MCA/GEN/1/CC1: Computer Architecture and Parallel Processing								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
Core Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: To study the fundamental concepts of computer architecture, various computational models, evolution of instruction level processors, classification of parallel architectures and MIMD architectures.

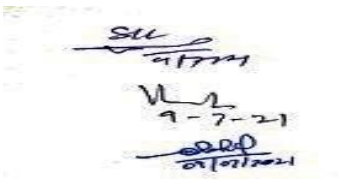
Course Outcomes	At the end of this course, the student will be able to:
CO1	define the concepts of: computer architecture including types of computer architecture, computational model, instruction level processors, code scheduling for ILP processors, distributed and shared MIMD architectures.
CO2	understand and explain: different types of computational model, parallel and distributed computing, instruction level processors, distributed and shared MIMD architectures.
CO3	illustrate different types of: computational models, architecture, processors, and memory models.
CO4	classify: computational models, computer architectures, processors, and memory models.
CO5	Compare and choose (and justify) a particular: computational model, architecture and memory model in a given situation.

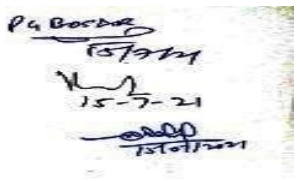
CO-PEO Mapping Matrix for Course MCA/GEN/1/CC1

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/GEN/1/CC1

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	-	-	-





CO2	2	1	1	3	1	-	3	-	-	-	-	-
CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/1/CC1

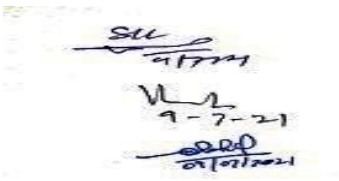
COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.4	-

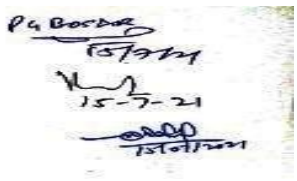
Course Content
MCA/GEN/1/CC1: Computer Architecture and Parallel Processing

Unit – I	Concurrent and Parallel Execution: Von-Neumann computational model, evolution and interpretation of the concept of computer architecture at different levels of abstraction, introduction to parallel processing, types and levels of parallelism, Flynn's classification of parallel architectures.
Unit – II	Instruction level Processors: Overview of ILP processors, dependencies between instructions, instruction scheduling, concepts of pipeline processing, introduction to VLIW and superscalar architectures, code scheduling for ILP processors.
Unit – III	Distributed Memory MIMD Architectures: introduction, direct interconnection networks, interconnection topologies, switching techniques-packet and circuit switching, routing- deterministic and adaptive routing.
Unit – IV	Shared Memory MIMD Architectures: Dynamic interconnection networks-shared path, switching networks-crossbar and multistage networks, Cache coherence problem, Hardware based cache coherence protocol-snoopy cache protocol, Directory scheme, Hierarchical cache coherence protocol, software-based protocols.

Text/Reference Books

Text Books	1. D. Sima, Advanced Computer Architectures, Pearson Education
Reference Books	1. Kai Hwang, Advanced Computer Architecture – Parallelism, Scalability, Programmability, Tata McGraw Hill.





MCA/GEN/1/CC2: Computer Networks								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
Core Compulsory Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: The objective of this course is to make the students familiar with the topics of networking, data communication, modes of transmission, communication media, routing, error control and congestion control.

Course Outcomes	At the end of this course, the student will be able to:
CO1	define the terms and concepts of data communication and computer networking including types of network topologies, reference models, protocols used in data communication, transmission modes and media, switching and multiplexing.
CO2	understand and describe various concepts of data communication and computer networking including network topologies, reference models, protocols used in data communication, data transmission modes and transmission media, switching and multiplexing.
CO3	apply the techniques learnt here in the design and evaluation of computer and communication networks and decide which competing communication media, and network topology/switching/protocol/technology will suit a particular situation.
CO4	differentiate various types of: computer and data communication networks, network topologies, switching and multiplexing mechanisms, error control mechanisms, routing protocols, transmission modes, transmission media, congestion control techniques.
CO5	compare, evaluate and choose between candidate: network topologies, transmission media, switching and multiplexing techniques, protocols and different layers, error control mechanisms, congestion control techniques.

CO-PEO Mapping Matrix for Course MCA/GEN/1/CC2

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO.2	2	3	1	3	3

CO3	3		3		1		3		3			
CO4	3		3		1		3		3			
CO5	3		3		1		3		3			
Average	2.4		3		1		3		3			

CO-PO Mapping Matrix for Course MCA/GEN/1/CC2

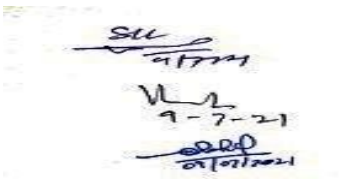
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	2	-	-
CO.2	2	1	1	3	1	-	3	2	-	2	-	-
CO3	3	1	1	3	3	-	3	3	-	2	-	-
CO4	2	1	1	3	1	-	3	3	-	2	-	-
CO5	2	1	3	1	3	-	3	3	-	2	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	2.4	-	2	-	-

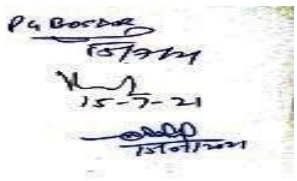
CO-PSO Mapping Matrix for Course MCA/GEN/1/CC2

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	1	-
CO.2	3	2	3	2	-
CO3	3	2	3	3	-
CO4	3	2	3	3	-
CO5	3	2	3	3	-
Average	3	2	3	2.4	-

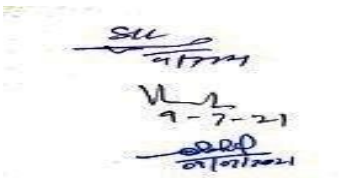
Course Content
MCA/GEN/1/CC2: Computer Networks

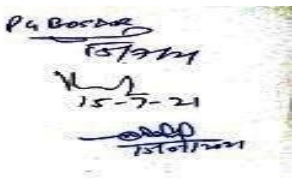
Unit - I	Network concepts: goals and applications of computer networks; topologies; categories of networks - LAN, MAN, WAN; point-to point, and broadcast networks. Networks architecture: concepts of protocols & services; OSI model and functions of its layers; TCP/IP reference model. TCP/IP: elements of transport protocols; transmission control protocol (TCP); user datagram protocol (UDP); internet protocol (IP).
Unit - II	Data communication concepts: components of a data communication system; transmission modes; transmission media – guided and wireless media; introduction to switching (circuit, message and packet) and multiplexing (frequency division and time division); modem. Introduction to SMDS, X.25, ISDN networks, frame relay and ATM networks.
Unit - III	Framing and error control: framing techniques; error control - error detection &





	correction. Data link control: acknowledgments, sliding window protocols. Multiple Access Control, flow and error control, token bus, token ring, DQDB.
Unit - IV	Routing: deterministic and adaptive routing; centralized and distributed routing; shortest-path; flooding; flow-based; optimal; distance-vector, link-state, hierarchical; routing for mobile hosts; broadcast and multicast routing. Congestion control: principles of congestion control; traffic shaping; choke packets; load shading; RSVP.
Text/Reference Books	
Text Books	2. Andrews, Tananbaum, Computer Networks – PHI. 3. Fred Halsall, Data Communications, Computer Networks and Open Systems, 4e, Addison Wesley. 4. William Stalling, Data and Computer Communications, 5e, PHI.
Reference Books	2. Behrouz, Frozen, Introduction to Data Communications and Networking, Tata McGraw Hill.





MCA/GEN/1/CC3: Software Engineering								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
Core Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: The objective of this course is to make the students familiar with the topics of software crisis, software engineering paradigms, software configuration management, design, coding, testing and maintenance.

Course Outcomes	At the end of this course, the student will be able to:
CO1	enumerate/define the concepts of: software and software engineering, software development paradigms, phases of software development, methods of assessing quality and reliability.
CO2	describe and summarize: phases of software development process, testing techniques, relationship between reliability and quality.
CO3	illustrate various techniques of: requirement analysis, design, coding, testing and maintenance, quality and reliability.
CO4	analyse and classify: software engineering paradigms, cost estimation models, design methodologies, testing techniques, maintenance process, reliability and quality models.
CO5	compare and select from amongst candidate: software engineering paradigms, cost estimation models, design methodologies, testing techniques, maintenance process, reliability and quality models.
CO6	design and develop simple software using the concepts, techniques and principles of software engineering.

CO-PEO Mapping Matrix for Course MCA/GEN/1/CC3

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	2.4	3	3	3	3

CO-PO Mapping Matrix for Course MCA/GEN/1/CC3

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	2	1	-	2	-
CO2	2	1	1	3	1	-	3	2	1	-	2	-
CO3	3	1	1	3	3	-	3	2	1	-	2	-
CO4	2	1	1	3	1	-	3	2	1	-	2	-
CO5	2	1	3	1	3	-	3	2	1	-	2	-
Average	2	1.4	1.4	2.2	1.8	-	3	2	1	-	2	-

CO-PSO Mapping Matrix for Course MCA/GEN/1/CC3

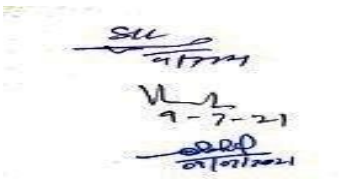
COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	-
CO2	3	3	3	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
Average	3	3	3	2.4	-

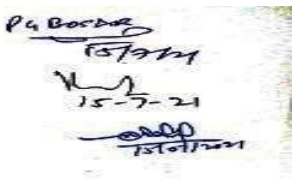
Course Content
MCA/GEN/1/CC3: Software Engineering

Unit - I	Software and software engineering, software characteristics, software crisis, software engineering paradigms, planning a software project, software cost estimation, project scheduling, personnel planning, team structure.
Unit - II	Software requirement analysis: structured analysis, object-oriented analysis and data modeling, software requirement specification, validation. Software configuration management, quality assurance, project monitoring, risk management.
Unit - III	Design and implementation of software: software design fundamentals, structured design methodology and object-oriented design, design verification, monitoring

	and control, coding. Software Reliability: metric and specification, fault avoidance and tolerance, exception handling, defensive programming.
Unit - IV	Testing: testing fundamentals, white box and black box testing, software testing strategies: unit testing, integration testing, validation testing, system testing, debugging. Software maintenance: maintenance characteristics, maintainability, maintenance tasks, maintenance side effects. CASE tools. agile development.
Text/Reference Books	
Text Books	5. Mall, Rajib, Fundamentals of Software Engineering, PHI Learning Pvt. Ltd 6. Aggarwal, K.K, and Singh, Yogesh, Software Engineering, New Age International 7. Jalote, Pankaj, An Integrated Approach to Software Engineering, Narosa Publishing House.
Reference Books	3. Pressman, S. Roger, Software Engineering, Tata McGraw-Hill.

MCA/GEN/1/CC4: Operating Systems								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
Core Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		
Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.								
Course Objectives: The objective of this course is to get the students familiar with fundamental concepts of operating systems, namely, types of operating systems, functions of memory management module, process management module, deadlock management and file protection, etc.								





Course Outcomes	At the end of this course, the student will be able to:
CO1	outline and define: the goals, functions and types of operating system, interprocess communication, deadlock; identify the techniques of allocation of memory, processor, and disk space.
CO2	describe and discuss: the goals, functions and types of operating system, interprocess communication, deadlock management, techniques of allocation of memory, processor, and disk space.
CO3	illustrate: the concepts of operating system like process scheduling, memory management, virtual memory, directory structure, disk space allocation, and process deadlocks.
CO4	classify: operating systems, deadlock management approaches, process scheduling algorithms, disk scheduling algorithms, page replacement algorithms, directory structure, disk space allocation methods.
CO5	determine and argue the suitability of a particular types of: operating system, deadlock management approach, process scheduling algorithm, disk scheduling algorithm, page replacement algorithm, disk space allocation method, directory structure, memory management, disk scheduling algorithm in a given situation.

CO-PEO Mapping Matrix for Course MCA/GEN/1/CC4

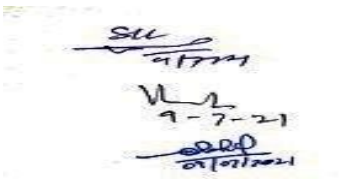
COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

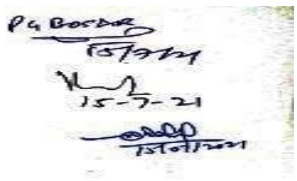
CO-PO Mapping Matrix for Course MCA/GEN/1/CC4

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	2	-	-
CO2	2	1	1	3	1	-	3	2	-	2	-	-
CO3	3	1	1	3	3	-	3	3	-	2	-	-
CO4	2	1	1	3	1	-	3	3	-	2	-	-
CO5	2	1	3	1	3	-	3	3	-	2	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	2.4	-	2	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/1/CC4

COs	PSO1	PSO2	PSO3	PSO4	PSO5





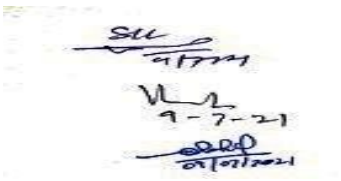
CO1	3	2	3	1	-
CO2	3	2	3	2	-
CO3	3	2	3	3	-
CO4	3	2	3	3	-
CO5	3	2	3	3	-
Average	3	2	3	2.4	-

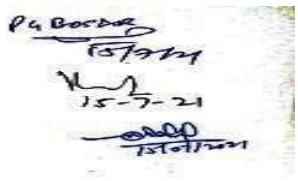
Course Content
MCA/GEN/1/CC/4: Operating Systems

Unit - I	Introductory concepts: Operating system goals and functions, types of operating systems – batch operating system, multitasking operating system, time-sharing operating systems, real-time operating systems, distributed operating systems, system calls and their types, layered architecture of operating system; modules of kernel of operating system their functions.
Unit - II	Memory management: Functions of memory management module, memory allocation methods – contiguous and non-contiguous memory allocation; real and virtual memory allocation; fragmentation – internal and external, paging, segmentation, virtual memory concepts, demand paging, page replacement algorithms, thrashing, Belady's anomaly.
Unit - III	Process management: Process concept, PCB, Process switch and mode switch; system state and state space, state transition diagram; scheduling criteria, preemptive and non-preemptive scheduling, starvation and its mitigation, process scheduling algorithms, levels of scheduling, comparison of scheduling algorithms, inter-process communication, critical code section, mutual exclusion and its implementation, semaphore, hardware support for mutual exclusion.
Unit - IV	Deadlock - concept, conditions; deadlock management – prevention, avoidance, deadlock detection and recovery, practical considerations – ostrich approach; file – concept, file protection, file access control, file access methods; directory structure; disk space allocation; disk scheduling algorithms and their performance comparison.

Text/Reference Books

Text Books	1. Silberschatz A., Galvin P. B., Gagne G., Operating System Concepts, Wiley India Pvt. Ltd. 2. ChauhanNaresh, Principles of Operating Systems, Oxford University Press. 3. Tanenbaum A.S., Operating System- Design and Implementation, PHI Learning.
Reference Books	1. Deitel H.M., Operating Systems, Pearson Education. 2. Stallings William, Operating System, PHI Learning.





	3. Godbole A.S., Operating Systems, Tata McGraw-Hill, New Delhi

Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks				Exam Duration	Assessment Methods
				External	Internal				
Compulsory Theory	04	04	Lecture	70	30			3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5	5		

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

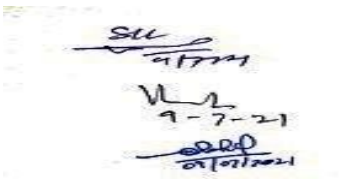
Course Objectives: The objective of this course is to get the basic concepts and building blocks of Core Java and C#.Net programming languages using the modular approach which emphasizes on small programs. Learn how to write moderately complex programs efficiently. Learn making GUI-based applications in Core Java as well as C#.Net.

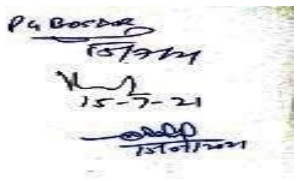
Course Outcomes	By the end of this course, the student will able to:
CO1	outline: programming environment, data types, control constructs, loops, arrays, programming approaches, threads in programming, file system for data storing, data structure library, graphical user interface concepts.
CO2	summarize: programming fundamentals, programming approaches, multithreaded programming, data storing using file system, data structure library, GUI concepts.
CO3	apply: basic programming concepts: to solve basic mathematical operations, data structure operations, concurrent execution of threads, user friendly interfaced programs.
CO4	categorize: data types, programming approaches, flow controls constructs, loops, single and multithreaded programming, various classes in collection framework, GUI controls.
CO5	choose: data types, programming approaches, branching and iteration methods, serial or concurrent programming, data structures supporting classes in collection framework.
CO6	create: programs using basic concepts, multithreading and GUI based concepts.

CO-PEO Mapping Matrix for Course MCA/GEN/1/CC5

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	3	3	3	3

CO-PO Mapping Matrix for Course MCA/GEN/1/CC5





Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	-	-	-
CO2	2	1	1	3	1	-	3	2	-	-	-	-
CO3	3	1	1	3	3	-	3	3	-	-	-	-
CO4	3	3	1	3	1	-	3	3	-	-	-	-
CO5	3	1	3	1	3	-	3	3	-	-	-	-
CO6	3	3	3	3	3	-	3	3	-	-	-	-
Average	2.5	2	1.66	2.33	2	-	3	2.5	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/1/CC5

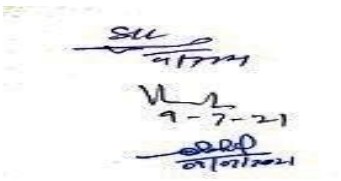
COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	-
CO2	3	2	2	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	2.5	2.5	2.5	-

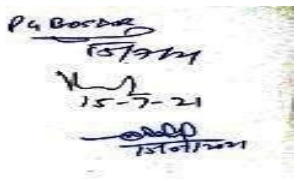
Course Content
MCA/GEN/1/CC5: Java and C#

Unit - I	Java and C#:introduction on [dot]net environment, basic concepts, data types, reference types, operators and its types, decision controls, control statements, loops, array, string, functions, boxing unboxing, scope of variables,
Unit - II	OOPS concepts in Java and C#: encapsulation, class, object, constructors, destructors, Polymorphism: function overloading and operator overloading in C#, inheritance, interface, abstract class, packages, exception handling.
Unit - III	Multithreading in Java and C#:thread model, multithreading supporting classes and methods, creating single and multiple threaded program, context switching, thread synchronization, inter thread communication.
Unit – IV	Working with GUI in Java and C#: containers and components. Collection framework in Java and C#: interfaces and classes for collection framework, list, set, map. I/O stream in Java and C#:input and output stream, file handling operations.

Text/Reference Books

Text Books	1. Darrel Ince& Adam Freeman, Programming the Internet with Java, 2e, Addison Wesley. 2. K.A. Mughal, R.W. Rasmussen, A Programmer's Guide to Java Certification, Addison Wesley. 3. E. Balagurusamy, Programming with Java, 6e, Tata McGraw Hill. 4. E. Balagurusamy, Programming in C# - A Primer, 4e, Tata McGraw Hill.
Reference Books	1. Herbert Schildt, The Complete Reference Java, 10e, Tata McGraw Hill. 2. Herbert Schildt, C #: A Beginner's Guide, Tata McGraw Hill.





MCA/GEN/1/CC6: Software Lab –Java							
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Practical	02	04	Lab Work	50	-	3 Hours	TEE/ Practical File

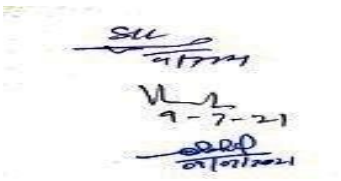
Instructions to paper setter for Final-Term Examination: The Final-Term examination will be conducted by a panel of internal and external examiners. Examinees will be evaluated based on the practical file, performance in practical exam and a viva voce exam.

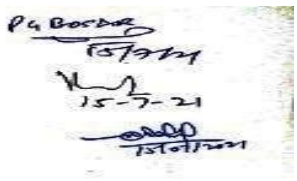
Course Objectives: The objective of this course is to get the students hands-on practice with Core Java programming concepts covered in course **MCA/GEN/1/CC5.**

Course Outcomes	By the end of this course, the student will able to:
CO1	outline: programming environment, data types, control constructs, loops, arrays, programming approaches, threads in programming, file system for data storing, data structure library, graphical user interface concepts.
CO2	summarize: programming fundamentals, programming approaches, multithreaded programming, data storing using file system, data structure library, GUI concepts.
CO3	apply: basic programming concepts: to solve basic mathematical operations, data structure operations, concurrent execution of threads, user friendly interfaced programs.
CO4	categorize: data types, programming approaches, controls constructs, loops, single and multithreaded programming, various classes in collection framework, GUI controls.
CO5	choose: data types, programming approaches, branching and iteration methods, serial or concurrent programming, data structures supporting classes in collection framework.
CO6	develop: programs using basic concepts, multithreading and GUI based concepts.

CO-PEO Mapping Matrix for Course MCA/GEN/1/CC6

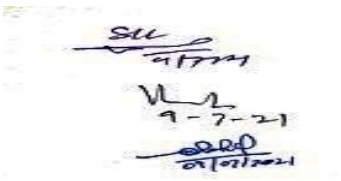
COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	3	3	3	3

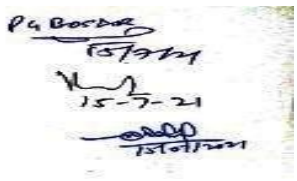




CO-PO Mapping Matrix for Course MCA/GEN/1/CC6												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	-	-	-
CO2	2	1	1	3	1	-	3	2	-	-	-	-
CO3	3	1	1	3	3	-	3	3	-	-	-	-
CO4	3	3	1	3	1	-	3	3	-	-	-	-
CO5	3	1	3	1	3	-	3	3	-	-	-	-
CO6	3	3	3	3	3	-	3	3	-	-	-	-
Average	2.5	2	1.66	2.33	2	-	3	2.5	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/1/CC6					
COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	-
CO2	3	2	2	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	2.5	2.5	2.5	-





MCA/GEN/1/CC7: Software Lab – C#							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Practical	02	04	Lab Work	50	-	3 Hours	TEE/ Practical File

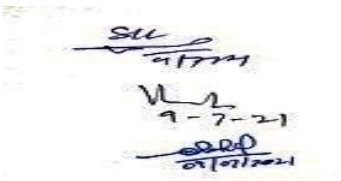
Instructions to paper setter for Final-Term Examination: The Final-Term examination will be conducted by a panel of internal and external examiners. Examinees will be evaluated on the basis of practical file, performance in practical exam and a viva voce exam.

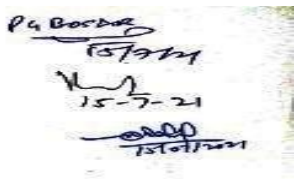
Course Objectives: The objective of this course is to get the students hands-on practice with C# programming concepts covered in course **MCA/GEN/1/CC5.**

Course Outcomes	At the end of this course, the student will be able to:
CO1	outline: programming environment, data types, control constructs, loops, arrays, programming approaches, threads in programming, file system for data storing, data structure library, graphical user interface concepts.
CO2	summarize: data types, programming concepts, programming approaches, multithreaded programming, data storing using file system, data structure library, GUI concepts.
CO3	apply: basic programming concepts: to solve basic mathematical operations, data structure operations, concurrent execution of threads, user friendly interfaced programs.
CO4	categorize: programming approaches, controls constructs, loops, single and multithreaded programming, various classes in collection framework, GUI controls.
CO5	choose: programming approaches, branching and iteration methods, serial or concurrent programming, data structures supporting classes in collection framework.
CO6	develop: programs using basic concepts, multithreading and GUI based concepts.
Average	

CO-PEO Mapping Matrix for Course MCA/GEN/1/CC7

Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3





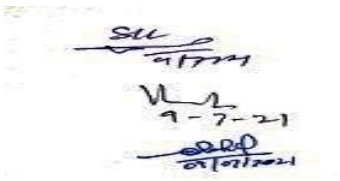
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	3	3	3	3

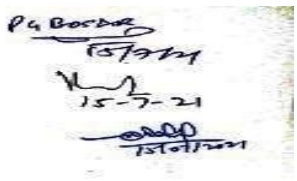
CO-PO Mapping Matrix for Course MCA/GEN/1/CC7

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	-	-	-
CO2	2	1	1	3	1	-	3	2	-	-	-	-
CO3	3	1	1	3	3	-	3	3	-	-	-	-
CO4	3	3	1	3	1	-	3	3	-	-	-	-
CO5	3	1	3	1	3	-	3	3	-	-	-	-
CO6	3	3	3	3	3	-	3	3	-	-	-	-
Average	2.5	2	1.66	2.33	2	-	3	2.5	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/1/CC7

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	-
CO2	3	2	2	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	2.5	2.5	2.5	-





MCA/GEN/2/CC8: Data Structures								
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
Compulsory Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment/Attendance
					20	5 5		

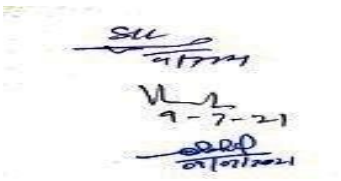
Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

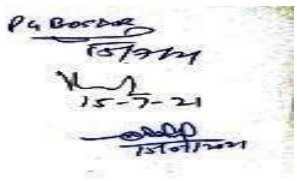
Course Objectives: The objective of this course is to get the students familiar with various types of data structure and different techniques to implement the data structures and their real-life applications.

Course Outcomes	At the end of this course, the student will be able to:
CO1	define: abstract data types, algorithms, complexity of algorithms, linear data structures, non-linear data structures, searching, sorting, hashing.
CO2	give: original examples of : data structures and its types; explain: sorting techniques, searching methods, hashing and collision resolution techniques.
CO3	calculate: (complexity of algorithm). use array , stack, queue, linked list, tree, graph, linear search, binary search, bubble sort, selection sort, insertion sort , radix sort, shell sort, merge sort, quick sort, heap sort , hash function to solve given problems.
CO4	differentiate: data structure, searching techniques, sorting techniques, hash functions; analyze: time and space complexity.
CO5	evaluate: the complexity of linear search, binary search, bubble sort, selection sort, insertion sort , radix sort, shell sort, merge sort, quick sort, heap sort , hash function and select the best one for given problem.

CO-PEO Mapping Matrix for Course MCA/GEN/2/CC8

Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3





CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/GEN/2/CC8

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	-	-	-
CO2	2	1	1	3	1	-	3	-	-	-	-	-
CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.5	-	3	-	-	-	-	-

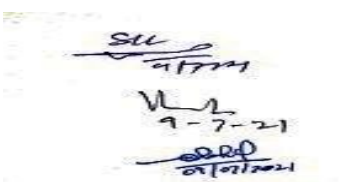
CO-PSO Mapping Matrix for Course MCA/GEN/2/CC8

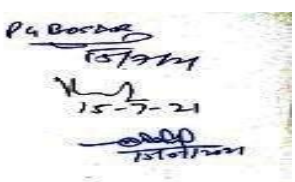
Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	-
CO2	3	3	3	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
Average	3	3	3	2.4	-

Course Content
MCA/GEN/2/CC8: Data Structures

Unit – I	Data structure and algorithm preliminaries: Definitions, time and space analysis of algorithms, time-space trade off, mathematical notation and functions, asymptotic notations for complexity of algorithms, recursion, divide and conquer strategy.
Unit – II	Linear data structures: abstract data types, array-based implementation, Stack: operations and application of stacks. Queues: operation on queues, circular queue, priority queues and de-queue, linked list: implementation of linked list, header linked list for polynomial manipulation.
Unit – III	Non-linear data structures: Trees: binary tree, tree traversals, binary search tree, threaded binary tree, AVL tree, B-tree, B+ tree, heap and its applications, Huffman coding. Graph: representation of graphs, types of graph, graph traversals, topological sort, minimum spanning trees, Kruskal and Prim's algorithm, application of graphs.
Unit – IV	Searching, sorting and hashing techniques:

	Searching: linear search, binary search. Sorting: bubble sort, selection sort, insertion sort, radix sort, shell sort, merge sort, quick sort, heap sort, Hashing: hash functions, open addressing, chaining, rehashing.
Text/Reference Books	
Text Books	1. Seymour Lipschutz, Data Structures, McGraw-Hill Book Company,Schaum's Outline series, NewYork (1986). 2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education, 2002.
Reference Books	1. Tanenbaum A.M., Langsam Y, Augenstien M.J., Data Structures using C & C++, Prentice Hall of India, 2002. 2. SartajSahni, Data structures, Algorithms and Applications in C++, University Press (India) Pvt.Ltd, 2e, Universities Press Orient Longman Pvt. Ltd.





MCA/GEN/2/CC9:Computer Graphics							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Compulsory Theory	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: Objective of this course is to make the students familiar with the basic concepts of Computer Graphics and the working of various graphic devices and their applications.

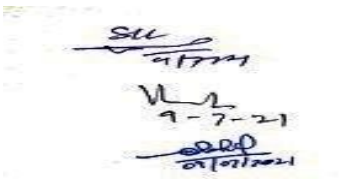
Course Outcomes	At the end of this course, the student will be able to:
CO1	define: computer graphics, soft copy computer devices, hard copy computer devices use in computer graphics , 2D graphics, 3D graphics, multimedia , 2D transformation, 3D transformation, resolution, graphic operation.
CO2	describe: computer graphic application, random scan, raster scan, coordinate system, homogeneous coordinate system, scan conversion , DDA, Bresenham line drawing algorithm, 2D and 3D transformation, positioning, pointing, rubber band techniques, clipping operation on line , polygon clipping, hidden surface removal, parallel and perspective projection, shading.
CO3	apply algorithms: line drawing, clipping, hidden surface removal, projection.
CO4	categorize: scan conversion methods, projection techniques, clipping algorithms, shading methods.
CO5	compare and evalutate: scan conversion methods, projection techniques, clipping algorithms, shading methods.

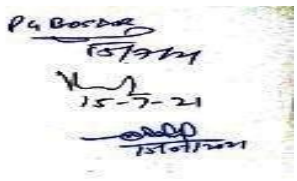
CO-PEO Mapping Matrix for Course MCA/GEN/2/CC9

Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/GEN/2/CC9

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12





CO1	1	3	1	1	1	-	3	-	-	-	-	-
CO2	2	1	1	3	1	-	3	-	-	-	-	-
CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.5	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/2/CC9

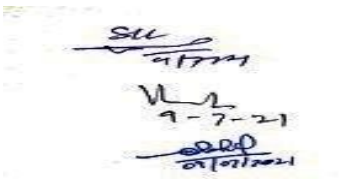
Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.4	-

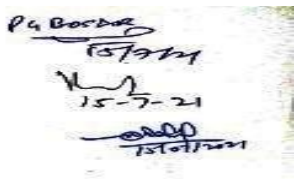
Course Content
MCA/GEN/2/CC9: Computer Graphics

Unit I	Introduction: survey of computer graphics and its applications; Interactive and passive graphics; Introduction to GKS primitives; display processors; graphic devices: display system-refresh CRTs, raster scan and random scan monitors grey shades, Interlacing, beam penetration shadow mask monitors, look up tables, plasma panel, LED and LCD monitors, LCD monitors, VGA and SVGA resolution; hard copy devices-printers, plotters
Unit - II	Drawing geometry: coordinate system, resolution, use of homogeneous coordinate system; Scan conversion: symmetrical DDA, simple DDA, Bresenham's line drawing algorithm, generation of ellipse; 2-D Transformations: translation; rotation; scaling; mirror reflection; shearing: zooming; panning; input techniques-pointing, positioning, rubber and methods and dragging; tweezing.
Unit - III	Graphic operations: clipping-line clipping using Sutherland-Cohen and midpoint sub-division algorithm, polygon clipping; window and view port; windowing transformation; filling-stack based fill algorithm; Multimedia: concepts of hypertext/hypermedia; multimedia applications; multimedia authoring; multimedia hardware; images; bitmaps; windows paint brush.
Unit - IV	3-D Graphics: 3D modeling of objects; 3D display techniques; coordinate system; 3D transformation matrices for translation, scaling and rotation; parallel projection; perspective projection; hidden surface removal, z-buffer, back face, scan line, depth sorting, area subdivision; shading- modeling light intensities, gouraud shading, phong shading.

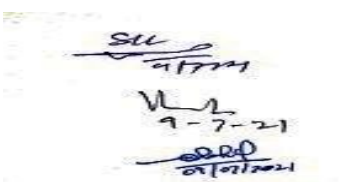
Text/Reference Books

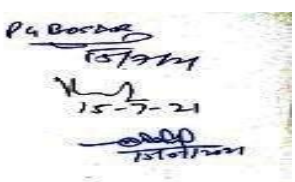
Text Books.	1. Donald Hearn and M. Pauline Baker, Computer Graphics, PHI. 2. Newman &Sproull, Principles of Interactive Computer Graphics, McGraw Hill.





Reference Books	1.John F. KoegelBufore, Multimedia Systems, Addison Wesley. 2. Foley, Computer Graphics Principles & Practice, Addison Wesley. 3. Rogers, Procedural elements of Computer Graphics, McGraw Hill. 4. D.P. Mukherjee, Fundamentals of computer Graphics and Multimedia, PHI.





MCA/GEN/2/CC10: Database Systems							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Compulsory Theory	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: The objective of this course is to get the students familiar with the concepts, models, architecture and applications of database systems.

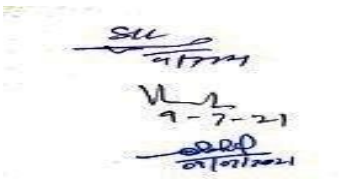
Course Outcomes	At the end of this course, the student will be able to:
CO1	define: schema architecture, ER diagrams, EER model,, functional dependencies, normal forms, data types, views in SQL, concurrency control techniques, database security issues, semantic data models, and client server architecture.
CO2	describe: ER diagram, relational model, EER model, functional dependencies, normal forms, SQL constraints and views, recovery algorithm.
CO3	apply: inheritance, SQL queries, constraints, recovery techniques.
CO4	differentiate: subclass and super class, specialization and generalization, functional dependencies,normal forms.
CO5	justify: architecture, relational schema , recovery technique and data model shall be better suited in different situation.

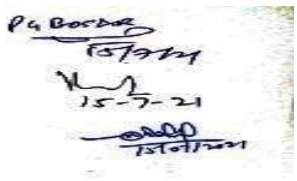
CO-PO Mapping Matrix for Course MCA/GEN/2/CC10

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	2	-	-
CO2	2	1	1	3	1	-	3	-	-	2	-	-
CO3	3	1	1	3	3	-	3	-	-	2	-	-
CO4	2	1	1	3	1	-	3	-	-	2	-	-
CO5	2	1	3	1	3	-	3	-	-	2	-	-
Average	2	1.4	1.4	2.2	1.5	-	3	-	-	2	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/2/CC10

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	-
CO2	3	3	3	2	-
CO3	3	3	3	3	-





CO4	3	3	3	3	-
CO5	3	3	3	3	-
Average	3	3	3	2.4	-

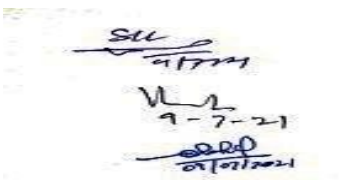
CO-PEO Mapping Matrix for Course MCA/GEN/2/CC10

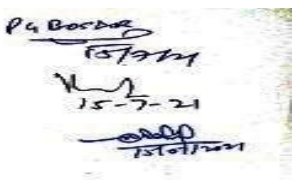
COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

Course Content
MCA/GEN/2/CC10: Database Systems

Unit I	Basic concepts: a historical perspective, file system vs. DBMS, characteristics of the database approach, abstraction and data integration, database users, advantages and disadvantages of a DBMS, implication of database approach. Database system concepts and architecture- data models, schemas and instances, DBMS architecture and data independence database languages & interfaces, DBMS functions and component modules.
Unit - II	Entity-relationship model: entity types, entity sets, attributes & keys, relationships, relationship types, roles and structural constraints, design issues, weak entity types, E-R diagrams, design of an E-R database schema. Conventional data models- an overview of network and hierarchical data models. relational data model- relational model concepts, integrity constraints over relations, relational algebra – basic operations.
Unit – III	SQL: data definition, constraints, & schema changes in SQL, insert, delete & update statements in SQL, view in SQL, specifying constraints and indexes in SQL, queries in SQL. ORACLE – a historical perspective, basic structure, database structure and its manipulation in Oracle, storage organization in Oracle programming, Oracle applications. Relational database design: functional dependencies, decomposition, desirable properties of decomposition, normal forms based on primary keys (1 NF, 2 NF, 3 NF and BC NF). Practical database design: role of information systems in organizations, database design process, physical database design in relational databases.
Unit – IV	Transaction processing concepts: introduction to transaction processing, transaction & system concepts, properties of transaction, schemes and recoverability, serializability of schedules.

	Concurrency control techniques: locking techniques, timestamp ordering, multiversion techniques, optimistic techniques. Recovery techniques: recovery concepts, recovery techniques in centralized DBMS. database security: introduction to database security issues.
Text/Reference Books	
Text Books	1. Elmasri&Navathe, Fundamentals of Database System, 3e, Addison Wesley, New Delhi. 2. Korth&Silberschatz, Database System Concept, 4e, McGraw Hill International Edition.
Reference Books	1. C.J. Date, An Introduction to Database System 7e, Addison Western, New Delhi. 2. Abbey Abramson & Cory, ORACLE SI-A Beginner's Guide, Tata McGraw Hill Publishing Company Ltd.





MCA/GEN/2/CC11: Artificial Intelligence							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Compulsory Theory	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: The objective of this course is to providean understanding of Artificial Intelligence techniques and their applications. Various search techniques and expert systems along with other components of artificial intelligence in computer science will be covered.

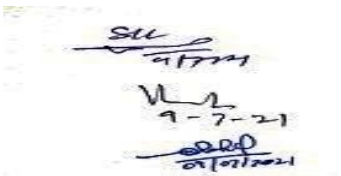
Course Outcomes	At the end of this course, the student will be able to:
CO1	define: artificial intelligence terms, types of search strategy, production system, knowledge representation, learning techniques and genetic algorithm terminologies.
CO2	explain: the types and properties of search algorithm, predicate calculus, knowledge representation and explore the theories that demonstrate intelligent behavior including intelligent editor, learning by induction and dealing with uncertainty.
CO3	use: search strategy/genetic algorithm/ fuzzy logic and learning technique.
CO4	classify types of: search strategy, production system, learning, operator of genetic algorithm, knowledge representation and approaches that deals with uncertainty.
CO5	compare and select types of: search strategy, production system, learning, operator of genetic algorithm, knowledge representation and approaches that deals with uncertainty.

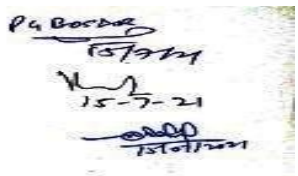
CO-PEO Mapping Matrix for Course MCA/GEN/2/CC11

Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/GEN/2/CC11

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





CO5	2	1	3	1	3	-	3	-	-	2	-	-
Average	2	1.4	1.4	2.2	1.5	-	3	-	-	2	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/2/CC11

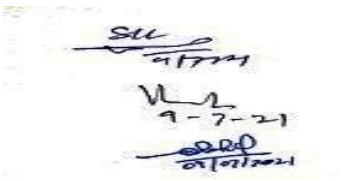
Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.4	-

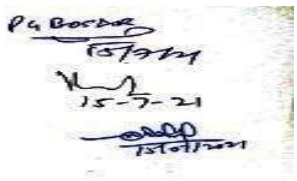
Course Content
MCA/GEN/2/CC11: Artificial Intelligence

Unit – I	Introduction: background and history, overview of AI applications areas. The predicate calculus: syntax and semantic for propositional logic and FOPL, clausal form, inference rules, resolution and unification. Knowledge representation: network representation, associative network & conceptual graphs, structured representation, frames & scripts.
Unit – II	Search strategies: strategies for state space search, data-driven and goal driven search, Search algorithms: uninformed search (depth-first, breadth-first, depth-first with iterative deepening) and informed search (hill climbing, best first, A* algorithm, mini-max etc.), computational complexity, properties of search algorithms, admissibility, monotonicity, optimality, dominance.
Unit - III	Production system: types of production system-commutative and non-commutative production systems, decomposable and non-decomposable production systems, control of search in production systems. Rule-based expert systems: architecture, development, managing uncertainty in expert systems, Bayesian probability theory, Stanford certainty factor algebra, nonmonotonic logic and reasoning with beliefs, Fuzzy logic, Dempster/Shaffer and other approaches to uncertainty.
Unit – IV	Knowledge acquisition: types of learning, learning by automata, intelligent editors, learning by induction. Genetic algorithms: problem representation, encoding schemes, operators: selection, crossover, mutation, replacement etc.

Text/Reference Books

Text Books	1. George F. Luger, Artificial Intelligence, Pearson Education. 2. Dan W. Patterson Introduction to Artificial Intelligence and Expert system, PHI.
Reference Books	1. Eugene Charniak, Drew McDermott, Introduction to Artificial Intelligence" Addison Wesley. 2. Wils J. Nilsson, Principles of Artificial Intelligence, Narosa Publishing house. 3. Jackson Peter, Introduction to Expert systems, 3e, Addison Wesley, 2000.





MCA/GEN/2/CC12: Web Development using Servlet, JSP and ASP.NET								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
Compulsory Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

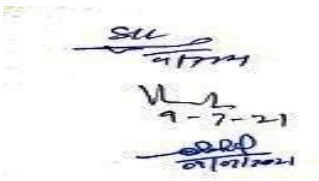
Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

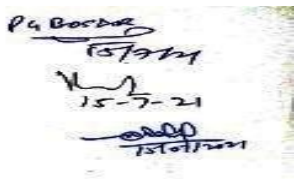
Course Objectives: To illustrate the basic concepts and building blocks of Servlet, JSP and ASP.Net language programming using the tire architecture approach. Learn how to write moderately complex programs efficiently. Learn making Web-based application in Servlet, JSP as well as ASP.Net

Course Outcomes	At the end of this course, the student will able to:
CO1	outline: basic html tags, cascading style sheet, javascript fundamentals, server side programming concepts: jsp, servlet, asp.net, secure socket layer, cookies, java mail, master pages, site navigation.
CO2	explain: html tags, javascript concepts, servlet, servlet life cycle, java server pages, secure connection using SSL, cookies, controls in asp.net, master pages, site navigation, java mail.
CO3	apply: html tags, css, javascript, servlet, jsp and asp.net concepts, secure connection importance, cookies in web programs.
CO4	categorize: static and dynamic pages, client side and server side programming, server types, get and post methods, servlet and jsp programming, jap and asp.net platform, asp.net controls;
CO5	choose: static or dynamic pages, client side or server side programming, server types, get or post method, servlet or jsp programming, jap or asp.net platform, asp.net controls; and
CO6	create: sample application using javascript, html, jsp, servlet and asp.net.

CO-PEO Mapping Matrix for Course MCA/GEN/2/CC12

Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3





CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	3	3	3	3

CO-PO Mapping Matrix for Course MCA/GEN/2/CC12

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	-	-	-
CO2	2	1	1	3	1	-	3	2	-	-	-	-
CO3	3	1	1	3	3	-	3	3	-	-	-	-
CO4	3	3	1	3	1	-	3	3	-	-	-	-
CO5	3	1	3	1	3	-	3	3	-	-	-	-
CO6	3	3	3	3	3	-	3	3	-	-	-	-
Average	2.5	2	1.66	2.33	2	-	3	2.5	-	-	-	-

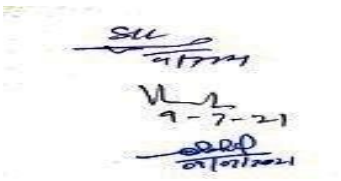
CO-PSO Mapping Matrix for Course MCA/GEN/2/CC12

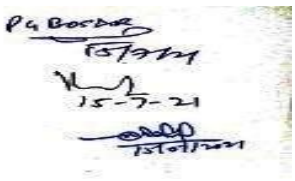
Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	-
CO2	3	2	2	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	2.5	2.5	2.5	-

Course Content
MCA/GEN/2/CC12: Web Development using Servlet, JSP and ASP.NET

Unit - I	Foundation for web development: basic tags of html, basic concepts of cascading style sheet, java script fundamentals (data types, conditional statements, looping, functions), introductions to types of servers.
Unit - II	Working with servlet: introduction to servlet, life cycle of servlet, supporting classes for servlet programming, use HTTP GET and POST methods, Request and response objects, data validation in servlet, working with web.xml.
Unit - III	Working with JSP: introduction to Java Server Pages, JSP tags, use JSP tags with JavaBeans, introduction to session tracking and how it works, working with cookies (creations, view, delete), using JavaMail, introduction to Secure Socket Layer(SSL), how SSL works, when to use secure connection.
Unit – IV	Working with ASP.Net: introduction, visual studio environment, web form

	structure(container and components- textbox, list box, combo box, buttons, pictures), user and server controls, basic client side script, Working with master page, site navigation, asp.net security model and its types, forms authentication and its types.
Text/Reference Books	
Text Books	1. Scott Guelich, Shishir Gundavaram, Gunther Birznieks, CGI Programming with Perl, 2e, O'Reilly. 2. William J. Pardi, XML in Action, Web Technology, Microsoft Press. 3. Aaron Weiss, Rebecca Taply, Kim Daniels, Stuven Mulder, Jeff Kaneshki, Web Authoring Desk Reference, BPB Publication. 4. E. Balagurusamy, Programming in C#, 4e, Tata McGraw Hill. 5. Herbert Schildt, C #: A Beginner's Guide, Tata McGraw Hill 6. Jon Galloway, Professional ASP.NET Core 2.0, Wrox Publication.
Reference Books	1. Thomas A Powell, HTML-The Complete Reference, 3e, Tata McGraw Hill. 2. Jeffery R. Shapiro, The Complete Reference Visual Basic.NET, Tata McGraw Hill 3. V.P. Jain, The Complete Guide to C # Programming, Dreamtech Press. 4. Methew Macdonald, The Complete Reference ASP.NET, Osborne TMH.





MCA/GEN/2/CC13 Software Lab: Web Development using Servlet, JSP							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Practical	02	04	Lab Work	50	-	3 Hours	TEE/ Practical File

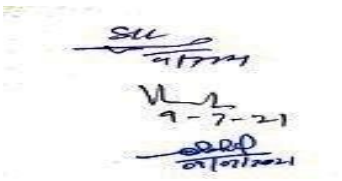
Instructions to paper setter for Final-Term Examination: The Final-Term examination will be conducted by a panel of internal and external examiners. Examinees will be evaluated based on practical file, performance in practical exam and a viva voce exam.

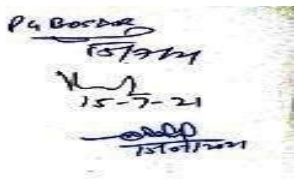
Course Objectives: The objective of this course is to get the students hands-on practice with J2EE programming concepts covered in course **MCA/GEN/2/CC12**.

Course Outcomes	At the end of this course, the student will be able to:
CO1	outline: basic html tags, cascading style sheet, javascript fundamentals, server side programming concepts: jsp, servlet, secure socket layer, cookies, java mail.
CO2	explain: tags in html, concepts of javascripts, servlet, servlet life cycle, java server pages, secure connection using SSL, cookies.
CO3	apply: html tags, css, javascript, servlet, jsp concepts, secure connection, cookies in web programs.
CO4	categorize: static and dynamic pages, client side and server side programming, server types, get post methods, servlet and jsp programming;
CO5	choose: static or dynamic pages, client side or server side programming, server types, get or post method, servlet or jsp programming.
CO6	develop: web application using javascript, html, jsp, servlet.

CO-PEO Mapping Matrix for Course MCA/GEN/2/CC13

Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3





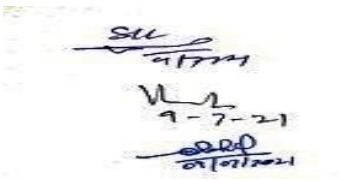
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	3	3	3	3

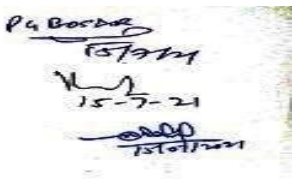
CO-PO Mapping Matrix for Course MCA/GEN/2/CC13

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	-	-	-
CO2	2	1	1	3	1	-	3	2	-	-	-	-
CO3	3	1	1	3	3	-	3	3	-	-	-	-
CO4	3	3	1	3	1	-	3	3	-	-	-	-
CO5	3	1	3	1	3	-	3	3	-	-	-	-
CO6	3	3	3	3	3	-	3	3	-	-	-	-
Average	2.5	2	1.66	2.33	2	-	3	2.5	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/2/CC13

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	-
CO2	3	2	2	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	2.5	2.5	2.5	-



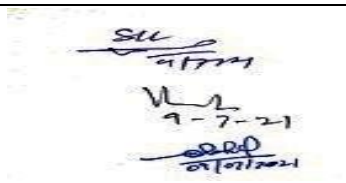


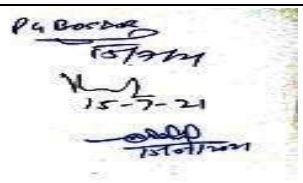
MCA/GEN/2/CC14 Software Lab: Web Development using ASP[dot]NET							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Practical	02	04	Lab Work	50	-	3 Hours	TEE/ Attendance/ Practical File

Instructions to paper setter for Final-Term Examination: The Final-Term examination will be conducted by a panel of internal and external examiners. Examinees will be evaluated based on practical file, performance in practical exam and a viva voce exam.

Course Objectives: The objective of this course is to get the students hands-on practice with ASP[dot]NET programming concepts covered in course **MCA/GEN/2/CC12**.

Course Objectives	At the end of this course, the student will be able to :
CO1	outline: basic html tags, cascading style sheet, javascript fundamentals, server side programming concepts, asp.net, secure socket layer, cookies, master pages, site navigation.
CO2	explain: tags in html, concepts of javascripts, secure connection using SSL, cookies working, visual studio environment, asp.net security model, controls in asp.net, master pages, site navigation.
CO3	apply: html, asp.net concepts controls in designing web pages.
CO4	categorize: static and dynamic pages, client side and server side programming, server types, get post methods, asp.net controls, security models.
CO5	choose: static or dynamic pages, client side or server side programming,





	server types, get or post method, asp.net controls, forms authentication.
CO6	develop: web application using javascript, html, asp.net.

CO-PEO Mapping Matrix for Course MCA/GEN/2/CC14

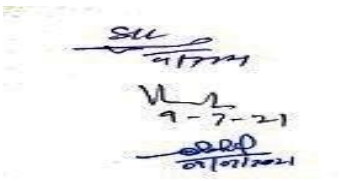
Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	3	3	3	3

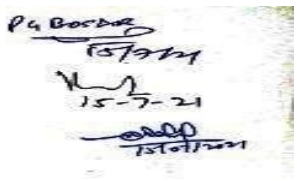
CO-PO Mapping Matrix for Course MCA/GEN/2/CC14

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	-	-	-
CO2	2	1	1	3	1	-	3	2	-	-	-	-
CO3	3	1	1	3	3	-	3	3	-	-	-	-
CO4	3	3	1	3	1	-	3	3	-	-	-	-
CO5	3	1	3	1	3	-	3	3	-	-	-	-
CO6	3	3	3	3	3	-	3	3	-	-	-	-
Average	2.5	2	1.66	2.33	2	-	3	2.5	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/2/CC14

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	-
CO2	3	2	2	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	2.5	2.5	2.5	-



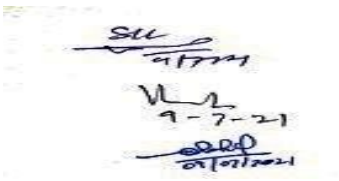


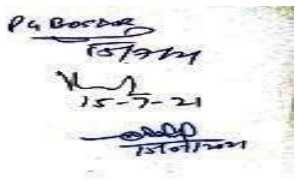
MCA/GEN/3/CC15: Web Development							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Compulsory Theory	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: The objective of this course is to get the students familiar with different concepts related with information architecture, HTML5 and XML for web development.

Course Outcomes	At the end of this course, the student will be able to:
CO1	outline: information architecture, role of architect, collaboration, organizing information, navigation design, designing search interface, indexing, grouping content, conceptual design, html tags, layouts, basics of xml, html5 fundamentals.





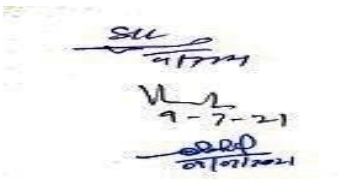
CO2	summarize: information architecture, role of architect, collaboration and organizing information, navigation design, designing search interface, indexing, grouping content, conceptual design, html tags, layouts, basics of xml, html5 fundamentals.
CO3	illustrate: web application navigation, design architecture, html tags, audio support in browser, style sheets, form controls, features & structure of XML, relationship between html, sgml and xml, overview of html5.
CO4	categorize: information system, navigation system, organization system, different elements of html and xml, video format and binary format, attributes of xml objects, generation of web development.
CO5	determine: information system, navigation system, organization system, different elements of html & xml, video format and binary format, attributes of xml objects, generation of web development.
CO6	create: web applications using html and xml, development of web services.

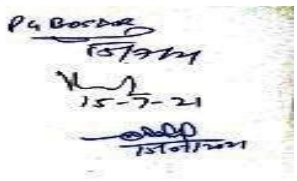
CO-PEO Mapping Matrix for Course MCA/GEN/3/CC15

Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	3	3	3	3

CO-PO Mapping Matrix for Course MCA/GEN/3/CC15

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	-	-	-
CO2	2	1	1	3	1	-	3	2	-	-	-	-
CO3	3	1	1	3	3	-	3	3	-	-	-	-
CO4	3	3	1	3	1	-	3	3	-	-	-	-
CO5	3	1	3	1	3	-	3	3	-	-	-	-
CO6	3	3	3	3	3	-	3	3	-	-	-	-
Average	2.5	2	1.66	2.33	2	-	3	2.5	-	-	-	-





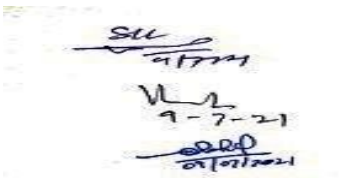
CO-PSO Mapping Matrix for Course MCA/GEN/3/CC15					
Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	-
CO2	3	2	2	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	2.5	2.5	2.5	-

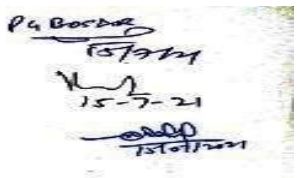
Course Content
MCA/GEN/3/CC15: Web Development

Unit-I	Information architecture: the role of information architect, collaboration and communication, organization information, organizational challenges, organizing web sites and intranets, creating cohesive organization systems, designing navigation systems, types of navigation systems, integrated navigation elements, remote navigation elements, designing elegant navigation systems, searching your web site, designing the search interface, indexing the right stuff, to search or not to search, grouping content, conceptual design; high-level architecture blueprints, architectural page markups, design sketches.
Unit - II	Images & HTML: image preliminaries, image download issues, images as buttons, introduction to layout: backgrounds, colors and text, fonts, layout with tables, advanced layout: frames and layers, html and other media types. audio support in browsers, video support, other binary format. style sheets, positioning with style sheets. Basic interactivity and HTML: forms, forms control, new and emerging form elements.
Unit - III	XML: Introduction of XML, features of XML, structure of XML document, the XML declaration, element tags nesting and structure, XML text and text formatting element, table element, mark-up element and attributes, document type definition (DTD), types. XML objects. XML relationship between HTML, SGML, and XML, basic XML, valid documents. ways to use XML, XML for data files, embedding XML into HTML documents, converting XML to HTML as XML, the future of XML.
Unit - IV	HTML5: overview of HTML5 and other web technologies: internet and web technologies, HTML5 and its essentials, next generation of web development, exploring editors and browsers supported by HTML5, creating and saving an HTML document, validating an HTML document, viewing an HTML document, hosting web pages. Fundamentals of HTML: understanding elements- root elements, metadata elements, section elements, heading elements, flow elements, phrasing

	elements, embedded elements, interactive elements, describing data types- RFC and IANA documentations, W3C specifications, immediate solutions.
Text/Reference Books	
Text Books	1. Steven Holzner,"HTML Black Book", Dreamtech Press India Pvt. Ltd. 2000. 2. Savaliya, Developing Web Applications, 2e, Wiley India Ltd 3. Web Technologies - Black Book, Dreamtech Press India Pvt. Ltd.
Reference Books	1. Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML and Ajax, Black Book by Kogent, Wiley India Ltd. 2. P.J. Deitel& H.M. Deitel, Internet and World Wide Web How to program, Pearson.

MCA/GEN/3/CC16: IoT& Cloud Computing								
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
Compulsory Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		
Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2								





marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: To study the fundamental concepts of cloud computing, its enabling technologies, cloud service models and security concerns, to learn core issues of Internet of Things, IOT communication protocols and security concerns.

Course Outcomes	At the end of this course, the student will be able to:
CO1	list/defineIoT: framework, architecture, design, communication challenges, applications, principles of web connectivity. list/define cloud computing: evolution, characteristics, working, service models, virtualization, architecture, security challenges and risks.
CO2	understand and describe IoT: framework, architecture, design, communication challenges, applications, principles of web connectivity. understand and describe cloud computing: evolution, characteristics, working, service models, virtualization, architecture, security challenges and risks.
CO3	use cloud computing services in different fields of applications.
CO4	diagrammatise IOT: framework, architecture, physical and logical design. diagrammatise cloud computing: service models, service-oriented architecture.
CO5	grade/compareIoT: communication challenges, security issues, enabling technologies, application areas, and protocols. grade/compare cloud computing: service models. virtualization, and hypervisors.

CO-PEO Mapping Matrix for Course MCA/GEN/3/CC16

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/GEN/3/CC16

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	2	-	-
CO2	2	1	1	3	1	-	3	2	-	2	-	-
CO3	3	1	1	3	3	-	3	3	-	2	-	-
CO4	2	1	1	3	1	-	3	3	-	2	-	-
CO5	2	1	3	1	3	-	3	3	-	2	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	2.4	-	2	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/3/CC16

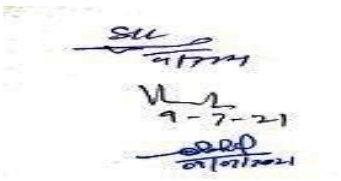
COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	-
CO2	3	3	3	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
Average	3	3	3	2.4	-

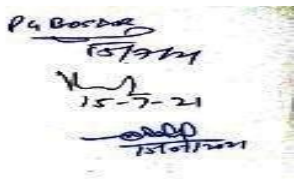
Course Content
MCA/GEN/3/CC16: IoT& Cloud Computing

Unit - I	Internet of Things: what is the IOT and why is it important, IoT conceptual framework, IoT architectural view, technology behind IoT, sources of IoT, examples of IoT, M2M communication, layered architecture (3 & 5 Layered) of IoT, physical design and logical design, domain-specific IoTs, security issues of IoT.
Unit - II	Communication challenges related to IoT, enabling technologies for IoT. Applications of IoT: home automation, smart cities, social life and entertainment, health & fitness, smart environment and agriculture, supply chain and logistics, energy conservation. Design principles for web connectivity: web communication protocols for connected devices, message communication protocols for connected devices.
Unit - III	Introduction to cloud computing: what is a cloud, definition of cloud computing, evolution of cloud computing, characteristics of cloud computing, how cloud computing works, role of networks in cloud computing. Service models: IaaS, PaaS, SaaS, public, private and hybrid cloud.
Unit - IV	Introduction to virtualization, resource virtualization-server, storage, network, load balancing and virtualization. Hypervisors and its types, service oriented architecture (SOA), overview of security issues, challenges and risks of cloud.
Text/Reference Books	
Text Books	1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Cloud Computing a Practical Approach, Tata McGraw Hill, New Delhi, 2010 2. Robert Elsenpeter, Toby J. Velte, Anthony T. Velte, Cloud Computing: A Practical Approach, 1e, Tata McGraw Hill Education, 2011. 3. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, Cloud Computing for Dummies, Wiley Publishing, 2010
Reference Books	1. RajkumarBuyya, James Broberg, AndrzejGoscinski, Cloud Computing-Principles and Paradigms, Wiley, 2011. 2. Raj Kamal, Internet of Things-Architectures and Design Principles, McGraw Hill Education, 2017

MCA/GEN/3/DSC1(i) : Linux and Shell Scripts

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		





Optional Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: The objectives of this course are to provide the in-depth coverage of various concepts of Linux. Linux administration is an essential course for the students.

Course Outcomes	At the end of this course, the student will be able to:
CO1	define and outline: basic requirements, features, essential commands of Linux, vi editors, processes scheduling, communication commands, simple (grep, sed) and advanced filters (awk, perl).
CO2	explain: the organization, file system, Shells, file permissions, priorities, processes, communication commands in Linux and operations performed by the simple as well as advanced filters.
CO3	perform: operations in Linux, modes of operations in vi, mailing communication, regular expressions along with the simple and advanced filters.
CO4	categorize: the Linux commands, processes, priorities, communication commands, simple and advanced filters using regular expressions.
CO5	compare: shells, file permissions, processes, command with different options, simple filters like grep, sed and advanced filters like awk, perl.
CO6	create: Linux shell scripts showing the use of commands, regular expressions and filters.

CO-PEO Mapping Matrix for Course MCA/GEN/3/DSC1(a)

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
CO6	3	3	1	3	3
Average	3	3	1	3	3

CO-PO Mapping Matrix for Course MCA/GEN/3/DSC1(a)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	-	3	1	-	-	-	-

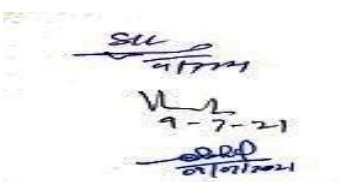
CO2	2	2	1	3	1	-	3	2	-	-	-	-
CO3	3	3	1	3	3	-	3	3	-	-	-	-
CO4	2	3	1	3	3	-	3	3	-	-	-	-
CO5	2	3	3	1	3	-	3	3	-	-	-	-
CO6	2	3	3	1	3	-	3	3	-	-	-	-
Average	2	2.5	1.66	2	2.33	-	3	2.5	-	-	-	-

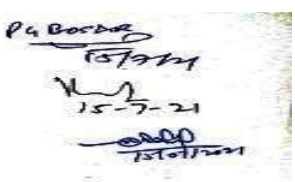
CO-PSO Mapping Matrix for Course MCA/GEN/3/DSC1(a)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	-
CO2	3	3	3	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	3	3	2.5	-

Course Contents **MCA/GEN/3/DSC1(a) : Linux and Shell Scripts**	
Unit I	Introduction, hardware requirements for Unix/Linux, salient features of Unix-multiuser capability, multitasking, communication, security, portability. Unix system organization, types of shells, Unix commands, the Unix file system, listing of files and directories, file permissions with chmod, disk related commands. Essential Unix/ Linux commands: cal, touch, file, file related commands, viewing files, taking printouts, file compression, the on-line Unix manual.
Unit - II	I/O redirection and piping, the vi editor, modes of operations in vi. processes in Unix/Linux: background processes, nohup command, killing a process, changing process priorities, scheduling of processes- the at command, the batch command, the crontab command. Communication: the write command, the wall command, motd command, mail-sending, handling incoming mail, customizing mail.
Unit - III	Simple Filters: the sample database, pr- paginating files, head, tail, cut, paste, sort, unique, tr, displaying a word-count list. Filters using regular expressions: grep – searching for a pattern, basic regular expression, extended regular expression. Sed: the stream editor, line addressing, using multiple instruction (-E and –F), context addressing, text editing, substitution(s), basic regular expression revisited.
Unit - IV	Awk: an advanced filter, simple awk filtering, splitting into fields, variables and expressions, the comparison operators, number processing, variables, the –f option, the begin and end sections, built-in-variables, arrays, functions.

	Perl: the master manipulator- perl preliminaries, chop function, string handling functions, split, join, for each, lists and arrays, file handling, file tests, subroutines.
Text/Reference Books	
Text Books	1. Sumitabha Das, Your Unix – The Ultimate Guide, Tata McGraw Hill, 2008. 2. YaswantKanetkar, "Unix Shell Programming", BPB Publication, (2009).
Reference Books	1. Matthew Neil, Stones Richard, Beginning Linux Programming, Wiley India Pvt. Ltd. 2. Christopher Negus, Linux Bible, Wiley India Pvt. Ltd. 3. Richard Peterson, Linux – The Complete Reference, Tata McGraw Hill





MCA/GEN/3/DSC1 (b) Android Software Development

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks				Exam Duration	Assessment Methods
				External	Internal				
Optional Theory	04	04	Lecture	70	30			3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5	5		

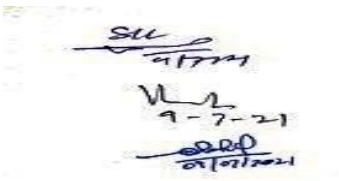
Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

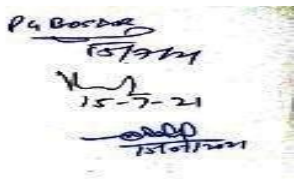
Course Objectives: The objective of this course is to provide in-depth coverage of various concepts of android application development. This course will help the students in learning to develop and publish their own android applications.

Course Outcomes	At the end of this course, the student will able to:
CO1	define: android, features, development environment, architecture, software development platform and the framework related to android applications.
CO2	explain: versions of android, architecture, software development platform, JAVA SE, the Dalvik virtual machine and various android services.
CO3	demonstrate: android SDK, IDE, AVDs, project configuration settings, directory structure of android project, activities and services of android.
CO4	illustrate: android versions, features, system requirements, applications, directory structures, resource folders, android services, screen sizes and android framework.
CO5	compare and contrast: android versions with their functions, types of android applications, development platforms, layout of android applications, activities associated with android and user interfaces.
CO6	create: android applications using different types of resources and development platforms.

CO-PEO Mapping Matrix for Course MCA/GEN/3/DSC1 (b)

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
CO6	3	3	1	3	3





Average	2.5	3	1	3	3

CO-PO Mapping Matrix for Course MCA/GEN/3/DSC1 (b)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	-	3	1	-	-	-	-
CO2	2	2	1	3	1	-	3	2	-	-	-	-
CO3	3	3	1	3	3	-	3	3	-	-	-	-
CO4	2	3	1	3	3	-	3	3	-	-	-	-
CO5	2	3	3	1	3	-	3	3	-	-	-	-
CO6	2	3	3	1	3	-	3	3	-	-	-	-
Average	2	2.5	1.66	2	2.33	-	3	2.5	-	-	-	-

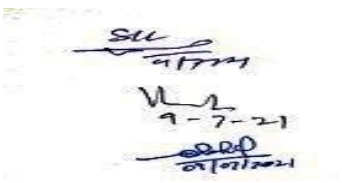
CO-PSO Mapping Matrix for Course MCA/GEN/3/DSC1 (b)

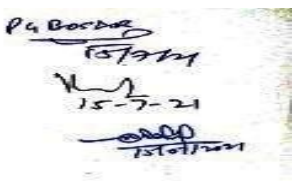
COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	-
CO2	3	3	3	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	3	3	2.5	-

Course Content
MCA/GEN/3/DSC1 (b) Android Software Development

Unit - I	Introduction: Android, Android versions and its feature, The Android market application store. Android Development Environment: system requirements, Android SDK, installing Java, and ADT bundle, eclipse integrated development environment (IDE), creating Android Virtual Devices (AVDs).
Unit - II	Android Architecture Overview, creating a new Android project, defining the project name and SDK settings, project configuration settings, configuring the launcher icon, creating an activity, running the application in the AVD, stopping a running application, modifying the example application, reviewing the layout and resource files.
Unit - III	Android software development platform, understanding Java SE and the Dalvik Virtual Machine, The directory structure of an Android project, common default resources folders, screen sizes, launching your application.
Unit - IV	Android Framework overview, Android application components, Android

	activities: defining the UI, Android services: processing in the background, Android Manifest XML: declaring your components, understanding Android views, view groups and layouts, Graphical User Interface screen with views, displaying pictures, files, content providers, and databases.
Text/Reference Books	
Text Books	1. Burton Michael, Android App Development for Dummies, Wiley, 2015. 2. Wei-Meng Lee, Beginning Android 4 Application Development, Wiley India (Wrox), 2013. 3. John Horton, Android Programming for Beginners, Packet Publishing, 2015.
Reference Books	1. Ian F. Darwin, Android Cookbook Problems and Solutions for Android Developers**,** 2e, O′Reilly,2017.





MCA/GEN/3/DSC2 (a): Network Security

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks				Exam Duration	Assessment Methods
				External	Internal				
Optional Theory	04	04	Lecture	70	30			3 Hours	TEE/MTE/ Assignment(s)/ Attendance
					20	5	5		

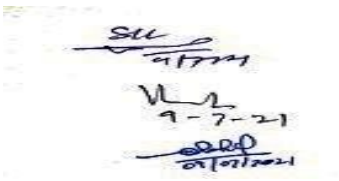
Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

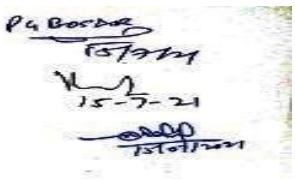
Course Objectives: To study fundamental concepts in Network Security, security attack, cryptography, authentication, web security, system and email security.

Course Outcomes	At the end of this course, the student will be able to :
CO1	define: computer security, security standards, cipher model, encryption techniques, data encryption standards, public-key cryptography, security at transport layer, SSL/TSL attacks, wireless security and IEEE 802.11i.
CO2	explain: computer concepts related with the security, symmetric techniques, advanced encryption standard, RSA, concept of digital signature, security protocols, wireless security measures and email security.
CO3	illustrate: the different features related with computer security, encryption and symmetric techniques, data encryption standards, security at transport layer and wireless LAN security.
CO4	classify: the information about security, its architecture, types of attacks, security mechanism, encryption standards, protocols at transport layer and wireless LAN security.
CO5	evaluate: the security trends, security mechanisms, cipher model, RSA, Diffie-Hellman key exchange, transport layer security, SSL/TSL attacks, wireless security and IP security.

CO-PEO Mapping Matrix for Course MCA/GEN/3/DSC2(a)

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3





CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/GEN/3/DSC2 (a)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	2	-	-
CO2	2	1	1	3	1	-	3	2	-	2	-	-
CO3	3	1	1	3	3	-	3	3	-	2	-	-
CO4	2	1	1	3	1	-	3	3	-	2	-	-
CO5	2	1	3	1	3	-	3	3	-	2	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	2.4	-	2	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/3/DSC2 (a)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	1	-
CO2	3	2	3	2	-
CO3	3	2	3	3	-
CO4	3	2	3	3	-
CO5	3	2	3	3	-
Average	3	2	3	2.4	-

Course Content **MCA/GEN/3/DSC2 (a): Network Security**	
Unit – I	Computer Security Concepts – Introduction, security, security trends, components of information system, OSI security architecture, security attacks, goals for security, security mechanisms, security standards. Cipher model, cryptanalysis and brute-force attack, classical encryption techniques – symmetric techniques – substitution techniques, transposition techniques, rotor machines, steganography.
Unit – II	Traditional block cipher; data encryption standard – encryption and decryption, advanced encryption standard – structure and expansion functions. Public-key cryptography – principles, applications and requirements; RSA, Diffie-Hellman key exchange. Concept of digital signature.
Unit – III	Security at Transport Layer, web security considerations, Transport Layer Security, TLS record protocol, change cipher spec protocol, alert protocol, handshake protocol, heart-beat protocol;

	SSL/TSL attacks; HTTPS; Secure shell; user authentication protocol, connection protocol.
Unit – IV	Wireless Security, wireless security measures, mobile device security - threats and strategy. Wireless LAN security, IEEE 802.11i - services, operation and phases. Email security, S/MIME, PGP, overview of IP security.
Text/Reference Books	
Text Books	1. William Stallings, Cryptography And Network Security Principles And Practice, Pearson Education 2. Forouzan, Mukhopadhyay, Cryptography & Network Security, McGraw Hill
Reference Book	1. AtulKahate, Cryptography and Network Security, TMH 2. Godbole, Information Systems Security, Wiley India Mark Stamp, Information Security Principles and Practice, Willy India

MCA/GEN/3/DSC2 (b): Wireless Network

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks				Exam Duration	Assessment Methods
				External	Internal				
Optional Theory	04	04	Lecture	70	30			3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5	5		

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: To study fundamental concepts in wireless network, various LAN standards, IP and IPV6 Layer, Transmission protocols and WAN standards.

Course Outcomes	At the end of this course, the student will be able to:
CO1	define: wireless LAN, architecture, mobile network layer, mobile transport layer and wireless wide area network.
CO2	describe: WLAN technologies, IEEE 802.11 types , IEEE 802.16, Bluetooth, IPV6, mobile ad-hoc network, TCP enhancements for wireless network, UTMS, 3G-MSC, 3G-SGSN, 3G-GGSN, applications of 4G, features and challenges of 5G.
CO3	illustrate: wireless LAN, system architecture, physical layer, Mac layer, Bluetooth architecture, mobile IP, mobile ad-hoc network, mobile transport layer, TCP improvements, wireless wide area network, HSDPA, features and challenges of 4G, 5G.
CO4	analyze: WLAN technologies, 802.11b, 802.11a, IEEE 802.16, IPV6, Routing, TCP enhancements, TCP improvements, UMTS core network architecture, firewall, 3G, 4G and 5G networks.

CO5	compare: different Wireless LAN technologies, mobile network layer, mobile transport layer, Mobile IP, mobile ad-hoc networks, protocols, TCP improvements and wireless WAN types.

CO-PEO Mapping Matrix for Course MCA/GEN/3/DSC2 (b)

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/GEN/3/DSC2 (b)

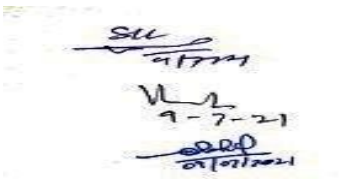
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	2	-	-
CO2	2	1	1	3	1	-	3	2	-	2	-	-
CO3	3	1	1	3	3	-	3	3	-	2	-	-
CO4	2	1	1	3	1	-	3	3	-	2	-	-
CO5	2	1	3	1	3	-	3	3	-	2	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	2.4	-	2	-	-

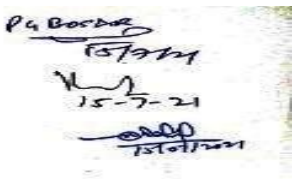
CO-PSO Mapping Matrix for Course MCA/GEN/3/DSC2 (b)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	1	-
CO2	3	2	3	2	-
CO3	3	2	3	3	-
CO4	3	2	3	3	-
CO5	3	2	3	3	-
Average	3	2	3	2.4	-

Course Content **MCA/GEN/3/DSC2 (b) : Wireless Network**	
Unit - I	Wireless LAN: Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum -IEEE802.11: System architecture, protocol architecture, physical layer, MAC layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband layer, Link manager Protocol, security - IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX.

Unit - II	Mobile Network Layer: Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6- Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing, Destination Sequence distance vector, Dynamic source routing.
Unit - III	Mobile Transport Layer :TCP enhancements for wireless protocols - Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility - Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission, Transaction oriented TCP - TCP over 3G wireless networks.
Unit - IV	Wireless Wide Area Network: Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP-High speed Downlink packet access (HSDPA)- LTE network architecture and protocol, features and challenges of 4G, Applications of 4G, Introduction to 5G vision,5G features and challenges.
Text/Reference Books	
Text Books	1. Jochen Schiller, "Mobile Communications", 2e, Pearson Education 2012. 2. Vijay Garg, "Wireless Communications and Networking", 1e, Elsevier, 2007.
Reference Books	1. William Stallings, Wireless Communications and Networks, Pearson/Prentice Hall of India. 2. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", 2e, Academic Press, 2008. 3. Anurag Kumar, D. Manjunath, Joy Kuri, "Wireless Networking", 1e, Elsevier 2011. 4. Simon Haykin, Michael Moher, David Koilpillai, "Modern Wireless Communications", 1e, Pearson Education, 2013.



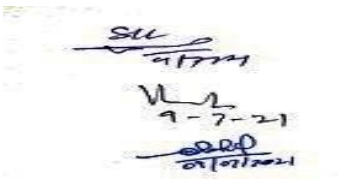


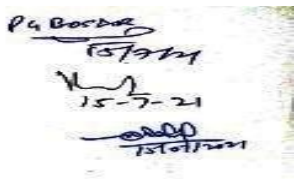
MCA/GEN/3/DSC3 (a): Discrete Mathematics								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
Optional Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: This course is aimed at making the students familiar with various discrete structures, operations performed thereupon and their implementation mechanism.

Course Outcomes	By the end of this course, the student will be able to
CO1	define: sets and elements, introduction and representation of relations, types of functions, graphs and multigraphs, Boolean algebra, group, and subgroups
CO2	describe and discuss: inclusion-exclusion principle, finite and Infinite sets., types & composition of relations, types of graphs, sorting and searching, Boolean algebra and groups.





CO3	solve: various mathematical problems related to sets, graphs, Boolean algebra and groups, directed and undirected graphs, basic logical operations on propositions and truth tables.
CO4	illustrate: sets and elements, representation of relations, types of graphs and multigraph, Boolean algebra operations, group and subgroups lattices.
CO5	determine: complex problem related to sets and elements, graphs and multigraphs, Boolean algebra, groups and subgroups.

CO-PEO Mapping Matrix for Course MCA/GEN/3/DSC3 (a)

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/GEN/3/DSC3 (a)

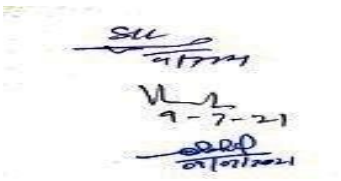
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	-	-	-
CO2	2	1	1	3	1	-	3	-	-	-	-	-
CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	-	-	-

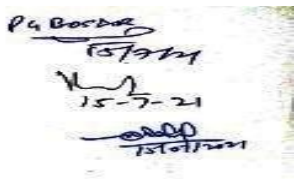
CO-PSO Mapping Matrix for Course MCA/GEN/3/DSC3 (a)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.6	-

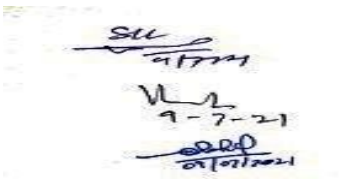
Course Content

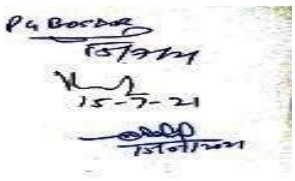
MCA/GEN/3/DSC3 (a): Discrete Mathematics





Unit - I	Sets and elements, inclusion-exclusion principle, finite and Infinite sets, power sets, multisets, introduction and representation of relations, types of relations, composition of relations: introduction to functions, types of functions.
Unit - II	Graphs and multigraphs, sequential and linked representation of graphs, Directed and Undirected graphs: Types of graphs, labelled and weighted graphs, complete, regular and bipartile graphs, planar graphs, tree graphs, paths, connectivity, depth first search, breadth first search, topological sort.
Unit - III	Boolean algebra, basic definitions, duality, truth tables, boolean functions, basic logical operations on propositions, proposition and truth tables, tautologies and contradictions, algebra of propositions, rules of inference.
Unit - IV	Group and subgroups, semigroups groups, normal subgroups, homomorphisms, rings, integral domain and fields, ordered sets, hasse diagram of partially ordered sets, lattices, bounded lattices, distributive lattices, complemented lattices.
Text/Reference Books	
Text Books	1. Seymour Lipschutz, Marc Lars Lipson, Discrete Mathematics, McGraw-Hill International Editions, Schaum's Series. 2. Bernard Kolman, Robert C. Busbym, Discrete Mathematical Structures for Computer Science, Prentice-Hall of India Pvt. Ltd.
Reference Books	1. Alan Doerr, Kenneth Levaseur, Applied Discrete Structures for Computer Science, Galgotia Publication Pvt. Ltd. 2. Kennech G. Rosen, Discrete Mathematics and its Applications, McGraw-Hill International Editions, Mathematics Series.





MCA/GEN/3/DSC3 (b): Theory of Computation								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
Optional Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: to understand fundamental concepts of finite automata, regular grammar, mealy and Moore machine, context free language and grammar their properties, context free language and grammar.

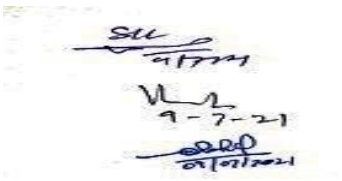
Course Outcomes	By the end of this course, the student will be able to
CO1	define: fundamental concept of finite automata, pushdown automata, Linear bound automata, Turing machine, context free language & grammar, context sensitive language & grammar.
CO2	discuss: concept of context free language and grammar, pushdown automata, equivalence of deterministic and non-deterministic finite automata, ambiguity in grammars and languages, concept of Turing machine.
CO3	use: Pumping lemma to check language is not regular, pushdown automata to check context free language ,Turing machine to solve basic calculation.
CO4	classify: finite automata, regular grammar, context free grammar, context free language, context sensitive grammar, normal forms, pushdown automata, Turing machine.
CO5	Compare and contrast: NFA & DFA, mealy and Moore machine ,CNF& GNF, languages, grammars, different automatas, Turing machine.

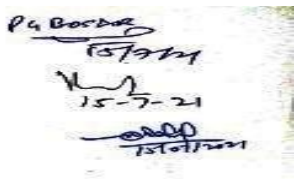
CO-PEO Mapping Matrix for Course MCA/GEN/3/DSC3 (b)

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/GEN/3/DSC3 (b)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	-	-	-
CO2	2	1	1	3	1	-	3	-	-	-	-	-





CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/3/DSC3 (b)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.6	-

Course Content
MCA/GEN/3/DSC3 (b): Theory of Computation

Unit - I	Finite Automata: Deterministic and non-deterministic finite automata, applications of finite automata, equivalence of deterministic and non-deterministic finite automata, state minimization of DFA, Kleen's characterization theory for sets accepted by finite automata, regular grammar, mealy and Moore machine.
Unit - II	Context Free Language and Grammar: Context free grammar, parse tree, application of context free grammars, ambiguity in grammars and languages. Pushdown Automata: Deterministic pushdown automata and Non-deterministic pushdown automata, language of pushdown automata, equivalence of PDA's and CFG's.
Unit - III	Properties of Context-Free Languages: Normal form of context free grammars, pumping lemma for context-free grammars, closure properties of context-free languages, decision properties of context free languages. Context Sensitive Language and Grammar: Introduction, closure properties of CSL.
Unit - IV	Turing machine: Construction of Turing machine, programming techniques for Turing machine, extensions to the basic Turing machine (multi-tape Turing machine, equivalence of one-tape and multi-tape Turing machine, Non Deterministic Turing machine), restricted Turing machine (multi-stack machines, counter machines).

Text/Reference Books

Text Books	1. John C. Martin, Introduction to Languages and the Theory of Computation, McGraw Hill. 2. Peter Linz, An introduction to formal language & automata, Jones & Bartlett publications.
Reference Books	1. Hopcroft J. E. & Ullman J. D, Formal languages and their relation to Automata, Pearson Education. 2. Lewis, H.R. &Papadimitrious, C. H., Elements of the theory of

	computation, PHI Learning. 3. Michael Sipser, Introduction to the Theory of Computation, Cengage Learning.

MCA/GEN/3/DSC3 (c): Compiler Construction

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks				Exam Duration	Assessment Methods
				External	Internal				
Optional Theory	04	04	Lecture	70	30			3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5	5		

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

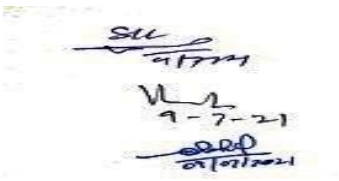
Course Objectives: To study fundamental concepts of compiler, interpreters, assemblers, lexical analysis, syntax analysis, intermediate code generation and code optimization techniques used in compiler design.

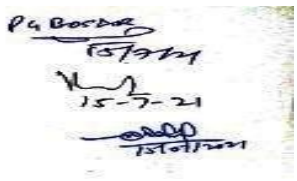
Course Outcomes	At the end of this course, the student will be able to:
CO1	define: syntax analysis, grammar, intermediate code, code optimization, code generation ,syntax directed translation.
CO2	explain: basics of compilers, interpreters, assemblers, compiler construction tools, process of lexical analysis, syntax analysis, types of grammar, code optimization and code generation.
CO3	illustrate: various analysis-synthesis model of translation, lexical analysis, syntax analysis, optimization of basic blocks, loops optimization, peephole optimization and blocks code generation from directed acyclic graphs.
CO4	analyze: phase of compilation, finite state automata recognition of regular expressions, parser generator, optimization technique of code and management of code.
CO5	contrast: compiler, interpreters and assemblers, finite state automata recognition, process of syntax analysis, code improving transformations and syntax directed translation scheme.

CO-PEO Mapping Matrix for Course MCA/GEN/3/DSC3 (c)

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/GEN/3/DSC3 (c)





COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	-	-	-
CO2	2	1	1	3	1	-	3	-	-	-	-	-
CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/3/DSC3 (c)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.6	-

Course Content
MCA/GEN/3/DSC3 (c): Compiler Construction

Unit - I	Introduction to Compilers: Basics of compilers, interpreters, assemblers, phases of compilation, analysis-synthesis model of translation, compiler construction tools. Lexical Analysis: Process of lexical analysis, finite state automata recognition of regular expressions.
Unit – II	Syntax Analysis: Process of syntax analysis, types of grammars, top-down and bottom-up parsing techniques, Parser generator.
Unit – III	Intermediate Code Generation: Intermediate languages, generating intermediate code for assignment statement, Boolean expression, and case statement. Code Optimization: Introduction to code optimization, potential cases of code optimization, optimization of basic blocks, loops optimization, code improving transformations.
Unit – IV	Code Generation: Basics, dynamic storage management, translating basic blocks, a simple code generator, peephole optimization, directed acyclic graphs and basic blocks code generation from directed acyclic graphs. Syntax Directed Translation: Overview of syntax directed translation scheme.
Text/Reference Books	
Text Books	1. Alfred V Aho, Principles of Compiler Design, Narosa Publishing House. 2. Aho, Sethi, & Ullman, Compilers Principles, Techniques and Tools, Pearson Education.

Reference Books	1. Dhamdhere D.M, System programming and operating system, McGraw Hill. 2. Beck L. Leland, System Software, Pearson Education. 3. Fischer, Crafting a Compiler in C, Pearson Education. 4. Jean Paul Tremblay and Sorenson, The Theory and Practice of Compiler Writing, McGraw Hill.

MCA/GEN/3/CC17: Software Lab based on MCA/GEN/3/CC15(Web Development)

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Practical	02	04	Lab Work	50	-	3 Hours	TEE/ Practical File

Instructions to paper setter for Final-Term Examination: The Final-Term examination will be conducted by a panel of internal and external examiners. Examinees will be evaluated on the bases of practical file, performance in practical and a viva voce exam.

Course Objectives: The objective of this course is to get the students hands on practice with the concepts of web development/programming covered in course **MCA/GEN/3/CC15**.

Course Outcomes	At the end of this course, the student will be able to:
CO1	outline: information architecture, its role collaboration, organization information, design navigation, designing search interface, indexing, grouping content, conceptual design, html tags, layouts, basics of xml, html5 fundamentals.
CO2	summarize: information architecture, its role collaboration and organization information, design navigation, designing search interface, indexing, grouping content, conceptual design, html tags, layouts, basics of xml, html5 fundamentals.
CO3	illustrate: web application navigation, design architecture, html tags, audio support in browser, style sheets, form controls, features & structure of XML, relationship between html, sgml and xml, overview of html5.
CO4	categorize: information system, navigation system, organization system, different elements of html and xml, video format and binary format, attributes of xml objects, generation of web development.
CO5	determine: information system, navigation system, organization system, different elements of html & xml, video format and binary format, attributes of xml objects, generation of web development.
CO6	develop: web applications using html and xml, development of web services.
CO-PEO Mapping Matrix for Course MCA/GEN/3/CC17	

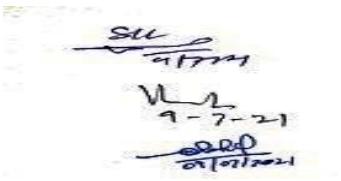
Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	3	3	3	3

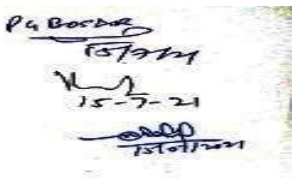
CO-PO Mapping Matrix for Course MCA/GEN/3/CC17

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	-	-	-
CO2	2	1	1	3	1	-	3	2	-	-	-	-
CO3	3	1	1	3	3	-	3	3	-	-	-	-
CO4	3	3	1	3	1	-	3	3	-	-	-	-
CO5	3	1	3	1	3	-	3	3	-	-	-	-
CO6	3	3	3	3	3	-	3	3	-	-	-	-
Average	2.5	2	1.66	2.33	2	-	3	2.5	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/3/CC17

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	-
CO2	3	2	2	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	2.5	2.5	2.5	-



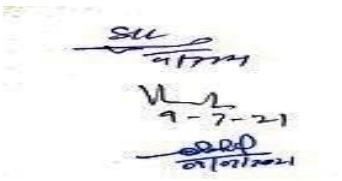


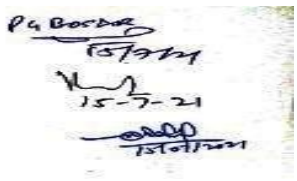
MCA/GEN/3/CC18 (i): Software Lab based on MCA/GEN/3/DSC-1 (i) (Linux and Shell Scripts)

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Practical	02	04	Lab Work	50	-	3 Hours	TEE/ Practical File
Instructions to paper setter for Final-Term Examination: The Final-Term examination will be conducted by a panel of internal and external examiners. Examinees will be evaluated on the bases of practical file, performance in practical and a viva voce exam.							

Course Objectives: The objective of this course is to get the students hands on practice with scripting/programming concepts of Linux and Shell script as covered in course **MCA/GEN/3/DSC1 (i)**

Course Outcomes	At the end of this course, the student will be able to :
CO1	define and outline: basic requirements, features, essential commands of Linux, vi editors, processes scheduling, communication commands, simple (grep, sed) and advanced filters (awk, perl).
CO2	explain: the organization, file system, Shells, file permissions, priorities, processes, communication commands in Linux and operations performed by the simple as well as advanced filters.
CO3	perform: operations in Linux, modes of operations in vi, mailing communication, regular expressions along with the simple and advanced filters.
CO4	categorize: the Linux commands, processes, priorities, communication commands, simple and advanced filters using regular expressions.
CO5	compare: shells, file permissions, processes, command with different options, simple filters like grep, sed and advanced filters like awk, perl.
CO6	create: Linux shell scripts showing the use of commands, regular expressions and filters.





CO-PEO Mapping Matrix for Course MCA/GEN/3/CC18 (i)

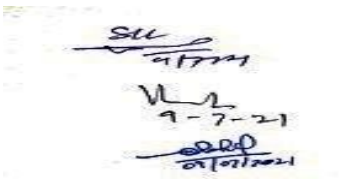
COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
CO6	3	3	1	3	3
Average	2.5	3	1	3	3

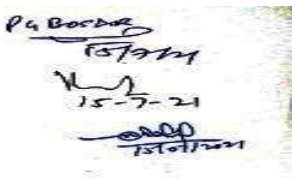
CO-PO Mapping Matrix for Course MCA/GEN/3/CC18 (i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	-	3	1	-	-	-	-
CO2	2	2	1	3	1	-	3	2	-	-	-	-
CO3	3	3	1	3	3	-	3	3	-	-	-	-
CO4	2	3	1	3	3	-	3	3	-	-	-	-
CO5	2	3	3	1	3	-	3	3	-	-	-	-
CO6	2	3	3	1	3	-	3	3	-	-	-	-
Average	2	2.5	1.66	2	2.33	-	3	2.5	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/3/CC18 (i)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	-
CO2	3	3	3	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	3	3	2.5	-





MCA/GEN/3/CC18 (ii): Software Lab based on MCA/GEN/3/DSC-1 (ii) (Android Software Development)

Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Practical	02	04	Lab Work	50	-	3 Hours	TEE/ Practical File

Instructions to paper setter for Final-Term Examination: The Final-Term examination will be conducted by a panel of internal and external examiners. Examinees will be evaluated on the bases of practical file, performance in practical and a viva voce exam.

Course Objectives: The objective of this course is to get the students hands on practice with scripting/programming concepts of Android programming/development as covered in course **MCA/GEN/3/DSC1 (ii).**

Course Outcomes	At the end of this course, the student will able to:
CO1	define: android, features, development environment, architecture, software development platform and the framework related to android applications.
CO2	explain: versions of android, architecture, software development platform, JAVA SE, the Dalvik virtual machine and various android services.

CO3	demonstrate: android SDK, IDE, AVDs, project configuration settings, directory structure of android project, activities and services of android.
CO4	illustrate: android versions, features, system requirements, applications, directory structures, resource folders, android services, screen sizes and android framework.
CO5	compare and contrast: android versions with their functions, types of android applications, development platforms, layout of android applications, activities associated with android and user interfaces.
CO6	create: android applications using different types of resources and development platforms.

CO-PEO Mapping Matrix for Course MCA/GEN/3/CC18 (ii)

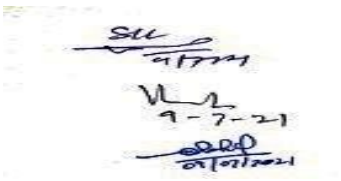
COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
CO6	3	3	1	3	3
Average	2.5	3	1	3	3

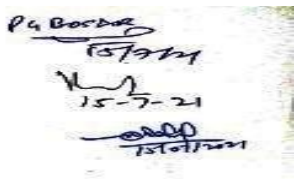
CO-PO Mapping Matrix for Course MCA/GEN/3/CC18 (ii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	-	3	1	-	-	-	-
CO2	2	2	1	3	1	-	3	2	-	-	-	-
CO3	3	3	1	3	3	-	3	3	-	-	-	-
CO4	2	3	1	3	3	-	3	3	-	-	-	-
CO5	2	3	3	1	3	-	3	3	-	-	-	-
CO6	2	3	3	1	3	-	3	3	-	-	-	-
Average	2	2.5	1.66	2	2.33	-	3	2.5	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/3/CC18 (ii)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	-
CO2	3	3	3	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-





CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	3	3	2.5	-

MCA/Gen /3/SEC1: Presentation/Viva on Internship/Summer Training							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Internship/ Summer Training	04	-	Internship/ Training	100	-	-	Training Report/ Viva Voce
Instructions to paper setter for Final-Term Examination: The Final-Term examination will be conducted by a panel of internal and external examiners. Examinees will be evaluated on the bases of the Internship/Training Report and a presentation based viva voce exam during third semester of MCA/GEN.							
Course Objectives: To expose students to real work of environment experience and at the same time, to gain the knowledge through hands on observation and job execution and allows them to relate the theory to practice. The interns/trainees will also develop skills in work ethics, communication, management and others.							
Course	At the end of this course, the student would be able to:						

Outcomes	
CO1	recognize and define (i) the gaps and interface between the academia and the industry, (ii) nitty-gritty of work culture of industry, and (iii) ethics and the best practices of industry.
CO2	understand and describe (i) the academia-industry interface, (ii) work culture in the industrial setup as a lifelong skill, (iii) the ethics and the best practices of the industry.
CO3	apply the best practices and the information/knowledge gained thus far to academia.
CO4	classify the differences between work practices and work environments of academia and industry.
CO5	compare the work practices and work environments of industry and academia.

CO-PEO Mapping Matrix for Course MCA/Gen /3/SEC1

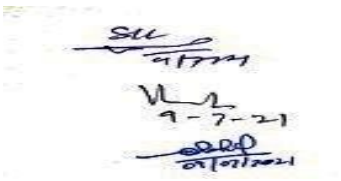
Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	2.4	3	3	3	3

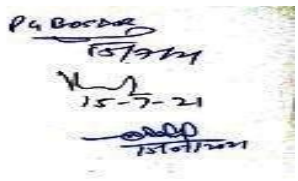
CO-PO Mapping Matrix for Course MCA/Gen /3/SEC1

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	3	3	3	3	3	3	-	3	3
CO2	2	2	2	3	3	3	3	3	3	-	3	3
CO3	3	2	2	3	3	3	3	3	3	-	3	3
CO4	3	2	2	3	3	3	3	3	3	-	3	3
CO5	3	2	2	3	3	3	3	3	3	-	3	3
Average	2.4	2	2	3	3	3	3	3	3	-	3	3

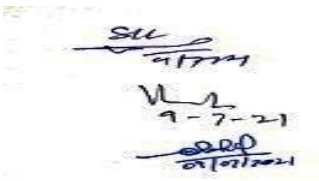
CO-PSO Mapping Matrix for Course MCA/Gen /3/SEC1

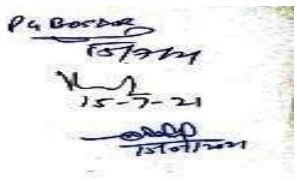
Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	3	3	3	3	3





MCA/GEN/4/CC19:Python Programming								
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
Compulsory Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment/Attendance
					20	5	5	
Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise								





comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: The objectives of this course is to get the students familiar with basic concepts of Python programming, decision making and functions, file handling and object oriented programming concepts, database programming and to implement machine learning concepts.

Course Outcomes	At the end of this course, the student will possess an understanding of:
CO1	define:installations,working,structures,controlstatements,operators,lists , object oriented programming concepts,python libraries.
CO2	explain: conditional & control statements ,strings, OOPs ,file handling concepts ,libraries and packages of python programming.
CO3	use: various python libraries such as numpy,matplotlib ,pandas . apply: python programming constructs to solve real world problems.
CO4	categorize:datatypes,dictionaries,conditional&controlstatements,functions,python libraries.
CO5	compare: datatypes,dictionaries,conditional&controlstatements,functions,python libraries.
CO6	design:basic and advanced applications in python.

CO-PEO Mapping Matrix for Course MCA/GEN/4/CC19

Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	3	3	3	3

CO-PO Mapping Matrix for Course MCA/GEN/4/CC19

COs	PO1	PO2	PO3	PO4	PO5	PO	PO7	PO8	PO9	PO1	PO1	PO12
CO1	1	3	1	1	1	-	3	1	-	-	-	-
CO2	2	1	1	3	1	-	3	2	-	-	-	-
CO3	3	1	1	3	3	-	3	3	-	-	-	-
CO4	3	3	1	3	1	-	3	3	-	-	-	-
CO5	3	1	1	3	3	-	3	3	-	-	-	-
CO6	3	3	3	3	3	-	3	3	-	-	-	-
Average	2.5	2	1.3	2.6	2	-	3	2.5	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/4/CC19

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	-

CO2	3	2	2	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	2.5	2.5	2.5	-

Course Content **MCA/GEN/4/CC19: Python Programming**	
Unit – I	Installation and Working with Python, Using Help, Structure of a Python Program, Control flow, Interpreter shell, Tokens, Identifiers, Reserved keywords, Literals, Variables, Python basic Operators, Declaring and using Numeric data types: int, float, complex, using string data type. Python Casting, Scope of a Variable, Working with: String, List, Tuples and Dictionaries.
Unit – II	Conditional blocks using if, else and elif, For loops in python, While loops, Continue, Break and Else, organizing python codes using functions, Modules: Creating Module, using Modules and Built-in Modules. Packages: Package Types, Importing Package, Viewing Package Content and Documentation. Powerful Lambda Function in python, Programming: Using Functions, Modules and Packages.
Unit – III	Object Oriented Programming: Concept of Class, Object and Instances, Constructor, Class Attributes and Destructors, Built-in Class Attributes, Inheritance, Method Overriding, Data Encapsulation, Overloading Operators, Data Hiding, Exception Handling, Programming using Oops concepts. File Handling: Creating, Opening, Closing, Writing & Reading File Content, Deleting a File. Programming using file operations.
Unit – IV	Python NumPy: Array Slicing, Array Indexing, Data Types, Array Shape & Reshape, Array Join, Array Split, Random. Python Pandas: Data Frames, Read CSV, Analyzing Data and Cleaning Data. Python Matplotlib: Line, Grid, Scatter, Bars, Histograms and Pie Charts. Machine Learning: Mean, Median, Mode, Standard Deviation, Percentile, Normal Data Distribution, Scatter Plot and Linear Regression.
Text/Reference Books	
Text Books	1. Chun, J Wesley, Core Python Programming, 2e, Pearson, 2007. 2. E. Balagurusamy, Introduction to Computing and Problem Solving Using Python, McGraw Hill Education, 2016.
Reference Books	1. Barry and Paul, Head First Python, 2e, O Reilly, 2010. 2. Lutz and Mark, Learning Python, 4e, O Reilly, 2009

MCA/GEN/4/CC20: R Programming							
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		

Compulsory Theory	04	04	Lecture	70	30			3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5	5		

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: To study the fundamental concepts in R programming language, data types, operators, decision making statements and iteration, functions, different data structures like list, vectors, matrices, data frames, charts and graphs, graphics functions and statistical analysis.

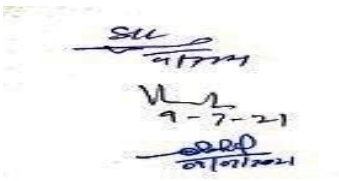
Course Outcomes	At the end of this course, the student will be able to:
CO1	list : data types, functions in R programming, visualization.
CO2	describe: the syntax of decision making statements, loops, user defined functions,used define packages; explain: the process of import and export of data in text file, excel file and MYSQL .
CO3	use: various in built ,user defined function and packages . apply: R programming constructs to solve real world problems.
CO4	categorize:datatypes,conditional & control statements, in built and user defined functions and packages.
CO5	compare: datatypes, conditional & control statements,functions, packages in R programming.
CO6	design:basic and advanced applications in R programming.

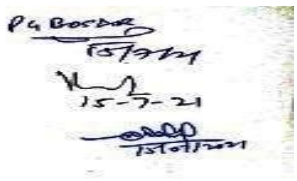
CO-PEO Mapping Matrix for Course MCA/GEN/4/CC20

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	1	3	3	3
CO2	2	2	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	2.5	3	3	3

CO-PO Mapping Matrix for Course MCA/GEN/4/CC20

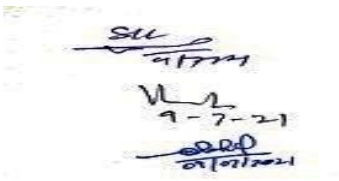
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	-	-	-	-	1	3
CO2	2	1	1	3	1	-	-	-	-	-	2	3
CO3	3	1	1	3	3	-	-	-	-	-	3	3
CO4	3	3	1	3	1	-	-	-	-	-	3	3
CO5	3	1	1	3	3	-	-	-	-	-	3	3
CO6	3	3	3	3	3	-	-	-	-	-	3	3
Average	2.5	2	1.3	2.6	2	-	-	-	-	-	2.5	3

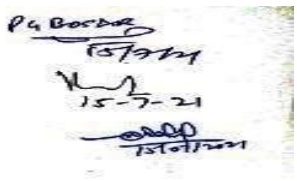




CO-PSO Mapping Matrix for Course MCA/GEN/4/CC20					
COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	-	3
CO2	3	3	2	-	3
CO3	3	3	3	-	3
CO4	3	3	3	-	3
CO5	3	3	3	-	3
CO6	3	3	3	-	3
Average	3	3	2.5	-	3

Course Content MCA/GEN/4/CC20: R Programming	
Unit - I	Basic of R: Introduction to R, Features of R, Variables in R, In-Built Functions in R (mathematical, trigonometric, logarithmic, Date and Time, Sequence, I/O). Data Types in R: Vectors, Matrices, Arrays, Lists, Factors, Data Frames.
Unit - II	Programming in R: Decision making structures (if, Switch), Loops (For, while, repeat), User Defined functions (with argument without argument), User Defined Package. Reports using remark down (direct rendering, in-direct rendering).
Unit - III	Data Exploration and Manipulation: Missing Data Management, Data reshaping through melting and casting, special functions across data elements. Import and Export of data: Import and Export of data in text files, excel files and MySQL.
Unit - IV	Basic Visualization: Pie chart, bar chart, Histogram, Line chart, Dot Chart, Bubble plot, Image Plot, Violin Plot. Advanced Visualization: Scatter plot, corrgrams, star and segment plots, tree maps, heat map.
Text/Reference Books	
Text Books	1. Christian Heumann, Michael Schomaker and Shalabh, Introduction to Statistics and Data Analysis - with Exercises, Solutions and Applications in R, Springer, 2016. 2. Pierre Lafaye de Micheaux, RémyDrouilhet, Benoit Liquet, The R Software-Fundamentals of Programming and Statistical Analysis, Springer 2013.
Reference Books	1. Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters, Use R - A Beginner's Guide to R, Springer 2009.





MCA/GEN/4/DSC4(a): Soft Computing								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
Optional Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: The objective of this course is to cover fundamental soft computing concepts with an exposure to ANN, fuzzy Logic, optimization techniques using Genetic Algorithm (GA).

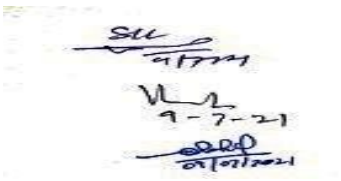
Course Outcomes	By the end of this course, the student will be able to:
CO1	recognize the concept of: soft computing and hard computing, simple genetic a fuzzy set, neuron, neural network and activation function.
CO2	understand and describe: the role of genetic algorithm operators, representatio set and its operation, types of neural network and activation function including and cons.
CO3	use: genetic algorithm, fuzzy logic , ANN and their constituents for solving optimization problem.
CO4	differentiate: soft computing and hard computing, operators of genetic algo activation functions of ANN. Analyze: fuzzification and defuzzification.
CO5	compare: soft computing and hard computing, operators of genetic algo different activation functions of ANN.

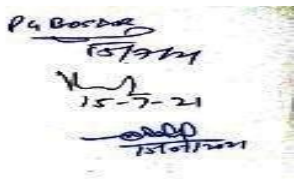
CO-PEO Mapping Matrix for Course MCA/GEN/4/DSC4(a)

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/GEN/4/DSC4(a)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	-	-	-
CO2	2	1	1	3	1	-	3	-	-	-	-	-
CO3	3	1	1	3	3	-	3	-	-	-	-	-





CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/4/DSC4(a)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.6	-

Course Content
MCA/GEN/4/DSC4(a): Soft Computing

Unit – I	Introduction to Soft Computing: Overview of Soft Computing, difference between soft and hard computing, brief descriptions of different components of soft computing including artificial neural networks, fuzzy logic, genetic algorithms.
Unit – II	Genetic Algorithm- Introduction to genetic algorithm, simple genetic algorithm, its representation. Selection: Roulette wheel selection, random, rank, tournament, Boltzmann selection. Crossover and its types: Single point crossover, two point crossover, multipoint crossover, ordered crossover, uniform crossover, crossover for real-valued representation. Mutation and its types: Flipping, Interchanging, reversing, replacement, mutation for real-valued representation, crossover rate, mutation rate and convergence criteria.
Unit – III	Fuzzy Logic: Introduction to fuzzy logic, representation of a classical set, representation of fuzzy set, basic properties of fuzzy sets. Fuzzy set operation: Intersection of fuzzy sets, union of fuzzy sets, complement of fuzzy sets, important terminologies in fuzzy set operations, properties of fuzzy sets, fuzzy arithmetic. Fuzzy Composition: Max-Min composition, max-star composition, max-product composition, max-average composition. fuzzification and de-fuzzification.
Unit - IV	Artificial Neural Network: Basic of neural network: neuron, artificial neuron, neural network, artificial neural network , perceptron, feed forward, multilayer perceptron neural network, advantage and disadvantage of ANNs. activation function and types of activation function. perceptron network, XOR problem.
Text/Reference Books	
Text Books	1. David E. Goldberg, Genetic Algorithms in Search, Optimization and machine learning, Addison Wesley. 2. ZbigniewMichalewicz, Genetic algorithms +Data Structures = Evolution Programs, SpringersVerlag.
Reference Books	1. M. Mitchell, An Introduction to Genetic Algorithms, Prentice-Hall.

	2. S. Rajasekaran& G. A. VijayalakshmiPai, Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, PHI. 3. S. N. Sivanandam& S. N. Deepa, Principles of Soft Computing, Wiley - India. 4. Simon O. Haykin, Neural Networks, A Comprehensive Foundation, PHI.

MCA/GEN/4/DSC4(b): Machine Learning

Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks				Exam Duration	Assessment Methods
				External	Internal				
Optional Theory	04	04	Lecture	70	30			3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5	5		

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

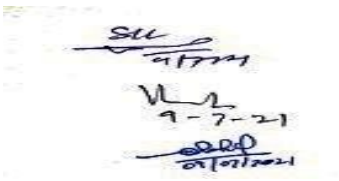
Course Outcomes	At the end of this course, the student will be able to :
CO1	define: the terms of machine learning: types of machine learning, data preprocessing, classification, regression, and neurons.
CO2	explain: learning types, data preprocessing and architecture of ANN.
CO3	apply: training and testing data using data pre processing and model selection techniques and classification, regression, clustering techniques according to their problem.
CO4	Classify: data preprocessing, model selection, regression, classification, and unsupervised learning techniques.
CO5	compare: Data Preprocessing techniques, Supervised and unsupervised learning.

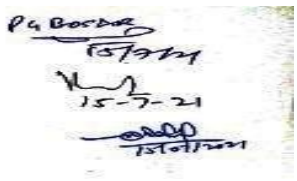
CO-PEO Mapping Matrix for Course MCA/GEN/4/DSC4(b)

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/GEN/4/DSC4(b)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	-	-	-
CO2	2	1	1	3	1	-	3	-	-	-	-	-





CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/4/DSC4(b)

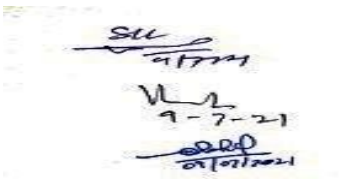
COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.6	-

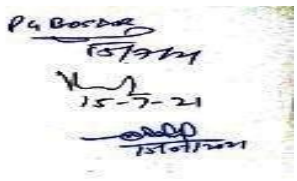
Course Content
MCA/GEN/4/DSC4(b): Machine Learning

Unit – I	Basics of Machine Learning: Introduction to artificial Intelligence and machine learning, types of machine learning and its comparisons, applications of machine learning, issues in machine learning.
Unit – II	Preparing to Model: Introduction, machine learning activities, types of data in machine learning, exploring structure of data, data pre-processing (dimension reduction and feature subset selection), model selection.
Unit – III	Supervised Learning: Introduction, classification (introduction, classification model, learning steps, common classification algorithm), regression (linear regression, multivariable regression, logistic regression).
Unit – IV	Unsupervised Learning: Introduction and its applications, techniques in unsupervised learning (clustering, K-means). Neural Network: Introduction, architecture of artificial neural network.

Text/Reference Books

Text Books	1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education (India) Private Limited. 2. EthemAlpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press.
Reference Books	1. Stephen Marsland, Machine Learning: An Algorithmic Perspective, CRC Press. 2. Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press. 3. Peter Harrington, Machine Learning in Action, Manning 4. ShaiShalevShwartz and Shai Ben David, Understanding Machine Learning From Theory to Algorithms, Cambridge University Press





MCA/GEN/4/DSC4(c):Genetic Algorithms

Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks				Exam Duration	Assessment Methods
				External	Internal				
Optional Theory	04	04	Lecture	70	30			3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5	5		

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: To study fundamental concepts of evolutionary algorithm, genetic algorithm, their applications, genetic operators, the theoretical Analysis of Evolutionary Algorithms , Niche and Speciation

Course Outcomes	At the end of this course, the student will be able to:
CO1	define concepts of: evolutionary algorithms, population, gene, alleles, phenotype, fitness function, crossover, selection and mutation.
CO2	describe/explain: crossover, selection mutation, Diploid, dominance, abeyance, Niche and Speciation. understand: application of genetic algorithms for job shop scheduling problems.
CO3	use: encoding scheme, crossover, selection, mutation operators and fitness scaling.
CO4	differentiate: evolutionary algorithms and traditional algorithms, types of crossover, mutation, selection, inversion and reordering operator, crowding and restricted mating.
CO5	select and defend: crossover, mutation and selection operators of genetic algorithms.

CO-PEO Mapping Matrix for Course MCA/GEN/4/DSC4(c)

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3

CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/GEN/4/DSC4(c)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	-	-	-
CO2	2	1	1	3	1	-	3	-	-	-	-	-
CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/4/DSC4(c)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.6	-

Course Content
MCA/GEN/4/DSC4(c): Genetic Algorithms

Unit - I	Introduction: Introduction to evolutionary algorithm, history of evolutionary algorithm, advantage of evolutionary algorithm, application of evolutionary algorithm - biological and AI, introduction of genetic algorithm, difference between traditional approach and evolutionary algorithm.
Unit - II	Genetic modelling: Basic terminologies and operators like individual, gene, alleles, phenotype and fitness function. simple genetic algorithm, its representation, advantage and limitation of genetic algorithm.
Unit - III	Operators of GA Selection: Roulette wheel selection, random, rank, tournament, Boltzmann selection. Crossover and its types: Single point crossover, two point crossover, multipoint crossover, ordered crossover, uniform crossover, crossover for real-valued representation. Mutation and its types: Flipping, Interchanging, reversing, replacement, mutation for real-valued representation, crossover rate, mutation rate and convergence criteria
Unit - IV	Theoretical Analysis of Evolutionary Algorithms: Diploid, dominance and abeyance, inversion and reordering operator, fitness scaling.

	Niche and Speciation: Fitness sharing, crowding and restricted mating. Application of GA: Genetic Algorithm for job shop scheduling problems (JSSP).
Text/Reference Books	
Text Books	1. S.N. Sivanandam, S.N. Deepa, Introduction to Genetic Algorithms, Springer. 2. Mitchell, Melanie, An Introduction to Genetic Algorithms, United Kingdom, MIT Press, 1998.
Reference Books	1. Goldberg, David Edward, Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley, 2002. 2. D. Nagesh Kumar, Multicriterion Analysis in Engineering and Management, PHI Learning, 2010. 3. Lance Chambers, The Practical Handbook of Genetic Algorithms: Applications, 2e, United Kingdom, CRC-Press, 1995.

MCA/GEN/4/DSC5(a): Data Warehousing and Data Mining

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Optional Theory	04	04	Lecture	70	30	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: The objective of this course is to get the students familiar with different concepts of data warehouse and data mining, namely, OLAP, Association rule mining, classification and prediction.

Course Outcomes	At the end of this course, the student will be able to :
CO1	define: the concepts of data mining, data pre-processing, outliers, data warehouse ,OLAP , association rule mining, data classification prediction and cluster Analysis.
CO2	describe: key process of data mining ,data warehousing, OLAP, data warehousing to data mining , association rule, classification and prediction methods.
CO3	apply: OLAP technology and association rules. use: decision induction, Bayesian and back prorogation classification methods.
CO4	differentiate: operational database systems and data warehousing, single dimensional and multidimensional association rules, and between various data mining classification methods.

CO5	evaluate: data mining and data warehouse, OLAP technology, single and multi-dimensional association rule.

CO-PEO Mapping Matrix for Course MCA/GEN/4/DSC5(a)

Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/GEN/4/DSC5(a)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	1	-	-
CO2	2	1	1	3	1	-	3	-	-	1	-	-
CO3	3	1	1	3	3	-	3	-	-	1	-	-
CO4	2	1	1	3	1	-	3	-	-	1	-	-
CO5	2	1	3	1	3	-	3	-	-	1	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	1	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/4/DSC5(a)

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.4	-

Course Content
MCA/GEN/4/DSC5(a): Data Warehousing and Data Mining

Unit I	Data Mining: Introduction: Motivation, Importance, Knowledge discovery process, data mining, kind of data, Functionalities, interesting patterns, classification of data mining system, Major issues, Data Mining Primitives. Data Pre-processing: Data cleaning, Data Integration and transformation, Data reduction, Discretization and concept hierarchy generation. Data visualization. Outliers, Types of Outliers and challenges of Outlier Detection.
Unit - II	Data warehouse and OLAP Technology for data mining: data warehouse, difference between operational data base systems and data warehouse, A

	Multidimensional Data Model, Data warehouse Architecture, Data warehouse Implementation, data warehousing to data mining, Data warehouse usage.
Unit - III	Association Rule Mining: Mining single-dimensional Boolean association rules from transactional databases, mining multilevel association rules from transaction databases, Mining multidimensional association rules from relational databases and data warehouses, From association mining to correlation analysis, constraint-based association Mining.
Unit - IV	Data Mining-Classification and Prediction: issues regarding classification and prediction, classification by decision induction, Bayesian classification, classification by back propagation, classification based on concepts from association rule mining other classification methods. Cluster Analysis: What is Cluster Analysis, Types of Data in Cluster Analysis, Applications and Trends in Data Mining.
Text/Reference Books	
Text Books.	1. Ale Berson, Stephen Smith, KorthTheorling, Data Mining,Tata McGraw Hill. 2. Pieter Adriaans and DolfZantinge, Data Mining, Addison-Wesley Longman. 3. Sam Anahory, Data Warehousing in the Real World, Addison-Wesley Longman.
Reference Books	1. Chanchal Singh, Data Mining and Warehousing, Wiley.

MCA/GEN/4/DSC5(b): Big Data Analytics									
Course Type	Course Credits	Contact Hours/ Week	Delivery Mode	Maximum Marks				Exam Duration	Assessment Methods
				External	Internal				
Optional Theory	04	04	Lecture	70	30			3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5	5		

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: The objective of this course is to get the students familiar with different concepts of Big Data and their realization/implementation using Hadoop and Map Reduce tool sets.

Course Outcomes	At the end of this course, the student will be able to :
CO1	define: Big Data and Hadoop, digital data, Apache Hadoop, analysing Data with Unix tools and Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, HDFS, Hadoop Ecosystem, Pig, Hive shell and services, HBasics, Big SQL.
CO2	understand and describe: Big Data and Hadoop, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy,

	Hadoop Distributed File System, command line interface, job scheduling, shuffle and sort, task execution, Hadoop Ecosystem, Pig, HiveQL, Hbase.
CO3	apply and use: Apache Hadoop, HDFC,HBasic, Big Data and Hadoop,HDFS command line interface, Hadoop file system interfaces, data flow, Hive services.
CO4	classify: Big Data and Hadoop, Big Data Analytics, Apache Hadoop, HDFS ,Hive shell, Hive services.
CO5	Compare feature set of Pig, Hadoop, HDFS.

CO-PEO Mapping Matrix for Course MCA/GEN/4/DSC5(b)

Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/GEN/4/DSC5(b)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	1	-	-
CO2	2	1	1	3	1	-	3	-	-	1	-	-
CO3	3	1	1	3	3	-	3	-	-	1	-	-
CO4	2	1	1	3	1	-	3	-	-	1	-	-
CO5	2	1	3	1	3	-	3	-	-	1	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	1	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/4/DSC5(b)

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.4	-

Course Content
MCA/GEN/4/DSC5(b): Big Data Analytics

Unit I	Introduction to Big Data and Hadoop**:** Types of digital data, introduction to Big Data,Vs of Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data

	Strategy,Big Data applications.
Unit – II	HDFS (Hadoop Distributed File System):The design of HDFS, HDFS concepts, command line interface, Hadoop file system interfaces, data flow, data ingest with flume and Scoop and Hadoop archives, Hadoop I/O: compression, serialization, Avro and file-based data structures.
Unit – III	Map Reduce:Anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce types and formats, Map Reduce features.
Unit – IV	Hadoop Ecosystem: Pig: Introduction to Pig, execution modes of Pig, comparison of Pig with databases, grunt, Pig latin, user defined functions, data processing operators. Hive: Hive shell, Hive services, Hive metastore, comparison with traditional databases, HiveQL, tables, querying data and user defined functions. Hbase: HBasics, concepts, clients, example, Hbaseversus RDBMS. Big SQL: Introduction
Text/Reference Books	
Text Books	1. Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012. 2. SeemaAcharya, SubhasiniChellappan, "Big Data Analytics", Wiley 2015. 3. ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press.
Reference Books	1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007. 2. Jay Liebowitz, "Big Data and Business Analytics" AuerbachPublications, CRC press (2013) 3. AnandRajaraman and Jeffrey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012. 4. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley &Sons, 2012.

MCA/GEN/4/DSC5(c): Data Science

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks				Exam Duration	Assessment Methods
				External	Internal				
Optional Theory	04	04	Lecture	70	30			3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5	5		

Instructions to paper setter for Final-Term Examination: The question paper will consist of nine questions in all. First question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions of 15 marks each selecting at least one question from each unit.

Course Objectives: The objective of this course is to get the students familiar with the concepts and processes of Data Science including collection, filtering, processing, analysis and visualization.

Course Outcomes	At the end of this course, the student will be able to :
CO1	define: data science process, classification of data, big data, web data, sampling, data analysis techniques-correlation, regression, mean, mode, kurtosis, Bayesian inference etc., neural network, fuzzy logic, rule of mining, hadoop, hive, cloud database, and visualization.
CO2	understand and describe: graphical representation of data, storage and retrieval of data, evolution of analytic scalability, sampling distribution, data analysis techniques, Bayesian model and network, induction rule, neural network, fuzzy logic, data mining techniques, data analysis framework and visualization.
CO3	use: data science process, modern data analytic tools, statistical concepts, data analysis techniques, Bayesian network, induction rule, fuzzy logic, data mining techniques, hadoop file system, hive, S3, cloud database, inference and visualization.
CO4	categorize: analytic processes and tools, analysis, reporting, sampling and re-sampling, data analysis techniques, linear and non-linear time series, sequential, temporal and spatial mining, egonets systems and application.
CO5	choose: data science process, data storage, data analytic tools and processes, sampling method, data analysis technique, time series, mining techniques, visual data analysis framework and technique suitable in given situation.

CO-PEO Mapping Matrix for Course MCA/GEN/4/DSC5(c)

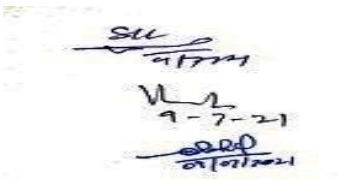
Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

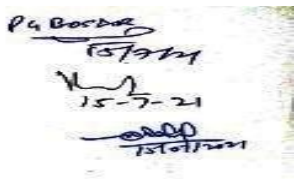
CO-PO Mapping Matrix for Course MCA/GEN/4/DSC5(c)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	1	-	-
CO2	2	1	1	3	1	-	3	-	-	1	-	-
CO3	3	1	1	3	3	-	3	-	-	1	-	-
CO4	2	1	1	3	1	-	3	-	-	1	-	-
CO5	2	1	3	1	3	-	3	-	-	1	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	1	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/4/DSC5(c)

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-





Average	3	1	3	2.4	-

Course Content
MCA/GEN/4/DSC5(iii):Data Science

Unit I	Introduction to Data Science : data science process, exploratory data analysis, collection of data, graphical presentation of data, classification of data, storage and retrieval of data, big data, challenges of conventional systems, web data, evolution of analytic scalability, analytic processes and tools, analysis vs reporting, modern data analytic tools; Statistical Concepts: sampling distributions, re-sampling, statistical inference, prediction error.
Unit – II	Data Analysis: Correlation, regression, probability, Conditional probability, random variables, analysis using mean, median, mode, standard deviation, skewness, kurtosis, regression modeling, multivariate analysis, Bayesian modeling, inference and Bayesian networks, support vector and kernel methods; Analysis of Time Series: linear systems analysis, nonlinear dynamics.
Unit – III	Data Mining Techniques: Rule induction: neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy Logic: extracting fuzzy models from data, fuzzy decision trees, stochastic search methods, neuro fuzzy modelling, Association Rule Mining: clustering, outlier analysis, sequential pattern mining, temporal mining, spatial mining, web mining.
Unit – IV	Data Analysis Frameworks and Visualization: Map Reduce, Hadoop, Hive, sharding, NoSQLdatabases, cloud databases, S3, Hadoop Distributed File Systems, visualizations, visual data analysis techniques, interaction techniques, social network analysis,collective inferencing, Egonetssystems and applications.
Text/Reference Books	
Text Books.	1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007. 2. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
Reference Books	1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & Sons, 2012. 2. Jiawei Han, MichelineKamber "Data Mining Concepts and Techniques", 2e, Elsevier.

3. Rachel Schutt, Cathy O'Neil, "Doing Data Science", O'Reilly Publishers, 2013.
4. Foster Provost, Tom Fawcet, "Data Science for Business", O'Reilly Publishers, 2013.
5. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2014.

MCA/Gen /4/SEC2: Project Work

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Core Compulsory Project Work	08	16	Project Work	150	50	-	Teacher Interaction/ Project Report/ Viva Voce

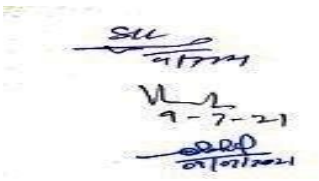
Instructions to paper setter for Final-Term Examination: The Final-Term examination will be conducted by a panel of internal and external examiners. Examinees will be evaluated on the bases of project report and a presentation based viva voce exam.

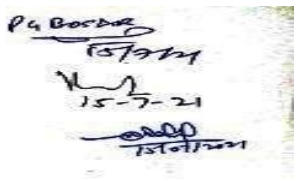
Course Objectives: To expose students to the realm of software development by working on some real-life problem. Students get to apply the principles of software development in practice and apply one of the several software development paradigms.

Course Outcomes	At the end of this course, the student would have learnt to :
CO1	enumerate various software development paradigms and steps/phases therein as well as the general concepts in software development life cycle.
CO2	understand and describe various software development paradigms and steps/phases therein as well as the general concepts in software development life cycle.
CO3	use/apply the principals and practices of software engineering in real-life software development project work.
CO4	classify software development environments, paradigms, tools and technologies based on various parameters.
CO5	choose (and justify) between the competing technologies and software development paradigms that suit to particular type of software development project.
CO6	design and develop software systems for simple real-life problems individually and complex systems as a member of team.

CO-PEO Mapping Matrix for Course MCA/Gen /4/SEC2

Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3





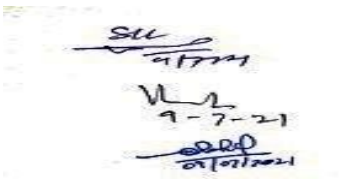
Average	2.5	3	3	3	3

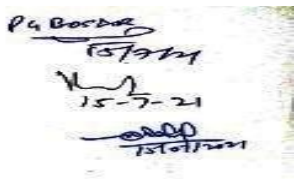
CO-PO Mapping Matrix for Course MCA/Gen /4/SEC2

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	3	3	3	3	1	3	-	3	3
CO2	2	3	1	3	3	3	3	2	3	-	3	3
CO3	3	3	1	3	3	3	3	3	3	-	3	3
CO4	3	3	1	3	3	3	3	3	3	-	3	3
CO5	3	3	3	3	3	3	3	3	3	-	3	3
CO6	3	3	3	3	3	3	3	3	3	-	3	3
Average	2.5	3	1.6	3	3	3	3	2.5	3	-	3	3

CO-PSO Mapping Matrix for Course MCA/Gen /4/SEC2

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	3
CO2	3	3	3	2	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	3	3	3	2.5	3





MCA/GEN/4/CC21: Software Lab based on MCA/GEN/4/CC19(Python Programming)							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Practical	02	04	Practical/ Lab Work	50	-	-	TEE/ Practical File

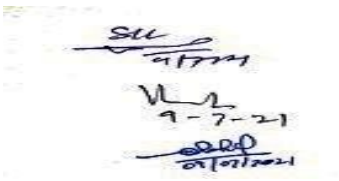
Instructions to paper setter for Final-Term Examination: The Final-Term examination will be conducted by a panel of internal and external examiners. Examinees will be evaluated on the basis of practical file, performance in practical exam and a viva voce exam.

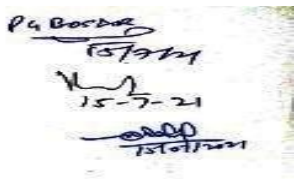
Course Objectives: The objective of this course is to get the students hands on practice with scripting/programming concepts of Python language as covered in course **MCA/GEN/4/CC19**.

Course Outcomes	At the end of this course, the student will be able to :
CO1	define: installations, working, structures, control statements , operators, lists ,object oriented programming concepts, python libraries.
CO2	explain: conditional & control statements ,strings, OOPs ,file handling concepts ,libraries and packages of python programming.
CO3	use: various python libraries such as numpy, matplotlib ,pandas . apply: python programming constructs to solve real world problems.
CO4	categorize:datatypes,dictionaries,conditional&controlstatements,functions,python libraries.
CO5	compare: datatypes,dictionaries,conditional&controlstatements,functions,python libraries.
CO6	design:basic and advanced applications in python.

CO-PEO Mapping Matrix for Course MCA/GEN/4/CC21

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3





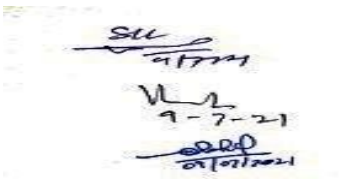
Average	2.5	3	3	3	3

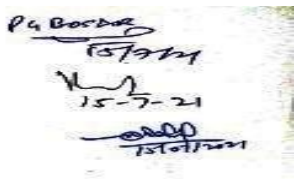
CO-PO Mapping Matrix for Course MCA/GEN/4/CC21

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	-	-	-
CO2	2	1	1	3	1	-	3	2	-	-	-	-
CO3	3	1	1	3	3	-	3	3	-	-	-	-
CO4	3	3	1	3	1	-	3	3	-	-	-	-
CO5	3	1	1	3	3	-	3	3	-	-	-	-
CO6	3	3	3	3	3	-	3	3	-	-	-	-
Average	2.5	2	1.3	2.6	2	-	3	2.5	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/GEN/4/CC21

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	-
CO2	3	2	2	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	2.5	2.5	2.5	-





MCA/GEN/4/CC22: Software Lab based on MCA/GEN/4/CC20(R Programming)							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Practical	02	04	Practical/ Lab Work	50	-	-	TEE/ Practical File

Instructions to paper setter for Final-Term Examination: The Final-Term examination will be conducted by a panel of internal and external examiners. Examinees will be evaluated on the bases of practical file, performance in practical and a viva voce exam.

Course Objectives: The objective of this course is to get the students hands on practice with scripting/programming concepts of R programming language as covered in course **MCA/GEN/4/CC20**.

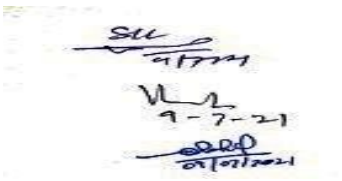
Course Outcomes	At the end of this course, the student will be able to:
CO1	list : data types, functions in R programming, visualization.
CO2	describe: the syntax of decision making statements, loops, user defined functions,used define packages; explain: the process of import and export of data in text file, excel file and MYSQL .
CO3	use: various in built ,user defined function and packages . apply: R programming constructs to solve real world problems.
CO4	categorize:datatypes,conditional& control statements, in built and user defined functions and packages.
CO5	compare: datatypes, conditional & control statements,functions, packages in R programming.
CO6	design:basic and advanced applications in R programming.

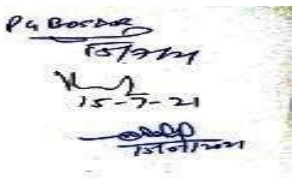
CO-PEO Mapping Matrix for Course MCA/GEN/4/CC22

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	3	3	3	3

CO-PO Mapping Matrix for Course MCA/GEN/4/CC22

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	-	-	-
CO2	2	1	1	3	1	-	3	2	-	-	-	-
CO3	3	1	1	3	3	-	3	3	-	-	-	-
CO4	3	3	1	3	1	-	3	3	-	-	-	-
CO5	3	1	1	3	3	-	3	3	-	-	-	-
CO6	3	3	3	3	3	-	3	3	-	-	-	-
Average	2.5	2	1.3	2.6	2	-	3	2.5	-	-	-	-





CO-PSO Mapping Matrix for Course MCA/GEN/4/CC22					
COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	-
CO2	3	2	2	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	2.5	2.5	2.5	-