Low Association												

COURSE: CYBER LAW & INFORMATION SECURITY
COURSE CODE: CS-203

COURSE OBJECTIVES:

1. Knowledge about cyber law, intellectual property and cyber crimes(internet security threats), trademarks and domain theft
2. Knowledge on the disciplines of technology, E-business and law to allow them to minimize the occurrence and severity of information security incidents.
3. Knowledge about Information System and principles of Information Security (as confidentiality, integrity, and availability)
4. Knowledge of cryptography and techniques used to detect and prevent network intrusions.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

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

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Understand key terms and concepts in cyber law, intellectual property and cyber crimes(Internet security threats), trademarks and domain theft	3	2				3		3	2			2
CO2	Keep an appropriate level of awareness, knowledge and skill on the disciplines of technology, E-business and law to allow them to minimize the occurrence and severity of information security incidents.	3	3				1		2				2
CO3	Understand about Information System and principles of Information Security (as confidentiality, integrity, and availability)	3	2				2	3	2				3
CO4	Understand about cryptography and techniques used to detect and prevent network intrusions.	3	2				3	2	2				2
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: Compiler Design
COURSE CODE: CS315

COURSE OBJECTIVES:
- Understand the process of language translation.
- Able to design and implement Lexical analyzer with the help of rules given in standard notation.
- Design and evaluate Parsers with the help of CFG.
- Design Semantic rules and generate intermediate code for the language specified.
- Optimize and generate efficient compiler.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand the Process and complexities of language translation.
CO2	Given the set of rules in the form of Regular expressions, would be able to design and implement Lexical analyzer for the language defined by the regular expressions.
CO3	Given the Context free grammar rules for the language, would be able to design and evaluate various Parsers for the language.
CO4	For the given translation rules, would be able to design Semantic rules and Intermediate Code specified by the semantic rules.
CO5	Given the various constraints of the programming structures, would be able to optimize the intermediate code generated and improve the efficiency of the final compiler.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 Understand the Process and complexities of language translation.	1	1							1	1		2
CO2 Given the set of rules in the form of Regular expressions, would be able to design and implement Lexical analyzer for the language defined by the regular expressions.	3	3	3	1	3				1	1	1	2
CO3 Given the Context free grammar rules for the language, would be able to design and evaluate various Parsers for the language.	3	3	3	1	3				1	1	1	2
CO4 For the given Semantic rules, would be able to design Intermediate Code specified by the semantic rules.	2	3	3	1	3				1	1	1	2
CO5 Given the various constraints of the programming structures, would be able to optimize the intermediate code generated and improve the efficiency of the final compiler.	2	3	3	1	2		1		1	1	1	2
3: Strong contribution, 2: average contribution, 1: Low contribution												

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: DATA WAREHOUSING & DATA MINING
COURSE CODE: CS418

COURSE OBJECTIVES:

- Understand the concepts of Data Warehouse and its building blocks.
- Study the architecture of Data Warehouse and the essential processes in building a data warehouse.
- Study of data mining functionalities, related technologies and its techniques.
- Study of various classification and prediction algorithms.
- Study of major clustering techniques and current trends in data mining.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
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.

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: ADVANCE CLOUD COMPUTING
COURSE CODE: CS606

COURSE OBJECTIVES:

- To study the basic technologies that form the foundations of cloud computing.
- To study the programming aspects of cloud computing with a view to rapid prototyping of complex applications.
- To understand the specialized aspects of cloud computing including cloud application, cloud security, and big data analytics
- Case study on the current research and applications of the cloud in industry

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Apply his knowledge to develop a cloud environment using hardware and software virtualization techniques and perform MapReduce job execution
CO2	Use common cloud services and components of Hadoop ecosystem in order to solve a real world problem.
CO3	Utilize the SOA and MVC techniques, classify and cluster Big Data and able to develop a recommendation system
CO4	Develop highly secured and high performance cloud applications.
CO5	Develop a research attitude in emerging fields of cloud computing and write quality research papers.

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: COMPUTER PROGRAMMING
COURSE CODE: CS101

COURSE OBJECTIVES:

- To give knowledge of computers, networks, algorithms & flowcharts.
- To provide fundamental concepts of programming language 'C'.
- To show the use of functions and pointers to different problems.
- To study the implementation of arrays, matrices and strings.
- To give concepts of user defined data types structure & union.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand basic concepts of computer, networks and formulation of algorithmic solutions to problems.
CO2	Understanding of programming concepts of C language and their implementation.
CO3	Analyze and develop programs on pointers and functions.
CO4	Develop programs on different operations on arrays, matrices & strings.
CO5	Implement programs on structure, union & Dynamic memory allocation.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 Understand basic concepts of computer, networks and formulation of algorithmic solutions to problems. .	2	2	3	1					2			3
CO2 Understanding of programming concepts of C language and their implementation.	2	3	3	2					2			1
CO3 Analyze and develop programs on Pointers and Functions.	3	3	2	2					2			1
CO4 Develop programs on different operations on Arrays, matrices & Strings.	2	2	3	2					2			1
CO5 Implement programs on Structure, Union & Dynamic memory allocation.	2	2	2	2					2			1
3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: OBJECT ORIENTED PROGRAMMING & C++
COURSE CODE: CS205

COURSE OBJECTIVES:

- Give the basic concepts of OOPs principles and modeling
- Provide fundamental concepts of programming language 'C++'.
- Study the concepts of classes and objects.
- Study the implementation of concepts of polymorphism, inheritance, constructor & destructors.
- Give the concepts of files, templates and exceptional handling.

Course Outcomes	
After completion of the course, a student will be able to	
CO1	Understand concepts of OOP and modeling for real world problem.
CO2	Understanding of programming concepts of C++ language
CO3	Develop programs based on classes and objects.
CO4	Analyze & develop programs on function & operator overloading, constructors, destructors, Inheritance and virtual functions.
CO5	Develop programs based on files and its operations, types of templates and exceptional handling mechanisms

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations in complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
	COs and POs MAPPING												
CO1	Understand concepts of OOP and modeling for real world problem.	3	3	3	1		1			2	2		1
CO2	Understanding of programming concepts of C++ language	3	3	2	2						2		2
CO3	Develop programs based on classes and objects..	3	3	3	2						2		3
CO4	Analyze & develop programs on function & operator overloading, constructors, destructors, inheritance and virtual functions.	3	3	2	3						2		3
CO5	Develop programs based on files and its operations, types of templates and exceptional handling mechanisms	2	3	3	3						2		2
	3: Strong contribution, 2: average contribution, 1: Low contribution												

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

COURSE: Advance concepts of Database design
COURSE CODE: CS 522

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 (CO): After completion of the course, a student will

COURSE OUTCOME (CO)	DESCRIPTION	Bloom's Taxonomy Level
CO1	Have knowledge about advance SQL queries and its applications.	Knowledge (level1), apply(level 3)
CO2	Have knowledge and understanding of distributed database.	Knowledge (Level 1) Understand (level 2)
CO3	Have knowledge about database tuning and Explain basic issues related to Database security.	Understand (level 2) Apply (level 3) Evaluate (level 5)
CO4	Have knowledge about PL/SQL and its implementation in various query process.	Knowledge (level1), apply(level 3)
CO5	Have knowledge and understanding of data warehouse and internet database.	Knowledge (level1), Evaluate (level 5)

CO-PO MAPPING:

CO	Description	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Have knowledge about advance SQL queries and its applications.	3	3	3	2	1	3			2	1		3
CO2	Have knowledge and understanding of distributed database.	3	3	1	2	1	2		1				1
CO3	Have knowledge about database tuning and Explain basic issues related to Database security.	3	3	2	1	2	2		3	2			3
CO4	Have knowledge about PL/SQL and its implementation in various query process.	3	3	3	2	3	3				1		2

| CO5 | Have knowledge and understanding of data warehouse and internet database. | 3 | 3 | 1 | 1 | 1 | 2 | 1 | | | | | 3\ |

3: Strong contribution, 2: average contribution, 1: Low contribution

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

COURSE: Data Communication and Computer Network
COURSE CODE: CS 514

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 protolcols 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 (CO): After completion of the course, a student will be able to understand:

COURSE OUTCOME (CO)	DESCRIPTION	Bloom's Taxonomy Level
CO1	To understand the transmission media and type of switching	Knowledge (level1)
CO2	To analyze different networking functions and features of data link protocols and sliding window protocol.	Understand (level 2)
CO3	To apply different networking concepts for implementing network solution	Understand (level 2) Apply (level 3)
CO4	To evaluate and implement routing algorithms for implanting solution for the real life problems.	Analyze (level 4) Evaluate (level 5)
CO5	To implement model of fault tolerant computer networks.	Apply (level 3) Evaluate (level 5)

CO-PO MAPPING:

CO \ PO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	To understand the transmission media and type of switching	3	3	2	1	1	3				1		3
CO2	To analyze different networking functions and features of data link protocols and sliding window protocol.	3	3	3	2	1	1		1				2
CO3	To apply different networking concepts for implementing network solution	3	2	1	1	2	2	3		2			3

CO4	To evaluate and implement routing algorithms for implanting solution for the real life problems.	3	2	2	2	3	3				1		2
CO5	To implement model of fault tolerant computer networks.	3	1	1	1	1	2	1					2

3: Strong contribution, 2: average contribution, 1: Low contribution

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: Core Java
COURSE CODE: CS215

COURSE OBJECTIVES:

- Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- Be aware of the important topics and principles of software development.
- Have the ability to write a computer program to solve specified problems.
- Be able to use the Java SDK environment to create, debug and run simple Java programs.

COURSE OUTCOMES (CO): Upon successful completion of this course, students should be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Knowledge of the structure and model of the Java programming language, (knowledge)
CO2	Use the Java programming language for various programming technologies (understanding)
CO3	Develop software in the Java programming language, (application) .
CO4	Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (synthesis)
CO5	Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems.

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: ARTIFICIAL INTELLIGENCE
COURSE CODE: CS317

COURSE OBJECTIVES:

- Explain the basic problem solving techniques, knowledge representation methods and learning methods of Artificial Intelligence.
- Assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving particular engineering problems.
- Understand the role of knowledge representation, problem solving, and learning in intelligent-system engineering.
- Develop intelligent systems by assembling solutions to concrete computational problems.
- Develop an interest in the field sufficient to take more advanced subjects.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Design an intelligent agent to solve real world problems.
CO2	Identify the best heuristic for problem solving that will lead to find the optimal solution within constraints and adverse conditions.
CO3	Represent knowledge using logic programming, create knowledge base and apply inference mechanisms.
CO4	Apply statistical and probabilistic machine learning techniques for a real world problem in order to solve it.
CO5	Design and develop an expert system, solve problems using evolutionary programming, using swarm intelligence and develop programs using PROLOG

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 Knowledge of the structure and model of the Java programming language, (knowledge)	3	2	2	2		1						2
CO2 Use the Java programming language for various programming technologies (understanding)	3	3	3	2	2	1						2
CO3 Develop software in the Java programming language, (application) .	3	3	3	1	1	2						2
CO4 Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (synthesis)	3	2	2	2	3	3		2				3
CO5 Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems.	3	1	1	1		2						2

3: Strong contribution, 2: average contribution, 1: Low contribution

COURSE: E-Commerce

COURSE CODE: CS328

COURSE OBJECTIVES:
- Recognize the impact of Information and Communication technologies, especially of the
- Internet in business operations
- Recognize the fundamental principles of e-Business and e-Commerce
- Distinguish the role of Management in the context of e-Business and e-Commerce
- Explain the added value, risks and barriers in the adoption of e-Business and e-Commerce
- Examine applications of e-Commerce in relation to the applied strategic
- Use tools and services of the internet in the development of a virtual e-commerce site.

COURSE OUTCOMES (CO): Upon successful completion of this course, students should be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Demonstrate an understanding of the foundations and importance of E-commerce.
CO2	Demonstrate an understanding of retailing in E-commerce by: 1. analyzing branding and pricing strategies, 2. using and determining the effectiveness of market research 3. assessing the effects of disintermediation
CO3	Describe Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational
CO4	Describe the infrastructure for E-commerce, Describe the key features of Internet, Intranets and Extranets and explain how they relate to each other.
CO5	Assess electronic payment systems, Recognize and discuss global E-commerce issues.

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Demonstrate an understanding of the foundations and importance of E-commerce.	3	2	2	2		1						2
CO2	Demonstrate an understanding of retailing in E-commerce by: 4. analyzing branding and pricing strategies, 5. using and determining the effectiveness of market research 6. assessing the effects of disintermediation	3	3	3	2	2	1						2
CO3	Describe Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational	3	3	3	1	1	2						2
CO4	Describe the infrastructure for E-commerce, Describe the key features of Internet, Intranets and Extranets and explain how they relate to each other.	3	2	2	2	3	3		2				3
CO5	Assess electronic payment systems, Recognize and discuss global E-commerce issues.	3	1	1	1		2						2
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

COURSE: Principles of Operating System
COURSE CODE: CS303

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 (CO): After completion of the course, a student will be able to understand:

COURSE OUTCOME (CO)	DESCRIPTION
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	Analyze 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.

CO-PO MAPPING:

		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	The basic concepts of Operating System, its functions and services.	3	1	1	3	2	3				1		3
CO2	Design and effective memory management scheme for the operating system where there is less wastage and the response time is quick.	3	3	3	2	1	1			1			2
CO3	The basic concepts of Processes in Operating System and the application of various CPU scheduling algorithms.	3	2	1	1	2	2	3		2			3

CO4	Analyze the basic concepts of process synchronization, deadlock and related issues.	3	2	2	2	3	3				1		2
CO5	The basic components of file management, disk management etc and will become familiar with the protection and security mechanisms taken by operating system.	3	1	1	1	1	2	1					2
	3: Strong contribution, 2: average contribution, 1: Low contribution												

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INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

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COURSE: Theory of Automata & Formal languages
COURSE CODE: CS304

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 (CO): Upon successful completion of this course, students should be able to

COURSE OUTCOME (CO)	DESCRIPTION
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 modeling 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.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 To demonstrate computational mathematical models for problem solving and describe how they relate to formal languages.	2	2	2	2		1		1		1		2
CO2 To analyze the relationship among language classes and grammars with the help of Chomsky Hierarchy.	3	2	3	2	2	1						2
CO3 To apply rigorous formal mathematical model for proving different properties of grammars, languages and automata.	3	3	3	2	1	2			2			2
CO4 To apply mathematical foundations, algorithmic principles and computer science theory to the modeling and design of computer based systems in a way that demonstrates.	3	2	2	2	3	3	1	2		1	1	2
CO5 Have an overview of how the theoretical study in this course is applicable to and engineering application like designing the compilers.	3	2	1	1		2				2		2
3: Strong contribution, 2: average contribution, 1: Low contribution												

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

COURSE: Real Time System
COURSE CODE: CS320

COURSE OBJECTIVES:
- To introduce students with basic real time system concepts like tasks and scheduling.
- To critique how different types of real time scheduling is implemented in single processor and multiprocessor environments.
- To introduce the basic concepts of real time databases and their applications
- To provide the knowledge of basic concepts of fault tolerance, clocks and clock synchronization in real time systems.
- To introduce the basic concepts of real time network topologies and various real time networking protocols..

COURSE OUTCOMES (CO): After completion of the course, a student will be able to understand:

COURSE OUTCOME (CO)	DESCRIPTION
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.

CO-PO MAPPING:

CO	Description	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Apply the knowledge of operating system concepts to understand real time system concepts like tasks and scheduling.	2	1		1	2	3				1		3
CO2	Analyze the various parameters related to the different types of scheduling in single processor and multiprocessor environments.	2	3	2	3	1	1						2
CO3	The basic concepts of real time databases and their applications.	3	2	1	1	2	2	3		2			3
CO4	Apply the basic concepts of fault tolerance and clocks to design an effective real time system.	3	2	2	2	3	3				1		2
CO5	Understand the various protocols for effective resource sharing.	3	1	1	1	1	2	1					2
	3: Strong contribution, 2: average contribution, 1: Low contribution												

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

COURSE: Graph Theory
COURSE CODE: CS333

COURSE OBJECTIVES:
- Learn the fundamental concepts in graph theory in view of its applications in modern science.
- Learn to understand and create mathematical proofs, including an appreciation of its significance in C S.
- Use the concepts of Graph theory in subsequent courses in the design and analysis of algorithms, computability theory, software engineering and computer systems.
- Apply concepts of the theory of probability in study of random phenomena, analyzing and interpreting data that involves uncertainties

COURSE OUTCOMES (CO): After completion of the course, a student will be able to understand:

COURSE OUTCOME (CO)	DESCRIPTION	Bloom's Taxonomy Level
CO1	Demonstrate the knowledge of fundamental concepts in graph theory, including properties and characterization of graphs and trees.	Knowledge (level1)
CO2	Apply models of Graph theory, Probability theory respectively to solve problems of connectivity and uncertainty.	Understand (level 2) Apply (level 3)
CO3	Analyzing graphs, trees and random phenomena occurring in real life situations using Graph theory and Probability theory respectively.	Understand (level 2) Analyze (level 4)
CO4	Interpret the models of Graph theory, Probability theory for real life and engineering problems.	Apply (level 3)
CO5	Develop efficient algorithms for graph related problems in different domains of engineering and science.	Apply (level 3) Evaluate (level 5)

CO-PO MAPPING:

CO	Description	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Demonstrate the knowledge of fundamental concepts in graph theory, including properties and characterization of graphs and trees.	3	3	2	1	1	3				1		3
CO2	Apply models of Graph theory, Probability theory respectively to solve problems of connectivity and uncertainty.	3	3	3	2	1	1			1			2
CO3	Analyzing graphs, trees and random phenomena occurring in real life situations using Graph theory and Probability theory respectively.	3	2	1	1	2	2	3		2			3
CO4	Interpret the models of Graph theory, Probability theory for real life and engineering problems.	3	2	2	2	3	3				1		2
CO5	Develop efficient algorithms for graph related problems in different domains of engineering and science.	3	1	1	1	1	2	1					2

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

COURSE: Basics of Database Management System
COURSE CODE: CS335

COURSE OBJECTIVES:
- To describe a sound introduction to the discipline of database management systems.
- To give a good formal foundation on the Entity-Relationship model Relational model of data and usage of Relational Algebra.
- To introduce the concepts of basic SQL as a universal Database language
- To demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization.
- To provide an overview of the concept of serializability, deadlock and how to recover from deadlock.

COURSE OUTCOMES (CO): After completion of the course, a student will be able to understand:

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Explain the features of database management systems and Relational database.
CO2	Design conceptual models of a database using ER modeling for real life applications and also construct queries in Relational Algebra.
CO3	Create and populate a RDBMS for a real life application, with constraints and keys, using SQL. Retrieve any type of information from a database by formulating complex queries in SQL.
CO4	Analyze the existing design of a database schema and apply concepts of normalization to design an optimal database.
CO5	Analyze the concepts of serializability, deadlock and ways to recover from deadlock.

CO-PO MAPPING:

		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Explain the features of database management systems and Relational database.	3	1	1	1	1	2		2	2	1		3
CO2	Design conceptual models of a database using ER modeling for real life applications and also construct queries in Relational Algebra.	2	2	3	3	2	1		1	2			2
CO3	Create and populate a RDBMS for a real life application, with constraints and keys, using SQL. Retrieve any type of information from a database by formulating complex queries in SQL.	3	2	1	1	2	2	3	1	2			3
CO4	Analyze the existing design of a database schema and apply concepts of normalization to design an optimal database.	3	2	2	2	3	3				1		2
CO5	Analyze the concepts of serializability, deadlock and ways to recover from deadlock.	3	1	1	1	1	2	1					2
	3: Strong contribution, 2: average contribution, 1: Low contribution												

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

COURSE: Computer Architecture
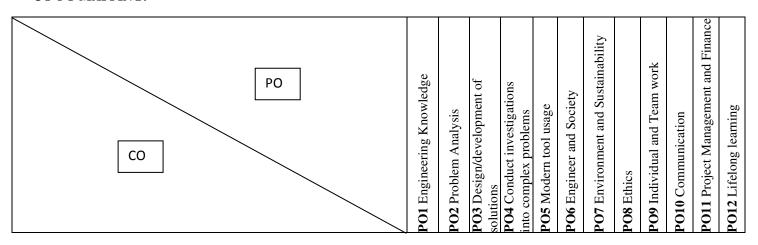**COURSE CODE: CS409**

COURSE OBJECTIVES:
1. Understand the evolution of Computer Architecture (Hardware and Software).

2. Understand the types of processors and their scalability.

3. Understanding of multiprocessor and multicomputer

4. Measure the performance of multiprocessor and multicomputer architecture

5. Measure the performance of the architecture in terms of right parameters.

6. Summarize parallel architecture and software used for them.

COURSE OUTCOMES (CO): After completion of the course, a student will be able to understand:

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understands the concepts of parallel computing and hardware technologies.
CO2	Understanding the concept of parallelism and type of parallelism
CO3	Understanding of various processor architecture like Superscalar Architecture, Vector Architecture and VLIW Architecture
CO4	Analyse linear and non-linear pipeline processors.and Compare and contrast the parallel architectures.
CO5	Illustrate parallel programming concepts.

CO-PO MAPPING:

CO \ PO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning

CO1	Understands the concepts of parallel computing and hardware technologies.	3	2	2	3	2	1				1		3
CO2	Understanding the concept of parallelism and type of parallelism	3	3	3	2	2	1						3
CO3	Understanding of various processor architecture like Superscalar Architecture, Vector Architecture and VLIW Architecture	3	2	3	1	2	2						3
CO4	Analyse linear and non-linear pipeline processors. and Compare and contrast the parallel architectures.	3	2	2	2	3	3						2
CO5	Illustrate parallel programming concepts.	3	1	1	1	1	2	1					2
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: Advance Distributed Operating System
COURSE CODE: CSE525

COURSE OBJECTIVES:

- To study some of the most important topics in modern distributed technology.

- To study the internal working of in distributed systems.

- To study the concepts of distributed file systems.

- To study the concepts of Distributed Multimedia Systems & QoS.

- To study the emerging trends in distributed computing systems : Cloud computing & Grid computing.

COURSE OUTCOMES (CO): Upon successful completion of this course, students should be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	To understand the background and knowledge of some advanced topics in distributed systems typical topics are distributed objects and remote invocation, security in distributed systems, multimedia systems.
CO2	To design a distributed application using RMI for remote computation.
CO3	To create and analyze efficient distributed file systems to handle the failure.
CO4	To improve and measure the performance of various distributed systems.
CO5	To understand the Modern distributed systems like real time distributed systems, grid computing, cloud computing.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 To understand the background and knowledge of some advanced topics in distributed systems typical topics are distributed objects and remote invocation, security in distributed systems, multimedia systems.	2		2	2		1		1				2
CO2 To design a distributed application using RMI for remote computation.	3	1	3	2		1			1		1	2
CO3 To create and analyze efficient distributed file systems to handle the failure.	2		3	1	1	2		2		1		2
CO4 To improve and measure the performance of various distributed systems.	3	2		2	3	2		2				3
CO5 To understand the Modern distributed systems like real time distributed systems, grid computing, cloud computing.	3	1		1		2					3	2
3: Strong contribution, 2: average contribution, 1: Low contribution												

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

COURSE: Mobile Computing
COURSE CODE: CS 417

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 protolcols 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 (CO): After completion of the course, a student will be able to understand:

COURSE OUTCOME (CO)	DESCRIPTION	Bloom's Taxonomy Level
CO1	To understand and compare the various wireless communication technologies.	Knowledge (level1)
CO2	To visualize the various important steps in GSM communication	Understand (level 2)
CO3	To specify and identify the requirement the mobile IP and Transport Protocol	Understand (level 2)
CO4	To examine and simulate the important aspects of Mobile Adhoc Networks	Analyze (level 4) Evaluate (level 5)
CO5	To apply the knowledge gained to design and develop a mobile application	Apply (level 3) Evaluate (level 5)

CO-PO MAPPING:

CO \ PO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	To understand and compare the various wireless communication technologies.	3	3	2	1	1	3						3
CO2	To visualize the various important steps in GSM communication	3	3	3	2	1	1						2
CO3	To specify and identify the requirement the mobile IP and Transport Protocol	3	2	1	1	2	2	3					3
CO4	To examine and simulate the important aspects of Mobile Adhoc Networks	3	2	2	2	3	3						2

CO5	To apply the knowledge gained to design and develop a mobile application	3	1	1	1	1	2	1				2

3: Strong contribution, 2: average contribution, 1: Low contribution

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE : **Open Source Software Technologies**
COURSE CODE : **CS-309**

COURSE OBJECTIVES:

- The objectives of this course are to introduce students to open source software. Students will study common open source software licenses, open source project structure, distributed team software development, and current events in the open source world. Students will also work on an open source project and will be expected to make a significant contribution to understand brief over view of Open source software, how open source software differ from other type of software like freeware ,shareware and closed source with L.A.M.P Technologies
- Understand concepts, strategies, and methodologies related to open source software development. Understand the business, economy, societal and intellectual property issues of open source software. ƒ
- Be familiar with open source software products and development tools currently available on the market. Be able to utilize open source software for developing a variety of software applications, particularly Web applications.

COURSE OUTCOMES (CO): Upon successful completion of this course, students should be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Explain common open source licenses and the impact of choosing a license explain open source project structure and how to successfully setup 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.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 Explain common open source licenses and the impact of choosing a license explain open source project structure and how to successfully setup a project	3	2	2	2		1		3				2
CO2 Competent with Linux in their systems Install different useful packages in Linux using RPM can Schedule task automatically and run Run administrative commands.	3	3	3	2	2	1						3
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 .	3	3	3	1	1	2				2		2
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.	3	2	2	2	3	3		2			2	3
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.	3	2	1	1		2		3	3		3	2

3: Strong contribution, 2: average contribution, 1: Low contribution

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: Concepts in Advanced Database system
COURSE CODE: CS414

COURSE OBJECTIVES:

- Able to understand the basic Concepts of Query processing and Query Optimization, which help the student to learn the working of Internal processing of DBMS, when the query imputed.
- Able to understand the background and knowledge of some advanced topics in database that have become key techniques in modern database theory and process; typical topics are distributed concurrency control, database recovery, query optimization, sptial databases.
- Able to understand and Query writing in Object oriented databases.
- Able to Understand the Modern databases like Active databases, Sptial databases, Multimedia databases and temporal databases.

COURSE OUTCOMES (CO): Upon successful completion of this course, students should be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Utilize the knowledge of Query processing and Query Optimization and apply the appropriate algorithm for various Database operations and also became familiar with basic database storage structures and access techniques
CO2	Utilize the knowledge of basics of Object oriented databases and construct queries using SQL
CO3	Know about basic issues of Distributed databases and their accessing techniques.
CO4	Explain basic issues of Database security and able to write SQL queries for authorization of database.
CO5	Design and build a advanced database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing of emerging DBMS technologies.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 Utilize the knowledge of Query processing and Query Optimization and apply the appropriate algorithm for various Database operations and also became familiar with basic database storage structures and access techniques	3	2	2	2		1						2
CO2 Utilize the knowledge of basics of Object oriented databases and construct queries using SQL	3	3	3	2	2	1						2
CO3 Know about basic issues of Distributed databases and their accessing techniques.	3	3	3	1	1	2						2
CO4 Explain basic issues of Database security and able to write SQL queries for authorization of database.	3	2	2	2	3	3		2				3
CO5 Design and build a advanced database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing of emerging DBMS technologies.	3	1	1	1		2						2
3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: Advanced Computer Networks

COURSE CODE: CSE507

COURSE OBJECTIVES:

1. To understand the state-of-the-art in network protocols, architectures and applications.

2. To assist students in planning the next stage of network development.

3. To provide standard networking 'models' and best practice to students that will assist students

in their network planning.

4. Aim of this course is to develop some familiarity with current research problems and research methods

 in advance computer networks.

5. To investigate novel ideas in the area of Networking via term-long research projects.

COURSE OUTCOMES (CO): Upon successful completion of this course, students should be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Illustrate reference models with layers, protocols and interfaces. Summarize functionalities of different Layers
CO2	Describe and Analysis of basic protocols of computer networks, and how they can be used to assist in network design an development of routing protocols.
CO3	Summarize functionalities of TCP, UDP and SCTP.
CO4	Specify and identify the causes of Congestion control and how to improve quality of service. Also have a basic knowledge of the use of cryptography and network security.
CO5	Specify and identify deficiencies in existing protocols, and then go onto formulate new and better protocols.

CO-PO MAPPING:

	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations in complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	3	3	2	1	1	1						2
CO2	3	2	3	3	3	1						1
CO3	3	3	2	1	2							
CO4	3	2	2	3	1							
CO5	3	3	3	3		1						

3: Strong contribution, 2: average contribution, 1: Low contribution

INTEGRAL UNIVERSITY, LUCKNOW
Department of Computer Science & Engineering

COURSE: Computer Graphics
COURSE CODE: CS 207

COURSE OBJECTIVES:
- Basic concepts of Computer Graphics components and their relevance to classical and modern problems.
- Study of algorithms for Line generation, Curve generation, Display File, Segments and Polygon filling.
- Knowledge of mapping from a world coordinate system to device coordinates, clipping, and projections.
- Basic concepts and principles of Two Dimensional & Three Dimensional Computer Graphics primitive operations (Translation, Scaling, Rotation, Reflection, Shearing and problems based on these).
- Study of Curve generation, Hidden line surface removal techniques and concepts on Animation.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
O1	Know about the concept of Computer Graphics components and their relevance to classical and modern problems.
O2	Know about the concept of writing algorithms for Line generation, Curve generation, Display File, Segments and Polygon filling.
O3	Know about the concept of mapping from a world coordinate system to device coordinates, clipping, and projections.
O4	Know about the concept and principles of Two Dimensional & Three Dimensional Computer Graphics primitive operations (Translation, Scaling, Rotation, Reflection, Shearing and problems based on these).
O5	Know about the concept of Curve generation, Hidden line surface removal techniques and concepts on Animation.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and
CO1	Know about the concept of Computer Graphics components and their relevance to classical and modern problems.	3	3	1		2	1					
CO2	Know about the concept of writing algorithms for Line generation, Curve generation, Display File, Segments and Polygon filling.	3	3	3	3	3				1		
CO3	Know about the concept of mapping from a world coordinate system to device coordinates, clipping, and projections.	3	3	2	2	2						
CO4	Know about the concept and principles of Two Dimensional & Three Dimensional Computer Graphics primitive operations (Translation, Scaling, Rotation, Reflection, Shearing and problems based on these).	3	3	2	2	3						
CO5	Know about the concept of Curve generation, Hidden line surface removal techniques and concepts on Animation.	3	3	2	1	2	1	1		1		

3: Strong contribution, 2: average contribution, 1: Low contribution

INTEGRAL UNIVERSITY, LUCKNOW
Department of Computer Science & Engineering

COURSE: Microprocessor & its Applications
COURSE CODE: CS 313

COURSE OBJECTIVES:

- Knowledge of architectural block diagram, pin diagram, timing Diagram, interrupts and addressing modes of 8085 and 8086 microprocessors.
- Knowledge and understanding of instruction set of 8085 and 8086 microprocessor and apply it to write assembly language programs.
- Study and Understand the Interfacing with Peripheral Devices and Memory with 8085 microprocessor 8257(DMA), 8255(PPI), 8251 (USART), Keyboard- Display Controller (8279), PIC (8259).
- The student will be able to understand interfacing with Programmable Interval Timer/Counter (8253/8254) and ADC 0808/0809 ADC, its working and Application.
- Basic concepts of higher end microprocessors 80186,80286,80386,80486, architecture and application of 8051 Micro-controller & Embedded

COURSE OUTCOMES (CO):
After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
O1	Know about the concept of architectural block diagram, pin diagram, timing Diagram, interrupts and addressing modes of 8085 and 8086 microprocessors.
O2	Know about the concept of instruction set of 8085 and 8086 microprocessor and apply it to write assembly language programs.
O3	Know about the concept of Interfacing with Peripheral Devices and Memory with 8085 microprocessor 8257(DMA), 8255(PPI), 8251 (USART), Keyboard- Display Controller (8279), PIC (8259).
O4	Know about the concept of interfacing with Programmable Interval Timer/Counter (8253/8254) and ADC 0808/0809 ADC, its working and Application.
O5	Know about the concept of higher end microprocessors 80186,80286,80386,80486, architecture and application of 8051 Micro-controller & Embedded

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance
CO1	Know about the concept of architectural block diagram, pin diagram, timing Diagram, interrupts and addressing modes of 8085 and 8086 microprocessors.	3	3	1	1	2						
CO2	Know about the concept of instruction set of 8085 and 8086 microprocessor and apply it to write assembly language programs.	3	3	3	2	1				1		
CO3	Know about the concept of Interfacing with Peripheral Devices and Memory with 8085 microprocessor 8257(DMA), 8255(PPI), 8251 (USART), Keyboard- Display Controller (8279), PIC (8259).	3	2	1	2	2						
CO4	Know about the concept of interfacing with Programmable Interval Timer/Counter (8253/8254) and ADC 0808/0809 ADC, its working and Application.	3	2	1	2	3						
CO5	Know about the concept of higher end microprocessors 80186,80286,80386,80486, architecture and application of 8051 Micro-controller & Embedded	3	3	2	1	2	1					
3: Strong contribution, 2: average contribution, 1: Low contribution												

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: Computers in Management
COURSE CODE: CS-403

COURSE OBJECTIVES:

1. Give students an in-depth understanding of why computers are essential components in business.
2. Introduce the fundamentals of computing devices and reinforce computer vocabulary, particularly with respect to personal use of computer hardware and software, the Internet, networking and mobile computing.
3. Provide hands-on use of Microsoft Office (On Latest version) applications Word, Excel, Access and PowerPoint. Completion of the assignments will result in MS Office applications knowledge and skills.
4. Provide foundational or "computer literacy" curriculum that prepares students for life-long learning of computer concepts and skills.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Describe the usage of computers and why computers are essential components in business and society.
CO2	Utilize the Internet Web resources and evaluate on-line e-business system.
CO3	Solve common business problems using appropriate Information Technology applications and systems.
CO4	Identify categories of programs, system software and applications. Organize and work with files and folders.
CO5	Describe various types of networks network standards and communication software.

CO-PO MAPPING:

↓CO\PO→	PO1: Ability to apply knowledge	PO2: Ability to analyze the	PO3: Ability to develop and	PO4: Ability to handle complex	PO5: Ability to apply state of the	PO6: Ability of being aware about	PO7: Ability to provide	PO8: Ability to understand their	PO9: Ability to work as an	PO10: Ability to communicate with	PO11: Ability to manage the day to	PO12: Ability to engage and
CO1: Describe the usage of computers and why computers are essential components in business and society.	1	2		3	1		3	2				1
CO2: Utilize the Internet Web resources and evaluate on-line e-business system.			2	3	3				2	3	1	1
CO3: Solve common business problems using appropriate Information Technology applications and systems.	1	3			2	1		2	3			
CO4: Identify categories of programs, system software and applications. Organize and work with files and folders.			1	2			3			3	2	1
CO5: Describe various types of networks network standards and	1	2	3		1	2		3				

communication software.														
3: Strong Association, 2: Average Association, 1: Low Association														

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF ELECTRICAL ENGINEERING

COURSE: BASIC ELECTRICAL ENGINEERING
COURSE CODE: EE103

COURSE OBJECTIVES:

- Knowledge and concept of Applet programming and Abstract Window Toolkit.
- Concepts of Swing Application, Controls and JDBC.
- Basics of Java Beans, EJB and RMI.
- Knowledge and concepts of Java Servlet, and Cookies.
- Concepts of JSP and Scripting Elements.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Construct Applet and Abstract Window Toolkit Applications.
CO2	Make Swing Applications and use JDBC functionality.
CO3	Know the features of Bean Environment and RMI.
CO4	Perform Servlet programming.
CO5	Understand construction of dynamic web pages.

CO-PO MAPPING:

CO		PO1 Ability to apply knowledge of science, computing and mathematics to deal with computer engineering problems.	PO2 Ability to analyze the computer engineering problems, formulate them in order to achieve the solution.	PO3 Ability to develop and design solutions based on analysis to solve engineering problems.	PO4 Ability to handle complex and interdisciplinary engineering problems by using their research methodology.	PO5 Ability to apply state of the art tools and techniques in order to achieve economic solutions to the problems.	PO6 Ability of being aware about the existing social problems and keen to find their solutions by using their computer engineering skills.	PO7 Ability to provide environment friendly and sustainable solutions.	PO8 Ability to understand their professional and ethical responsibility.	PO9 Ability to work as an individual as well as in teams.	PO10 Ability to communicate with the stake holders by applying their soft skills.	PO11 Ability to manage the day to day challenges by optimizing the project resources.	PO12 Ability to engage and encourage themselves in continuous learning process in order to cope up with the rapidly growing tools and technology.
CO1	Construct Applet and Abstract Window Toolkit Applications.		2			1				2			3
CO2	Make Swing Applications and use JDBC functionality.		2	1		2				2			3
CO3	Know the features of Bean Environment and RMI.		2	1		3				3		1	3
CO4	Perform Servlet programming.		2			2				2			3
CO5	Understand construction of dynamic web pages.		2			3				2			3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: Introduction To Computers
COURSE CODE: CS-103

COURSE OBJECTIVES:

1. To give students basic knowledge of computers –its components and architecture.
2. To give knowledge about Disk operating system and its commands.
3. To give knowledge about windows operating system applications knowledge and skills.
4. To give knowledge and applications of MS WORD.
5. To give knowledge and applications of MS POWER POINT which is very useful for their future carreer.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Describe basic components of modern digital computers and functions of each component.
CO2	Become familiar with Disk Operating System and can perform various DOS commands.
CO3	Become familiar with WINDOWS environment and its various tools.
CO4	Type and work in Ms word comfortably.
CO5	Create Their own power point presentation(slides) for any task.

CO-PO MAPPING:

↓CO\PO→	PO1: Ability to apply knowledge of science, computing and mathematics to deal with computer engineering	PO2: Ability to analyze the computer engineering	PO3: Ability to develop and design solutions based on analysis to solve engineering problems.	PO4: Ability to handle complex and interdisciplinary	PO5: Ability to apply state of the art tools and techniques in order to achieve economic solutions	PO6: Ability of being aware about the existing social problems and keen to find their solutions by	PO7: Ability to provide environment friendly and sustainable solutions.	PO8: Ability to understand their professional and ethical responsibility	PO9: Ability to work as an individual as well as in teams.	PO10: Ability to communicate with the stake holders by applying their soft skills	PO11: Ability to manage the day to day challenges by optimizing the project resources	PO12: Ability to engage and encourage themselves in continuous learning process in order to cope up with the rapidly
CO1: Describe basic components of modern digital computers and functions of each component..	3	3	1		1		1	1				1
CO2: Become familiar with Disk Operating System and can perform various DOS commands.	3	3	1							1		1
CO3: Become familiar with WINDOWS environment and its various tools..	3	3	1		2	1		2				2
CO4: Type and work in Ms word comfortably.	3	3	2	1	2					2		2
CO5: Create Their own power point presentation(slides) for any task..	3	3	2	1	2	2		3		3		2
3: Strong Association, 2: Average Association, 1: Low Association												

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: Computer Networks
COURSE CODE: CS-305

COURSE OBJECTIVES:

- Able to understand the fundamental Concepts of Computer Networking, Network Model and basic components of Network which enable students to recognize and understand the fundamental communication process and working of Network models.
- Able to understand and learn various error handling techniques, and flow control techniques at Data Link layer
- Able to understand Routing mechanism and IP addressing schemes which helps students to recognize, formulate and deduce basic routing algorithms and designing of network for small offices & Universities.
- Able to understand the concept of Transmission Control Protocol and differentiate between connectionless and connection oriented services.
- Students will be able to have in depth knowledge of networking-process, issues, challenges and various approaches to resolve them thru classical networking techniques and modern tools like NetSim.

COURSE OUTCOMES (CO): Upon successful completion of this course, students should be able to…

COURSE OUTCOME (CO)	DESCRIPTION
CO1	A. Students shall be able to understand the basic concepts of communication process including the key aspects of networking such as hardware components and their hierarchical interrelationship. B. Demonstrate the ability to recognize and differentiate various transmission media, switching techniques and demonstrate the ability to identify limitations of typical communication systems, physical structures, network models, and internetworking. C. Students shall be able to compare and contrast Open System Interconnect (OSI) and the TCP/IP Model.
CO2	A. Demonstrate clear understanding & Ability to utilize the knowledge of error handling techniques to detect and remove errors from data packets. B. Analyze and distinguish various flow control techniques at Data Link layer and formulate concrete logic to resolve flow control issues in network. C. Utilize the knowledge of access control mechanism and demonstrate the ability to apply the knowledge in problem domain of access control issues.
CO3	A. Able to demonstrate clear understanding of Routing mechanism and IP addressing schemes B. Able to understand and apply the knowledge IP addressing schemes to identify, deduce and design network structure based on the concept of sub-netting/super-netting using modern tools in lab such as Packet-Tracer. C. Identify and Apply knowledge of routing approaches and schemes to identify and develop appropriate routing algorithms as solution by analyzing to problem statement in the purview of inter-networking using modern tools in lab such as Net-Sim.
CO4	A. Demonstrate the clear understanding of Transmission Control Protocol and Congestion control techniques. B. Illustratively explain the concept of Connectionless and Connection oriented services and unambiguously differentiate and identify the best preferred service for a given problem statement. C. Able to apply the knowledge of flow control and congestion control techniques to evaluate the performance of network using modern tools in Lab such as Network Simulator
CO5	A. Students shall able to recognize, evaluate and explain various reasons and causes affecting Network performance. B. Able to analyze and evaluate to Quality of Service in networking and apply knowledge to improve the same. C. Demonstrate the ability to identify various protocols and its internal functioning which are used at Application layer . Students will have in depth knowledge of networking-process, issues, challenges and various approaches to resolve them thru classical networking techniques and modern tools like NS2. .

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	A. Students shall be able to understand the basic concepts of communication process including the key aspects of networking such as hardware components and their hierarchical interrelationship. B. Demonstrate the ability to recognize and differentiate various transmission media, switching techniques and demonstrate the ability to identify limitations of typical communication systems, physical structures, network models, and internetworking. C. Students shall be able to compare and contrast Open System Interconnect (OSI) and the TCP/IP Model.	3	3	3	2		1						2
CO2	A. Demonstrate clear understanding & Ability to utilize the knowledge of error handling techniques to detect and remove errors from data packets using lab tools NetSim. B. Analyze and distinguish various flow control techniques at Data Link layer and formulate concrete logic to resolve flow control issues in network. C. Utilize the knowledge of access control mechanism and demonstrate the ability to apply the knowledge in problem domain of access control issues.	3	3	3	3	3	1			2			2
CO3	A. Able to demonstrate the clear understanding of Routing mechanism and IP addressing schemes and be able to know & explain the frame formats of IPv4 & IPv6, its worth and significance. B. Able to understand and apply the knowledge IP addressing schemes to identify, deduce and design network structure based on the concept of sub-netting/super-netting using modern tools in lab such as Packet-Tracer. C. Identify and Apply the knowledge of routing approaches and schemes to identify and develop appropriate routing algorithms as solution by analyzing to problem statement in the purview of inter-networking using modern tools in lab such as Net-Sim.	3	3	3	2	3	2			3			2
CO4	A. Demonstrate the clear understanding of Transmission Control Protocol and Congestion control techniques. B. Illustratively explain the concept of Connectionless and Connection oriented services and unambiguously differentiate and identify the best preferred service for a given problem statement. C. Able to apply the knowledge of flow control and congestion control techniques to evaluate the performance of network using modern tools in Lab such as Network Simulator	3	2	3	3	3	2		3				3

CO5	A. Students shall able to recognize, evaluate and explain various reasons and causes affecting Network performance. B. Able to analyze and evaluate to Quality of Service in networking and apply knowledge to improve the same. C. Demonstrate the ability to identify various protocols and its internal functioning which are used at Application layer . Students will have in depth knowledge of networking-process, issues, challenges and various approaches to resolve them thru classical networking techniques and modern tools like NS2.	3	2	2	3		2		1				2

3: Strong contribution, 2: average contribution, 1: Low contribution

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Course Level: PG
COURSE: Soft computing
COURSE CODE: CS519

COURSE OBJECTIVES:

This course aims at introducing the fundamental theory and concepts of Soft computing methods, in particular neural networks, fuzzy systems, genetic algorithms and their applications in the area of machine intelligence. This course focuses on the following key aspects:

- To familiarize with soft computing concepts
- To introduce the fuzzy logic concepts, fuzzy principles and relations.
- To Basics of ANN and Learning Algorithms.
- Ann as function approximation.
- Genetic Algorithm and its applications to soft computing.
- Hybrid system usage, application and optimization.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	List the facts and outline the different process carried out in fuzzy logic, Artificial Neural Network and Genetic Algorithms
CO2	Explain the concepts of soft computing and meta-cognitive methods and Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its application
CO3	Apply Soft computing techniques such as recognition of character, pattern classification, regression and similar problems.
CO4	By using soft computing process/procedures able to handle real world problems using soft computing.
CO5	Evaluate various techniques of soft computing to defend the best working solutions and Design hybrid system to revise the principles of soft computing in various applications.

CO-PO MAPPING:

CO\PO	PO1: Ability to apply knowledge of science, computing and mathematics to deal with computer engineering problems.	PO2: Ability to analyze the computer engineering problems, formulate them in order to achieve the solution.	PO3: Ability to develop and design solutions based on analysis to solve engineering problems.	PO4: Ability to handle complex and interdisciplinary engineering problems by using their research methodology.	PO5: Ability to apply state of the art tools and techniques in order to achieve economic solutions to the problems.	PO6: Ability of being aware about the existing social problems and keen to find their solutions by using their computer engineering skills.	PO7: Ability to provide environment friendly and sustainable solutions.	PO8: Ability to understand their professional and ethical responsibility.	PO9: Ability to work as an individual as well as in teams.	PO10: Ability to communicate with the stake holders by applying their soft skills.	PO11: Ability to manage the day to day challenges by optimizing the project resources.	PO12: Ability to engage and encourage themselves in continuous learning process in order to cope up with the rapidly growing tools and technology.
CO1 — List the facts and outline the different process carried out in fuzzy logic, ANN and Genetic Algorithms	3	2	3	1	1	3	1	2	1	1	2	3
CO2 — Explain the concepts and meta-cognitive of soft computing and Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its application	3	2	3	2	1	1		3				2
CO3 — Apply Soft computing techniques the solve character recognition, pattern classification, regression and similar problems.	3	2	1	1	2	2	3		1			3
CO4 — By using soft computing process/procedures able to handle real world problems using soft computing.	3	2	2	2	3	3				2		2
CO5 — Evaluate various techniques of soft computing to defend the best working solutions and Design hybrid system to revise the principles of soft computing in various applications.	3	2	1	1	1	2	1			2		2

3: Strong contribution, 2: average contribution, 1: Low contribution

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Course Level: PG
COURSE: Forensic Science and cyber crime
COURSE CODE: CS528

COURSE OBJECTIVES:
The course main objective as a forensic science program is to develop professional, ethical Post Graduate whose competence in problem-solving, legal analysis and application, quantitative reasoning, investigation and scientific laboratory procedures can be applied to immediate employment or advanced study. This course focuses on the following key aspects:

- 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 (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
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.

CO-PO MAPPING:

CO\PO	PO1: Ability to apply knowledge of science, computing and mathematics to deal with computer engineering problems.	PO2: Ability to analyze the computer engineering problems, formulate them in order to achieve the solution.	PO3: Ability to develop and design solutions based on analysis to solve engineering problems.	PO4: Ability to handle complex and interdisciplinary engineering problems by using their research methodology.	PO5: Ability to apply state of the art tools and techniques in order to achieve economic solutions to the problems.	PO6: Ability of being aware about the existing social problems and keen to find their solutions by using their computer engineering skills.	PO7: Ability to provide environment friendly and sustainable solutions.	PO8: Ability to understand their professional and ethical responsibility.	PO9: Ability to work as an individual as well as in teams.	PO10: Ability to communicate with the stake holders by applying their soft skills.	PO11: Ability to manage the day to day challenges by optimizing the project resources.	PO12: Ability to engage and encourage themselves in continuous learning process in order to cope up with the rapidly growing tools and technology.
CO1 — Demonstrate competency in the principles of crime scene investigation, including the recognition, collection, identification, preservation, and documentation of physical evidence.	2	1	3	1	1	3	1	2	1	1	2	3
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.	3	2	3	2	1	1			2			2
CO3 — Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection	2	2	1	1	2	2	3		1			3
CO4 — Demonstrate the ability to document and orally describe crime scenes, physical evidence, and scientific processes.	3	2	2	2	3	3						2
CO5 — Identify and examine current and emerging concepts and practices within the forensic science field.	3	1	1	1	1	2	1					2

3: Strong contribution, 2: average contribution, 1: Low contribution

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: CONCEPTS OF COMPUTERS
COURSE CODE: CS109

COURSE OBJECTIVES:

- Study of computer history and structure of computer system.
- Understanding of computer peripheral devices, operating environment and software.
- Basic knowledge of computer networking and internetworking devices.
- Fundamental concepts of Internet and web technologies.
- Study of biological databases, algorithms and flowchart design.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Have a strong foundation of knowledge about the structure of computer system.
CO2	Utilize and configure computer peripheral devices, install and operate system and application software.
CO3	Establish a small computer network and utilize resource sharing.
CO4	Design and develop a website with limited features.
CO5	Design flowcharts, apply algorithms to solve problems and make use of biological databases.

CO-PO MAPPING:

CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Have a strong foundation of knowledge about the structure of computer system.	3	2				3		
CO2	Utilize and configure computer peripheral devices, install and operate system and application software.	3			3				2
CO3	Establish a small computer network and utilize resource sharing.	3						1	
CO4	Design and develop a website with limited features.	2	1			1		2	
CO5	Design flowcharts, apply algorithms to solve problems and make use of biological databases.	2	2				3		1
3 Strong contribution, **2** average contribution, **1** Low contribution									

COURSE: DATABASE MANAGEMENT SYSTEM
COURSE CODE: CS212

COURSE OBJECTIVES:

The objectives of this course are
1. Understand values of Data.
2. Understand significant role of DBMS.
3. Understand need for normalizing a Database.
4. Understand problems with unnecessary duplication of data.
5. Understand concepts of transaction
6. Understand concepts of concurrent transactions

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Acquire knowledge of handling large volume of data.
CO2	Acquire skills to deal with Real life database implementation.
CO3	Response off faster queries and serve as many users as possible concurrently.
CO4	Fit with any Database project in industry after completion of degree.
CO5	Acquire skills to deal with concurrent transactions

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Acquire knowledge of handling large volume of data.	3	1	3	1	3	1	1	1	2	1	3	1
CO2	Acquire skills to deal with Real life database implementation.	3	1	3	1	3	1	1	1	2	1	3	1
CO3	Response off faster queries and serve as many users as possible concurrently.	3	1	3	1	3	1	1	1	2	1	3	1
CO4	Fit with any Database project in industry after completion of degree.	3	1	3	1	3	1	1	1	2	1	3	1
CO5	Acquire skills to deal with concurrent transactions	3	1	3	1	3	1	1	1	2	1	3	1
3: Strong contribution, 2: average contribution, 1: Low contribution													

COURSE: VISUAL PROGRAMMING TECHNIQUES
COURSE CODE: CS332

COURSE OBJECTIVES:

- Knowledge about .Net Architecture.
- Describe the concepts of delegates along with events and exception handling.
- Detailed study of the working of collections and cocepts of file handling.
- Understanding the concepts of ADO.NET along with ASP.NET for web development.
- Describing networking and different web services with applications.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Use console applications for developing different programming skills.
CO2	Implement delegates for creating different events with limited line of codes.
CO3	Perform file handling and adding controls at runtime with MDI forms.
CO4	Establish the connection between database and web applications using different validation controls.
CO5	Develop web services for publishing and consuming it and work on stored procedure.

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Use console applications for developing different programming skills.	3	3	3	1	2	2		2	2	1	1	1
CO2	Implement delegates for creating different events with limited line of codes.	3	2	3		3	1	3	2	2	1	3	3
CO3	Perform file handling and adding controls at runtime with MDI forms.	3	1	1	1	3				2	2	1	1
CO4	Establish the connection between database and web applications using different validation controls.	3		3		3	2		2	2	3	2	2
CO5	Develop web services for publishing and consuming it and work on stored procedure.	3		3		1	1		3	1	2	2	2
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: DATA STRUCTURE
COURSE CODE: CS204

COURSE OBJECTIVES:

- Explain the basics of Data Structure , their Managements and Operations such as array, string manipulations and various operation over linked list. Programming implementation
- To learn stack, queue and various operations, different application based on given data structure such as, recursion, polish and reverse polish conversion parenthesis management, priority Queue. Programming implementations
- Understand the deep knowledge of tree data structure and its various applications to control the operation complexity management. Programming implementation
- To study the various sorting and searching strategy and different algorithms approach, know hashing and collision resolving techniques. Programming implementation
- Understand the new range of hierarchical data structure such as Graph and various routing and traversal algorithms over the graph. Introduction to file and record handling

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Describe the basics of Data structure operation and programming implementation skills
CO2	Stack and Queue and various application based on these data structures
CO3	Learning the different types of tree and learn its augmentation to control the operation complexity.
CO4	Learn different sorting and searching algorithms and analyze their performances.
CO5	Learning File and record management, implementing various searching and routing applications on graph.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 Describe the basic data structure operation and programming implementations.	3	3	2	1	2	2			2			2
CO2 Implement the different application based on Stack and queue	3	3	3	2	3			1				3
CO3 Programming implementation of searching, insertion deletion creation and traversal of tree Data structure.	3	3	3	2	2							3
CO4 Learn the complexity analysis of different sorting and searching algorithm.	3	3	3	3	2	3						3
CO5 Design and analysis of Graph routing and traversal algorithms, learn to manage file and records.	3	3	3	3	2	2	1	1	1	2		2
3: Strong contribution, 2: average contribution, 1: Low contribution												

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: Data Compression techniquesCOURSE CODE: CS416

COURSE OBJECTIVES:

- To develop understandings of basic principles Data compression techniques and their limitations
- To solve variousproblems mathematically using Various Lossless Data compression algorithmsegShannon, Huffman and compression ratio.
- Understand the basics ofarithmetic, adaptive and various lossless/lossy compression approaches and JBIG image compression approachcomputer engineering.
- Simplify and understanding of prediction and partial matching, to understand the dynamic compression model
- Understand the basics of vector representation of compression models, and apply it to solve various engineering problems.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
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 .

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 Understanding the compression importance and mathematical proof of information content over given source data.	2	3		1		2						2
CO2 Solving the problem based on lossless compression approach with help of Huffman ,adaptive approach to reduce the variance	2	3	2	1								3
CO3 Ability to solve problems arithmetic and dictionary model of compression techniques	2	3	3	2	1							2
CO4 Apply predicates, and transform algorithms to audio video compression.	2	3	2	2	3	3						3
CO5 Represent the source data in the form of structured vectors .	3	2	2	3	2	2	1	1	1	2		2
3: Strong contribution, 2: average contribution, 1: Low contribution												

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: DISCRETE STRUCTURE
COURSE CODE: CS206

COURSE OBJECTIVES:

- To develop understandings of basic principles of sets, relations and functions
- To solve various problems mathematically using group theory, rings and fields.
- Understand the basics of lattices, boolean algebra, and trees for solving problems related to computer engineering.
- Simplify and evaluate basic logic statements including compound statements, implications, and equivalence using truth tables, first order logic and predicate logic.
- Understand the basics of graph theory and recurrence relations and apply it to solve various engineering problems

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Solve the problems using sets, relations, functions and proof by contradiction.
CO2	Identify the domain where group theory can be used to solve the problems.
CO3	Solve problems using lattices, boolean algebra, and tree algorithms.
CO4	Apply predicates, quantifiers, and logical connectives to express a logical sentence.
CO5	Propose a solution for various engineering problems using graph algorithms.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 Solve the problems using sets, relations, functions and proof by contradiction.	3	2		1		2						2
CO2 Identify the domain where group theory can be used to solve the problems.	2	2	1	2								3
CO3 Ability to solve problems using lattices, boolean algebra, and tree algorithms.	3	3	2	2	1							3
CO4 Apply predicates, quantifiers, and logical connectives to express a logical sentence.	3	3	2	3	3	3						3
CO5 Propose a solution for various engineering problems using graph algorithms.	3	3	3	3	2	2	1	1	1	2		2
3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: DISDRETE STRUCTURE
COURSE CODE: CS206

COURSE OBJECTIVES:

- Explain the basic components of computer, their interconnection and data representation techniques in computer systems
- To assess the working of cpu and become familiar with computer arithmetic's.
- Understand the control unit design using hardwired and micro programmed approach.
- To study the memory organization and articulate design issues in each element of memory hierarchy.
- Understand the input output organization, data transfer, and modes of communication.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Describe the basic organization of computer and data representation techniques used in computer systems.
CO2	Use the computer arithmetic in designing of CPU.
CO3	Design the control unit using hardwired and micro programmed approach.
CO4	Resolve the issues arising in the design of elements of memory hierarchy.
CO5	Design the input output organization and resolve the issues arising in data transfer.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 Describe the basic organization of computer and data representation techniques used in computer systems.	3	2		1		2						2
CO2 Use the computer arithmetic in designing of CPU.	2	2	3	2	3			1				3
CO3 Design the control unit using hardwired and micro programmed approach.	3	3	3	2	2							3
CO4 Resolve the issues arising in the design of elements of memory hierarchy.	3	3	2	3	3	3						3
CO5 Design the input output organization and resolve the issues arising in data transfer.	3	3	3	3	2	2	1	1	1	2		2
3: Strong contribution, 2: average contribution, 1: Low contribution												

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: Fuzzy logic & Neural Networks
COURSE CODE: CS415

COURSE OBJECTIVES:

The objectives of this course are
1. To introduce the concepts in Soft Computing such as Artificial Neural Networks, Fuzzy logicbased systems, genetic algorithm-based systems and their hybrids
2. Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
3. Reveal different applications of these models to solve engineering and other problems.
4. Understand the theory and applications of artificial neural network and fuzzy systems to engineering applications with emphasis on image processing and control.
5. Discuss neural networks and fuzzy systems, architectures, algorithms and applications, including Back-propagation, Competitive Learning, Fuzzy inference methods and expert systems etc.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Learn about soft computing techniques and their applications
CO2	Analyze various neural network architectures.
CO3	Enable students to understand different Clustering Algorithms.
CO4	Define the fuzzy systems.
CO5	Identify and select a suitable Soft Computing technology to solve the problem; construct asolution and implement a Soft Computing solution

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Learn about soft computing techniques and their applications	1	1	3									
CO2	Analyze various neural network architectures.	2	2	3									
CO3	Enable students to understand different Clustering Algorithms.	2	2	3		2							
CO4	Define the fuzzy systems.	1	1	2		3							
CO5	Identify and select a suitable Soft Computing technology to solve the problem; construct asolution and implement a Soft Computing solution	2	2	3	3	3	3	3		2		3	
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Course Level: UG
COURSE: Storage Technology and Management
COURSE CODE: CS319

COURSE OBJECTIVES:

The course provides detailed knowledge, practical training and insight into the implementation and management of various storage technologies with a focus towards applying these technologies in an information lifecycle paradigm. This course focuses on the following key aspects:

- To study the history and evolution of storage with other implementation models
- To study Storage devices principles including structure, host I/O processing, & core algorithms
- Storage classes (SAN, NAS. CAS), interconnection protocols, and management principles
- Storage network design principles
- Networked storage capabilities (Snaps, mirroring, virtualization)
- Backup, Business Continuity, and Disaster Recovery principles

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Able to apply Search, retrieve and synthesize information from a variety of systems and sources.
CO2	Evaluate systems and technologies in terms of quality, functionality, cost-effectiveness and adherence to professional standards.
CO3	Integrate emerging technologies into professional practice.
CO4	Apply theory and principles to diverse information contexts.
CO5	Able to understand the concept of Disaster recovery and its principle.

CO-PO MAPPING:

CO\PO	PO1: Ability to apply knowledge of science, computing and mathematics to deal with computer engineering problems.	PO2: Ability to analyze the computer engineering problems, formulate them in order to achieve the solution.	PO3: Ability to develop and design solutions based on analysis to solve engineering problems.	PO4: Ability to handle complex and interdisciplinary engineering problems by using their research methodology.	PO5: Ability to apply state of the art tools and techniques in order to achieve economic solutions to the problems.	PO6: Ability of being aware about the existing social problems and keen to find their solutions by using their computer engineering skills.	PO7: Ability to provide environment friendly and sustainable solutions.	PO8: Ability to understand their professional and ethical responsibility.	PO9: Ability to work as an individual as well as in teams.	PO10: Ability to communicate with the stake holders by applying their soft skills.	PO11: Ability to manage the day to day challenges by optimizing the project resources.	PO12: Ability to engage and encourage themselves in continuous learning process in order to cope up with the rapidly growing tools and technology.
CO1 Search, retrieve and synthesize information from a variety of systems and sources.	3	3	2	1	1	3	1	2	1	1	2	3
CO2 Evaluate systems and technologies in terms of quality, functionality, cost-effectiveness and adherence to professional standards.	3	3	3	2	1	1						2
CO3 Integrate emerging technologies into professional practice.	3	2	1	1	2	2	3		1			3
CO4 Apply theory and principles to diverse information contexts.	3	2	2	2	3	3						2
CO5 Able to understand the concept of Disaster recovery and its principle.	3	1	1	1	1	2	1					2
3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: SOFTWARE PROJECT & QUALITY MANAGEMENT
COURSE CODE: CS-311

COURSE OBJECTIVES:
- To study overview of stepwise software project development planning.
- Study and analysis of project evaluation.
- Analysis of software effort estimation.
- Study and analysis of resource allocation.
- Evaluation and analysis of Contract & Technical Project Management.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
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.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 Analyze the systematically stepwise project planning.	3	3	2	1	1	3						3
CO2 Have knowledge of strategic program management, analysis of technical assessment of projects and study and analysis of different Cost-Benefit Evaluation Techniques.	3	3	3	2	1	1						2
CO3 Apply, analyze and compare effort estimation and different network planning models.	3	2	1	1	2	2	3					3
CO4 Evaluation and analysis of different resources and Critical Path, monitoring and control, Prioritizing monitoring and change control.	3	2	2	2	3	3						2
CO5 Compare and analyze modern project management, contract management, ISO Standards, CMM, Six Sigma Approach.	3	1	1	1	1	2	1					2
3: Strong contribution, 2: average contribution, 1: Low contribution												

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: ADVANCE SOFTWARE PROJECT & QUALITY MANAGEMENT
COURSE CODE: CS-517

COURSE OBJECTIVES:

- Study and evaluation of different process models for advance approaches of software development.
- Study and evaluation of different advance methods of software design.
- To understand different programming paradigms, Global software development and aspect oriented programming concepts.
- Study and analysis of advance concepts and methods of software testing.
- Evaluation and analysis of Contract & Technical Project Management.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Apply and evaluate the Agile Manifesto, Agile process and principles, Extreme programming, Scrum, RUP, CMMi, ISO 12207, perform the critical analysis of process models.
CO2	Apply modern design patterns; create User Interface Design, evaluation and analysis of OOD, UML and universal design application and analysis.
CO3	Evaluate and compare the Imperative programming, Functional programming and Logical programming. Practice and analysis of Global Software development tools, Application and analysis of advance coding standards and Aspect Oriented Software Engineering.
CO4	Evaluation and analysis of Testing Processes, Create, evaluate and analyze new testing tools, analyze the quality models, apply, evaluate and analyze the test driven software development, evaluation and analysis OOT with C & K metrics.
CO5	Compare and analyze modern project management, Project Portfolio management, Strategic Management and Step Wise Project Planning.

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE: DISTRIBUTED SYSTEMS
COURSE CODE: CS-410

COURSE OBJECTIVES:

- To understand basics of distributed systems and advanced operating systems.
- Study of different algorithms of deadlock detection the agreement protocols in distributed systems, their comparison and analysis.
- Study and analysis of Distributed Objects and Remote Invocations.
- Evaluation and analysis of transactions and concurrency control in distributed systems.
- Applications and analysis of Distributed Shared Memory (DSM) and Distributed Multimedia Systems.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand the software and hardware concepts of distributed systems
CO2	Evaluate and analyze the issues and implementations of deadlock detection and the agreement problems.
CO3	Analyze the RMI, RPC and security issues, replication and fault tolerance in the distributed systems.
CO4	Compare and analyze the flat and nested transactions, applications and analysis of locks in view of distributed systems, File systems and recent advances.
CO5	Implement and analyze distributed multimedia, CORBA RMI, Java RMI, CORBA services.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 Understand the software and hardware concepts of distributed systems	3	3	2	1	1	3						3
CO2 Evaluate and analyze the issues and implementations of deadlock detection and the agreement problems.	3	3	3	2	1	1						2
CO3 Analyze the RMI, RPC and security issues, replication and fault tolerance in the distributed systems.	3	2	1	1	2	2	3					3
CO4 Compare and analyze the flat and nested transactions, applications and analysis of locks in view of distributed systems, File systems and recent advances.	3	2	2	2	3	3						2
CO5 Implement and analyze distributed multimedia, CORBA RMI, Java RMI, CORBA services.	3	1	1	1	1	2	1					2
3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: Introduction to Communication Skills

COURSE CODE: CS230

COURSE OBJECTIVES:

- To state the principles of Communication
- Classify the different models of communication
- Explain how to plan a presentation
- Compose business letters and reports

COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	*State***[L1: Knowledge]**the principles of communication
CO2	*Classify***[L2: Comprehension]**the different models of communication
CO3	*Explain***[L2: Comprehension]**how to plan a presentation
CO4	*Compose***[L4: Analyze]**business letters and reports

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	*State***[L1: Knowledge]**the principles of communication		1				1			2	3		
CO2	*Classify***[L2: Comprehension]**the different models of communication		1				1	2			3		3

CO3	*Explain***[L2: Comprehension]**how to plan a presentation		3	2		1				2	3		1
CO4	*Compose***[L4: Analyze]**business letters and reports						3	2		3			1
	3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: Computer Architecture and Organization

COURSE CODE: CS231

COURSE OBJECTIVES:

To provide elementary and application based knowledge of different components that can be used to design an efficient architecture of the system

COURSE OUTCOMES (COs):

Upon completion of the course, students will be able to:

CO1: Define**[L1: Knowledge]**registers, bus as well as memory and its hierarchy and input/output devices.

CO2: Explain**[L2: Comprehension]**division based algorithms for different representation of data and discuss I/O interfaces, ports and Data Transfer modes

CO3: Apply**[L3: Application]**register and stack organization and construct different control units.

CO4: Classify**[L4: Analysis]**types of memory and memory mapping of one type with other

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 Define **[L1: Knowledge]** registers, bus as well as memory and its hierarchy and input/output devices.	3	3	2	1								3
CO2 Explain **[L2: Comprehension]**division based algorithms for different representation of data and discuss I/O interfaces, ports and Data Transfer modes	3	3	3	2	1	1						3
CO3 Apply **[L3: Application]**register and stack organization and construct different control units.	3	3	2	1	2	1						3

CO4	Classify **[L4: Analysis]**types of memory and memory mapping of one type with other	3	2	3	2	2	1						2
	3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: DATA STRUCTURES &ALGORITHMS

COURSE CODE: CS232

COURSE OBJECTIVES:

To introduce the fundamental concepts of data structures and to emphasize the importance of data structures in development and implementation of efficient algorithms.

COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Students would be able to Define **[L1:Knowledge]** facts, terms and basic concepts of various data structures like Array, List, Stack, Queue, Tree and Graph using C as the programming language with static or dynamic implementations.
CO2	Students would be able to Demonstrate **[L2: Comprehension]** the basic understanding using programming techniques for illustrating solution of problems.
CO3	Students would be able to Perform **[L3: Application]** different operations on data structures by applying knowledge and facts gained.
CO4	Student would be able to Analyze **[L4: Analysis]** and test appropriate data structures and algorithms to solve problems and also to draw conclusions regarding the best data structure for the problem.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 Students would be able to Define **[L1:Knowledge]** facts, terms and basic concepts of various data structures like Array, List, Stack, Queue, Tree and Graph using C as the programming language with static or dynamic implementations.	3	3										3

CO2	Students would be able to Demonstrate **[L2: Comprehension]** the basic understanding using programming techniques for illustrating solution of problems.	3	3	2	1										3
CO3	Students would be able to Perform **[L3: Application]** different operations on data structures by applying knowledge and facts gained.	3	3	2											3
CO4	Student would be able to Analyze **[L4: Analysis]** and test appropriate data structures and algorithms to solve problems and also to draw conclusions regarding the best data structure for the problem.	3	2	3	2										2
3: Strong contribution, 2: average contribution, 1: Low contribution															

COURSE: OBJECT ORIENTED PROGRAMMING USING JAVA

COURSE CODE: CS234

COURSE OBJECTIVES:

- Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
- Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc. and exception handling mechanisms.
- Understand the principles of inheritance, packages and interfaces.

COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	*Identify***[L1: Knowledge]**classes, objects, members of a class and relationships among them needed for a specific problem.
CO2	*Explain***[L2: Comprehension]**Java application programs using OOP principles and proper program structuring.
CO3	*Demonstrate***[L3: Application]**the concepts of polymorphism and inheritance.
CO4	WriteJava programs to *Analyze***[L4: Analyze]** error handling techniques usingexception handling

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 *Identify* **[L1: Knowledge]**classes, objects, members of a class and relationships among them needed for a specific problem.	3	3	2	1								3
CO2 *Explain* **[L2: Comprehension]**Java application programs using OOP principles and proper program structuring.	3	3	3	2	1	1						3
CO3 *Demonstrate* **[L3: Application]**the concepts of polymorphism and inheritance.	3	3	2	1	2	1						3
CO4 WriteJava programs to *Analyze***[L4: Analyze]** error handling techniques using exception handling	3	2	3	2	2	1						2
3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: INTRODUCTION TO INFORMATION SECURITY AND CRYPTOGRAPHY

COURSE CODE: CS254

COURSE OBJECTIVES:

The course is designed to provide Basic knowledge of information security and cryptography. Students will be able to learn various algorithm used in securing information.

COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

CO1. Describes **[L1: Knowledge]** Information System and classify **[L2: Comprehension]** various threats to Information System.

CO2. Illustrate **[L2: Comprehension**] various types of cyber-attacks and demonstrate **[L3: Application]** various security techniques.

CO3. Apply **[L3: Application]** different ways for developing **[L5: Synthesis]** secure Information System.

CO4. Define [L1: Knowledge] various encryption & decryption algorithms, Message authentication codes and Digital Signature and ability to relate [L1: Knowledge] Modular arithmetic Approaches and Network Security Approaches with Data Security.

CO5. Explain **[L2: Comprehension]** Key Management & Distribution Technique, Electronic mail security and ability to Discuss **[L2: Comprehension]** IP Security and System security to compute **[L2: Comprehension]** keys for encryption and decryption

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Describes **[L1: Knowledge]** Information System and classify **[L2: Comprehension]** various threats to Information System.	3	3	2									3
CO2	Illustrate **[L2: Comprehension]** various types of cyber-attacks and demonstrate **[L3: Application]** various security techniques	3	3	2	1	2							3
CO3	Apply **[L3: Application]** different ways for developing **[L5: Synthesis]** secure Information System.	3	3	2	2	2							3
CO4	Define [L1: Knowledge] various encryption & decryption algorithms, Message authentication codes and Digital Signature and ability to relate [L1: Knowledge] Modular arithmetic Approaches and Network Security Approaches with Data Security.	3	2	3	2	2							2
CO5	Explain **[L2: Comprehension]** Key Management & Distribution Technique, Electronic mail security and ability to Discuss **[L2: Comprehension]** IP Security and System security to compute **[L2: Comprehension]** keys for encryption and decryption	3	2	3	2	3							2

3: Strong contribution, 2: average contribution, 1: Low contribution

COURSE: PYTHON PROGRAMMING

COURSE CODE: CS252

COURSE OBJECTIVES:

The course is designed to provide Basic knowledge of Python. Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language. Major Course learning objectives

1. To acquire programming skills in core Python.

2. To acquire Object Oriented Skills in Python

3. To develop the skill of designing Graphical user Interfaces in Python

4. To develop the ability to write database applications in Python

COURSE OUTCOMES (COs):
After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	*Define*[**L1:Knowledge**] Object Oriented Programming paradigm and its use in web programming
CO2	*Explain*[**L2: Comprehension**]basic principles of Python programming language and its integration with database
CO3	*Apply*[**L3: Application**] python programming techniques to accessing Data in Structured Flat File Form and sending Data in Unstructured File Form.
CO4	*Analyze*[**L4: Analysis**] problem solving and programming capability of python programming
CO5	*Design*[**L4: Design**]and Develop an application using python for Multithreading

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	*Define*[**L1:Knowledge**] Object Oriented Programming paradigm and its use in web programming	3	3	2									3
CO2	*Explain*[**L2: Comprehension**]basic principles of Python programming language and its integration with database	3	3	2	1	2							3

CO3	*Apply***[L3: Application]** python programming techniques to accessing Data in Structured Flat File Form and sending Data in Unstructured File Form.	3	3	2	2	2							3
CO4	*Analyze***[L4: Analysis]** problem solving and programming capability of python programming	3	2	3	2	2							2
CO5	*Design***[L4: Design]** and Develop an application using python for Multithreading	3	2	3	2	3							2
	3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: Operating Systems Building Blocks

COURSE CODE: CS239

COURSE OBJECTIVES:

To study and apply concepts relating to operating systems, such as concurrency and control of asynchronous processes, deadlocks, memory management, processor and disk scheduling, parallel processing, and file system organization

COURSE OUTCOMES (COs):

Upon completion of the course, students will be able to:

CO1: Analyze**[L4: Analysis]** the structure of OS and basic architectural components involved in OS design .

CO2: Analyze**[L4: Analysis]** and design the applications to run in parallel either using process or thread models of different OS .

CO3: Analyze**[L4: Analysis]** the various device and resource management techniques for timesharing and distributed systems

CO4: Understand**[L2: Comprehension]** the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 — Analyze[L4: **Analysis**] the structure of OS and basic architectural components involved in OS design .	3	3	2	1								3
CO2 — CO2: Analyze[L4: **Analysis**] and design the applications to run in parallel either using process or thread models of different OS .	3	3	3	2	1	1						3
CO3 — Analyze[L4: **Analysis**] the various device and resource management techniques for timesharing and distributed systems	3	3	2	1	2	1						3
CO4 — Understand[L2: **Comprehension**] the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system	3	2	3	2	2	1						2

3: Strong contribution, 2: average contribution, 1: Low contribution

COURSE: Human Values & Professional Ethics

COURSE CODE: BM-226

COURSE OBJECTIVES:

➤To understand the **[L2: Comprehension]**moral values that ought to guide the Management profession, Resolve the moral issues in the profession,

➤ To justify the moral judgment**[L6: Evaluation]** concerning the profession.

➤To create an awareness on **[L5: Synthesis]**Management Ethics and Human Values.

➤ To inspire Moral and Social Values and Loyalty.

➤ Intended to develop a set of beliefs, attitudes, and habits that engineers should display concerning morality.

➤ To appreciate**[L6: Evaluation]**the rights of others.

COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	*Define***[L1: Knowledge]**the human values and related terms.
CO2	*Explain***[L2: Comprehension]** the difference between the moral, social and human values and others
CO3	*Build* **[L3: Application]**become a moral human being from inside.
CO4	*Analyze***[L4: Analysis]**the right or wrong before proceeding to a task.
CO5	*Create* **[L5: Synthesis]**awareness about management ethics and human values.
CO6	*Judge* **[L6: Evaluation]**the moral concerns regarding the profession.
CO6	*Appraise* **[L6: Evaluation]**the right of others.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 *Define*[L1: **Knowledge**]the human values and related terms.							3	3	3	3		3
CO2 *Explain*[L2: **Comprehension**] the difference between the moral, social and human values and others			3			3	2	3	3	3		3
CO3 *Build* [L3: **Application**]become a moral human being from inside.		3	2			3	3	3	2	3		3
CO4 *Analyze*[L4: **Analysis**]the right or wrong before proceeding to a task.		3	3			3	3	3	1	3		3
CO5 *Create* [L5: **Synthesis**]awareness about management ethics and human values.		3	2			3	3	3	3	3		3
CO6 *Judge* [L6: **Evaluation**]the moral concerns regarding the profession.		3	3			3	3	3	1	3		2
CO6 *Appraise* [L6: **Evaluation**]the right of others.		3	3			3	3	3	3	3		3
3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: DESKTOP OPERATING SYSTEM

COURSE CODE: CS240

COURSE OBJECTIVES:

Student will be able to understand the basic components of a computer operating system, and the interactions among the various components. The course will cover an introduction on the policies for scheduling, deadlocks, memory management, synchronization, system calls, and file systems.

COURSE OUTCOMES (COs):

CO1: Describeand explain**[L2: Comprehension]**the fundamental components of a windows operating system

CO2: Learn **[L1: Knowledge]** to do file processing, process management, storage backup, account management etc.

CO3: Demonstrate **[L3: Application]**the policies for scheduling, deadlocks, memory management, synchronization, system calls, and file systems

CO4: Analyze **[L4: Analysis]**the application of windows administrative features available to make system secure and easy to use.

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Describeand explain**[L2: Comprehension]**the fundamental components of a windows operating system	3	3	2									3
CO2	Learn **[L1: Knowledge]** to do file processing, process management, storage backup, account management etc.	3	3	2	1	2							3
CO3	Demonstrate **[L3: Application]**the policies for scheduling, deadlocks, memory management, synchronization, system calls, and file systems	3	3	2	2	2							3

| CO4 | Analyze **[L4: Analysis]**the application of windows administrative features available to make system secure and easy to use. | 3 | 2 | 3 | 2 | 2 | | | | | | 2 |

3: Strong contribution, 2: average contribution, 1: Low contribution

COURSE: RELATIONAL DATABASE MANAGEMENT SYSTEMS

COURSE CODE: CS242

COURSE OBJECTIVES:

The objective of this course is to expose the students to the fundamentals & basic concepts in relational Data Base Management Systems. This course discusses architecture of Database Systems with concept of relational model & ER model. This course explains techniques for database design, Normalization and database recovery and protection.

COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	*Define***[L1:Knowledge]**the conceptual frameworks and definitions of specific terms that are integral to the Relational Database Management Systems
CO2	*Demonstrate***[L2: Comprehension]** an understanding of the elementary & advanced features of DBMS & RDBMS
CO3	*Evaluate***[L3: Application]**options to make informed decisions that meet data storage, processing, and retrieval needs
CO4	*Analyze***[L4: Analysis]**normalized database that meets business requirements using industry standards and best practices
CO5	*Design***[L4: Design]**and documents data structures incorporating integrity constraints to satisfy business rules by applying the relational model

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 *Define***[L1:Knowledge]**the conceptual frameworks and definitions of specific terms that are integral to the Relational Database Management Systems	3	3										3
CO2 *Demonstrate***[L2: Comprehension]** an understanding of the elementary & advanced features of DBMS & RDBMS	3	3	2	1								3

	CO											
CO3	*Evaluate*[**L3: Application**]options to make informed decisions that meet data storage, processing, and retrieval needs	3	3	2	2	2						3
CO4	*Analyze*[**L4: Analysis**]normalized database that meets business requirements using industry standards and best practices	3	2	3	2	2						2
CO5	*Design*[**L4: Design**]and documents data structures incorporating integrity constraints to satisfy business rules by applying the relational model	3	2	3								2
3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: NETWORK SECURITY BASICS

COURSE CODE: CS244

Course Objectives

To Develop an understanding of information assurance as practiced in computer operating systems, distributed systems, networks and representative applications and Gain familiarity with prevalent network and distributed system attacks, defenses against them, and forensics to investigate the aftermath.

Course Outcomes:

Upon completion of the course, students will be able to:
1.CO1:Analyze[**L4: Analysis**]your exposure to security threats
2.CO2:Protect[**L6: Evaluation**]your organization's systems and data
3.CO3:Deploy[**L5: Synthesis**] firewalls and data encryption to minimize threats
4.CO4:Assess[**L6: Evaluation**] alternative user and host authentication mechanisms
5.CO5:Manage[**L5: Synthesis**] risks originating from inside the organization and the internet

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	CO1:Analyze **[L4: Analysis]**your exposure to security threats	3	3	2	1								3
CO2	CO2:Protect **[L6: Evaluation]**your organization's systems and data	3	3	3	2	1	1						3

CO3	CO3:Deploy **[L5: Synthesis]** firewalls and data encryption to minimize threats	3	3	2	1	2	1						3
CO4	CO4:Assess**[L6: Evaluation]** alternative user and host authentication mechanisms	3	2	3	2	2	1						2
CO5	CO5:Manage**[L5: Synthesis]** risks originating from inside the organization and the internet	3	2	3	2	1	1						2
	3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: ENTERPRISE ENGINEERING NETWORKS

COURSE CODE: CS246

Course Objectives

To provide an in-depth view of the advanced technologies used in enterprise-wide computer networks,provide the theoretical foundation and practical skills of advanced computer networks for many other relevant topics, such as distributed computing

Course Outcomes

Upon completion of the course, students will be able to:
1.CO1:Analyze**[L4: Analysis]** state-of-the-art real-world enterprise-wide networks.
2.CO2:Design**[L5: Synthesis]** build, and implement advanced enterprise-wide computer networks;
3.CO3:Manage**[L5: Synthesis]** configure, troubleshoot, and maintain typical enterprise-wide computer networks
4.CO4:Introduce**[L1: Knowledge]** both theoretical, practical, and technical issues in enterprise-wide computer networks

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1:Analyze**[L4: Analysis]** state-of-the-art real-world enterprise-wide networks.	3	3	2	1								3
CO2:Design **[L5: Synthesis]** build, and implement advanced enterprise-wide computer networks	3	3	3	2	1	1						3
CO3:Manage**[L5: Synthesis]** configure, troubleshoot, and maintain typical enterprise-wide computer networks	3	3	2	1	2	1						3
CO4:Introduce **[L1: Knowledge]** both theoretical, practical, and technical issues in enterprise-wide computer networks	3	2	3	2	2	1						2

3: Strong contribution, 2: average contribution, 1: Low contribution

COURSE: INTRODUCTION TO LINUX

COURSE CODE: CS248

COURSE OBJECTIVES:

The course is designed to provide Basic knowledge of linux operating systems. Major Course learning objectives are

1. Teach Basics of Linux Operating System
2. Teach ownership and permissions of the files and directories.
3. Explain why these issues exist.
4. How to set permissions files/directories
5. How to manipulate files/directories

COURSE OUTCOMES (COs):

CO1: Students will be able to understand**[L1: Knowledge]**the basics of the UNIX and Linux Operating Systems

CO2: Students will have the Illustrate **[L3: Application]**about the UNIX and Linux file system and comprehend the system calls

CO3: Students will be able to understand**[L1: Knowledge]** the UNIX process management

CO4: Student will be able to discuss **[L2: Comprehension]** the use and the functionality of the VI editor

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 Students will be able to understand**[L1: Knowledge]**the basics of the UNIX and Linux Operating Systems	3	3	2									3
CO2 Students will have the Illustrate **[L3: Application]**about the UNIX and Linux file system and comprehend the system calls	3	3	2	1	2							3
CO3 Students will be able to understand **[L1: Knowledge]** the UNIX process management	3	3	2	2	2							3

CO4	Student will be able to discuss **[L2: Comprehension]** the use and the functionality of the VI editor	3	2	3	2	2							2
	3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: MATHEMATICAL ANALYSIS

COURSE CODE: MT206

COURSE OBJECTIVES:

• To understand the concepts of algebraic and transcendental equations

• Gain basic of numerical integration and solution of ordinary differential equation

• Understanding the concepts of binomial distribution, poison distribution and normal distribution.

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COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	*Define* **[L1: Knowledge]** normalization and state its consequences.
CO2	*Explain***[L2: Comprehension]** various methods of numerical analysis
CO3	*Demonstrate* **[L3: Application] integral** transformation of an equation using Fourier transformation.
CO4	*Analyze***[L4: Analysis]** correlation and regression of a coefficient.
CO5	*Compare***[L4: Synthesis]** Euler's Method and Modified Euler's Method

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	*Define* **[L1: Knowledge]** normalization and state its consequences.	3		3									3

CO	Description												
CO2	*Explain* **[L2: Comprehension]** various methods of numerical analysis	3	2	1						2			
CO3	*Demonstrate* **[L3: Application]** integraltransformation of an equation using Fourier transformation.	3	3	3									
CO4	*Analyze* **[L4: Analysis]** correlation and regression of a coefficient.	3	3	2									3
CO5	*Compare* **[L4: Synthesis]** Euler's Method and Modified Euler's Method	3	2	3						2			

3: Strong contribution, 2: average contribution, 1: Low contribution

COURSE: Logical Reasoning and Thinking

COURSE CODE: CS-361

COURSE OBJECTIVES:

- The subject aims to provide students with an understanding **[L1: Knowledge]**of the structure of arguments and reasoning.
- The subject will also help students develop **[L3: Application]**logical skills in rationally constructing, analyzing, justifying and criticizing arguments.

COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	*Identify* **[L1: Knowledge]**the formula to apply as per the question, understand the trick of the question.
CO2	*Recognize***[L2: Comprehension]**the question pattern and the topic from which question has been asked for.
CO3	*Calculate***[L3: Application]**the question while applying the formula.
CO3	*Solve* **[L3: Application]**the question through the shortcut method to save their time.
CO4	*Diagram***[L4: Analysis]**will be able to analyze the type of diagram in Data Interpretation section.
CO5	*Create* **[L5: Synthesis]**will be able to think about other method to solve the problem.
CO6	*Evaluate* **[L6: Evaluation]**will be able to judge by self that the question solved is right or not as per the methods taught.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 *Identify* [L1: Knowledge] the formula to apply as per the question, understand the trick of the question.		3	3	1					3			3
CO2 *Explain* [L2: Comprehension] the question pattern and the topic from which question has been asked for.		3	3	2					3			3
CO3 *Calculate* [L3: Application] the question while applying the formula.		3	2	1	2				1			3
CO3 *Solve* [L4: Application] the question through the shortcut method to save their time.		3		2	2				1			2
CO4 *Diagram* [L4: Analysis] will be able to analyze the type of diagram in Data Interpretation section.		3	2	2	2				3			3
CO5 *Create* [L5: Synthesis] will be able to think about other method to solve the problem.		2	2	1	1				1			2
CO6 *Evaluate* [L6: Evaluation] will be able to judge by self that the question solved is right or not as per the methods taught.		3	3	2					3			3
3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: STORAGE TECHNOLOGY

COURSE CODE: CS353

COURSE OBJECTIVES:

• Provides a comprehensive view of storage and networking infrastructures for highly virtualized cloud ready deployments.

• To Understand the process of backup and recovery, local replication and remote replication.

• To know various RAID levels and their use cases.

• To understand the evolution of storage technologies.

COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	*State***[L1: Knowledge]** various key challenge in managing information
CO2	*Explain***[L2: Comprehension]**storage network technologies
CO3	*Compare***[L3: Application]** various RAID levels
CO4	*Differentiate***[L4: Analysis]** between local and remote backup
CO5	*Specify***[L4: Synthesis]** the components of storage system environment.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 *State***[L1: Knowledge]** various key challenge in managing information	3	3	2			2			1			3
CO2 *Explain***[L2: Comprehension]**storage network technologies	3	3	2	3		2	1		2			3

CO3	*Compare***[L3: Application]** various RAID levels	3	3	3	1					2			3
CO4	*Differentiate***[L4: Analysis]** between local and remote backup	3	3	3	2		1			3			2
CO5	*Specify***[L4: Synthesis]** the components of storage system environment.	3	3	3		2				1			2
3: Strong contribution, 2: average contribution, 1: Low contribution													

COURSE: DATABASE SECURITY

COURSE CODE: CS363

COURSE OBJECTIVES:

• Master the security architecture

• Master virtual private databases

• Master multilevel secure relational model

• Master auditing in relational databases

• Understand NoSQL databases and its differences with RDBMS

• Understand administration of users

• Understand the databases security models

COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	*Identify* **[L1: Knowledge]** the schemas for security and concepts of symmetric Encryption.
CO2	*Explain***[L2: Comprehension]**the different models in the Security Architecture
CO3	*Illustrate* **[L3: Application]** auditing in relational database and demonstrate the authentication stored procedure by signature.
CO4	*Analyze***[L4: Analysis]** the concept of least privilege in information security and difference between classical DBMS with the NoSQL.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 *Identify* **[L1: Knowledge]** the schemas for security and concepts of symmetric Encryption.	3	3	2			1						3
CO2 *Explain***[L2: Comprehension]**the different models in the Security Architecture	3	3	2	3		1						3
CO3 *Illustrate* **[L3: Application]** auditing in relational database and demonstrate the authentication stored procedure by signature.	3	3	2	2								3
CO4 *Analyze***[L4: Analysis]** the concept of least privilege in information security and difference between classical DBMS with the NoSQL.	3	2	3	2								2
3: Strong contribution, 2: average contribution, 1: Low contribution												

Installation & Configuration of Server CS-357

Course Objectives:

To learn with paired demonstrations on how to configure, install, and monitor server 2012.

Course Outcomes:

Upon completion of the course, students will be able to:

1.Be able to install**[L3: Application]**, configure, and monitor servers and local storage.

2.Know how to configure**[L3: Application]**, servers for remote management.

3.Create and configure**[L5: Synthesis]** virtual machine settings, storage, and networks.

4.Review**[L6: Evaluation]** how to install domain controllers and create and manage group policy by understanding its processing.

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 Be able to install**[L3: Application]**, configure, and monitor servers and local storage	3	3	2	1								3
CO2 Know how to configure**[L3: Application]**, servers for remote management.	3	3	3	2	1	1						3
CO3 Create and configure**[L5: Synthesis]** virtual machine settings, storage, and networks.	3	3	2	1	2	1						3
CO4 Review**[L6: Evaluation]** how to install domain controllers and create and manage group policy by understanding its processing.	3	2	3	2	2	1						2

3: Strong contribution, 2: average contribution, 1: Low contribution

ETHICAL HACKINGCS355

COURSE OBJECTIVES

1.To enable students to better understand the Ethical hacking concepts and various phases of hacking along with the objective of providing an in-depth knowledge on Web Application vulnerabilities and exploitation techniques.

2.To familiarize them with the wide range of attacks in a Networking environment and to enable him/her to prepare a well-defined vulnerability reporting procedure along with the remediation techniques

Course Outcome: At the end student will able to understand:

1.Outline**[L2: Comprehesion]** ethical considerations of hacking

2.Assess**[L6: Evaluation]** an environment using footprinting

3.Collect**[L5: Synthesis]** information using network scanning

4.Analyze**[L4: Analysis]** social engineering methods

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Outline**[L2: Comprehesion]** ethical considerations of hacking	3	3	2	1								3
CO2	Assess**[L6: Evaluation]** an environment using footprinting	3	3	3	2	1	1						3
CO3	Collect**[L5: Synthesis]** information using network scanning	3	3	2	1	2	1						3
CO4	Analyze**[L4: Analysis]** social engineering methods	3	2	3	2	2	1						2

3: Strong contribution, 2: average contribution, 1: Low contribution

COURSE: CLOUD TECHNOLOGY

COURSE CODE: CS351

COURSE OBJECTIVES:

• To understand cloud services and solutions.

• To understand the process and purposes of migrating into cloud.

• To understand the relevance of Cloud, SOA and benchmarks

• To Know about governance in cloud and Do's and Don'ts in cloud

COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	*State***[L1: Knowledge]** various delivery models and service models of cloud computing
CO2	*Explain***[L2: Comprehension]**seven-step model for migrating into cloud
CO3	*Illustrate***[L3: Application]** various considerations for selecting cloud solution
CO4	*Analyze***[L4: Analysis]** importance of governance in cloud
CO5	*Specify***[L4: Synthesis]**the do's and don'ts of cloud computing.

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	*State***[L1: Knowledge]** various delivery models and service models of cloud computing	3	3	2			2						3

CO	Description												
CO2	*Explain***[L2: Comprehension]**seven-step model for migrating into cloud	3	3	2	3		2						3
CO3	*Illustrate***[L3: Application]** various considerations for selecting cloud solution	3	3	2	2	2							3
CO4	*Analyze***[L4: Analysis]** importance of governance in cloud	3	2	3	2		1						2
CO5	*Specify***[L4: Synthesis]**the do's and don'ts of cloud computing.	3	2	3		2							2

3: Strong contribution, 2: average contribution, 1: Low contribution

COURSE: WEB TECHNOLOGY

COURSE CODE: CS371

COURSE OBJECTIVES:

Students will try to learn:

1. To get familiar with basics of the Internet Programming.

2. To acquire knowledge and skills for creation of web site considering both client and server sideprogramming

3. To gain ability todevelop responsiveweb applications

4. To explore differentweb extensions andweb servicesstandards

COURSE OUTCOMES (COs):

CO1: Define **[L1: Knowledge]** of Internet and the World Wide Web and to design **[L5: Synthesis]**and interactive web page(s) using HTML, CSS and JavaScript.
CO2: Describe **[L2: Comprehension]** and differentiate **[L2: Comprehension]**different Web Extensions and Web Services.
CO3: Design **[L5: Synthesis]** a responsive web site using HTML5 and CSS3
CO4: Design **[L5: Synthesis]** Dynamic web site using server side PHP Programming and Database connectivity.

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Define **[L1: Knowledge]** of Internet and the World Wide Web and to design **[L5: Synthesis]**and interactive web page(s) using HTML, CSS and JavaScript	3	3	2									3

CO2	Describe **[L2: Comprehension]** and differentiate **[L2: Comprehension]**different Web Extensions and Web Services.	3	3	2	1	2							3
CO3	Design **[L5: Synthesis]** a responsive web site using HTML5 and CSS3	3	3	2	2	2							3
CO4	Design **[L5: Synthesis]** Dynamic web site using server side PHP Programming and Database connectivity	3	2	3	2	2							2
	3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: CLOUD SECURITY

COURSE CODE: CS373

COURSE OBJECTIVES:

•Introduces the basic concepts of security systems and cryptographic protocols.

•Multi tenancy operation, virtualized infrastructure security.

•Improve virtualization security.

COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	*State* **[L1: Knowledge]** the impact of virtualization in the context of security on business benefits.
CO2	*Discuss***[L2: Comprehension]** various preventive, detective and corrective security controls for Cloud computing.
CO3	*Demonstrate* **[L3: Application]** Business Continuity Management and Disaster Recovery in the Cloud.
CO4	*Analyze***[L4: Analysis]** security risk of cloud provider.
CO5	*Compare***[L4: Synthesis]**traditional IT and Cloud Security with appropriate example.

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	*State* **[L1: Knowledge]** the impact of virtualization in the context of security on business benefits.	3	3	3									3

CO2	*Discuss***[L2: Comprehension]** various preventive, detective and corrective security controls for Cloud computing.	3	2	1						2			
CO3	*Demonstrate* **[L3: Application]** Business Continuity Management and Disaster Recovery in the Cloud.	3		3			1						
CO4	*Analyze***[L4: Analysis]** security risk of cloud provider.	3	3	2			1						3
CO5	*Compare***[L4: Synthesis]**traditional IT and Cloud Security with appropriate example.	3		3						2			
	3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: THEORY OF AUTOMATA AND COMPILER DESIGN

COURSE CODE: CS372

COURSE OBJECTIVES:

• Demonstrate different language processing abstract machines.

• Explain relationship between different languages and automata

• Design automata and language under specific criteria.

COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	*State* **[L1: Knowledge]** procedure to convert regular expression to NFA and NFA to DFA
CO2	*Discuss***[L2: Comprehension]** properties of different grammars and languages
CO3	*Solve* **[L3: Application]** problems related to string membership to an automata and respective Language
CO4	*Analyze***[L4: Analysis]** importance of governance in cloud
CO5	*Create***[L4: Synthesis]** grammar for specific language.

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	*State* **[L1: Knowledge]** procedure to convert regular expression to NFA and NFA to DFA	3	3	3			2			1			3
CO2	*Discuss***[L2: Comprehension]** properties of different grammars and languages	3	3	2	3		2			3	2		3

CO3	Solve [L3: Application] problems related to string membership to an automata and respective Language	3	3	2	2	2				3			3
CO4	Analyze[L4: Analysis] importance of governance in cloud	3	2	2	2		1						2
CO5	Create[L4: Synthesis] grammar for specific language.	3	2	3		2				1			2
3: Strong contribution, 2: average contribution, 1: Low contribution													

Principles of Virtualization CS 374

COURSE OBJECTIVES:

This course focuses on the challenges in setting up a data center. Resource monitoring using hypervisors and access control to virtual machines will be covered in depth in this course. Setting up of a virtual data center and how to manage them with software interfaces will be discussed in detail.

Course Outcomes:

Upon completion of the course, students will be able to:

1. Identify**[L61: Knowledge]** various constraints and challenges in setting up a data center

2. Demonstrate**[L3: Application]**,   Enterprise level virtualization and access control in virtual machines

3. Perform**[L3: Application]** Resource monitoring and execute backup and recovery of virtual machines.

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Identify**[L61: Knowledge]** various constraints and challenges in setting up a data center	3	3	2	1								3
CO2	Demonstrate**[L3: Application]**, Enterprise level virtualization and access control in virtual machines	3	3	3	2	1	1						3
CO3	Perform**[L3: Application]** Resource monitoring and execute backup and recovery of virtual machines.	3	3	2	1	2	1						3
	3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: INFRASTRUCTURE SOLUTIONS ON CLOUD

COURSE CODE: CS375

COURSE OBJECTIVES:

• To Understand Microsoft Azure and Azure Storage.

• Creating a SQL, SQL DB, Tables and adding data to the table in Microsoft Azure

•To gain basic understanding of Azure storage and networking.

COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	DescribeAzure AD and *list* **[L1: Knowledge]** its advantages
CO2	*Discuss***[L2: Comprehension]** various best practices for azure storage
CO3	*Build* **[L3: Application]** configure and use load balances in Azure
CO4	*Analyze***[L4: Analysis]** the identity and authentication in public cloud
CO5	*Create***[L4: Synthesis]** SQL tables in Microsoft Azure and adding data to it.

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	DescribeAzure AD and *list* **[L1: Knowledge]** its advantages	3	3	3						3			2
CO2	*Discuss***[L2: Comprehension]** various best practices for azure storage	3	3	2	3					3			3

CO3	*Build* **[L3: Application]** configure and use load balances in Azure	3	3	2						3			2
CO4	*Analyze* **[L4: Analysis]** the identity and authentication in public cloud	3	2	3	3								3
CO5	*Create* **[L4: Synthesis]** SQL tables in Microsoft Azure and adding data to it.	3	3	3									2
3: Strong contribution, 2: average contribution, 1: Low contribution													

COURSE: CYBER SECURITY INCIDENTS RESPONSE MANAGEMENT

COURSE CODE: CS379

COURSE OBJECTIVES:

Students will try to learn:

1. To get an overview of the cyber incidents.

2. To acquire knowledge and skills for responding to a cyber-incidents

3. To understand various solution to recover from cyber-security incidents

4. To learn various laws that can be applied on a given scenario of cyber incident

COURSE OUTCOMES (COs):

CO1: Define **[L1: Knowledge]**the importance and identify **[L1: Knowledge]** the need of CSIRM.
CO2:Apply**[L3: Application]**the security concepts to Handle a Cyber Security Incident.
CO3:Illustrate**[L3: Application]**the solution to Recovering from Cyber Security Incidents
CO4:Design **[L5: Synthesis]**the Cyber Security Incidents responses through Scenarios

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Define **[L1: Knowledge]** the importance and identify **[L1: Knowledge]** the need of CSIRM	3	3	2									3
CO2	Apply **[L3: Application]**the security concepts to Handle a Cyber Security Incident	3	3	2	1	2							3

CO3	Illustrate **[L3: Application]** the solution to Recovering from Cyber Security Incidents	3	3	2	2	2						3
CO4	Design **[L5: Synthesis]** the Cyber Security Incidents responses through Scenarios	3	2	3	2	2						2
3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: ADVANCE VIRTUALIZATION

COURSE CODE: CS469

COURSE OBJECTIVES:

• To learning the security concepts in virtualization

• Learn to create, configure, and managevNetwork

• To understand the process of creating using and optimizing virtual machines.

COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	*Define* **[L1: Knowledge]** backup and recovery in virtual machines using VMware Data Recovery.
CO2	*Explain***[L2: Comprehension]** role-based access control
CO3	*Demonstrate* **[L3: Application]** the process of creating, configuring and managing vNetwork standard switches.
CO4	*Analyze***[L4: Analysis]** the CPU and memory usage using vCenter Server performance graphs and alarms
CO5	*Create***[L4: Synthesis]** and manage vSphere data store.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 *Define* **[L1: Knowledge]** backup and recovery in virtual machines using VMware Data Recovery.	3		3									1

CO2	*Explain***[L2: Comprehension]** role-based access control	3	2		3										2
CO3	*Demonstrate* **[L3: Application]** the process of creating, configuring and managing vNetwork standard switches.	3	3	3	2										
CO4	*Analyze***[L4: Analysis]** the CPU and memory usage using vCenter Server performance graphs and alarms	3	3		2										3
CO5	*Create***[L4: Synthesis]** and manage vSphere data store.	3	2	3											
3: Strong contribution, 2: average contribution, 1: Low contribution															

COURSE: CYBER FORENSICS & INVESTIGATION

COURSE CODE: CS461

COURSE OBJECTIVES:

To provide an understanding Computer forensics fundamentals, analyze various computer forensics technologies, identify methods for data recovery and apply the methods for preservation of digital evidence.

COURSE OUTCOMES (COs):

CO1: Learn **[L1: Knowledge]**the basics of computer forensics.
CO2:Apply **[L3: Application]**the knowledge of cyber laws in the forensics' cases.
CO3:Illustrate **[L3: Application]** the solution to Recovering from Cyber Security Incidents
CO4: **A**nalyze**[L4: Analysis]** and implement various Forensics Techniques

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 Learn **[L1: Knowledge]**the basics of computer forensics.	3	3	2									3
CO2 Apply **[L3: Application]**the knowledge of cyber laws in the forensics' cases.	3	3	2	1	2							3
CO3 Illustrate **[L3: Application]** the solution to Recovering from Cyber Security Incidents	3	3	2	2	2							3
CO4 Analyze**[L4: Analysis]** and implement various Forensics Techniques	3	2	3	2	2							2
3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: CLOUD WEB SERVICES

COURSE CODE: CS462

COURSE OBJECTIVES:

• To learn how to use Cloud Services

• To understand the implementation of Virtualization using AWS cloud

• To Build Private Cloud using AWS Cloud platform

COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	*State* **[L1: Knowledge]** various EC2 instance types.
CO2	*Explain***[L2: Comprehension]** the Amazon Simple Storage Service
CO3	*Demonstrate* **[L3: Application]** the procedure ofdeploying Scalable Application on AWS
CO4	*Analyze***[L4: Analysis]** security in AWS Key Management service
CO5	*Create***[L4: Synthesis]** EC2 instances in public and private VPC.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 *Identify* **[L1: Knowledge]** various EC2 instance types.	3		3									3
CO2 *Explain***[L2: Comprehension]** the Amazon Simple Storage Service	3	3	1	3						1		3

CO3	*Demonstrate* **[L3: Application]** the procedure ofdeploying Scalable Application on AWS	3	3	3	2	2							3
CO4	*Analyze***[L4: Analysis]** security in AWS Key Management service	3	3	3	2		1			3			3
CO5	*Create***[L4: Synthesis]** EC2 instances in public and private VPC.	3	3	3		2	2			3			3
	3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: LINUX ADMINISTRATION

COURSE CODE: CS463

COURSE OBJECTIVES:

Linux Administration Certification training is designed to shape you as a Linux professional & help you to run applications, perform desired functions on your system and networks, create a network configuration, and maintain security administration.

COURSE OUTCOMES (COs):

CO1: Learn **[L1: Knowledge]**and remember factual knowledge relevant to system administration tools and technologies in Linux based OS
CO2: Learn**[L1: Knowledge]** to do file processing, process management, storage backup, account management etc.
CO3: Apply**[L3: Application]**the knowledge to manage resources and security of a computer running Linux
CO4: Analyze**[L4: Analysis]**and make effective use of Unix utilities, and scripting languages

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Learn **[L1: Knowledge]** and remember factual knowledge relevant to system administration tools and technologies in Linux based OS	3	3	2									3
CO2	Learn **[L1: Knowledge]** to do file processing, process management, storage backup, account management etc.	3	3	2	1	2							3
CO3	Apply **[L3: Application]** the knowledge to manage resources and security of a computer running Linux	3	3	2	2	2							3
CO4	Analyze**[L4: Analysis]**and make effective use of Unix utilities, and scripting languages	3	2	3	2	2							2

3: Strong contribution, 2: average contribution, 1: Low contribution

COURSE: DISASTER RECOVERY AND BUSINESS CONTINUITY MANAGEMENT

COURSE CODE: CS464

COURSE OBJECTIVES:

• To make understand the importance of Disaster Recovery and Business Continuity Management

• To develop a completed, customized plan

• To identify, analyze and address your organization's risks

COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	*Identify***[L1: Knowledge]** and address the organization's risks
CO2	*Explain***[L2: Comprehension]**Business Resumption Plan (BRP), Disaster Recovery Plan (DRP) and Common terminologies used in BCP and DRP
CO3	*Compare***[L3: Application]** the different types of tests including structured walk-through
CO4	*Analyze***[L4: Analysis]** the organization's risks
CO5	Organize**[L4: Organize]**a case study of IT Organization and prepare a Business Continuity Plan for the same using the learning from this course.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 *Identify* **[L1: Knowledge]** and address the organization's risks	3	3	2			2						3
CO2 *Explain***[L2: Comprehension]**Business Resumption Plan (BRP), Disaster Recovery Plan (DRP) and Common terminologies used in BCP and DRP	3	3	2	3		2						3

CO3	*Compare* **[L3: Application]** the different types of tests including structured walk-through	3	3	2	2	2							3
CO4	*Analyze***[L4: Analysis]** the organization's risks	3	2	3	2		1						2
CO5	Organize**[L4: Organize]**a case study of IT Organization and prepare a Business Continuity Plan for the same using the learning from this course.	3	2	2		2							2
	3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: IT GOVERNANCE,RISK AND INFORMATION SECURITY MANAGEMENT

COURSE CODE: CS471

COURSE OBJECTIVES:

• To make understand the importance of IT Governance, Risk and Information Security Management

• To develop a Risk Management Program.

• To identify, analyse and address various outcomes of effective cloud governance.

COURSE OUTCOMES (COs): *After completion of the course, a student will be able to*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	*State*[**L1: Knowledge**] Best Practices for IT Governance and Role of Governance in Information Security
CO2	*Explain*[**L2: Comprehension**]role of strategic planning for IT, strategic direction and alignment of security strategy with business objectives
CO3	*Illustrate*[**L3: Application**] the Val-IT framework of ISACA
CO4	*Analyze*[**L4: Analysis**] Role of IT Strategy Committee and Security Steering Committee
CO5	*Design*[**L4: Synthesis**]anIT governance strategy for a particular cloud provider of your choice by following the best practices for IT Governance.

CO-PO MAPPING:

CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of Solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1 *State*[**L1: Knowledge**] Best Practices for IT Governance and Role of Governance in Information Security	3	3	3	2		3	1		3			3
CO2 *Explain*[**L2: Comprehension**]role of strategic planning for IT, strategic direction and alignment of security strategy with business objectives	3	3	2	3		2						3
CO3 *Illustrate*[**L3: Application**] the Val-IT framework of ISACA	3	3	2	2	2							2

CO4	*Analyze***[L4: Analysis]** Role of IT Strategy Committee and Security Steering Committee	3	3	3	2		1					3
CO5	*Design***[L4: Synthesis]**an IT governance strategy for a particular cloud provider of your choice by following the best practices for IT Governance.	3	3	3		2				3		3
	3: Strong contribution, 2: average contribution, 1: Low contribution											

COURSE: IT INFRASTRUCTURE LIBRARY

COURSE CODE: CS481

COURSE OBJECTIVES:

• Defining the ITIL component and services

• Understanding service translation life cycle

• Continual Service Improvement principles

COURSE OUTCOMES (COs):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	*State* **[L1: Knowledge]** stages of Service Design Lifecycle
CO2	*Discuss***[L2: Comprehension]** various service operation functions
CO3	*Illustrate* **[L3: Application]** various components of the ITIL Library
CO4	*Analyze***[L4: Analysis]** the service level management process
CO5	*Specify***[L4: Synthesis]** various continual service improvement

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	*State* **[L1: Knowledge]** stages of Service Design Lifecycle	3	2	3			2			2			3
CO2	*Discuss***[L2: Comprehension]** various service operation functions	3	3	1	3		2			3	1		3
CO3	*Illustrate* **[L3: Application]** various components of the ITIL Library	3	3	3	2	2							3
CO4	*Analyze***[L4: Analysis]** the service level management process	3	2	3	2		1			3			2
CO5	*Specify***[L4: Synthesis]** various continual service improvement	3	3	3		2							2
	3: Strong contribution, 2: average contribution, 1: Low contribution												