

CO'S & CO-PO MAPPING

FOR

MASTER OF COMPUTER APPLICATION (MCA)

(W.E.F 2019-2020)



DEPARTMENT OF COMPUTER APPLICATION

INTEGRAL UNIVERSITY, LUCKNOW

INTEGRAL UNIVERSITY, LUCKNOW

VISION

- To lead the teeming millions of the world through the wilderness of ignorance and illiteracy, as "Kindly Light" (Exodus 13:21) with the resounding divine proclamation "Read : Thy Lord is the most bounteous (Quran 30:96:3)." and to educate them in the most constructive and Innovative way.
- To inculcate a spirit of confidence, self-respect and firm commitment in students along with farsighted wisdom and understanding.
- To integrate the ebullience, intellect and dynamism of youth with decency, decorum, discipline and dedication through value-based quality education.

MISSION

- To make every student a role model of intellectuals and torch bearers for others all over the world through his / her inspiring existence.
- To make India a self-reliant and dominant G-1 country, recognized for quality education, higher economic growth and valuable moral practices.

OBJECTIVES

- To harness education in the service of mankind, and to enable the students to think globally and act nationally.
- To integrate spiritual and moral values with education and to develop human potential to its totality. To develop a sense of self-reliance and to create the awareness of the same in the young generations.
- To ignite the latent potentialities of young and budding generation through cutting-edge technology and state-of-the-art academic programmes.
- To bring about innovation in education by restructuring courses and adopting novel methods of teaching and learning to target multifaceted personality development.

**DEPARTMENT OF COMPUTER APPLICATIONS
MCA PROGRAMME**

VISION

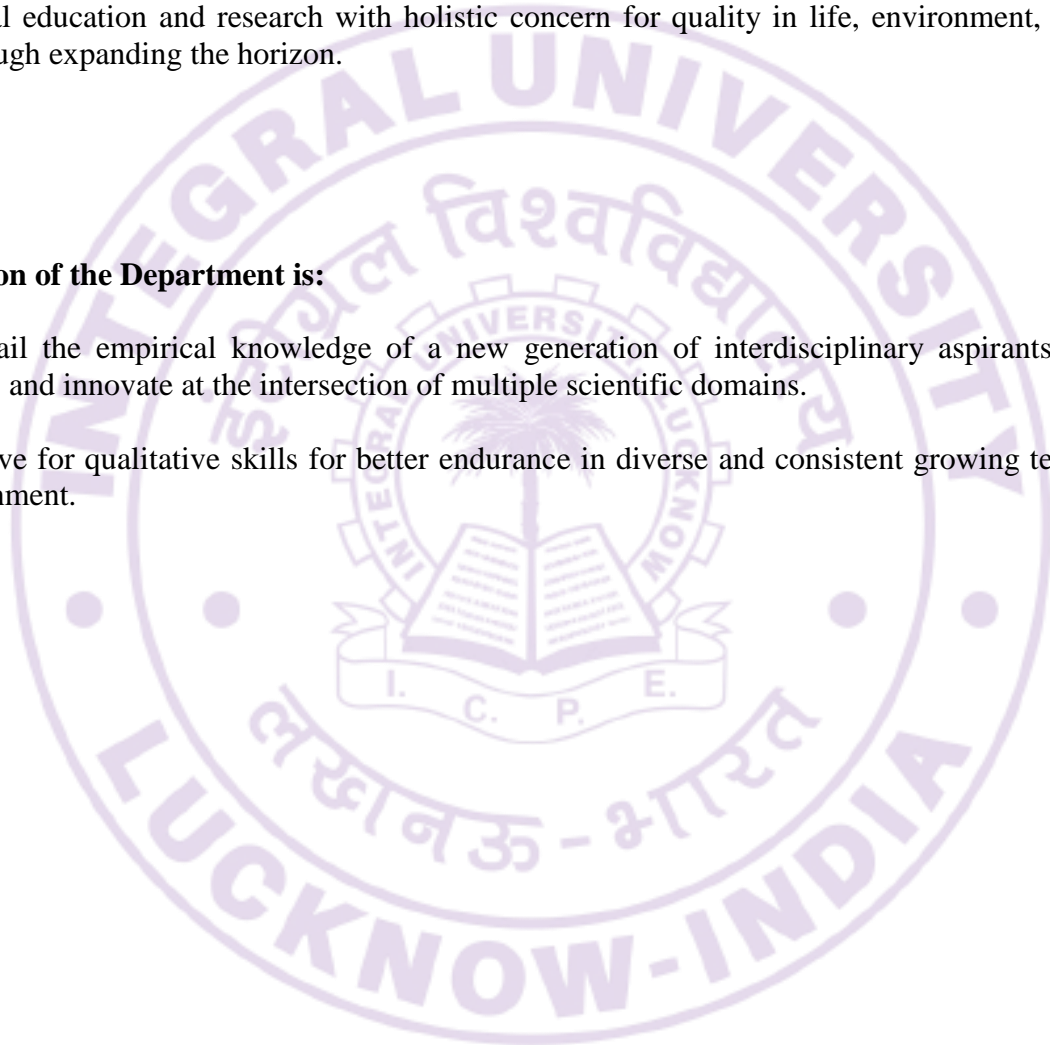
The Vision of the Department is:

Visualizing the department as an academic distinction recognize for its total commitment to superiority in technical education and research with holistic concern for quality in life, environment, society and ethics through expanding the horizon.

MISSION

The Mission of the Department is:

- To entail the empirical knowledge of a new generation of interdisciplinary aspirants who build bridges and innovate at the intersection of multiple scientific domains.
- To thrive for qualitative skills for better endurance in diverse and consistent growing technological environment.



**DEPARTMENT OF COMPUTER APPLICATIONS
MCA PROGRAMME**

Programme Educational Objectives (PEO)

- To enhance foundation of mathematics, computer application and problem solving methodology for effective implementation in the area of s/w development.
- To effectively design, implement, improve, and manage the integrated socio-technical systems.
- To inculcate effective communication skills combined with professional & ethical attitude.
- To gain multidisciplinary knowledge through real time projects and industry internship training and providing a sustainable competitive edge in R&D and meeting industry needs.

Programme Outcomes (PO)

- **Computational knowledge:** Acquire knowledge of Computing Fundamentals, Basic Mathematics, Computing Specialization and Domain Knowledge of proper computing models from defined problems.
- **Problem analysis:** Identify, formulate review research literature and analyze complex engineering problems reading substantiated conclusions using first principles mathematics, computing science and relevant domains.
- **Design/development of solutions:** Ability to design system s/w or process as per needs and specifications.
- **Conduct investigations of complex computing problems:** Use research-based knowledge and research methods including design of experiments, analysis & interpretation of data & synthesis of information to provide valid conclusions.
- **Modern Tool Usage:** Ability to demonstrate skills to use modern s/w & h/w tools to analyze problems.
- **Professional Ethics:** Apply ethical principles and commit to professional ethics and cyber regulations.
- **Life-Long Learning:** Ability to develop confidence for self-education and life-long learning in the broadest context of technological change.
- **Project management and finance:** Ability to demonstrate knowledge & understanding of the engineering and management principles and apply them as a member & as a leader in a team to manage multidisciplinary projects.
- **Communication Efficacy:** Ability to communicate effectively in both verbal and written form.
- **Societal and Environmental Concern:** Ability to understand the impact of IT solutions in a global and societal context.
- **Innovations and entrepreneurship:** Find out right opportunity for entrepreneurship and create odd value for the betterment of an individual and society at large.

Programme Specific Outcome (PSO)

- Understand the concepts and application in the field of Computing Sciences like Web designing & development, mobile application development and Network & Communication technologies.
- Ability to test & analyze the quality of various sub-systems and to integrate them in order to evolve a larger computing system.

Integral University, Lucknow
Department of Computer Application
STUDY & EVALUATION SCHEME
Choice Based Credit System
Master of Computer Application (MCA)
w.e.f. Session 2016-17

Total Credits = 155

Year I, Semester I

S. No.	Course Category	Subject Code	Name of the Subject	Periods				Evaluation Scheme				Subject Total
				L	T	P	C	Sessional (CA)			End Sem. Exam	
								CT	TA	Total	ESE	
1.	Core	CA401	Discrete Mathematics	3	1	0	4	25	15	40	60	100
2.	Foundation	BM433	Principles of Management and Organizational Behavior	3	1	0	4	25	15	40	60	100
3.	Core	CA402	Computer Organization	3	1	0	4	25	15	40	60	100
4.	Core	CA403	Fundamentals of Computer and C Programming	3	1	0	4	25	15	40	60	100
5.	Core	CA404	Combinatorics and Graph Theory	3	1	0	4	25	15	40	60	100
6.	Foundation	MT401	Computer Oriented Numerical Methods	3	1	0	4	25	15	40	60	100
7.	Core	CA405	C Programming Lab	0	0	3	1	30	30	60	40	100
8.	Core	CA406	Computer Organization Lab	0	0	3	1	30	30	60	40	100
9.	Foundation	MT405	Numerical Methods Lab	0	0	2	1	30	30	60	40	100
Total				18	6	8	27					900

L - Lecture T – Tutorial P – Practical C – Credit CT – Class Test TA – Teacher Assessment

Sessional Total (CA) = Class Test + Teacher Assessment

Subject Total = Sessional Total (CA) + End Semester Examination (ESE)

COURSE: DISCRETE MATHEMATICS
COURSE CODE: CA401
COURSE CREDIT: 4

COURSE OBJECTIVES:

- Understand the concepts of relation, function, discrete numeric function, and algebraic structure.
- To develop the logical skills and know the concept of lattices.
- Know the concepts of formal language.
- Learn the concepts related to finite automata.
- Learn the concepts how to design the automata machine.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Study the concepts of relation, function, discrete numeric function, and algebraic structure.
CO2	Understand and develop the logical skills and study the concept of lattices.
CO3	Study the concepts of formal language.
CO4	Develop the concepts construct finite automata with regular expression.
CO5	Develop the concepts to design the Turing/Pushdown automata machine.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	2	1		1	1					
CO2		1	3		2		1					
CO3	1	2		2		1						
CO4	2		2	1			1					
CO5		2	3		1							

COURSE: COMPUTER ORGANIZATION
COURSE CODE: CA 402
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To understand and design various digital logic devices.
- To understand concepts of register transfer logic and arithmetic operations.
- To understand different types of addressing modes and memory organization.
- To understand the design of the various functional units and components of computers.
- To identify the elements of modern instructions sets and their impact on processor design.
- To explain the function of each element of a memory hierarchy,
- To identify and compare different methods for computer I/O.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Identify, understand and apply different number systems and codes.(Understanding) ➤ Interpret the functional architecture and generation of computer. ➤ Analyze logic Gates and Boolean algebra, understand the K-map simplification and analyze and design various combinational and logic circuits.
CO2	Identify, compare and assess to Bus and memory (Applying, Analyzing) ➤ Register transfer logic and arithmetic operations. ➤ Summarize the types of micro operations. ➤ Understand the various arithmetic algorithm ➤ Design logic circuits for different micro operations.
CO3	Identify and analyze basic organization of CPU (Analyzing) ➤ Analyze the the architecture and functionality of central processing unit. ➤ Analyze the different types of addressing modes. ➤ Analyze the concepts of Hardwired control and micro programmed control. ➤ Analyze the different iinstructions formats
CO4	Identify and learn the concept of memory hierarchy ➤ Learn the concept of memory organization. ➤ Learn the use of cache memory and virtual memory. ➤ Understand the concept of memory management hardware.
CO5	Analyze and learn pperipheral ddevices (Analyzing, Designing) ➤ Analyze and design programmed I/O and Interrupt Driven I/O ➤ Learn and evaluate Input-Output Processor and I/O Controllers.

CO-PO MAPPING:

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

COURSE: FUNDAMENTALS OF COMPUTER AND C PROGRAMMING**COURSE CODE: CA403****COURSE CREDIT: 4****COURSE OBJECTIVES:**

- To learn the basic concepts of Computer fundamentals.
- To learn the basic concepts and syntax of C programming.
- To be able to develop logics which help them to create programs and applications using C language.
- To learn the use of C libraries functions in C language.
- To learn the file handling and basic memory allocation concepts in C language.
- After learning the C programming they can easily switch over to any other language.

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Able to understand the basic knowledge of Computer fundamental and its application in computers.
CO2	Able to understand the basic concepts of C programming language.
CO3	Able to design and develop various programming problems using C programming concepts.
CO4	Able to Implement advance C programming concepts like function, pointer, structure and union etc.
CO5	Able to understand the file handling using C Programming language.

CO-PO MAPPING:

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

COURSE: COMBINATORICS AND GRAPH THEORY
COURSE CODE: CA404
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To study the concepts of Fundamentals of permutation and combination and generating function.
- To learn recurrence relation and concepts of generating function.
- To learn the basic concepts of graph theory and their application in the field of computer science to solve different problems.
- To learn Fundamentals of planar graph, dual graph and vector representation of graph, Introduction to matrix representation of graph.
- To learn coloring of graph, chromatic number of a graph and chromatic polynomial of a graph.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand the different concepts of permutation, combination and generating function.
CO2	Understand the structure of recurrence relation and real time problems using concepts of generating function and solution of recurrence relations.
CO3	Understand the basic concepts of graph theory and all of the relevant theorems covered in the course.
CO4	Understand the concepts in planar graph and matrix representation of graph.
CO5	Understand the concept of graph coloring, its applicability and concepts of digraph.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1				1	1					
CO2	2	1	2	1		1						
CO3	1	2		2	1	1						
CO4		1	3	1	2		1					
CO5	1		2	1	2	1						

Integral University, Lucknow
Department of Computer Application
STUDY & EVALUATION SCHEME
Choice Based Credit System
Master of Computer Application (MCA)
w.e.f. Session 2016-17

Year I, Semester II

S. No.	Course Category	Subject Code	Name of the Subject	Periods				Evaluation Scheme				Subject Total
				L	T	P	C	Sessional (CA)			End Sem. Exam	
								CT	TA	Total	ESE	
1.	Foundation	BM434	Accounting and Financial Management	3	1	0	4	25	15	40	60	100
2.	Core	CA407	Data and File Structure Using C	3	1	0	4	25	15	40	60	100
3.	Core	CA408	Unix and Shell Programming	3	1	0	4	25	15	40	60	100
4.	Elective - I			3	1	0	4	25	15	40	60	100
5.	Elective - II			3	1	0	4	25	15	40	60	100
6.	Core	CA413	Computer Architecture and Microprocessor	3	1	0	4	25	15	40	60	100
7.	Core	CA414	Data Structure Lab	0	0	3	1	30	30	60	40	100
8.	Core	CA415	Unix / Linux Lab	0	0	3	1	30	30	60	40	100
9.	Core	CA416	Microprocessor Lab	0	0	2	1	30	30	60	40	100
Total				18	6	8	27					900

L - Lecture T – Tutorial P – Practical C – Credit CT – Class Test TA – Teacher Assessment

Sessional Total (CA) = Class Test + Teacher Assessment

Subject Total = Sessional Total (CA) + End Semester Examination (ESE)

Elective – I

CA409 Introduction to Operations Research

CA410 Simulation and Modelling

Elective – II

CA411 Information System Analysis and Design

CA412 E-Commerce

COURSE: DATA AND FILE STRUCTURE USING C
CODE: CA407
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To understand basics knowledge of data structure operations, algorithms and their application.
- To design and implement algorithms and data structure operations using C program.
- To learn various techniques for representation of the data in non linear fashion
- To learn advance concept of searching.
- To understand basics of file organization and graphs.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand basics knowledge of data structure operations like insertion, deletion etc for various data structure and their application.
CO2	Analyze the problem and create appropriate algorithm.
CO3	Develop and implement various programs using C for non linear data structure.
CO4	Investigate and solve difficulties in the implementation of searching techniques.
CO5	Know application file and graphs in real world.

CO-PO MAPPING:

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

COURSE: UNIX AND SHELL PROGRAMMING
COURSE CODE: CA408
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To learn basic structure and various commands of UNIX system.
- To learn and implement various concepts of shell programming.
- To learn basic concepts of process, Inter process communication in UNIX system.
- To learn basics concepts and commands of UNIX system Administration.
- To learn various Filter and Tools of UNIX system.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Able to understand the basic Unix architecture, commands and utilities of the UNIX operating system and to work confidently in Unix/Linux environment and open systems
CO2	Able to write simple and complex shell scripts to automate various tasks using shell programming
CO3	Understand various concepts of process, IPC and process related command in UNIX.
CO4	Able to understand UNIX system administration.
CO5	Master the students in the art of usage of simple advanced filters and tools.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		1		1	1					
CO2		1	1	2	2	1						
CO3	2	1	2		1		1					
CO4	1	1	2	1	2		1					
CO5	1		2	2	1	1						

COURSE: INTRODUCTION TO OPERATIONS RESEARCH
COURSE CODE: CA409
COURSE CREDIT: 4

COURSE OBJECTIVES:

- Understand the different methods of solving the linear programming problem and formulate the optimal solution / feasible solution related to various organizations.
- To develop skills find the solution of transportation.
- Study the assignment, and network problem.
- To introduce the concepts of sequencing problems.
- Study the Queuing model and learn the CPM and PERT theory that is used in finalize the real life projects.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Study the basics of OR and formulate the optimal solution / feasible solution related to various organizations of LPP.
CO2	Study the different method to find the solution of transportation and how to use them in computer application.
CO3	To understand how to assign the task for every person and determine the shortest path/minim cast in network problem.
CO4	Learn the concepts of job sequencing problems like n Jobs and Two machines et, and game theory.
CO5	Develop the concepts to design the CPM and PERT chart and learn the basics of Queuing model.

CO-PO MAPPING:

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

COURSE: SIMULATION AND MODELLING
CODE: CA 410
COURSE CREDIT: 4

COURSE OBJECTIVES:

- Introduce concepts of system and simulation models
- Analyzing the various probability distribution functions.
- Study about various simulation models and understand the differences between them.
- Analysis of Simulation models using input analyzer, and output analyzer
- Verify, Validate and perform output analysis of a simulation model

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Describe the role of important elements of discrete event simulation and modeling paradigm.
CO2	Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.
CO3	Generate and test random number variables and apply them to develop simulation models.
CO4	Analyze and develop methods to simulate any discrete system using queuing systems - Be able to work effectively with others
CO5	Develop skills to apply simulation software to construct and execute goal-driven system models.

CO-PO MAPPING:

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

COURSE: INFORMATION SYSTEM ANALYSIS AND DESIGN
CODE: CA411
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To learn the basic concepts Information System, and different types of Information Systems.
- To learn the basic concepts of Business Information Systems, Telecommunication, Database Management.
- To be able to understand the basics of Information Technology used for Information System, Security & Ethical Challenges.
- To learn Modern Approach of System Analysis and Design, and Systems Development Life Cycle,
- To learn Process Modeling, Conceptual Data Modeling and E-R Model, Introduction to DFD, Business

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Able to understand basic concepts Information System, and different types of Information Systems
CO2	Able to understand the Information System for Business Operations, Managerial Decision Support and Strategic Advantage.
CO3	Able to design and develop various, Enterprise Resource Planning, Supply Chain Management, Customer Relationship Management.
CO4	Able to approach Modern System Analysis and Design, Improving is Development Productivity, Identifying and Selecting System Development.
CO5	Able to understand Process Modeling, Logic Modeling, Structured English, Decision Tables, Decision Trees, Organizational.

CO-PO MAPPING:

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

COURSE: E-COMMERCE
COURSE CODE: CA412
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To give knowledge of e-commerce with its technology, need, pros & cons, model, impacts, sales life cycle along with its implementation in India.
- To offer practical knowledge of infrastructure and technologies used in e-commerce and mobile commerce.
- To provide the knowledge of security aspects used in e-commerce and mobile commerce.
- To build the knowledge for ensuring the implementation of secure information using encryption techniques and digital signature in e-commerce and mobile commerce.
- To build the concept of the process of electronic payment in e-commerce along with different technologies, policies and governments law.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Gain knowledge of e-commerce with its technology, need, pros & cons, model, impacts, sales life cycle along with its implementation in India.
CO2	Understand practical knowledge of infrastructure and technologies used in e-commerce and mobile commerce.
CO3	Learn about the knowledge of security aspects used in e-commerce and mobile commerce.
CO4	Apply knowledge for ensuring the implementation of secure information using encryption techniques and digital signature in e-commerce and mobile commerce.
CO5	Understand the concept of the process of electronic payment in e-commerce along with different technologies, policies and governments law.

CO-PO MAPPING:

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

COURSE: COMPUTER ARCHITECTURE AND MICROPROCESSOR**COURSE CODE: CA413****COURSE CREDIT: 4****COURSE OBJECTIVES:**

- To learn the concepts regarding microprocessor with 8 bit. To understand the basic idea of the internal architecture and register configuration of respective device in order to deal with the operations performed according to the instruction sets.
- To learn the concepts regarding microprocessor with 16 bit. To understand the basic idea of the internal architecture and register configuration of respective device in order to deal with the operations performed according to the instruction sets using interrupts
- To understand the programming techniques of 8086 microprocessor
- To understand significance of pipelining and parallelism, so that the devices used to perform according to the need of the designer so as to have appropriate results.
- To know the elementary knowledge regarding signals and systems in order to tackle different interconnections in time and frequency domain

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	For a microprocessor system, student should be able to deal with the internal architecture of 8 bits, to analyze the working operation and to know the pin configuration for the respective microprocessor. A student shall be having an idea of machine cycle for the good operation and results for other basic properties
CO2	For a 16 bit microprocessor, a student should overcome the working of 8 bit to 16 bit. He/she should be clear about the facts related to above said microprocessors. A student should be good enough to deal with interrupts internally or externally
CO3	For a particular data instruction set, student should be having a clear idea of solving machine language programs using kit. He/she shall be having an idea to tackle with counter delays and subroutines
CO4	He/she should be able to know the concept of pipelining and parallelism in uni-processor system for hazard detection. A student should have a basic idea of job levels that are governed by an organization on priority basis. He/she should know the classifications of Instruction and Arithmetic Pipelines
CO5	For good networking, a student should be able to draw SIMD interconnections and FFT or a butterfly method system for collision prevention and vector dispatching. He/she should be able to make Cube Interconnection Network, Shuffle-Exchange and Omega Network.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1		1		1						
CO2	1		2	2	1		1					
CO3		1	2	1	1		1					
CO4	1		1	2	1		1					
CO5		2	3	1		1	1					

Integral University, Lucknow
Department of Computer Application
STUDY & EVALUATION SCHEME
Choice Based Credit System
Master of Computer Application (MCA)
w.e.f. Session 2017-18

Year IInd, Semester IIIrd

S. No.	Course Category	Subject Code	Name of the Subject	Periods				Evaluation Scheme				Subject Total
								Sessional (CA)			End Sem. Exam	
				L	T	P	C	CT	TA	Total	ESE	
1.	Core	CA501	Computer Networks	3	1	0	4	25	15	40	60	100
2.	Core	CA502	Design and Analysis of Algorithms	3	1	0	4	25	15	40	60	100
3.	Core	CA503	Operating System	3	1	0	4	25	15	40	60	100
4.	Core	CA504	Database Management System	3	1	0	4	25	15	40	60	100
5.	Core	CA505	Object Oriented Systems and C++	3	1	0	4	25	15	40	60	100
6.	Elective - III			3	1	0	4	25	15	40	60	100
7.	Core	CA511	DBMS Lab	0	0	3	1	30	30	60	40	100
8.	Core	CA512	OOPS and C++ Lab	0	0	3	1	30	30	60	40	100
9.	Core	CA513	Mini Project Lab	0	0	2	1	30	30	60	40	100
Total				18	6	8	27					900

L - Lecture T – Tutorial P – Practical C – Credit CT – Class Test TA – Teacher Assessment

Sessional Total (CA) = Class Test + Teacher Assessment

Subject Total = Sessional Total (CA) + End Semester Examination (ESE)

Elective – III

- CA506 Software Engineering
- CA507 Software Reliability
- CA508 Software Testing and Quality Assurance
- CA509 Software Architecture and Project Management
- CA510 Agile Methodology

COURSE: COMPUTER NETWORKS
COURSE CODE: CA501
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To understand the concepts of communicating channel in order to deal with the different transmission media. To learn different about the different approaches of networking through switching modes and different multiplexing techniques.
- To learn the importance of IEEE standard to raise good results and modes to apply various protocols internally and externally in specified time domain. To deal with the problems arises due to channel allocation and ultimately to detect collisions so as to avoid them on priority basis
- To learn different models o transfer data through physical communicating medium with the help of routing algorithms. To analyze the features of different algorithms to find a short way to approach to the destination
- To understand significance of various layers in OSI as well as TCP/IP models to bring a data in segment form and to synchronize the interaction of source and destination using respective layers.
- To draw elementary knowledge regarding different known systems that provide various characteristics, when number of protocols are applied to secure the data

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	With a new approach of communication, a student shall be able to transfer data through respective medium; also he can opt various ways of networking using topologies. A student can also understand the difference between the time and frequency domain transmission in order to analyze various switching modes
CO2	For new IEEE standard, a student should overcome the previous phenomena for networking using different domains. He/ she should know the conditions regarding the channel allocations, collision detection and its avoidance
CO3	For a particular data transfer system, student shall be able to analyze which router is good for networking using different algorithms. A student shall able to differ between the approaches used in congestion control and protocols in network layer
CO4	He/she should be able to know the duties regarding respective layer. A student should be aware of the fact when to use TCP and when to use UDP for synchronization between hop points so that a student can analyze encryption and decryption techniques for proper data transfer
CO5	For securing data and a system, a student can evaluate different procedures and algorithms based on network security and he/she should learn about the protocols to used according to the format of data transfer

CO-PO MAPPING:

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

COURSE: DESIGN AND ANALYSIS OF ALGORITHMS**CODE: CA502****COURSE CREDIT: 4****COURSE OBJECTIVES:**

- To study the concepts of complexity of algorithms and understand the analysis of algorithms based on input size.
- To learn advanced data structure and their fundamentals for application development.
- To learn use of greedy and dynamic programming techniques and their application in the field of computer science to solve problems.
- To learn algorithms for graph theory problem like spanning tree problem, single source shortest path and advance features of graph application in field of computer science.
- To learn string matching algorithms and, P, NP problem in computer science domain.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand the algorithms and notation, including order notation, and how to analyze the complexity of the algorithms.
CO2	Understand the concept of Hashing, B-tree, and Red black tree and disjoint data structure.
CO3	Compare, contrast, and apply the key algorithmic design paradigms: divide and conquer, greedy method, dynamic programming techniques.
CO4	Understand the concepts of Graph algorithms to solve problem using Greedy method as well as dynamic programming techniques.
CO5	To understand the concepts of Randomized, and exact vs. approximate. Implement, empirically compare, and apply fundamental algorithms and string matching, P, NP and NP complete real-world problems.

CO-PO MAPPING:

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

COURSE: OPERATING SYSTEM**CODE: CA503****COURSE CREDIT: 4****COURSE OBJECTIVES:**

- To study types of Operating System and Process Management.
- To learn Scheduling and Process Synchronization.
- To study Deadlock and Storage management.
- To study about Virtual Memory and File Management.
- To learn Disc Management.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Explain the types of operating system and ability to create threads and perform interposes communication.
CO2	Understand CPU scheduling and able to solve process synchronization problems.
CO3	Understand issues surrounding deadlock handling and memory management.
CO4	Explain paging and segmentation methods suitable for virtual memory. Ability to manage files and directory.
CO5	Be able to recovery and manage disk spaces. Knowledge of files systems and Android OS.

CO-PO MAPPING:

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

COURSE: DATABASE MANAGEMENT SYSTEM
CODE: CA504
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To learn the basic knowledge of Database Management System and various types of data models.
- To learn the concept and syntax of ER Diagram and the extended ER features.
- To learn various constraints and writing SQL queries.
- To learn the basic structure of Oracle system.
- To learn the concept of Normalization.
- To learn the concept of Lossless decomposition and dependency preservation.
- To learn the various issues in transaction processing.
- To learn the recovery system
- To learn the various techniques for concurrency control in Databases.
- To learn the concepts and applications of Object oriented DBMS (OODBMS).

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Able to understand the basic concepts of DBMS and ER Model and How to draw ER Diagrams.
CO2	Ability to define constraints, writing queries using SQL syntax and Applying the Relational algebra and Calculus to define expressions for queries in Databases.
CO3	Able to understand the purpose of Normalization and defining various Normal forms.
CO4	Able to understand the basic issues while implementing the concept of Transaction and recovery.
CO5	Able to understand the various Concurrency Control techniques and concepts of Object Oriented databases.

CO-PO MAPPING:

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

COURSE: OBJECT ORIENTED SYSTEMS AND C++
CODE: CA505
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To learn basic concepts, notations of Object Modeling.
- To learn basic concepts, notations of Dynamic Modeling.
- To learn basic concepts, notations of functional modeling and OMT with other methodologies.
- To learn and implement classes, objects, functions, inheritance and constructor using C++.
- To learn and implement the concept of Pointer, Virtual function and Polymorphism using C++

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Able to understand the basic OMT notations of Object modeling and design object model of real world problems.
CO2	Able to understand the basic OMT notations of dynamic modeling and design state transition diagram of real world problems.
CO3	Able to understand the basic OMT notations of functional modeling and design data flow diagram of real world problems.
CO4	Able to use and implement the concepts of classes, objects, functions, inheritance and constructor using C++.
CO5	Able to use and implement the concepts of Pointer, Virtual function and Polymorphism using C++.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	1	1	1	1				
CO2	2	2	2	2	1	1	2					
CO3	2	3	2	2	1	1	1					
CO4	1	2	3	2	1	1		1				
CO5	1	2	3	2	1	1	2	1				

COURSE: SOFTWARE ENGINEERING
COURSE CODE: CA506
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To provide the concepts of software crisis, issues, characteristics, evolution and application with respect to software engineering.
- To give fundamental aspects of software development with respect to requirement engineering, requirement analysis, design, coding, testing and maintenance.
- To elaborate the implementation of life cycle and models used in software development.
- To give the practical knowledge of software designing along with object oriented design approach and its methodology.
- To give knowledge of practical implementation of software coding style and software testing strategies for software development.
- To provide the practical knowledge in software development in terms of maintenance of software after software implementation.
- To give the knowledge of management of software project from initial stage to final stage for software development.
- To provide the practical knowledge for ensuring the quality and reliability of software during software development using models.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Learn the concepts of software crisis, issues, characteristics, evolution and application with respect to software engineering.
CO2	Know the fundamental aspects of software development with respect to requirement engineering, requirement analysis, design, coding, testing and maintenance.
CO3	Elaborate the implementation of life cycle and models used in software development.
CO4	Gain practical knowledge of software designing along with object oriented design approach and its methodology.
CO5	Find the practical implementation of software coding style and software testing strategies for software development.
CO6	Know the practical knowledge in software development in terms of maintenance of software after software implementation.
CO7	Enhance the knowledge of management of software project from initial stage to final stage for software development.
CO8	Access the practical knowledge for ensuring the quality and reliability of software during software development using models.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1		2	1	1		1				
CO2	1	2	2	1	1		1					
CO3		1	3	2	1	1		1				
CO4	1	1	3	1	2		1					
CO5		1	2	1	2	1		1				
CO6	1		2		1	1						
CO7	2	1	1		1	1		1				
CO8	1		2	2	1		1					

COURSE: SOFTWARE RELIABILITY**CODE: CA507****COURSE CREDIT: 4****COURSE OBJECTIVES:**

- To learn basic knowledge about Reliability Fundamentals and Reliability Mathematics.
- To learn basic knowledge Reliability Analysis of Series Parallel Systems and Reliability Analysis of Non-Series Parallel Systems.
- To learn the importance Reliability Prediction, Reliability Allocation and Maintainability and Availability.
- To learn the basics of Reliability Testing, Software Reliability and Reliability Analysis of Special Systems.
- To learn basics of Reliability Engineering and Reliability Management.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Able to understand basics of Reliability Fundamentals and Reliability Mathematics.
CO2	Able to understand basic concepts of Reliability Analysis of Series Parallel Systems and Reliability Analysis of Non-Series Parallel Systems.
CO3	To understand the basic knowledge of Reliability Prediction, Reliability Allocation and Maintainability and Availability.
CO4	To understand the basic knowledge of Reliability Testing, Software Reliability and Reliability Analysis of Special Systems
CO5	Able to understand the concepts of Reliability Engineering and Reliability Management.

CO-PO MAPPING:

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

COURSE: SOFTWARE TESTING AND QUALITY ASSURANCE**CODE: CA508****COURSE CREDIT: 4****COURSE OBJECTIVES:**

- To get familiar the students about basic concepts of software testing and its techniques.
- To study in detail the process of performing the black box and white box testing approaches with examples.
- To study about the various test cases and advanced concepts of object oriented testing.
- To study about the various testing automation and debugging tools and case studies.
- To learn how to use available resources to develop software, reduce cost of software and how to maintain quality of software.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Design and develop the bug free software systems using basic concepts of software testing.
CO2	Apply verification, validation activities, static, dynamic testing, debugging tools and techniques and importance of working in teams.
CO3	Implement concepts of object oriented testing, web testing and regression testing.
CO4	Create, select and apply appropriate techniques, modern engineering concepts and IT tools for software testing.
CO5	Identify the techniques in testing phase for better quality assurance and software reliability.

CO-PO MAPPING:

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

COURSE: SOFTWARE ARCHITECTURE AND PROJECT MANAGEMENT**CODE: CA509****COURSE CREDIT: 4****COURSE OBJECTIVES:**

- To learn Software Product Life Cycle.
- To study Architecture Design Process.
- To learn Architecture Representation and Quality.
- To learn Project Concepts and its Management.
- To learn Project Evaluation and Emerging Trends.

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand the Software Product Life Cycle and Software Architecture Engineering Design View.
CO2	Analyze Evaluate, Transform and Design new Software Architecture.
CO3	Understand Functional Design Strategies and using it for Architecture Representation to Improve Quality in Architecture Evaluation.
CO4	Explain Life Cycle Models, Management Process Framework Reliability and Software Management Disciplines.
CO5	Understand Project Evaluation and Emerging Trends and Risk Evaluation.

CO-PO MAPPING:

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

COURSE: AGILE METHODOLOGY
CODE: CA510
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To learn the basic concepts of Agile Methodology
- To learn and understanding of what Agility means, when and why to employ Agile Methodology.
- To be able find the pitfalls, issues and common mistakes to watch out for, and will cover key methodologies including Scrum and Kanban.
- To learn the use of approaches, tools and scenarios to introduce Agile to your organization effectively.
- To learn the agile principles, practices, and roles of Scrum.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Able to understand the basic knowledge and concepts of Agile Methodology.
CO2	Able to understand the Agility means, when and why to employ Agile Methodology.
CO3	Able to uncover the pitfalls, issues and common mistake that teams will encounter in an Agile transition and understand how to overcome those challenges.
CO4	Able to use of approaches, tools and scenarios to introduce Agile to your organization effectively.
CO5	Able to understand agile principles, practices, and roles of Scrum and Working software over comprehensive documentation.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1		1	1	1						
CO2	2	1	1		1							
CO3	2	1		2	1	1		1				
CO4		1	2	1	3	2	1					
CO5	2		1	2	1			1				

Integral University, Lucknow
Department of Computer Application
STUDY & EVALUATION SCHEME
Choice Based Credit System
Master of Computer Application (MCA)
w.e.f. Session 2017-18

Year IInd, Semester IVth

S. No.	Course Category	Subject Code	Name of the Subject	Periods				Evaluation Scheme				Subject Total
				L	T	P	C	Sessional (CA)			End Sem. Exam	
								CT	TA	Total	ESE	
1.	Core	CA514	Distributed System	3	1	0	4	25	15	40	60	100
2.	Elective – IV			3	1	0	4	25	15	40	60	100
3.	Core	CA521	JAVA Programming	3	1	0	4	25	15	40	60	100
4.	Elective – V			3	1	0	4	25	15	40	60	100
5.	Core	CA527	Compiler Design	3	1	0	4	25	15	40	60	100
6.	Core	CA528	Computer Graphics and Animation	3	1	0	4	25	15	40	60	100
7.	Core	CA529	JAVA Programming Lab	0	0	3	1	30	30	60	40	100
8.	Core	CA530	Compiler Design Lab	0	0	3	1	30	30	60	40	100
9.	Core	CA531	Computer Graphics Lab	0	0	2	1	30	30	60	40	100
Total				18	6	8	27					900

L - Lecture T – Tutorial P – Practical C – Credit CT – Class Test TA – Teacher Assessment

Sessional Total (CA) = Class Test + Teacher Assessment

Subject Total = Sessional Total (CA) + End Semester Examination (ESE)

Elective – IV

CA516 Data Warehousing and Data Mining
 CA517 Cloud Computing
 CA518 Big Data
 CA519 ERP Systems
 CA520 Storage Technology and Management

Elective – V

CA522 Cryptography and Network Security
 CA523 Advanced Concepts in Database System
 CA524 Distributed Database
 CA525 Real Time Systems
 CA526 Social Network Analysis and Evolutionary Computing

COURSE: DISTRIBUTED SYSTEM
COURSE CODE: CA514
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To understand distributed system architecture and also the limitations in designing the distributed operating systems along with its proposed solution.
- To study distributed operating system concepts for Mutual exclusion and Deadlock handling algorithms and agreement protocols.
- To study basics of agreement problem along with its solution and understand the concepts of distributed file system.
- To know and implement the algorithms for distributed shared memory management and understand the concepts of load scheduling in distributed operating system.
- To study communication in distributed system along with communication protocols in a broader sense.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Students will attain knowledge with distributed system architecture, design and its implementation.
CO2	Learn mutual exclusion and Deadlock management in distributed system.
CO3	Learn use of agreement protocols in distributed system and distributed file system management.
CO4	Learn different resource management techniques like distributed shared memory and scheduling for distributed systems.
CO5	Learn routing algorithms and their applicability in distributed system.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	1		1						
CO2	1	2	1	1	1		1					
CO3	1	1	2	2	1	1	1					
CO4	2	2		2	1		1					
CO5	1	2	2	1	2	1						

COURSE: DATA WAREHOUSING AND DATA MINING
COURSE CODE: CA516
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To provide the understanding of data warehousing in terms of components, architecture, models and concepts.
- To explore the knowledge of mapping between database and data warehousing
- To enhance the understanding of business analytics using various analytical tools.
- To give the ability for finding information and take decision for enhancing the business with intelligence.
- To provide knowledge of data mining used in various application such as multimedia and web.
- To provide the view for increasing the data quality, recognition, find & speedup data extraction and adjustable reporting.
- To provide the skill for finding the hidden pattern, co-relational study, prediction and structure the unstructured data.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understanding the concept of data warehousing in terms of components, architecture and models.
CO2	Learn the knowledge of mapping between database and data warehousing
CO3	Enhance the understanding of business analytics using various analytical tools.
CO4	Find the ability for finding information and take decision for enhancing the business with intelligence.
CO5	Know the concept of data mining used in various applications such as multimedia and web.
CO6	Get the view for increasing the data quality, recognition, find & speedup data extraction and adjustable reporting.
CO7	Enhance the skill for finding the hidden pattern, co-relational study, prediction and structure the unstructured data.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		1		2						2	
CO2	2	3	2	3			1				3	
CO3	3	3	2	2							3	
CO4	3	2	2	3	3						3	
CO5	3	3	2	2	2		1	1	2		2	
CO6	3	2			2		3		1	2	1	
CO7	3	2	2	1			2	1		2	3	

COURSE: CLOUD COMPUTING
CODE: CA517
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To learn basic concepts ,types and characteristics of cloud computing
- To learn Cloud Computing Architecture and service models.
- To learn Virtualization and its type's in cloud computing.
- To learn fundamental concepts and architecture of cloud computing security.
- To learn basics of SOA and cloud based storage

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Able to understand basic concepts, principles and paradigm of Cloud Computing
CO2	Able to interpret various Cloud computing models and services.
CO3	Able to identify the significance of implementing virtualization techniques.
CO4	Able to understand the need of security in Cloud computing.
CO5	Understand the concept SOA and cloud based storage in Cloud computing.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1			1	1		1			1	
CO2	1	2	1	3	1		1					
CO3		1	3	1	2	1		1				
CO4	2	1	2	1		2	1					
CO5		1	1	2	1	2		1				

COURSE: BIG DATA ANALYTICS
COURSE CODE: CA518
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To provide understanding of Big Data and Data analysis.
- To give exposure of different analytic processes and tools with statistical concept related to sampling and error.
- To explore various techniques for mining data stream.
- To provide a practical understanding using case Studies of real time sentiment analysis.
- To provide hadoop and HDFS concepts with its architecture and processing.
- To give an understanding for developing map reduce an application.
- To provide the practical exposure for hadoop management and administration.
- To introduce programming tools PIG & HIVE.
- To give the practical enhancement of visualization techniques.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	To provide understanding of Big Data and Data analysis.
CO2	To give exposure of different analytic processes and tools with statistical concept related to sampling and error.
CO3	To provide a practical understanding using case Studies of real time sentiment analysis.
CO4	To explore various techniques for mining data stream.
CO5	To provide hadoop and HDFS concepts with its architecture and processing.
CO6	To give an understanding for developing map reduce an application.
CO7	To provide the practical exposure for hadoop management and administration.
CO8	To introduce programming tools PIG & HIVE.
CO9	To give the practical enhancement of visualization techniques.

CO-PO MAPPING:

PO	PO												
	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1		1	1	1			1				
CO2	1	3	1	2	1			1		1			
CO3	2	1	3	1	1	1			1				
CO4		2	1	3	3	1		1					
CO5		1	1	2	1				1				
CO6	2		1	1		1			1				
CO7	1		3		2	1		2					
CO8		1	1		3			1		1			
CO9		1	2	2		1		1	1			1	

COURSE: ERP SYSTEMS**CODE: CA519****COURSE CREDIT: 4****COURSE OBJECTIVES:**

- To learn the need and evolution of ERP Systems and related technologies.
- To learn ERP benefits and classification and implementation of ERP Life Cycle.
- To learn Analytical Hierarchy Process & its applications and ERP implementation approaches and its strategies.
- To learn factors affecting ERP success and effectiveness.
- To learn extend ERP and its learning and emerging issues.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Make basic use of enterprise software and its role in integrating business functions and also create reengineered business processes for successful ERP implementation.
CO2	Analyze the strategic options for ERP identification and adoption and classify different processes of the organization.
CO3	Design the ERP implementation strategies and to be able to map business processes using process mapping techniques.
CO4	To understand management concern for ERP Success and its useful guidelines for proper implementations.
CO5	To demonstrate knowledge of SAP and Oracle Apps.

CO-PO MAPPING:

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

COURSE: STORAGE TECHNOLOGY & MANAGEMENT**CODE: CA520****COURSE CREDIT: 4****COURSE OBJECTIVES:**

- To study the basic concepts of storage technology and its components.
- To understand the storage system architecture and Physical/Logical disk organization.
- Study storage technologies: SAN, NAS, IP storage etc., which will bridge the gap between the emerging trends in industry and academics.
- To learn the concepts of information availability and business continuity at the time of disaster.
- To study managing and monitoring of storage through industry standards and metrics by the application of various tools.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Students will analyze the limitations of the client-server architecture and evaluate the need for data protection and storage centric architectures such as Intelligent storage system
CO2	Students will be able to do memory mapping and operations based on RAID.
CO3	Students will understand, interpret and examine various SAN, DAS, CAS, NAS technologies.
CO4	Students will understand and evaluate different SAN management strategies to fulfill business continuity requirements.
CO5	Students will classify the applications as per their requirements and select relevant solutions.

CO-PO MAPPING:

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

COURSE: JAVA PROGRAMMING**CODE: CA521****COURSE CREDIT: 4****COURSE OBJECTIVES:**

- To get familiar with Java programming and to understand the importance of Classes and objects along with constructors, Arrays and Vectors.
- To learn basics of graphical user interfaces based programming in Java using Applet, AWT and SWING that respond to different user events.
- To study the Java Data Base Connectivity (JDBC) to access database through Java programs.
- To study the Remote Method Invocation (RMI) based Client Server application.
- To learn the multi-tier architecture of web-based enterprise applications using Enterprise JavaBeans (EJB) and understanding of Stateful, Stateless and Entity Beans.
- To learn the server side programming in the forms of Java Server pages (JSP) and Servlets.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Able to design and implement programs in the Java programming language that make strong use of classes and objects.
CO2	Design and develop GUI applications using Abstract Windowing Toolkit (AWT), Swing and Event Handling.
CO3	Learn to access database through Java programs, using Java Data Base Connectivity (JDBC).
CO4	Understand the multi-tier architecture of web-based enterprise applications using Enterprise JavaBeans (EJB) and development of stateful, Stateless and Entity Beans.
CO5	Expected to complete a project involving the design of a fairly complex Java program that consists of a GUI and utilizes at least two of the advanced programming areas.

CO-PO MAPPING:

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

COURSE: CRYPTOGRAPHY AND NETWORK SECURITY**CODE: CA 522****COURSE CREDIT: 4****COURSE OBJECTIVES:**

- To provide introduction to the concept of Network Security Model and Cryptography systems.
- To give the knowledge of Digital Signature and other Security Measures available.
- To familiarize with the security of messages and measures to secure the messages.
- To showcase IP Security Architecture & Transport Layer Security to identify the vulnerability of the Internet systems and recognize the mechanisms of the attacks.
- Identify and classify computer and security threats and develop a security model to prevent, detect and recover from attacks

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Illustrate the concepts of Network Security and Compare Various Symmetric and Asymmetric Cryptographic methods used for Network Security
CO2	Gain familiarity with prevalent network and distributed system attacks, defenses against them, and forensics to investigate the aftermath.
CO3	Develop a basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.
CO4	Summarize different Authentication Techniques & Describe programs like PGP & S/MIME
CO5	Determine appropriate mechanisms for protecting information systems ranging from operating systems to database management systems and to applications.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1		3	1	1		1				
CO2	3	1	1	2		1						
CO3	2	1	3	2	1	1		1				
CO4	2	1		2		2	1					
CO5		2	1	2	1			1				

COURSE: ADVANCED CONCEPTS IN DATABASE SYSTEM**CODE: CA523****COURSE CREDIT: 4****COURSE OBJECTIVES:**

- To study Query Processing, Optimization and Database Tuning..
- To learn Extended Relational Model.
- To learn use of Distributed Database System.
- To learn Enhanced Data Model for particular databases and its application.
- To learn concept of Expert Database and Fuzzy Database System.

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Analyze the background processes involved in queries and transactions, assess and apply database query optimization.
CO2	Create and use new database data types. Apply Data Log for Logic Based and Expert Database Model.
CO3	Understand issues surrounding concurrency control and recovery in distributed database systems data management.
CO4	Explain methods suitable for particular types of data such as temporal, multimedia or spatial data.
CO5	Be able to develop new methods to store and index data for expert and fuzzy databases based on knowledge of existing techniques

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	1			1					
CO2	1	2			2							
CO3	3	2	2	2			2					
CO4	1	3	2		2							
CO5	3	2	3		3		1					

COURSE: DISTRIBUTED DATABASE**CODE: CA524****COURSE CREDIT: 4****COURSE OBJECTIVES:**

- To learn Principles and Levels of Distribution Transparency.
- To study Distributed Database Design, Query Processing and its Optimization.
- To learn Management of Distributed Transactions and Concurrency Control.
- To learn Reliability and Heterogeneous Distributed Database Administration.
- To learn use of R* Project Database.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand the Principles of Distributed Databases and types of Data Fragmentation with levels of Distribution Transparency.
CO2	Design Distributed Database and analyze the background processes involved in queries, assess and apply database query optimization.
CO3	Understand issues surrounding management and concurrency control in Distributed Database.
CO4	Explain Reliability, Catalog Management and Problems of Heterogeneous Distributed Database.
CO5	Create and use new database data types and Inheritance. Apply logic in R* Project database.

CO-PO MAPPING:

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

COURSE: REAL TIME SYSTEMS
CODE: CA525
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To understand basics knowledge real time system and its classification.
- To learn various task scheduling mechanism.
- To learn various algorithm for task assignment and scheduling.
- To learn basic concept of fault tolerance techniques used in real time system.
- To understand real time communication in real time system.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Examine the issues in real time system and their classification.
CO2	To solve various scheduling problems and will be able to apply them in real time applications.
CO3	Develop and implement appropriate algorithm for task assignment in real time system and able to understand the possibility of scheduling a task set.
CO4	Analyze the condition of fault occurrence and apply solutions consequently.
CO5	Address the issues in real time system.

CO-PO MAPPING:

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

COURSE: SOCIAL NETWORK ANALYSIS AND EVOLUTIONARY COMPUTING
CODE: CA526
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To learn the basic knowledge, Limitations, Development and Emergence of Social Web.
- To learn the statistical properties of Social Network Analysis, Blogs, Online communities and Web-Based networks.
- To learn Visualization of Social Networks.
- To learn the Community mining and core methods for community detection and mining.
- To learn the algorithms for Social Influence analysis.
- To learn the basics of text mining in Social Network.
- To learn the concepts of Evolutionary Computing, Evolutionary Algorithms and Evolutionary Programming.
- To learn how to work with evolutionary algorithms.
- To learn the basic concepts of Genetic Algorithms and Genetic Programming.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Able to understand the basic concepts of Web, Emergence of Social Web, Statistical properties and key concepts and measures in Network analysis.
CO2	Ability to define the visualization of Online Social Networks, Graph Representation, Clustering and modeling and aggregating Social Network data.
CO3	Able to detect the Communities in Social Networks, Algorithms for Social Influence analysis and expert location in Social Networks along with text and opinion mining.
CO4	Able to understand the basic concepts in Evolutionary Computing, working with evolutionary algorithms and parent selection and Survivor selection in evolutionary programming.
CO5	Able to understand the working of evolutionary algorithms, basic concepts of Genetic Algorithms and Genetic programming.

CO-PO MAPPING:

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

COURSE: COMPILER DESIGN
CODE: CA527
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To know the fundamental concepts and techniques for compiler design and understand the different phases of compiler.
- To identify the methods and strategies for parsing techniques.
- Devise and perform syntax-directed translation schemes for compiler.
- Impart knowledge on Run-Time Environment and the life time of objects.
- Devise intermediate code generation schemes.
- Analyze the optimized code generated after the synthesis phase.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Students will acquire knowledge about phases of compilation. Students will be able to understand the role of Lexical Analyzer in Compilation Process.
CO2	Studies about the various parsing techniques helps the students to understand about Parsing Process. Students will learn the difference between top down and bottom up parser.
CO3	Knowledge of Ambiguities in the context free Grammar helps students in problem analysis. Students will be able to analyze different parsing techniques used for Compilation
CO4	Students gain the ability to learn about the Intermediate code generation in compilation process. Information acquired from the fundamentals of intermediate representation leads to implementation of target code.
CO5	Understanding the various storage allocation strategies helps in organization of information in the Run Time Environment of Compilation. Students will be acquiring knowledge about Instruction Level Optimization.

CO-PO MAPPING:

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

COURSE: COMPUTER GRAPHICS AND ANIMATION
CODE: CA528
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To study Computer Graphics and drawing algorithm.
- To learn Mathematics for Computer Graphics, Segments and Display Files and Windowing and Clipping.
- To learn use of Computer Graphics Algorithm.
- To learn Transformation (2D and 3D) and 3D Animation.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Analyze the background processes involved in computer graphics displays, understanding of Algorithms.
CO2	Use Mathematics in Vector. Create Segments and apply clipping to different shapes.
CO3	Understand and apply algorithms used in Computer Graphics.
CO4	Apply methods suitable for 2D and 3D Transformation such as Translation, Rotation, Scaling, Reflection, Shear etc.
CO5	Be able to use 3D Studio Max for Transforming Objects, Pivoting, Aligning, Snapping and Cloning Objects.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1			1	1			2	1	3	
CO2	1	3	1	2	1				3	2	1	
CO3	2	3		2	1	1		1	2	4	3	
CO4	1	2	2	1		2	1		3	4	2	
CO5		3	1	2	1	2		1	2	4	2	

Integral University, Lucknow
Department of Computer Application
STUDY & EVALUATION SCHEME
Choice Based Credit System

Master of Computer Application (MCA)
w.e.f. Session 2018-19

Year IIIrd, Semester Vth

S. No.	Course Category	Subject Code	Name of the Subject	Periods				Evaluation Scheme				Subject Total
								Sessional (CA)			End Sem. Exam	
				L	T	P	C	CT	TA	Total	ESE	
1.	Core	CA601	Web Technology	3	1	0	4	25	15	40	60	100
2.	Elective - VI			3	1	0	4	25	15	40	60	100
3.	Core	CA607	.NET Framework and C#	3	1	0	4	25	15	40	60	100
4.	Elective - VII			3	1	0	4	25	15	40	60	100
5.	Core	CA613	Artificial Intelligence	3	1	0	4	25	15	40	60	100
6.	Core	CA614	Cyber Law and E-Security	3	1	0	4	25	15	40	60	100
7.	Core	CA615	Web Technology Lab	0	0	3	1	30	30	60	40	100
8.	Core	CA616	.NET Framework and C# Lab	0	0	3	1	30	30	60	40	100
9.	Core	CA617	Colloquium	0	0	2	1	50	50	100		100
Total				18	6	8	27					900

L - Lecture **T** – Tutorial **P** – Practical **C** – Credit **CT** – Class Test **TA** – Teacher Assessment
Sessional Total (CA) = Class Test + Teacher Assessment

Subject Total = Sessional Total (CA) + End Semester Examination (ESE)

Elective – VI

CA602 Internet of Things
CA603 High Performance Computing
CA604 Animation and Gaming
CA605 Neural Network
CA606 Soft Computing

Elective – VII

CA608 Digital Image Processing
CA609 Human Computer Interaction
CA610 Mobile Computing
CA611 Research Methodology and Tools
CA612 Green Computing and E-Waste Management

COURSE: WEB TECHNOLOGY
CODE: CA601
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To learn basic concepts of web and web projects.
- To learn and implement interactive web pages using HTML, CSS.
- To learn basic concepts of JavaScript and design responsive web pages using HTML, CSS3 and add validation using JavaScript. .
- To learn fundamental concepts of XML and implement XML in Web Applications.
- To learn basics concepts and syntax of PHP and AJAX.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Able to understand the basic terminology of web and concepts of web projects.
CO2	Hands on practice on HTML and CSS and learn to implement CSS and HTML in web development.
CO3	Understand the concepts and use of JavaScript in web applications.
CO4	Able to use and implement XML in web development.
CO5	Understand the use of PHP as server side language and application of AJAX in web development.

CO-PO MAPPING:

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

COURSE: INTERNET OF THINGS
COURSE CODE: CA602
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To know the basic the concepts IOT architecture, its motivation and overview of the features involved during the process of communication over the channel. To understand the basic designing of IOT to know the requirement of general bodies or standard bodies
- To learn about the structural aspects and identification regarding the objects and services used worldwide. To understand the concept of key technologies those are used so far in IOT.
- To deal with different technological challenges in design issues those are governed with respect to the product codes. To learn the security challenges also in order to make secure environment using different integrating approaches and data link protocols
- To understand significance of software agents for representing respective objects using clustering principles. To understand the idea regarding the identity management for and by the customers with the help of different models.
- To draw elementary knowledge regarding security requirements for smart metering and automotive applications

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	As per the new technology, a student should perform data transfer operations using IOT that help the students to guide in a formal way to communicate over new IOT devises within a short span of time. He/she should be able to develop new ideas for new frameworks using basic nodal capabilities.
CO2	For a given situation, a student should be able to deal with different structural aspects of designing and he/she can shall know the use of key technologies that would be used by the students to promote the development of a coherent learning program
CO3	With the enhancement in technology, IOT deals with the challenges and unique product codes for a particular product so a student should be able to tackle the unique codes and he/she should development different approaches that can continue the legacy of an organization.
CO4	During clustering phenomena, a student should be prepared to deal with principles and policies governed according to the company rules so as to provide better identity management using different models like isolated and federated user identity models
CO5	A student should know the basic idea of security requirements and vulnerabilities in IOT. He/she should be good enough to deal with the establishment of identity for smart applications to be used in IOT

CO-PO MAPPING:

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

COURSE: HIGH PERFORMANCE COMPUTING**CODE: CA603****COURSE CREDIT: 4****COURSE OBJECTIVES:**

- To learn the basic concepts of Modern Processor.
- To learn the concept of access optimization and parallel computers.
- To learn the basic concept of parallel computing.
- Learn to design parallel programs on high performance computing.
- Learn the concept of message passing paradigm and issues of hybrid programming.

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Able to understand the basic concept of Computer architecture and Modern Processor .
CO2	Able to understand the basic concepts of access optimization and parallel computers.
CO3	Able to describe different parallel processing platforms involved in achieving high performance computing.
CO4	Develop efficient and high performance parallel programming.
CO5	Able to learn parallel programming using message passing paradigm.

CO-PO MAPPING:

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

COURSE: ANIMATION AND GAMING
CODE: CA604
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To study Interactive Graphics.
- To learn 2D and 3D Animation.
- To learn use of 3D Animation Modeling.
- To learn Game Theory.
- To learn concept of 3D Game Programming.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand the Uses of Computer Graphics and Converting Lines, Circles, Ellipses.
CO2	Create Clay Modeling and 2D Animation, 3D Motion Graphics and FX.
CO3	Create 3D Modeling, Crowd Simulation and Character Animation with 3D Projection Mapping.
CO4	Explain methods suitable for Game Theory such as Backward Induction and Symmetric Games.
CO5	Be able to develop new methods in Game Programming Concepts, Level Design, Obstacles and Creating Sound and Music for Games.

CO-PO MAPPING:

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

COURSE: NEURAL NETWORK
COURSE CODE: CA605
COURSE CREDIT: 4

COURSE OBJECTIVES:

- Understand the concepts of neural network and perception training Algorithm with modification.
- To develop the skills of supervised and unsupervised learning concepts.
- Understand the concepts of natural network architecture.
- Study the concepts related to SOM, and PC.
- Learn the concepts FUZZY technique and soft computing.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Study the concepts of neural network and some related algorithms.
CO2	Develop the knowledge supervised and unsupervised.
CO3	Study the concepts of architecture of neural network.
CO4	Learn the concepts of principle component and SOM.
CO5	Develop the skills on FUZZY techniques, soft computing and concepts of CVNN, CVBP.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1		2		1	1					
CO2	2		2	1	1		1					
CO3	2	1		2	1	1		1				
CO4	3	2	1	1		2	1					
CO5	1	1	3		2		1	1				

COURSE: SOFT COMPUTING
CODE: CA606
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To study the concepts Neuro, Fuzzy and Soft Computing and understand the Input Space partitioning and Fuzzy Modeling.
- To learn: Derivative-based Optimization and Simulated Annealing, Random Search, Downhill Simplex Search and their application development.
- To learn Supervised Learning Neural Networks and Unsupervised Learning Neural Networks their application in the field of computer science to solve problems.
- To learn Neuro Fuzzy Modeling, Methods that Cross-fertilize ANFIS and RBFN and Framework Neuron Functions for Adaptive Networks, Neuro Fuzzy Spectrum. [
- To learn Genetic Algorithm and understand the Working Principle, Procedure of GA, Flow chart of GA, Genetic Representations, Encoding, Application of GA.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand the concepts of Neuro, Fuzzy and Soft Computing and understand the Input Space partitioning and Fuzzy Modeling.
CO2	Understand the concept of Derivative-based Optimization and Simulated Annealing, Random Search, Downhill Simplex Search and their application development.
CO3	Understand the concept of Supervised Learning Neural Networks and Unsupervised Learning Neural Networks their application in the field of computer science to solve problems.
CO4	Understand the concepts of Neuro Fuzzy Modeling, Methods that Cross-fertilize ANFIS and RBFN and Framework Neuron Functions for Adaptive Networks, Neuro Fuzzy Spectrum.
CO5	To understand the concepts of Genetic Algorithm and understand the Working Principle, Procedure of GA, Flow chart of GA, Genetic Representations, Encoding, Application of GA.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1		1	1	1						
CO2	2	1	1	2	1		1			1		
CO3	2	1		1	1	1		1				
CO4	2		1	2		2	1					
CO5	2		1	2	1	2		1				

COURSE: .NET FRAMEWORK AND C#
CODE: CA607
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To study the features of .NET Technologies and to understand the framework and environment.
- To learn C# programming fundamentals for console application development.
- To learn use of C# libraries and exception handling techniques.
- To learn ADO. NET and advance features of C#.
- To learn .NET assemblies and attributes.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand .NET Framework, its runtime environment and application development IDE of Visual Studio.
CO2	Understand the concept of object oriented for making programs.
CO3	Implement C# language constructs in the form of stand-alone console and window form applications.
CO4	Understand database concepts in ADO.NET and apply the knowledge to implement distributed data-driven applications.
CO5	Design, document, debug ASP.NET web forms with server and validation controls and implement ASP.NET web services.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		3		3	1	1					
CO2	1		3				1					
CO3			3		2							
CO4	2		2		2							
CO5			3				1					

COURSE: DIGITAL IMAGE PROCESSING
CODE: CA608
COURSE CREDIT: 4

COURSE OBJECTIVES:

- Fundamental concepts of a digital image processing system.
- Concepts of image enhancement techniques.
- Understanding of various images transforms models.
- Compression techniques and Morphological concepts.
- Various segmentation techniques, and object descriptors.
- Color models and various applications of image processing.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Remember the fundamental concepts of image processing.
CO2	Capable to explain different image enhancement techniques
CO3	Understand and review image transforms model.
CO4	Analyze the basic algorithms used for image processing and image compression with morphological image processing.
CO5	Design and Synthesize Color image processing and its real world applications.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1			1	1	1	1				
CO2	2	2		2			1					
CO3	2	2		1		1		1				
CO4	1	3	2	1		1	1					
CO5			3	2	1		1	1				

COURSE: HUMAN COMPUTER INTERACTION
CODE: CA609
COURSE CREDIT: 4

COURSE OBJECTIVES:

- Identify and describe various HCI methodologies, including input and interaction types.
- Articulate the co-dependency of the user and the technology in an HCI system.
- Analyze how the study of interface / Interactivity / interaction influences the design of an HCI system.
- Apply some user-centered design methods to practical design problems.
- Develop basic prototypes with a range of interaction styles and technologies.
- Apply knowledge and understanding of the interaction design examples in order to analyze their situations and critically evaluate them in oral and written discussions.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Describe and apply core theories, models and methodologies from the field of HCI.
CO2	Describe what the user-centered design cycle is and explain how to practice this approach to design interactive software systems.
CO3	Analyze one after another the main features of interactive systems, and explain how to gauge the usability of digital environments, tools and interfaces.
CO4	Demonstrate a thorough understanding and solid knowledge of the principles and techniques of human-computer interaction.
CO5	Able to draw on a variety of techniques and relevant knowledge and appropriately apply them to new situations and real-life problems.

CO-PO MAPPING:

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

COURSE: MOBILE COMPUTING
CODE: CA610
COURSE CREDIT: 4

COURSE OBJECTIVES:

- Students to understand the concept of mobile computing paradigm, its functions and its new boundaries.
- Understanding the typical infrastructure for mobile networks through a popular GSM architecture.
- Understanding problems and solutions for different layers of mobile networks, namely MAC layers, network layers and transport layers.
- Understanding of the data delivery models and database issues in mobile environments.
- To understand the Mobile Ad-hoc Networks (MANETs) and Routing protocols.
- Understanding of the Platform/Operating Systems for Application Development and Android Application Development.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand and think to develop the new mobile computing based application.
CO2	Capable to discuss on some new methodological dispute associated to this new paradigm and can conclude with some good facts.
CO3	Understand the database issues in mobile environments and data delivery models in mobile computing.
CO4	Clever to improve mobile ad-hoc network (MANET) applications and/or procedures/protocols.
CO5	Able to develop and describe various existing or new mobile environment related protocols.

CO-PO MAPPING:

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

COURSE: RESEARCH METHODOLOGY AND TOOLS
CODE: CA611
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To understand basics knowledge of research methodology.
- To identify suitable research topics and appropriate research design.
- To choose and identify appropriate research problem and consideration.
- To plan a research proposal and appropriate analysis tool.
- To know concepts of hypothesis testing.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand basics knowledge research methodology and importance of research.
CO2	Analyze the problem and propose appropriate research design.
CO3	Develop a research plan and implement techniques for research analysis.
CO4	Investigate and solve difficulties in the implementation of research plan
CO5	Develop and implement appropriate hypothesis according to research plan.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1		2	1	1						
CO2	1	3	2	2	1		1					
CO3	1	1	3	2	1	1		1				
CO4		1	1	3		2	1					
CO5			3	2	1	2	1	1				

COURSE: GREEN COMPUTING AND E-WASTE MANAGEMENT
CODE: CA612
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To learn what is Green IT and how it can help to improve environment sustainability.
- To learn the concept of sustainable software development and energy management technique for data storage.
- To understand the concept of managing and regulating Green IT and measure the maturity of sustainable ICT world.
- To understand the basic concept of factors driving the development of IT sustainable services and greening the enterprises.
- Learn the concept of reusing and recycling Electronic waste.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Able to understand the environmental impact of IT and green IT.
CO2	Able to understand the basic concepts of energy efficient data storage and sustainable software development methodologies.
CO3	Able to use Green IT strategies and metrics for ICT development.
CO4	Able to illustrate various green IT services and role. Able to understand concept of greening the enterprises.
CO5	Able to understand Electronic Waste processing and impact on environment and health.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1		1	1	1				1		
CO2	2	1		2	1			1				
CO3	2			2	1	1		1				
CO4	3	2		1		2	1			1		
CO5	2	1		1	1	2		1				

COURSE: ARTIFICIAL INTELLIGENCE
COURSE CODE: CA613
COURSE CREDIT: 4

COURSE OBJECTIVES:

- Understand the concepts of AI and searching techniques.
- To develop the logical skills of knowledge and it's representational structure.
- Understand the concepts of natural language processing.
- Study the concepts related to machine learning.
- Learn the concepts how to design the program in PROLOG and pattern recognition techniques.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Study the concepts of AI and related searching algorithms.
CO2	Develop the knowledge skills and it's representational structure in AI.
CO3	Study the concepts of natural language processing in AI.
CO4	Study the concepts of supervised/unsupervised machine learning and game technique.
CO5	Study how design the programming skill in PROLOG, and concepts of pattern recognition approaches.

CO-PO MAPPING:

PO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	2	2	1	1					
CO2	1	2	3	1	2		1					
CO3	1	1		1	1		3					
CO4	2	1	2	3	1		1					
CO5	1	2	3	3	2		1					

COURSE: CYBER LAB AND E-SECURITY
COURSE CODE: CA614
COURSE CREDIT: 4

COURSE OBJECTIVES:

- To provide Knowledge and concept of information system with its type and e-commerce.
- To make familiar with security, threat, web security of information system.
- To know about the security threat related to e-commerce.
- To give the basic learning about the payment system of e-commerce.
- To provide an understanding the security issues on internet with respect to transaction, client-server, network and biometric.
- To develop an understanding the different types of cyber fraud, cyber crime and cyber law.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Know about the concept of information system with its type and e-commerce.
CO2	Get familiar with security, threat, web security of information system.
CO3	Know about the security threat related to e-commerce.
CO4	Learn the payment system of e-commerce.
CO5	Understand the security issues on internet with respect to transaction, client-server, network and biometric.
CO6	Understand the different types of cyber fraud, cyber crime and cyber law.

CO-PO MAPPING:

PO CO	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1			1	1	1	1				
CO2	2	1		2	1		1			1		
CO3	2			1		1	1	1		1		
CO4	1	1		2		2	1	1				
CO5	2	1		1	1	2		1		1		
CO6	3			2		1	1			1		