GALGOTIAS UNIVERSITY

(Established under Galgotias University Uttar Pradesh Act No. 14 of 2011)

School of Computing Science and Engineering

Programme: MCA

Scheme: 2019 – 2022

Curriculum

Semester 1

Sl.No	Course Code	Name of the Course					Assessment Pattern	
			L	T	P	C	IA	MTE	ETE
1	MCAS1160	Discrete Mathematics	3	0	0	3	20	50	100
2	MCAS1120	Digital Computer Fundamentals	3	1	0	4	20	50	100
3	MCAS1150	Object Oriented Paradigm	3	0	0	3	20	50	100
4	MCAS1170	Problem Solving Techniques	3	0	0	3	20	50	100
5	MCAS1180	Web Applications Development	3	0	0	3	20	50	100
6	SLMC5011	English Proficiency and Aptitude Building - 1	0	0	4	2	50	-	50
7	MCAS1151	Object Oriented Paradigm Lab	0	0	2	1	50	-	50
8	MCAS1171	Problem Solving Techniques Lab	0	0	2	1	50	-	50
9	MCAS1181	Web Applications Development Lab	0	0	2	1	50	-	50
		Total Credits	**15**	**1**	**10**	**21**			

Semester II

Sl No	Course Code	Name of the Course					Assessment Pattern	
			L	T	P	C	IA	MTE	ETE
1	MCAS1251	Numerical Analysis and Optimization Techniques	3	0	0	3	20	50	100
2	MCAS1252	Computer Architecture	3	0	0	3	20	50	100
3	MCAS1253	Database Management System (PBL)	3	0	0	3	20	50	100
4	MCAS1254	Ecommerce and IT infrastructure	3	0	0	3	20	50	100
5	MCAS1255	Data and File Structure using C	3	0	0	3	20	50	100
6	MCAS1256	Introduction to IOT	3	0	0	3	20	50	100
7	MCA9001	Programming in Python	0	0	4	2	50	-	50
8	MCAS1235	Database Management System Lab (PBL)	0	0	2	1	20	50	100
9	MCAS1236	Data and File Structure using C Lab	0	0	2	1	50	-	50
10	SLMC5012	English Proficiency and Aptitude Building - II	0	0	4	2	50	-	50
		Total Credits	**18**	**0**	**12**	**24**			

Semester III

Sl No	Course Code	Name of the Course					Assessment Pattern	
			L	T	P	C	IA	MTE	ETE
1	SLMC****	Numerical Aptitude	0	0	0	2	50	-	50
2	MCAS2120	Operating System	3	0	0	3	20	50	100
3	MCAS2130	Programming in Java	3	0	0	3	20	50	100
4	MCAS2140	Algorithm Analysis & Design	3	0	0	3	20	50	100
5	MCAS2150	Software Engineering	3	0	0	3	20	50	100
6	MCAS2160	Computer Networks	3	0	0	3	20	50	100
8	MCAS2161	Computer Network Lab	0	0	2	1	50	-	50
9	MCAS2151	Software Engineering Lab	0	0	2	1	50	-	50
10	MCAS2131	Programming in Java Lab	0	0	2	1	50	-	50
11	MCAS2121	Operating System Lab	0	0	2	1	50	-	50
		Total Credits	**15**	**0**	**8**	**21**			

Semester IV									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	MCAS2210	Cryptography and Network Security	3	0	0	3	20	50	100
2	MCAS2220	Data Warehousing & Data Mining	3	0	0	3	20	50	100
3	MCAS2230	Compiler Design	3	0	0	3	20	50	100
4	MCAS2240	Open Source Programming with Python	3	0	0	3	20	50	100
5	MCAS2250	Web services & Cloud Computing	3	0	0	3	20	50	100
6		Elective I	3	0	0	3	20	50	100
8	SLMCXXXX	Personality Development and Aptitude Building -3	0	0	4	2	50	-	50
9	MCAS2251	Web services & Cloud Computing Lab	0	0	2	1	50	-	50
10	MCAS2231	Compiler Design Lab	0	0	2	1	50	-	50
11	MCAS2241	Python Programming Lab	0	0	2	1	50	-	50
		Total Credits	**18**	**0**	**10**	**23**			
Semester V									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	MCAS3110	Big Data Technologies and Analytics	3	0	0	3	20	50	100
2	MCAS3120	Mobile Application Development	3	0	0	3	20	50	100
3	MCAS3130	Computer Graphics	3	0	0	3	20	50	100
4	MCAS3140	Artificial Intelligence	3	0	0	3	20	50	100
5		Elective -II	3	0	0	3	20	50	100
6	MCAS3131	Linux and Shell Programming Lab	0	0	2	1	50	-	50
8	MCAS3121	Mobile Application Development Lab	0	0	2	1	50	-	50
9	MCAS9998	Dissertation Phase I	-	-	-	5	50	-	50
		Total Credits	**15**	**0**	**4**	**22**			
Semester VI									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	MCAS9999	Dissertation Phase II	-	-	-	15	50	-	50
		Total Credits				**15**			

List of Electives

Basket-1

Sl No	**Course Code**	**Name of the Electives**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	MCAS9110	Cloud Security	3	0	0	3	20	50	100
2	MCAS9120	Cyber Security	3	0	0	3	20	50	100
3	MCAS9130	Network Security	3	0	0	3	20	50	100

Basket-2

Sl No	**Course Code**	**Name of the Elective**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	MCAS9210	Information Retrieval	3	0	0	3	20	50	100
2	MCAS9220	Foundation of Data Science	3	0	0	3	20	50	100
3	MCAS9230	Business Intelligence	3	0	0	3	20	50	100

Detailed Syllabus

Name of The Course	Discrete Mathematics			
Course Code	MCAS1160			
Prerequisite	None			
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

The objective of this course is to:

1. Familiarize the students with the basic mathematical concepts and numerical methods.
2. To understand the concepts and results in Mathematical logic, Number theory, Group theory and Numerical methods.

Course Outcomes:

At the end of the course student will be able to:

CO1	Understand basic mathematical concepts and numerical methods
CO2	Gain adequate knowledge to find the roots of transcendental equations
CO3	Effectively solve non-linear algebraic equations
CO4	Design and develop various algorithms for problems in Mathematical logic, Number theory, Group theory and Numerical methods
CO5	Easily able to evaluate complex integrals numerically
CO6	Learn concepts of discrete mathematics and its influence to various functional areas like communication system, logics etc.

Text Book (s)

1. Seymour Lipschutz and Marc Lipson– Discrete Mathematics– Second Edition – Tata McGraw Hill Edition– 2002.
2. Schaums Series – Discrete Mathematics – 2nd Edition.

Reference Book (s)

1. Steven C. Chopra and Raymond P. Canale – Numerical Methods for Engineers – Fourth Edition–McGraw Hill International Edition – 2004.
2. M.K. Venkatraman – Numerical Methods – 12th Edition -National Publications & Co. – 2004.
3. Schaums Series – Numerical Analysis – 2nd Edition

Unit I: Proposition and Logic **10 hours**
Propositions and Compound Propositions – Logical Operations – Truth tables – Tautologies and Contradictions – Logical Equivalence – Algebra of propositions – Conditional and Biconditional Statements – Arguments – Logical Implications – Quantifiers – Negation of Quantified Statements – Basic Counting Principles – Factorial – Binomial Coefficients – Permutations – Combinations Pigeonhole Principle
Unit-2 Mathematical Induction **10 hours**
Order and inequalities – Mathematical Induction – Division Algorithm – Divisibility – Euclidean Algorithm – Fundamental theorem of Arithmetic – Congruence relation – Congruence Equations –Semigroups – Groups – Subgroups – Normal subgroups – Homomorphisms – Rings – Integral Domains – Fields – Polynomials over a Field.
Unit-3 Recurrence Relations **8 hours**
Towers of Hanoi, Iterations, Homogeneous linear equations with constant coefficients, particular solution, difference table, finite order differences, Line in a plane in general position
Unit-4 Graph Theory **6 hours**
paths, connectivity, subgraphs, isomorphism, trees, complete graphs, bipartite graphs, matching colourability, planarity, digraphs;
Unit-5 Classification of Languages **6 hours**
Overview of Formal Languages : Representation of regular languages and grammars, finite state Machines

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	DIGITAL COMPUTER FUNDAMENTALS			
Course Code	MCAS1120			
Prerequisite	None			
Corequisite				
Antirequisite				
	L	T	P	C
	3	1	0	4

Course Objectives:

The objective of this course is to:

1. Familiarize the students with the basic mathematical concepts and numerical methods. To understand the concepts and results in Digital logic, Circuit, boolean algebra, sequential and combinational circuits, ALU Design and computer design

Course Outcomes

At the end of the course student will be able to:

CO1	Understand On completion of the course the student will be able to design a simple digital system.
CO2	On completion of the course the student will be able to design a simple digital system
CO3	Design and develop various algorithms for problems digital logic, Number theory.
CO4	Easily able to evaluate complex integrals numerically
CO5	Learn concepts of digital logic and its influence to various functional areas like communication system, logics etc.

Text Book (s)

1. Thomas Floyd – Fundamentals of Digital System – Pearson Education.-3rd Edition – 2003.
2. A.P. Malvino and D.P. Leach – Digital Principles and Applications – Tata McGraw Hill 4th Edition – 1999

Reference Book (s)

M. Morris Mano – Digital Logic and Computer Design PHI – 5th Edition- 2004

Unit-1 Number System	**8 hours**
Number System – Converting numbers from one base to another – Complements – Binary Codes – Integrated Circuits – Boolean algebra – Properties of Boolean algebra – Boolean functions – Canonical and Standard forms – Logic operations – Logic gates – Karnough Map up to 6 variables – Don't Care Condition – Sum of Products and Products of sum simplification – Tabulation Method.	
Unit-2 Combinational Circuit	**8 hours**
Adder – Subtractor – Code Converter – Analyzing a Combinational Circuit – Multilevel NAND and NOR circuits – Properties of XOR and equivalence function – Binary Parallel Adder – Decimal Adder – Magnitude Comparator – Decoders – Multiplexers – ROM – PLA.	
Unit-3 Sequential Circuit	**8 hours**
Flip Flops – Triggering of flip–flops – Analyzing a sequential circuit – State reduction – Excitation tables – Design of sequential circuits – Counters – Design with state equation – Registers – Shift Registers – Ripple and Synchronous Counters.	
Unit-4 Memory Unit	**8 hours**
Memory Unit – Bus Organization – Scratch Pad Memory – ALU – Design of ALU – Status Register – Effects of Output carry – Design of Shifter – Processor Unit – Microprogramming – Design of specific Arithmetic Circuits.	
Unit-5 Micro-Program Control	**8 hours**
Accumulator – Design of Accumulator – Computer Configuration – Instructions and Data formats – Instruction sets – Timing and control – Execution of Instruction – Design of Computer – H/W Control – PLA control and Micro-program control.	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	OBJECT ORIENTED PARADIGM				
Course Code	MCAS1150				
Prerequisite	None				
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

1. Perform object oriented programming to develop solutions to problems demonstrating usage of control structures, modularity, I/O. and other standard language constructs.
2. Demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation,Function Overloading,Operator Overloading and inheritance.

Course Outcomes:

CO1	Overview of OOP and C++ basics
CO2	Understand about dynamic memory allocation, overloading concepts
CO3	Understand the use and write program based on Inheritance, Polymorphism, Encapsulation, virtual keyword, Operator overloading
CO4	Understand the Templates and Exception Handling in C++.
CO5	Know the file handling concepts and Input-Output Stream in C++.

Text Book (s)

1. Venugopal – Mastering C++ - Tata McGraw Hill-2001.

Reference Book (s)

1. Herbert Schildt, C++ – The Complete Reference, Third Edition – Tata McGraw Hill – 1999.
2. Bruce Eckel, Thinking in C++, Second Edition, Volume One, Pearson Education Asia, 2000.

Unit-1 Introduction **8 hours**
Introduction to OOP– Overview of C++ – Classes – Structures – Unions – Friend Functions – Friend Classes – Inline functions – Constructors – Destructors – Static Members – Scope Resolution Operator – Passing objects to functions – Function returning objects.
Unit-2 Function Overloading **8 hours**
Arrays – Pointers – This pointer – References – Dynamic Allocation Operators – Function Overloading – Default function arguments – Overloading Constructors – Ambiguity in function overloading
Unit-3 Operator Overloading **8 hours**
Operator Overloading – Member Operator Function – Friend Operator Function – Overloading some special operators – Overloading [ ], ( ), —> and comma operator – Inheritance – Types of Inheritance – Protected members – Virtual Base Class Polymorphism – Virtual Functions – Pure virtual functions
Unit-4 Templates and Exception Handling **8 hours**
Class templates and generic classes – Function templates and generic functions – Overloading a function template – power of templates – Exception Handling – Derived class exception – Exception handling options – terminate() and unexpected() – uncaught_exception() function.
Unit-5 Input-Output Stream **8 hours**
I/O Streams – formations I/O with ios class functions and manipulators – overloading << and >> –creating own manipulator – File I/O – Name spaces – the std name space – conversion functions – Array based I/O – An overview of the STL – The container classes – General theory of operation – Vectors.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Problem Solving Techniques				
Course Code	MCAS1170				
Prerequisite	None				
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

1.To introduce students to the concepts of C programming.
2. Provide more emphasis on several topic of C programming like -functions, arrays, pointers, structures, files handling.
3. Learn to develop program using 'C' language.

Course Outcomes
At the end of this course students will be able:

CO1	The student would acquire the concept of C language.
CO2	The stsudent will able to develop application program using C language.
CO3	Implement and develop projects using C

Text Book (s)
1. E. Balagurusamy – Programming in ANSIC – Tata McGraw Hill 3rd Edition– 2004.

Reference Book (s)
2. B.S. Gottfried – Programming with C – Schaum's Outline Series – Tata McGraw Hill 2nd Edition – 1998.
3. K.R. Venugopal, Sudeep R. Prasad – Programming with C – Tata McGraw Hill - 2002.
4. Yashavant Kanetkar – Let us C – BPB Publications- 5th Edition - 2004.

Unit-1 Introduction **13 hours**
Identifiers – Keywords– Data Types – Data Type Conversions – Operators – Conditional Controls – Loop Controls– Input/Output operations.
Unit-2 Function **8 hours**
Function Prototyping – Function Arguments – Actual vs. Formal Parameters – Pointers – Pointer Variables – Pointers Concepts in Functions – Multiple Indirection
Unit-3 Arrays **8 hours**
Arrays – Accessing Array Elements Pointers and Arrays – Arrays as Function Arguments – Function Returning Addresses – Dynamic Memory Allocation – Storage Classes.
Unit-4 Structure and Union **7 hours**
Structures – Unions – typedef – enum – Array of Structures – Pointers to Structures – Macros and Pre-processor
Unit-5 File Handling **4 hours**
Character I/O – String I/O – Formatting input/output – File I/O – Error Handling during I/O – Command line Arguments

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Web Application Development				
Course Code	MCAS1180				
Prerequisite	None				
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

The objective of this course is to:

1. Enable the students to understand web-based site planning, management and maintenance.
2. Explain the concept of developing advanced HTML,ASP,JavaScript, XML pages.
3. This course enables students to develop web sites which are secure and dynamic in nature.
4. Design and implement an internet database application using existing tools and techniques.

Course Outcomes

CO1	To develop web page using HTML with formatting, links, tables, list and frames.
CO2	To learn the basics of DHTML
CO3	To understand the basics of java script and how to embed it in HTML
CO4	To learn dynamic web page creation
CO5	To know the basics of VB script and ASP.net

Text Book (s)

1.Bates C, "Web Programming - Building Internet Application", Second Edition, Wiley-Dreamtech India Pvt. Ltd., 2002.

2. Pitter K, Amato S and Callahan J et al, “Every students guide to the Internet”, Tata McGraw

Reference Book (s)

1. Deitel, “Java for programmers”, Pearson Education
2. Ivan Bayross,” HTML, DHTML, Java Script, Perl & CGI”, BPB Publication.
3. Jackson, “Web Technologies” Pearson Education
4. Patel and Barik,”Introduction to Web Technology & Internet”, Acme Learning

Unit-1 Introduction **8 hours**
Introduction to Web Designing – Web Server, Web Client – Browser & Web Server Communication – HTTP Protocol – HTML Document Basic Structure – Creating Links between Documents – Creating Tables – Creating Forms – The Input Element – Select Element – Text Area Element.
Unit-2 DHTML and VB Script **8 hours**
DHTML Object Model – Underlying Principles of the DHTML – Basic Components of DHTML – Introduction of Scripting – Scripts in HTML – VBScript – Variables – Functions –Intrinsic Functions – Conditional & Loops – VBScript Objects – Building a Sample Form.
Unit-3 Java Script **8 hours**
JavaScript – Introduction to JavaScript – Variables – Conditional and Loops – Events –Functions – Frames – HTML document – Predefined Objects – Image Object – Layers –Drag and Drop – Building a Sample Form.
Unit-4 Cascading Style Sheets **8 hours**
CSS – Introduction to Cascading Style Sheets – Inline Styles – Style Sheets – Grouping & Short Hand Properties – Inheritances – Classes – Link – Cascading Styles – Dynamic Style – Multimedia on the Web – Playing Multimedia – Streaming Multimedia – Animated GIFs – Creating Video Audio for the Web.
Unit-5 Active Server Page **8 hours**
Web Services – ASP Fundamentals – ASP Objects – Application Object – Session Object – Request Object – Response Object – Session Object – Design a Simple Web Page Using ASP –Design a simple web page with database connectivity.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Numerical Analysis and Optimization Techniques			
Course Code	MCAS1251			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

The objective of this course is to:

1. Learn fundamentals of Statistical Methods
2. Learn fundamentals of Numerical techniques
3. Make student familiar with basic concepts of probability and random variables, distribution of random variables
4. Learn correlation and regression analysis and apply certain statistical concepts in practical applications of computer science areas.
5. Learn how numerical techniques are useful
6. Learn about Linear and Non Linear Equation Systems and their applicability.

Course Outcomes:

CO1	Understand basics of statistical Analysis
CO2	Understand various distributions for random variables
CO3	Apply Statistical and Optimization techniques
CO4	Apply appropriate method to solve the system of Linear Equations
CO5	Apply appropriate method to solve the system of non-Linear Equations

Text Book (s)

1. K.S. Trivedi – Probability and Statistics with reliability, Queuing and Computer Science Applications – Prentice Hall India – 2001.
2. A.M. Mood, F. Graybil and Boes – Introduction to Mathematical Statistics – McGraw Hill – 1974.
3. S.C. Gupta & V.K. Kapoor – Fundamentals of Mathematical Statistics – Sultan Chand & Sons.-2002.

Reference Book (s)

1. R. K. Jain and S. R. K. Iyengar, **Advanced Engineering Mathematics**, 4th Edition, Narosa publishers.
2. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical methods, 6th Edition, New age international limited.

Unit-1 Introduction to Probability **9 hours**
Sample space – Events – Axiomatic approach to probability conditional probability Independent events Baye's formula Random Variables – Continuous and discrete random variables – distribution function of random variables Characteristic of distributions – Expectation, variance, – coefficient of variation, moment generation function Chebyshev'sinequality
Unit-2 Distribution **7 hours**
Bivariate distribution – conditional and marginal distributions discrete distributions – discrete uniform, Binomial poison and geometric Distributions – Continuous distributions – Uniform, Normal, Exponential and Gamma distributions
Unit-3 Statistical and Optimization techniques **9 hours**
Correlation coefficient – Rank Correlation coefficient of determination – Linear Regression – Method of Least squares – Fitting of the curve of the form ax + b, ax^2+bx+c, ab^x and ax^b multiple and partial correlation (3 – variables only). eros of a single transcendental equation and zeros of polynomial using Bisection Method, Iteration Method, Regula-Falsi method, Newton Raphson method, Secant method, Rate of convergence of iterative methods.
Unit-4 Linear Equations System **8 hours**
Solutions of system of Linear equations, Gauss Elimination, direct method and pivoting, Ill Conditioned system of equations, Refinement of solution. Gauss Seidal, iterative method, Rate of Convergence. Finite Differences, Difference tables, Polynomial Interpolation**:** Newton's forward and backward formula

Unit-5 Non- Linear Equations System	**8 hours**
Gauss forward and backward formula, Stirling's, Bessel's, Everett's formula. Introduction, Numerical Differentiation, Numerical Integration, Trapezoidal rule, Simpson's rules. Picard's Method, Euler's Method, Taylor's Method, Runge-Kutta methods, Predictor-corrector methodFitting of straight lines, polynomials, exponential curves	

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Exam (MTE)**	**End Term Exam (MTE)**	**Total Marks**
20	30	50	100

Name of The Course	Computer Architecture				
Course Code	MCAS1252				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

1. Explain the organization of the classical von Neumann machine and its major functional Modules.
2. Explain how an instruction is executed in a classical von Neumann machine.
3. Provide knowledge of computer system organization and structure through instruction cycles.
4. Provide knowledge of system interconnection and the different I/O techniques.
5. Explain the basic concepts of interrupts and how interrupts are used to implement I/Ocontrol and data transfers.
6. Identify various types of buses in a computer system and illustrate how data transfers is performed.

Course Outcomes:

CO1	Understand the organization of basic computer.
CO2	Compare different types of instructions.
CO3	Apply the principles and the implementation of computer arithmetic.
CO4	Understand the operation of modern CPUs and use of Pipelining.
CO5	Apply memory hierarchy to achieve efficient memory system. And Analyze different I/O Techniques.

Text Book (s)

1. M. M. Mano – Computer System Architecture – 3rd Edition – PHI – 1994

Reference Book (s)

1 . Patterson, Computer Organisation and Design, Elsevier Pub. 2009
2. William Stallings, "Computer Organization and Architecture – Designing for Performance", 6th Edition, Pearson Education, 2003.
3. David A.Patterson and John L.Hennessy, "Computer Organization and Design: The hardware / software interface", 2nd Edition, Morgan Kaufmann, 2002.
4. John P.Hayes, "Computer Architecture and Organization", 3rd Edition, McGraw Hill, 1998.

Unit-1 Central Processing Unit **8 hours**
Central Processing Unit ,General Register and Stack Organization – Instruction Formats – Addressing Modes– Data Transfer and manipulation – Program Control – RISC.
Unit-2 Pipeline and Vector Processing **8 hours**
Pipelining – Arithmetic Instruction and RISC Pipelining– Vector Processing – Array Processors.
Unit-3 Computer Arithmetic **8 hours**
Computer Arithmetic – Addition and Subtraction – Multiplication and Division Algorithms – Floating-Point and decimal Arithmetic operations.
Unit-4 Input Output Organization **8 hours**
Input–Output Organization – Peripheral devices – I/O Interface – Asynchronous Data Transfer – Modes of Transfer – Priority Interrupt – Direct Memory – Access I/O Processor – Serial Communications.
Unit-5 Memory Organization **8 hours**
Memory Organization – Memory Hierarchy – Main Memory Auxiliary Memory– Associative Cache and Virtual Memory – Interconnection Structures – lnterprocessor Arbitration.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE	Total Marks
20	30	50	100

Name of The Course	E-Commerce &IT Infrastructure			
Course Code	MCAS1254			
Prerequisite	None			
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

1. Define e-commerce and describe how it differs from e-business.
2. Identify and describe the unique features of e-commerce technology and discuss its advantages & impacts.
3. Learn about network infrastructure including its access equipment.
4. Describe the m-commerce.
5. Understand about the web security & firewalls and its importance in e-commerce.
6. Learn about encryption techniques and digital signature
7. Understand Electronic Payment System used in e-commerce and knowing about cyber laws & business ethics.

Course Outcomes:

CO1	Able to apply E – commerce principles in market place.
CO2	Able to understand the theory and applications Network Infrastructure.
CO3	Able to apply Web Security principles in E – commerce.
CO4	Able to understand Encryption techniques used in E – commerce.
CO5	Able to apply Electronic Payment system in E – commerce.

Text Book (s)

1. Pete Lohsin , John Vacca "Electronic Commerce", New Age International
2. Goel, Ritendra "E-commerce", New Age International

Reference Book (s)

1. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison Wesley.
2. Pete Lohsin , John Vacca "Electronic Commerce", New Age International
3. Laudon, "E-Commerce: Business, Technology, Society", Pearson Education
4. Bajaj and Nag, "E-Commerce the cutting edge of Business", TMH
5. Turban, "Electronic Commerce 2004: A Managerial Perspective", Pearson Education

Unit-1 Introduction **8 hours**
Definition of Electronic Commerce, E-Commerce: technology and prospects, incentives for engaging in electroniccommerce, needs of E-Commerce, advantages and disadvantages,framework, Impact of E-commerce on business.
Unit-2 Network Infrastructure for E- Commerce **8 hours**
Internet and Intranet based E-commerce – Issues and problems, Network Infrastructure, Network Access Equipment,Broadband telecommunication (ATM, ISDN, and FRAME RELAY).Mobile Commerce: Introduction, Wireless Application Protocol.
Unit-3 Web Security **8 hours**
Security Issues on web, Importance of Firewall, components of Firewall, Transaction security, Emerging client server,Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.
Unit-4 Encryption **8 hours**
Encryption techniques, Symmetric Encryption: Keys and data encryption standard, Triple encryption, Asymmetric encryption: public and private key pair encryption,Digital Signatures, Virtual Private Network.

Unit-5 Electronic Payments	**8 hours**
Overview, The SET protocol, Payment Gateway, certificate, Smart card, credit card,online banking, Payment wallet, EDI and its Application in business, Cyber Laws, Business Ethics, IT Act.	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Data and File Structure Using C				
Course Code	MCAS1255				
Prerequisite	C Programming				
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

1. Be familiar with basic techniques of algorithm analysis
2. Be familiar with writing recursive methods
3. Master the implementation of linked data structures such as linked lists and Stack and binary trees
4. Understanding with several sorting algorithms including quicksort, mergesort and heapsort
5. Understanding with some graph algorithms such as shortest path andspanning tree and file Organization
6. Master analyzing problems and writing program solutions to problems using the above techniques

Course Outcomes

CO1	To identify and define the most appropriate data structure(s) for a given problem. Analyse complexity of algorithms
CO2	To become expert in using linear data structures like Stacks, Queues and Linked Lists
CO3	To be conversant in using non-linear data structure,Tree
CO4	To become proficient in using non linear data structure, Graph
CO5	To understand all popular Searching and Sorting algorithms and learn when to use which sorting and searching algorithm
CO6	To understand file organization

Text Book (s)

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data Structures"

Reference Book (s)

1. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication Using C and C++" , PHI
2. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill R. Kruse etal, "Data Structures and Program Design in C", Pearson Education
3. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education
4. G A V Pai, "Data Structures and Algorithms", TMH

Unit-1 Introduction **8 hours**
Abstract Data Types, Asymptotic Notations , Time and space complexity of algorithms., Elementary data structures and their applications.Array Definition, Single and Multidimensional Arrays, application of arrays, String Operation, Ordered List, Sparse Matrices, Lower and Upper Triangular matrices, and tri-diagonal matrices.
Unit-2 Stacks, Queues and Linked lists **8 hours**
Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Linked Representation of Stack, Operations Associated with Stacks, Applications of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack. Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty. Circular queue, Deque, and Priority Queue
Unit-3 Trees **8 hours**
Trees – Binary Trees – Binary Tree Traversals – Binary Tree Representations – Binary Search Trees – Threaded binary Trees – Application of Trees (Sets) – Binary Search Tree (BST), Insertion and Deletion in BST, AVL Trees
Unit-4 Graphs **8 hours**
Representation of Graphs, Graph Traversal algorithms, Applications of Graphs, Minimum Cost Spanning Treess, Shortest Path Problems, Topological Sorting, Strongly connected Component
Unit-5 Sorting ,Searching and File Structure **8 hours**
Linear & Binary search, Hash table and Hashing.Sorting: Bubble sort, Insertion sort,Selection sort, Quicksort, Shellsort, Mergesort. Physical Storage Media File Organization, Organization of records into Blocks, Sequential Files, Indexing and Hashing, Primary indices, Secondary indices, Multi-level Indexing.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	DATABASE MANAGEMENT SYSTEMS (PBL)				
Course Code	MCAS1253				
Prerequisite	None				
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

1. The aim of this course is to introduce the students to basic concepts of databases and database management systems with emphasize on relational databases.
2. The entity relationship diagram helps the students to design the database and the concept of normalization. 3. 3. The SQL and PL/SQL are taught so as teach how to create tables, manipulate table and how to create stored procedure.
3. The objective of the course is make the students well versed with relational database and introduce them to the concepts of object-oriented database, multimedia database and distributed databases.

Course Outcomes:

CO1	Understand the relational database theory, application of database system in real life.
CO2	Describe DBMS architecture, physical and logical database designs, database modelling, relational, hierarchical and network models.
CO3	Learn and apply Structured query language (SQL) for database definition and database manipulation.
CO4	Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
CO5	Understand various issues of transaction processing and concurrency control mechanism.

Text Book (s)

1.Henry F. Korth and Abraham Silberschatz, Database System Concepts, McGraw Hill International Publications, 2002.

Reference Book (s)

1. Gerald V. Post – Database management systems – Designing and Building Business Applications – McGraw Hill International edition – 2nd Ed , 2002.
2. Thomas Connolly, Carolyn Begg - Database System – Pearson Education
3. Raghu Ramakrishnan – Database Management Systems – WCB/McGraw Hill , 3rd Ed, 2003.
4. Ivan Bayross - Pl Sql book
5. C.J.Date: Introduction to Database Systems, Pearson Education.
6. Elmasri Navrate: Data base Management System, Pearson Education.

Unit-1 Introduction to Database Management System **8 hours**
An overview of database management system, Database System Vs File System, Database system concepts and architecture, data models, schema and instances, data independence and data base language and interfaces, Data definitions language, DML, Overall Database Structure.
Unit-2 Entity Relationship Model **8 hours**
An overview of database management system, Database System Vs File System, Database system concepts and architecture, data models, schema and instances, data independence and data base language and interfaces, Data definitions language, DML, Overall Database Structure.
Unit-3 Relational Model and SQL Query **8 hours**
Relational data model concepts, integrity constraints, entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus. Introduction on SQL, Characteristics of SQL, advantage of SQL. SQl data type and literals. Types of SQL commands. SQL operators and their procedure. Tables, views and indexes. Queries and sub queries. Aggregate functions. Insert, update and delete operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PLSQL.

Unit-4 Normalization	**8 hours**
Normalization: Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, Alternative approaches to database design.	
Unit-5 Overview of Transaction Management and Concurrency Control	**8 hours**
Overview of Transaction Management: ACID Properties, Transactions and Schedules, Concurrent Execution of transaction, Lock Based Concurrency Control, Performance Locking, Transaction Support in SQL, Introduction to Crash recovery. **Concurrency Control:** Serializability, and recoverability, Introduction to Lock Management, Lock Conversions, Dealing with Dead Locks, Specialized Locking Techniques, Concurrency without Locking.	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Programming in Python				
Course Code	MCA9001				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		0	0	4	2

Course Objectives:

The objective of this course is to:

1. Learn basic programming constructs –data types, decision structures, control structures in python.
2. Know how to use libraries for string manipulation and File handling.
3. Learn to use in-built data structures in python – Lists, Tuples, Dictionary.
4. Learn the fundamental principles of Object-Oriented Programming.
5. Solve problems through application of OO concepts and using Files/database

Course Outcomes

CO1	Gain knowledge of Basic Programming with Python.
CO2	Familiarize with python string handling techniques and user defined functions.
CO3	Understand and use data structures like Lists, tuples and dictionaries.
CO4	Understand File handling and object oriented programming techniques
CO5	Understanding integration of database with python and develop applications using databases.

Text Book (s)

1. Tony Gaddis, Starting Out with Python, 3rd edition, Pearson
2. Y. Daniel Liang, Introduction to Programming Using Python, Pearson
3. Budd T A, Exploring Python , 2011, Tata McGraw Hill Education
4. Learning Python, Fourth Edition, Mark Lutz, O'Reilly publication

Reference Book (s)

1. Downey, Allen B., Think Python: How to Think Like a Computer Scientist. O'Reilly, 2012. Obtain free PDF at http://www.greenteapress.com/thinkpython/
2. Python Programming: An Introduction to Computer Science (Second Edition) John Zelle, ISBN 978-1-59028-241-0-9, Franklin, Beedle& Associates Inc., 2004.

Unit-1 Introduction **8 hours**

Python3: Features of Python3, Environmental setup, --Installation of Pycharm and tools required for running python --Python 3.x vs Python2.x--Basic Types—
Variable types and operators : Assigning values to variables --Multiple Assignments
--Standard Data Types

- Number
- String
- List
- Tuple
- Dictionary

---Set---Map--Single line comments using #--Multi-line comments using triple quote --Data Type Conversion Operators:
Types of Operator:

- Arithmetic operators
- Comparison Operators
- Assignment Operators
- Logical Operators
- Bitwise Operators
- Membership Operators
- Identity operators

Conditional statement: If statement, If –else statement, Nested If statement, Nested If-else statement, For Loop-While Loop-For loop and while loop with else-Pass-Break continue
Unit-2 Number and List **8 hours**
Accessing values in List-Delete,update List element-Basic List operations-Indexing, Slicing and Matrixes-Built in methods and Functions for List-Accessing values in Tuple-Delete, List element-Basic Tuple operations-Indexing, Slicing and Matrixes-Built in methods and Functions for Tuple
Unit-3 Dictionary, and Function **8 hours**
Accessing values in Dictionary-Updating Dictionary-Deleting Dictionary –elements-Properties of Dictionary keys-Built in Dictionary Functions and Methds Defining Function-Calling function- Pass by reference vs value-Function Arguments-Required arguments-Keyword arguments-Default arguments-Variable-length arguments-Recursion
Unit-4 Date and Time **&** Modules and Packages **8 hours**
Tick-Getting Current time-Getting Formatted Time-Getting calendar for Month-The Time Module and its functions-Calendar modules and its functions-Other modules and Functions Sum and Difference f time and date Import -From--- import statement-From--- import* statement-Executing modules as script Locating Modules-PYTHONPATH variable-Dir() function-Global and Local functions-Reload function-Packages in Python
Unit-5 File Input-output **&** Exception handling **8 hours**
Input function-Opening and closing files-The open Function-The File Object Attributes-The close method-Reading and Writing methods-Uniform reading and writing-Random reading and writing-File Positions-Renaming and Deleting files-Remove Method- Directories in python- Mkdir, chdir, rmdir- File and Directory related methds Exception handling and assertions-Standard Exceptions-Assertions in Python-Handling an exception-Except clause with no exception-Except Clause with multiple exception-Try-Finally Clause-Argument of an Exception-Raising an Exception

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	-	50	100

Name of The Course	Introduction to Internet of Things			
Course Code	MCAS1256			
Prerequisite	None			
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

The objective of this course is to:

1. Explain in a concise manner how the general Internet as well as Internet of Things works.
2. The focus will be more on the possibilities offered by the different technologies, and on the creative thinking techniques.
3. To find innovative applications of combinations of such technologies in real-life scenarios.

Course Outcomes

CO1	Describe terminology, technology and applications of IOT.
CO2	Illustrate the concept of M2M (machine to machine) with necessary protocols.
CO3	Illustrate the constraints and opportunities of wireless and mobile networks for Internet of Things.
CO4	Describe the need of IoT, deployment challenges and characteristics of the IoT.
CO5	Identify the ethical challenges and privacy requirement in implementing web based services for IoT.

Text Book (s)

1. Internet of Things (A Hands-on-Approach) , Vijay Madisetti , ArshdeepBahga, University Press, First Edition, 2014.

Reference Book (s)

1. Internet of Things: Principles and Paradigms edited by RajkumarBuyya, Amir VahidDastjerdi, Morgan Kaufmann, First Edition, 2016.
2. Recent research/white papers**.**

Unit-1 Introduction **8 hours**
Defining IoT, Characteristics of IoT ,Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs, Smart Objects: Sensors and actuatorsLCD, LED, PIR, IR Ultrasonic, Temperature , humidity, pressure, gas, bluetooth,GSM,Zigbee, etc
Unit-2 IoT& M2M **8 hours**
IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, and SNMP NETOPEER.
Unit-3 WIRELESS SENSOR NETWORKS AND THE INTERNET OF THINGS **8 hours**
Introduction of wireless sensor networks, wireless sensor network applications, security integration challenges, integration approaches, the TCP/IP solution issues
Unit-4 ENABLING TECHNOLOGIES, PROTOCOLS, AND APPLICATIONS **8 hours**
Market opportunity, IOT architecture, IoT Elements, IoT common standards, QoS criteria, IoT challenges and future directions
Unit-5 IoT Ethics and Privacy **8 hours**
Ethical Challenges of the Internet of Things, Privacy matters in the ‘internet of things, The Importance of the Internet of Things (IoT) in Society,Fog Computing Industrial IOT.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	**Operating Systems**			
Course Code	MCAS2120			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives:

The objective of this course is to:

1. Learn fundamental operating system abstractions such as processes, threads, files, Semaphores, IPC abstractions, shared memory regions, etc.,
2. Learn how the operating system abstractions can be used in the development of application programs, or to build higher level abstractions,
3. Learn how the operating system abstractions can be implemented,
4. Learn the principles of concurrency and synchronization, and apply them to write correct concurrent programs/software,
5. Learn basic resource management techniques (scheduling, time management, space management) and principles and how they can be implemented. These also include issues of performance and fairness objectives, avoiding deadlocks, as well as security and protection.

Course Outcomes

CO1	Understand functions and services of Operating system and identify the use of system calls.
CO2	Understand different type of CPU Scheduling Algorithm.
CO3	Understand process concept and synchronization of concurrent processes.
CO4	Understand classical problems of concurrent processes and their solution.
CO5	Understand concept of deadlock in system and its methods of handling deadlocks

Text Book (s)

1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley
2. D M Dhamdhere, "Operating Systems : A Concept based Approach", 2nd Edition

Reference Book (s)

1. Sibsankar Halder and Alex A Aravind, "Operating Systems", Pearson Education
2. Harvey M Dietel, " An Introduction to Operating System", Pearson Education
3. D M Dhamdhere, "Operating Systems : A Concept based Approach", 2nd Edition

Unit-1 Fundamentals Concepts of OS **8 hours**
Introduction – Types of Operating Systems – I/O structure – Dual–mode operation – Hardware protection – General system architecture.
Unit-2 Process Management **12 hours**
Process Management: Process concept – Concurrent process scheduling concepts – CPU scheduling – Scheduling algorithms, Multiple processors Scheduling – Critical section – Synchronization hardware – Semaphores, classical problem of synchronization, lnterprocess communication. Deadlocks: Characterization, Prevention, Avoidance and Detection.
Unit-3 Memory Management **8 hours**
Storage management – Swapping, single and multiple partition allocation – paging – segmentation – page segmentation, virtual memory – demand paging – page replacement and algorithms, thrashing. Secondary storage management – disk structure – free space management – allocation methods – disk scheduling – performance and reliability improvements – storage hierarchy
Unit-4 I/O Control and Information Management **8 hours**
Files and protection – file system organisation – file operations – access methods – consistency semantics – directory structure organisation – file protection – implementation issues – security encryption.
Unit-5 Case Study **2 hours**
UNIX , Linux and Windows XP operating systems.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	**Programming in Java**			
Course Code	MCAS2130			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives:

1. The aim of the course is to introduce students Core Java Concepts and to teach students the basic concepts of Java programming.
2. This course covers preliminaries, I/O streaming and file handling and teach students how to programme applets in Java, networking and allow the students to implement effectively remote method invocation (industrial java) to understand applets.
3. There are programs that can be embedded in a Web page and accessed over the Internet with database access (may be remote database).

Course Outcomes

CO1	Understand basic concepts of Java Programming
CO2	At the end of the course the student will be able to write efficiently the java programs
CO3	To design and develop various Exeception Handling Process.
CO4	Can develop applets, able to access database with JDBC, work with networking protocols using java with attractive GUI

Text Book (s)

1. R. Naughton and H. Schildt – Java2 (The Complete Reference) – Fifth Edition – TMH – 2004.

Reference Book (s)

1. K. Arnold and J. Gosling – The Java Programming Language – 3rd Edition., Pearson Edu, 2005
2. David Flanagan – Java in a Nutshell: A Desktop Quick Reference for Java Programmers – O'Reilly & Associates, Inc. 1999
3. Bruce Eckel –Thinking in Java – Prentice Hall, 2nd Ed 2002.

Unit-1 Introduction **8 hours**
Object oriented fundamentals, Features of Java, Java Virtual Machine (JMV), Byte-Code ,JAVA buzzwords, JAVA Environments, Command Line Arguments, Java program structure, Reserved keywords, Identifiers, Literals, Operators, Separators, Variables, Declaring a variable, Scope and lifetime of variables, Data types, Control Statements.
Unit-2Class and Methods **8 hours**
Arrays: One-Dimensional Arrays, Two-dimension Array, Strings, String Handling, Vectors, Wrapper Classes.Class :Fundamentals ,The General Form of a Class ,A Simple Declaring Objects ,Assigning Object Reference Variables. Methods: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing ,Returning Objects, Recursion Introducing Access Control, Overriding Methods, Final Variables and Methods, Final class, Finalizer Methods, Abstract Methods and Class, Visibility Control.
Unit-3Packages and Interface **8 hours**
Inheritance : basic ,Types of Inheritance, Member Access, Creating a Multilevel Hierarchy, When Constructors Are Called Method Overriding ,Dynamic Method Dispatch ,Why Overridden Methods?, Applying Method Overriding, Using Abstract Classes, Using final with Inheritance, Using final to Prevent Overriding . Using final to Prevent Inheritance, Object Class, Packages and Interfaces.
Unit-4Multithreading and Exception Handling **8 hours**
Exception Handling: Exception as Objects, Exception hierarchy, Try, Catch, Finally, Throw. Multi-threading: Creating threads, Thread Life Cycle, Main Thread, Multiple Threads ,Isalive() and join() ,Simple thread program ,Threads Priorities, Thread synchronization.
Unit-5 Applet Programming **8 hours**
Applet Programming: Local and remote applets, Building Applets Code, Applet Life Cycle, Creating an Executable Applet, Designing a web page, Applet Tag, , Passing parameters to Applets, AWT, Graphic Programming: Graphic Class, Drawing lines, Arcs, Rectangles, Polygon, Ellipse, Circle. I/O file in JAVA,: Stream Classes, Byte Stream Classes, Character Stream Classes and Stream Benefits.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Algorithm Analysis & Design			
Course Code	MCAS2140			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

To introduce students, the concepts of algorithm analysis for find out the space and time complexity of different algorithms. Different design techniques such as greedy method, divide and conquer, backtracking, dynamic programming, branch and bound are to be studied for finding the solution to the different problems. It also provides an insight into the basic concepts of NP and NP-hard problems and their relevance in research.

Course Outcomes

CO1	Ability to analyze the performance of algorithms
CO2	Ability to choose appropriate algorithm design techniques for solving problems
CO3	Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs.
CO4	To clear up troubles the usage of set of rules design methods including thegrasping approach, divide and overcome, dynamic programming, backtracking and department and certain
CO5	To understand the variations among tractable and intractable problems.

Text Book (s)

T. Cormen, C.E. Leiserson, R.L. Rivest& C. Stein – Introduction to Algorithms – PHI – 2nd Edition, 2005

Reference Book (s)

1. Knuth E. Donald, Art of Computer Programming Sorting and Searching Vol3, Second Edition, Pearson Education.
2. Brassard Bratley, “Fundamental of Algorithms”, PHI
3. A V Ahoetal, “The Design and analysis of Algorithms”, Pearson Education
4. Adam Drozdek, “Data Structures and Algorithms in C++”, Thomson Asia

Unit-1 Introduction to Algorithms **8 hours**
Introduction to Algorithms & Analysis- Mathematical Preliminaries , Design of Algorithms, Growth of function, Complexity of Algorithms, Asymptotic Notations, Recurrences. **Sorting:** Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Radix sort, Bucket Sort, Counting sort, Sorting in linear time, Medians and order statistics.
Unit-2 Advance Data Structure **8 hours**
Advanced Data Structure: Binary Search Trees, Red Black Trees, Augmenting Data Structure Binomial Heap, B-Tree, Fibonacci Heap, and Data Structure for Disjoint Sets, Union-find Algorithm, Dictionaries and priority Queues.
Unit-3 Advance Design and Analysis Techniques **8 hours**
Advanced Design and Analysis Techniques: Dynamic programming, Greedy Algorithm, Backtracking, Branch-and-Bound, Amortized Analysis
Unit-4 Graph Algorithms **8 hours**
Graph Algorithms: Elementary Graph Algorithms, Breadth First Search, Depth First Search, Minimum Spanning Tree, Kruskal’s Algorithms, Prim’s Algorithms, Single Source Shortest Path, All pair Shortest Path, Maximum flow and Traveling Salesman Problem
Unit-5 Special Topics in AAD **8 hours**
Randomized Algorithms, String Matching, NP-Hard and NP-Completeness Approximation Algorithms, Sorting Network, Matrix Operations, Polynomials & FFT, Number Theoretic Algorithms.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Software Engineering				
Course Code	MCAS2150				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

1. Develop complex systems (including analysis, design, construction, maintenance, quality assurance and project management) using the appropriate theory, principles, tools and processes.
2. Use appropriate computer science and mathematics principles in the development of software systems.
3. Solve problems in a team environment through effective use of written and oral communication skills.
4. Have knowledge of current issues presently involved in effectively performing duties as a software practitioner in an ethical and professional manner for the benefit of society.
5. Practice the lifelong learning needed in order to keep current as new issues emerge.
6. Develop software in at least one application domain.

Course Outcomes:

CO1	The ability to apply software engineering theory, principles, tools and processes, as well as the theory and principles of computer science and mathematics, to the development and maintenance of complex software systems.
CO2	The ability to design and experiment with software prototypes.
CO3	The ability to select and use software metrics.
CO4	The ability to participate productively on software project teams involving students from both software engineering and other majors.
CO5	Effective communications skills through oral and written reports and software documentation evaluated by both peers and faculty

Text Book (s)

1.R. S. Pressman, Software Engineering: A Practitioners Approach, McGraw Hill

Reference Book (s)

1. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
2. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International
3. Publishers.
4. S. Desikan and G. Ramesh, “Software Testing: Principles and Practices”, Pearson Education.
5. Aditya P. Mathur, “Fundamentals of Software Testing”, Pearson Education.
6. Naik and Tripathy, “Software Testing and Quality Assurance”, Wiley

Unit-1 Introduction **8 hours**
Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models, Selection of Software Process models.
Unit-2 Requirement Engineering Process **8 hours**
Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS. **Software Quality Assurance (SQA):** Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.

Unit-3Software Design	**8 hours**
Software design, Abstraction, Modularity, Software architecture, Effective modular design, Cohesion and Coupling, Architectural design and procedural design, Data flow oriented design, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures. **Design Strategies:**Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. **User Interface Design:** User Interface design, Human factors, Human computer interaction, Human, Computer interface design, Interface design, Interface standards.	
Unit-4 Coding & Testing	**8 hours**
Coding: Language classes, Structured Programming, need for structured programming, Coding standards, Coding style, Maintainability of programs, Code documentation – Code efficiency **Testing :**Software testing , Testing Objectives, Levels of testing– Unit Testing, Integration Testing, ystem testing, Acceptance Testing, Path testing – Control structures testing –Verification vs Validation and system testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom-Up Testing , Incremental vs Nonincremental testing. **Strategies:** Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suite Preparation, Alpha and Beta Testing of Products. **Static Testing Strategies:** Formal Technical Reviews (Peer Reviews), Walk Through, Code Inspection, Compliance with Design and Coding Standards. **Software Measurement and Metrics:** Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Bang Metrics, Cyclomatic Complexity Measures: -Control Flow Graphs, DD Graph.	
Unit-5 Maintenance	**8 hours**
Maintenance: Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re- Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	**Computer Networks**				
Course Code	MCAS2160				
Prerequisite					
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

To produce a core knowledge of networking concepts and techniques to design simple network, provide in-depth knowledge about the various communication technology and enable the student to understand how information are transmitted in networks. To introduce the students the concepts of wireless communications and various applications in computer networks.

Course Outcomes:

CO1	To develop knowledge about physical structure of computer network
CO2	To analysis the problem in different layer during the communication in network
CO3	To identify the security issue in network during the data transfer
CO4	Able to understand the connection management in network at transport layer
CO5	To develop the knowledge about congestion control over the network during the data transmission

Text Book (s)

1. L. L. Peterson and B. S. Davie, Computer Networks: A Systems Approach, 4th Ed, Elsevier India,
2. A. S. Tanenbaum, Computer Networks, 4th Ed, Pearson India

Reference Book (s)

1. Forouzen, "Data Communication and Networking", TMH
2. A.S. Tanenbaum, Computer Networks, Pearson Education
3. W. Stallings, Data and Computer Communication, Macmillan Press
4. S. Keshav, An Engineering Approach to Computer Networking, 1st Ed, Pearson India, 1999.
4. J. F. Kurose and K. W. Ross, Computer Networking: A Top Down Approach, 3rd Ed, Pearson India, 2005

Unit-1 Introduction	**8 hours**
Terminology used in Computer Networks, Evolution of computer networks, Goals and Applications of Networks, Basic communications model, types of Connections, Network structure and architecture, The OSI reference model, services, Network Topology Design - Delay Analysis, Back Bone Design, Local Access Network Design,– Transmission Media–Coaxial Cable–Fiber Optics–Line Coding – Modems – RS232 Interfacing sequences, Switching methods, ISDN, Terminal Handling.	
Unit-2 Data Link Layer	**8 hours**
Framing, HDLC, PPP, sliding window protocols, medium access control, Token Ring, Wireless LAN; Virtual circuit switching: Frame relay **MAC Sub Layer:** Channel Allocations, LAN protocols: ALOHA protocols - Overview of IEEE standards - FDDI. Data Link Layer - Elementary Data Link Protocols, Error Handling: Parity – LRC– CRC– Hamming code. Flow Control: stop and wait – go back-N ARQ – selective repeat ARQ- sliding window– HDLC.- LAN-Ethernet IEEE 802.3-IEEE 802.4 - IEEE 802.5 - IEEE 802.11– FDDI- SONET– Bridges.	
Unit-3 Network Layer	**8 hours**
Network Layer - Point-to-Pont Networks, routing, Congestion control, Internetworking: – Packet Switching and Datagram approach, IP addressing methods: Subletting, Routing, Distance Vector Routing, Link State Routing, Structure of a router. TCP / IP, IP packet, IPv4, IPv6.	
Unit-4 Transport Layer	**8 hours**
Design issues, **Duties of transport layer:** Multiplexing, De-multiplexing, connection management, Sockets, User Datagram Protocol (UDP),Transmission Control Protocol (TCP), Congestion Control, Quality of services (QOS), TCP Window Management. Integrated Services.TCP RTT estimation, Overlay Networks. **Session Layer:** Design issues, remote procedure call. **Presentation Layer:** Design issues, Data compression tech	

Unit-5	**8 hours**
File Transfer, Access and Management, Electronic mail, Virtual Terminals, Other application. Example Networks: Internet and Public Networks. Domain Name Space (DNS), SMTP, FTP, HTTP, WWW, Peer-to-peer file sharing networks **Security:** Symmetric & Public Cryptography, RSA, Digital Signature, Hash Functions, IP Security, Web Security, System Security	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Cryptography and Network Security				
Course Code	MCAS2210				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand Cryptography Theories, Algorithms and Systems.
2. To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

Course Outcomes:

CO1	Understand OSI security architecture and classical encryption techniques.
CO2	Acquire fundamental knowledge on the concepts of finite fields and number theory
CO3	Understand various block cipher and stream cipher models
CO4	Describe the principles of public key cryptosystems, hash functions and digital signature
CO5	Ability to understand the current legal issues towards information security

Text Book (s)

1. Cryptography and Network Security – Principles and Practice: William Stallings, Pearson Education, 6 th Edition
2. Cryptography and Network Security : Atul Kahate, Mc Graw Hill, 3rd Edition

Reference Book (s)

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security : Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH
5. Introduction to Network Security: Neal Krawetz, Cengage Learning
6. Network Security and Cryptography: Bernard Menezes, Cengage Learning

Unit-1Security Concepts **8 hours**
Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.
Unit-2 Symmetric key Ciphers **8 hours**
Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4. Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.
Unit-3 Cryptographic Hash Functions **8 hours**
Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme. Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure
Unit-4 Transport-level Security **8 hours**

Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH) Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security
Unit-5 E-Mail Security **8 hours**
Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, **Authentication** Header, Encapsulating security payload, combining security associations, Internet Key Exchange Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Data warehousing and mining				
Course Code	MCAS2220				
Prerequisite	Data Base Management System.				
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

1. Understand the Concept of data warehousing.
2. Understand the multidimensional data storage for system.
3. Learn OLAP techniques for data analysis.
4. Decision making through Hypothesis Testing.
5. Make students understand the knowledge discoveries in database.
6. Learn data mining techniques.

Course Outcomes:

CO1	Knowledge about design issues of data warehousing
CO2	Learn various mining tools.
CO3	Identification of the real time problems and able to design solution using various mining tools.
CO4	Prediction of AI techniques.
CO5	Classification of machine learning algorithm.

Text Book (s)

1. Data Mining- Concepts & Techniques; Jiawei Han &MichelineKamber- 2001, Morgan Kaufmann.
2. Data Mining Techniques; ArunPujar; 2001, University Press; Hyderbad.

Reference Book (s)

1. Data Mining; Pieter Adriaans&DolfZantinge; 1997, Pearson,
2. Data Warehousing, Data Miniing and OLTP; Alex Berson, 1997, McGraw Hill.
3. Developing the Data Warehouses; W.H Ionhman,C.Klelly, John Wiley & Son.
4. Building the Data Warehouse; W.H. Inman, 1996, John Wiley & Sons.

Unit-1 Introduction to Data Warehousing and Data Mining **8 hours**
Data warehousing Definition, usage and trends. DBMS vs data warehouse, Data marts, Metadata, Multidimensional data mode, Data cubes, Schemas for Multidimensional Database: stars, snowflakes and fact constellations.
Unit-2 Data Warehousing concepts and ETL process **8 hours**
Data warehouse implementation, computation of data cubes, modeling OLAP data, OLAP queries manager, data warehouse back end tools, complex aggregation at multiple granularities, tuning and testing of data warehouse, ETL process.
Unit-3 Business Analysis **8 hours**
Business Analysis. Reporting & Query Tools & Applications. On line Analytical processing(OLAP). Patterns & Models. Statistics. Artificial Intelligence. Data mining definition & task, KDD versus data mining, data mining techniques, tools and applications.
Unit-4 Data Mining Techniques **8 hours**
Data mining query languages, data specification, specifying knowledge, hierarchy specification, pattern presentation & visualization specification, data mining languages and standardization of data mining. Data mining techniques: Association rules, Clustering techniques, Decision tree.
Unit-5 Miscellaneous topics **8 hours**
Mining complex data objects, Spatial databases, Multimedia databases, Time series and Sequence data; mining Text Databases and mining Word Wide Web.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Compiler Design				
Course Code	MCAS2230				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

1. To learn the various phases of compiler.
2. To learn the various parsing techniques.
3. To understand intermediate code generation and run-time environment.
4. To learn to implement front-end of the compiler.
5. To learn to implement code generator.

Course Outcomes

CO1	Understand the different phases of compiler.
CO2	Design a lexical analyzer for a sample language
CO3	Apply different parsing algorithms to develop the parsers for a given grammar.
CO4	Learn to implement code optimization techniques and a simple code generator.
CO5	Design and implement a scanner and a parser using LEX and YACC tools.

Text Book (s)

Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools, Second Edition, Pearson Education, 2009.

Reference Book (s)

1. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, Advanced Compiler Design and Implementation, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Keith D Cooper and Linda Torczon, Engineering a Compiler, Morgan Kaufmann Publishers Elsevier Science, 2004.
4. V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers, 2010.
5. Allen I. Holub, Compiler Design in C, Prentice-Hall Software Series, 1993.

Unit-1 Introduction	**8 hours**
Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering –Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Minimizing DFA.	
Unit-2	**8 hours**
Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar –Top Down Parsing – General Strategies Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item Construction of SLR Parsing Table -Introduction to LALR Parser – Error Handling and Recovery in Syntax Analyzer-YACC.	
Unit-3	**8 hours**
Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.	
Unit-4	**8 hours**
Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management – Issues in Code Generation – Design of a simple Code Generator.	
Unit-5	**8 hours**
Principal Sources of Optimization – Peep-hole optimization – DAG- Optimization of Basic Blocks-Global Data Flow Analysis – Efficient Data Flow Algorithm.	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Open Source Programming with Python			
Course Code	MCAS2240			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

The objective of this course is to:

1. Learn basic programming constructs –data types, decision structures, control structures in python.
2. Know how to use libraries for string manipulation and File handling.
3. Learn to use in-built data structures in python – Lists, Tuples, Dictionary.
4. Learn the fundamental principles of Object-Oriented Programming.
5. Solve problems through application of OO concepts and using Files/database.

Course Outcomes

CO1	Gain knowledge ofBasic Programming with Python.
CO2	Familiarize with python string handling techniques and user defined functions.
CO3	Understand and use data structures like Lists, tuples and dictionaries.
CO4	Understand File handling and object oriented programming techniques.
CO5	Understanding integration of database with python and develop applications using databases.

Text Book (s)

1. Tony Gaddis, Starting Out with Python, 3rd edition, Pearson
2. Y. Daniel Liang, Introduction to Programming Using Python, Pearson
3. Budd T A, Exploring Python , 2011, Tata McGraw Hill Education
4. Learning Python, Fourth Edition, Mark Lutz, O'Reilly publication

Reference Book (s)

1. Downey, Allen B., Think Python: How to Think Like a Computer Scientist. O'Reilly, 2012.Obtain free PDF at http://www.greenteapress.com/thinkpython/
2. Python Programming: An Introduction to Computer Science (Second Edition) John Zelle, ISBN 978-1-59028-241-0-9, Franklin, Beedle& Associates Inc., 2004.

Unit-1 Introduction	**8 hours**
History , Features , Working with Python,Installing Python, basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; Arithmetic and Logical operators and Boolean expressions.Debugging, comments in the program; understanding error messages; Catching exceptions using try and except.Built-in functions – type(), id(), eval(), random, chr(), ord(); Conditional Statements: If, If-else, Nested if-else; Looping: For, While, Nested loops;Control Statements: Break, Continue, Pass;	
Unit-2 Function and Strings	**8 hours**
Functions in Python: Defining a function, Calling a function, Types of functions, Function Arguments, Global and local variables. String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa.	
Unit-3 Lists, Tuples and Dictionaries	**8 hours**
Basic List operators, iterating over a list,replacing, inserting, removing an element; searching and sorting lists,calculating the sum and average of items in a list; Tuples - sequence of values , immutability, Comparing tuples, Tuple assignment: Dictionary- Store data as key-value pairs in dictionaries, search for values, change existing values, add new, key-value pairs, and delete key-value pairs, nesting objects, sorting, dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries	

Unit-4 Files and Regular Expressions and Object Oriented Programming and Database Connectivity 8 hours
Manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; regular expressions Class, Objects, Class variables, Instance variables, Types of methods, Inheritance, Database Introduction, Connecting to database, Executing queries, Handling error, Sending email
Unit-5 Web Programming 8 hours
Fetching data from html forms, sending automated Email, Cookies, Sessions

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Web Services and Cloud Computing			
Course Code	MCAS2250			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

1. To study the importance of virtualization.
2. To study the cloud delivery models
3. To study the cloud deployment models.
4. To Study Cloud security and applications

Course Outcomes:

CO1	Learn knowledge of Cloud Computing.
CO2	Understand cloud computing delivery models.
CO3	Understand briefly cloud computing deployment models
CO4	Understand briefly cloud computing by deploying application on cloud.
CO5	Understanding of security and workload in cloud

Text Book (s)

1.Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
2.Cloud Computing First Steps: Cloud Computing for Beginners, Ravi Shankar, Navin **Sabharwal, PBC Distributors**
3. Thomas Erl, "Service Oriented Architecture", Concepts, Technology and Design", Prentice Hall of India, 2005

Reference Book (s)
1. Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012
2. Virtualization For Dummies, 3rd HP Special Edition (Bernard Golden)
3. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010 T10: D.Ulman, " Principles of Database and Knowledge base System", Computer Science Press.

Unit-1 Introduction	**8 hours**
Introduction to Web Services, Web service Architecture XML, XSD, DTD, XSLT, Parsers. WSDL- Purpos of WSDL, Types of WSDL, Message Exchange Patterns, Message Exchange Formats. WS- standard, WS Co-ordination, WS- Reliable messaging, WS- policy, JAX-WS, Web Services in .Net , UDDI, SOAP	
Unit-2 Introduction to Cloud Computing	**9 hours**
.Introduction to Virtualization ,Traditional IT Infrastructure, Benefits of Virtualization, Compare. Study of Hypervisors, VM History Cloud Computing, Cloud Benefits, Limitations, challenges; Importance of Virtualization in Cloud, Anatomy of Cloud, Cloud deployment models; Cloud delivery models; Stepping stones for the development of cloud, Grid Computing	
Unit-3 Cloud Models	**10 hours**
Decision Factors for Cloud Implementations, Public, Private and Hybrid Cloud, Infrastructure as a Service (IaaS) Cloud Delivery Model, Platform as a Service (PaaS) , Software as a Service (SaaS)	
Unit-4 Cloud Workloads and Security	**6 hours**

Cloud workload Overview, Workloads most suitable for Cloud, Workloads not suitable for Cloud. Intro to cloud security, Trust, and Privacy
Unit-5 Design & Development of Cloud Applications **6 hours**
Economics of choosing a Cloud platform for an organization based on application requirements, economic constraints and business needs, Applications deployment on Amazon, Microsoft, IBM, Google, Salesforce.com

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	ARTIFICIAL INTELLIGENCE				
Course Code	MCAS3140				
Prerequisite	None				
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

The objective of this course is to learn:

1. To provide a strong foundation of fundamental concepts in Artificial Intelligence
2. To provide a basic exposition to the goals and methods of Artificial Intelligence
3. To enable the student to apply these techniques in applications which involve perception, reasoning and learning.
4. Distinguish between a conventional system and an intelligent system.
5. Artificial Intelligent techniques in solving problems of a particular domain

Course Outcomes

CO1	Understand different types of AI agents and knows various AI search algorithms
CO2	Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving .
CO3	Know how to build simple knowledge-based systems
CO4	Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information
CO5	Ability to apply knowledge representation, reasoning, and machine learning techniques to real-world problems

Text Book (s)

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 2nd Edition, Pearson Education / Prentice Hall of India, 2004.

Reference Book (s)

1.Elaine Rich and Kevin Knight, "Artificial Intelligence", 2nd Edition, Tata McGraw- Hill, 2003

Unit-1 Introduction **8 hours**
Various definitions of AI, Introduction to AI applications and AI techniques, Production systems, control strategies, reasoning - forward & backward chaining Intelligent agents – agents and environments - good behavior – the nature of Environments –structure of agents - Problem Solving - problem solving agents – example problems – searching for solutions – uniformed search strategies – avoiding repeated states – searching with partial information.
Unit-2 Searching Techniques **8 hours**
Informed search and exploration – Informed search strategies – heuristic function – local search algorithms and optimistic problems – local search in continuous spaces – online search agents and unknown environments - Constraint satisfaction problems (CSP) – Backtracking search and Local search for CSP – Structure of problems - Adversarial Search – Games – Optimal decisions in games – Alpha – Beta Pruning – imperfect real-time decision – games that include an element of chance.
Unit-3 Knowledge Representation **8 hours**
First order logic – representation revisited – Syntax and semantics for first order logic – Using first order logic – Knowledge engineering in first order logic - Inference in First order logic –prepositional versus first order logic – unification and lifting – forward chaining – backward chaining - Resolution - Knowledge representation – Ontological Engineering - Categories and objects – Actions - Simulation and events - Mental events and mental objects
Unit-4 Learning **8 hours**
Learning from observations - forms of learning - Inductive learning - Learning decision trees -Ensemble learning - Knowledge in learning – Logical formulation of learning – Explanation based learning – Learning using relevant

information – Inductive logic programming - Statistical learning methods - Learning with complete data – Learning with hidden variable - EM algorithm - Instance based learning - Neural networks - Reinforcement learning – Passive reinforcement learning
Unit-5 Uncertainty **8 hours**
Different types of uncertainty - degree of belief and degree of truth, various probability constructs - prior probability, conditional probability, probability axioms, probability distributions, and joint probability distributions, Bayes' rule, other approaches to modeling uncertainty such as Dempster-Shafer theory and fuzzy sets/logic

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	**Big Data Technologies & Analytics**				
Course Code	MCAS3110				
Prerequisite	Data Warehousing and Data Mining				
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

The objective of this course is to:

1. Understand concepts of big data
2. Understand the architecture of Hadoop.
3. Learn types of analytics and techniques.
4. Make students understand different clustering techniques
5. Learn Hadoop and NoSQL

Course Outcomes:

CO1	Students should know about design issues of Hadoop Architecture.
CO2	Students should learn various techniques for big data analytics.
CO3	Students able to identify the real time problems and able to design solution using various big data analytics techniques.
CO4	Students use prediction of supervised and unsupervised learning.
CO5	Students can use classification of clustering algorithms

Text Book (s)

1. Seema Acharya ,Subhashini Chellappan ,"Big Data and Analytics (WIND)", Wiley, ISBN: 8126554789, 2015.
2. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2015.
3. Chris Eaton, Dirk deroos et al. , "Understanding Big data ", McGraw Hill, 2012.
4. Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", Wiley, 2014.

Reference Book (s)

1. Tom White, "HADOOP: The definitive Guide" , O Reilly 2012. 6 IT2015 SRM(E&T)
2. VigneshPrajapati, "Big Data Analytics with R and Haoop", Packet Publishing 2013.
3. Tom Plunkett, Brian Macdonald et al, "Oracle Big Data Handbook", Oracle Press, 2014.
4. Jay Liebowitz, "Big Data and Business analytics",CRC press, 2013.

Unit-1 Introduction to Big Data **8 hours**
Classification of Digital Data, Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Classification of Analytics , Top Challenges Facing Big Data, Responsibilities of data scientists, Big data applications in healthcare, medicine, advertising.
Unit-2 Hadoop Architecture **8 hours**
Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance, Managing Resources and Applications with Hadoop YARN. Interacting with Hadoop Ecosystem. Introduction to Hive, Introduction to Pig.

Unit-3 Introduction to NoSQL & Hadoop **8 hours**
Introduction to NoSQL Advantages of NoSQL, SQL versus No SQL, Introduction to Hadoop, Features of Hadoop, Hadoop Versions, Hadoop Ecosystems, Hadoop Distributions, Hadoop Versus SQL
Unit-4 Types of Analytics & Techniques **8 hours**
Open source technology for Big Data Analytics – cloud and Big Data – Mobile Business Intelligence and Big Data – Crowd Sourcing Analytics – Inter- and Trans-Firewall Analytics In-Memory Analytics, In-Database Processing, Symmetric Multiprocessor System, Massively Parallel Processing, Shared Nothing Architecture, Open source Analytical Tools, Sampling Techniques, Data classification, Tabulation, Frequency and Graphic representation, Measures of central value - Arithmetic mean, Geometric mean, Harmonic mean, Mode, Median, Regression Analysis, Correlation analysis.
Unit-5 Predictive Analysis **8 hours**
Predictive Analytics, Supervised, Unsupervised learning, Clustering Techniques, Hierarchical, K- Means, Basics of R, Working of R - Creating, listing and deleting the objects in memory - The on-line help Data with R Objects, R data Frames and Matrices, Reading data in a file , Saving data, Generating data, Manipulating objects Graphics with R Managing graphics , Graphical functions

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Mobile Application Development				
Course Code	MCAS3120				
Prerequisite	XML, Java				
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

1. Basics of Android OS
2. Develop Basic and advance Android Apps
3. Publishing and Monetizing the app

Course Outcomes

CO1	Understand about Android OS and its Development Environment
CO2	Concept of concepts of android application development, user interface design, shared preferences.
CO3	DevelopBasic and advance android app development for android devices.
CO4	Publish the app
CO5	Monetize from app development.

Text Book (s)

1. W.M Lee, "Begning Android 4 Application Development",Wiley
2. Retro Meier,"Android 4 Application Development",Wiley

Reference Book (s)

1. B. Phillips et al., Android Programming: Big Nerd Ranch Guide (as mentioned above);
2. Christian Keur and Aaron Hillegass, iOS Programming: The Big Nerd Ranch Guide, 6th edition, 2016;
3. Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design and Development, Prentice Hall, 2004;
4. Tomasz Nurkiewicz and Ben Christensen, Reactive Programming with RxJava, O'Reilly Media, 2016;
5. Raoul-Gabriel Urma, Mario Fusco, and Alan Mycroft, Java 8 in Action: Lambdas, Streams, and Functional-Style Programming, Manning Publications, 2015;

Unit-1 Introduction and Architecture of Android **5 hours**
History of Android, Features of Android, Android Devices, Android Versions, Open Handset Alliance (OHA) , Advantages of Android, Comparing Android with other platform, Architecture of Android. Android Directory Structure, Structure of Manifest files, Android Development Tools.
Unit-2 User Interfaces **10 hours**
Views, Views Group, Widgets - Button, EditText, CheckBox, TextView, ToggleButton, Layouts, Styles, Themes, Orientation, Screen Size and Density, Unit of measurement - px, dp, sp and dpi,pt, conversion of dp to px
Unit-3 Component s of Android **10 hours**
Activities, Activity life cycle,Intents, types of intents, Intent Filter, Fragment, fragment lifecycle, Services, Broadcast receivers, Content providers, Starting a new activity, Sending and Receiving of data.
Unit-4 Advance App Development **10 hours**
SQLite database, Cursors and content values, Opening and closing Database, Sensors, Bluetooth, GeoLocation, SMS & MMS, Graphics and Animation
Unit-5 Security, Publishing, Monetizing **5 hours**
Security Creating a signing certificate, Signing your applications for distribution, Publishing on Google Play, Monetization strategies, Application promotion strategies, Using Google Analytics

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Computer Graphics			
Course Code	MCAS3130			
Prerequisite	C-Programming			
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

1. To impart technological aspects of graphics problem solving through computer.
2. To lay foundation for the two and three dimensional computer graphics problem solving.
3. Introducing students the interdisciplinary nature of computer graphics with wide variety of applications and examples.
4. To lay foundation for animation, cartoon movie, presentation software, video games and GUI software development specially in coding.

Course Outcomes

CO1	Learn and understand the concept of graphics, graphics system and its components.
CO2	Learning concept of graphical device handling.
CO3	Understanding the fundamentals of graphics problem solving and able to implement graphics package and also write algorithms for graphics drawing.
CO4	Develop GUI applications, Video games and other software with high level abstractions.
CO5	Develop graphics routines for text handling and apply them to write programs/software.

Text Book (s)

1. Harrington S: "Computer Graphics - A Programming Approach", 2nd Edn. Mc GrawHill.

Reference Book (s)

1. Donald Hearn and M Pauline Baker, “Computer Graphics C Version”, Pearson Education
2. Heam Donald, Pauline Baker M: "Computer Graphics", PHI 2nd Edn. 1995.
3. Shalini Govil-Pai, Principles of Computer Graphics, Springer, 2004**.**

Unit-1 Introduction **8 hours**
Overview of Graphics Systems: Video display devices, Raster-Scan System, Random-Scan Systems. Random-Scan Systems Graphics monitors and work stations. Input devices: Hard copy devices. Graphics software. Output primitives: Line drawing algorithms circle generation algorithms. Ellipse Generating Algorithm. Pixel Addressing. Filled-Area Primitives. Fill Area Function, Cell Array, Character Generation.
Unit-2 Transformation **8 hours**
Attributes of Output Primitives: Line Attributes, Curve Attributes, Colour and Gray-Scale levels. Area-Fill Attributes, Character Attributes. Bundled attributes. Inquiry functions. Two-dimensional geometric transformations: Basic transformations. Homogenous coordinates, composite transformations, other transformations. Affine transformations, transformation functions, Roster methods for transformations.
Unit-3 Viewing and Clipping **8 hours**
Two-dimensional viewing: The viewing pipeline, viewing transformation, viewing functions. Line clipping, Cohen Sutherland line clipping, Liang Barsky line clipping Polygon clipping: Sutherland-Hodgman polygon clipping, Weiler Amerton polygon clipping
Unit-4 3-D Representation **8 hours**
Three Dimensional Concepts: Three Dimensional Display Methods. Three Dimensional Object Representations: Polygon surfaces, curved line and surfaces, spline representations, Bezier Curves & Surfaces, BSP line Curves and Surfaces, Constructive Solid- Geometry Methods, Octrees, BSP trees. Fractal geometry methods.
Unit-5 3-D Transformation **8 hours**
Three Dimensional Geometric and, Modeling Transformations Three Dimensional viewing: Projections Visible Surface Detection Methods: back face detection method, depth buffer method Basic illumination methods: Phong & Gourand Shading, Texture Mapping. Computer Animation: Design of Animation Sequences, General Computer Animation, Raster Animations, Computer-Animation Languages, Key-Frame Systems, Motion Specifications

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Cloud Security				
Course Code	MCAS9110				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

The objective of this course is to:

1. Understand Security Risks/Issues in the Cloud
2. Address -Tools/ Solutions on Security in Cloud

Course Outcomes

CO1	Understand cloud computing, security challenges and risk analysis
CO2	Learn different Policy, Governance, Compliance and Legal Considerations
CO3	Gain Knowledge of Security in Cloud
CO4	Understand Authentication and Authorization
CO5	Understand intrusion detection in the cloud

Text Book (s)

1. The Cloud Security Ecosystem: Technical, Legal, Business and Management Issues

Reference Book (s)

1. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance Tim Mather, Subra Kumaraswamy, Shahed Latif , O'Reilly
2. Cloud Security: A Comprehensive Guide to Secure Cloud Computing
   Ronald L. Krutz, Russell Dean Vines, John Wiley & Sons,

Unit-1 Introduction to Cloud Computing	**8 hours**
Delivery models: Software as a Service (SaaS) - Platform as a Service (PaaS) - Infrastructure as a Service (IaaS) - Cloud types (public, private, hybrid) - Jericho Cloud Cube Model	
Unit-2 Security Challenges and Risk Analysis	**8 hours**
Virtualization and multi-tenancy – Risk management - Risk assessment for cloud migration-Unique SaaS challenges- Cloud Access Security Brokers (CASBs) – Auditing the cloud	
Unit-3 Policy, Governance, Compliance and Legal Considerations	**8 hours**
Internal policy needs - Contract requirements for security-Service-level agreements-Governance models for the cloud. Compliance challenges for the cloud - Legal and geographic jurisdiction - Privacy concerns	
Unit-4 Data and Infrastructure Security in the cloud	**8 hours**
Encryption types and availability - Key management and encryption architectures -Data/information lifecycle – Retention – Disposal – Classification. Patch and configuration management - Change management - Network and virtualization security - Application security for SaaS, PaaS, and IaaS	
Unit-5 Intrusion Detection in the cloud	**8 hours**
Incident detection for different cloud models - Managing Intrusion Detection System/Intrusion Prevention System (IDS/IPS) and alerting - The event management feedback loop	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Cyber Security			
Course Code	MCAS9120			
Prerequisite	Wireless technologies and internet			
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

1. Identify the key components of cyber security network architecture
2. Apply cyber security architecture principles
3. Describe risk management processes and practices

Course Outcomes

CO1	Understand the concept of Data and the information. To know how the information system can be developed keeping in mind the security of data over the internet.
CO2	Knowledge on security threats to the data and Applications developed and the e-commerce like Trojan horses, Worms, Bombs etc.
CO3	Compare Cryptography Algorithms, different categories of Cryptography algorithms
CO4	Analysis of Encryption and Decryption Techniques
CO5	Knowledge of different methods of information Security, Data Security, hardware and software security.

Text Book (s)

1. Schou, Shoemaker, "Information Assurance for the Enterprise", Tata McGraw Hill.

2. CHANDER, HARISH**, "**Cyber Laws And It Protection**"**, PHI Learning Private Limited, Delhi, India

Reference Book (s)

1. Charles P. Pfleeger, Shari Lawerance Pfleeger, "Analysing Computer Security", Pearson Education India.
2. V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.

Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen kumar Shukla ,"Introduction to Information Security and Cyber Law" Willey Dreamtech Press

Unit-1 Introduction to Information System **8 hours**
Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, and Cyber Security
Unit-2 Information Security Threats **8 hours**
Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, and Cyber Security
Unit-3 Cryptography Techniques **8 hours**
Cryptography Algorithms and Techniques- Rail fence Algorithm, RSA Algorithm, Diffie- Hellman Key Exchange Algorithm, Simple Data Encryption Standard (SDES) Algorithm, Caesar Cipher, Hill Cipher, and Play Fair Cipher.
Unit-4 Cryptography Techniques **8 hours**
Application security (Database, E-mail and Internet), Archival Storage and Disposal of Data, Security Technology- Firewall and VPNs, Intrusion Detection, Access Control Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control, Backup Security Measures Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design.
Unit-5 Information Security Policies and Cyber Law **8 hours**
Security Policies, WWW policies, Email Security policies, Policy Review Process-Corporate policies-Sample Security Policies, Publishing and Notification Requirement of the Policies. Information Security Standards-ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law: Copy Right Law, Software License, Semiconductor Law and Patent Law.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Network Security				
Course Code	MCAS9130				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

1. Analyze, implement and maintain security requirements and mechanisms in various computer systems and networks.
2. Explain networking protocols and their hierarchical relationship hardware and software. Compare protocol models and select appropriate protocols for a particular design.
3. Explain common network vulnerabilities and attacks, defense mechanisms against network attacks, and cryptographic protection mechanisms
4. Explain the requirements of real-time communication security and issues related to the security of web services.

Course Outcomes

CO1	Understand the network security, services, attacks, mechanisms, types of attacks on TCP/IP protocol suite.
CO2	Comprehend and apply authentication services, authentication algorithms
CO3	Comprehend and apply network layer security protocols, Transport layer security protocols, Web security protocols.
CO4	Understand the wireless network security threats.
CO5	Determine firewall requirements, and configure a firewall.

Text Book (s)

1. Stallings, W.,.Cryptography and Network Security: Principles and Practice, 4th ed., Prentice Hall PTR.,2006

Reference Book (s)

1. Kaufman, c., Perlman, R., and Speciner, M., Network Security, Private Communication in a public world, 2nd ed., Prentice Hall PTR., 2002.
2. Cryptography and Network Security; McGraw Hill; Behrouz A Forouzan.
3. AtulKahate, Cryptography and Network Security, McGraw Hill.
4. Johannes A. Buchmann, "Introduction to Cryptography", Springer-Verlag.

Unit-1 Introduction **8 hours**
Overview of Network Security, Security services, attacks, Security Issues in TCP/IP suite- Sniffing, spoofing, buffer overflow, ARP poisoning, ICMP Exploits, IP address spoofing, IP fragment attack, routing exploits, UDP exploits, TCP exploits.
Unit-2 Public Key Encryption and Hash Functions **8 hours**
Authentication requirements, Authentication functions - Message Authentication Codes - Hash Functions - Security of Hash Functions and MACs - MD5 message Digest algorithm - Secure Hash Algorithm - RIPEMD - HMAC Digital Signatures, Authentication protocols-Kerberos, X.509
Unit-3 IP Security **8 hours**
IP Security-AH and ESP, SSL/TLS, SSH, Web Security-HTTPS, DNS Security, Electronic Mail Security (PGP, S/MIME).
Unit-4 Intruders and Viruses **8 hours**
Intruders, Viruses, Worms, Trojan horses, Distributed Denial-Of-Service (DDoS), Firewalls, IDS, Honey nets, Honey pots.
Unit-5 Wireless Network Security **8 hours**
Introduction to wireless network security, Risks and Threats of Wireless networks, Wireless LAN Security (WEP, WPA).

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	INFORMATION RETRIEVAL				
Course Code	MCAS9210				
Prerequisite	DBMS				
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

The Student should be made to:

1. Learn the information retrieval models.
2. Be familiar with Web Search Engine.
3. Be exposed to Link Analysis.
4. Understand Hadoop and Map Reduce.
5. Learn document text mining techniques.

Course Outcomes:

CO1	Apply information retrieval models.
CO2	Design Web Search Engine
CO3	Use Link Analysis
CO4	Use Hadoop and Map Reduce
CO5	Apply document Text Mining Techniques

Text Book (s)

1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval , Cambridge University Press, 2008.
2. Ricardo Baeza -Yates and Berthier Ribeiro - Neto, Modern Information Retrieval: The Concepts and Technology behind Search 2nd Edition, ACM Press Books 2011.
3. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1st Edition Addison Wesley, 2009.
4. Mark Levene, An Introduction to Search Engines and Web Navigation, 2nd Edition Wiley, 2010.

Reference Book (s)

1. Stefan Buettcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.
2. Ophir Frieder "Information Retrieval: Algorithms and Heuristics: The Information Retrieval Series ", 2nd Edition, Springer, 2004.
3. Manu Konchady, "Building Search Applications: Lucene, Ling Pipe", and First Edition, Gate Mustru Publishing, 2008.

Unit-1 Introduction **8 hours**
Introduction - History of IR - Components of IR - Issues – Open source Search engine Frameworks - The impact of the web on IR - The role of artificial intelligence (AI) in IR – IR Versus Web Search - Components of a Search engine - Characterizing the web
Unit-2 Information Retrieval 8 hours
Boolean and vector-space retrieval models - Term weighting - TF-IDF weighting - cosine similarity – Preprocessing - Inverted indices - efficient processing with sparse vectors – Language Model based IR - Probabilistic IR – Latent Semantic Indexing - Relevance feedback and query expansion.
Unit-3 Web Search Engine – Introduction and Crawling 8 hours

Web search overview, web structure, the user, paid placement, search engine optimization/ spam. Web size measurement - search engine optimization/spam – Web Search Architectures - crawling - meta-crawlers- Focused Crawling - web indexes –- Near-duplicate detection - Index Compression – XML retrieval
Unit-4 Web Search – Link Analysis and Specialized Search 8 hours
Link Analysis – hubs and authorities – Page Rank and HITS algorithms - Searching and Ranking – Relevance Scoring and ranking for Web – Similarity - Hadoop & Map Reduce - Evaluation - Personalized search - Collaborative filtering and content-based recommendation of documents and products – handling "invisible" Web - Snippet generation, Summarization, Question Answering, Cross-Lingual Retrieval
Unit-5 Document Text Mining 8 hours
Information filtering; organization and relevance feedback – Text Mining - Text classification and clustering - Categorization algorithms: naive Bayes; decision trees; and nearest neighbor - Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100

Name of The Course	Foundation to Data Science				
Course Code	MCAS9220				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

The student should be made to:

1. To understand the basic concept of cloud computing.
2. To describe the virtualization fundamentals in cloud.
3. To use SAAS and PAAS in cloud environment.
4. To compare various cloud storage mechanisms.
5. To develop applications in cloud
6.

Course Outcomes

CO1	Describe what Data Science is and the skill sets needed to be a data scientist.
CO2	Explain in basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data
CO3	Explain the significance of exploratory data analysis (EDA) in data science. Apply basic tools (plots, graphs, summary statistics) to carry out EDA.
CO4	Describe the Data Science Process and how its components interact. Use APIs and other tools to scrap the Web and collect data.
CO5	Identify and explain fundamental mathematical and algorithmic ingredients that constitute a Recommendation Engine (dimensionality reduction, singular value decomposition, principal component analysis). Build their own recommendation system using existing components.

Text Book (s)

1.Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.

Reference Book (s)

1. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)
2. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
3. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
4. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009. (free online)
5. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science. (Note: this is a book currently being written by the three authors. The authors have made the first draft of their notes for the book available online. The material is intended for a modern theoretical course in computer science.)
6. Mohammed J. Zaki and Wagner Miera Jr. Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press. 2014.
7. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, Third Edition. ISBN 0123814790. 2011.

Unit-1 Introduction to BI **8 hours**
What is Data Science? - Big Data and Data Science hype – and getting past the hype - Why now? – Datafication - Current landscape of perspectives - Skill sets needed 2. Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model - Intro to R
Unit-2 . Exploratory Data Analysis and the Data Science Process **8 hours**

Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Case Study: RealDirect (online real estate firm) 4. Three Basic Machine Learning Algorithms - Linear Regression - k-Nearest Neighbors (k-NN) - k-means
Unit-3 Machine Learning Algorithm and Usage in Applications 8 hours
Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam - Data Wrangling: APIs and other tools for scrapping the Web 6. Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests
Unit-4 Building a User-Facing Data Product 8 hours
Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis - Exercise: build your own recommendation system 8. Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighborhood properties in graphs
Unit-5 Data Visualization and Ethical Issues 8 hours
Basic principles, ideas and tools for data visualization , Examples of inspiring (industry) projects - Exercise: create your own visualization of a complex dataset Discussions on privacy, security, ethics - A look back at Data Science - Next-generation data scientists

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Name of The Course	**Business Intelligence**
Course Code	MCAS9230
Prerequisite	
Corequisite	

Antirequisite				
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives:

The student should be made to:

7. Be exposed with the basic rudiments of business intelligence system
8. understand the modeling aspects behind Business Intelligence
9. understand of the business intelligence life cycle and the techniques used in it
10. Be exposed with different data analysis tools and techniques

Course Outcomes

CO1	**D**emonstrate knowledge about and understanding of key concepts and current practices of business intelligence
CO2	Demonstrate knowledge about and understanding of the individual, organizational and societal impacts of BI systems
CO3	Demonstrate knowledge about and understanding of analytical techniques used in business intelligence systems
CO4	Identify business and technical requirements for a BI solution
CO5	Apply relevant theories, concepts and techniques to solve real-world BI problems

Text Book (s)

1. Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9th Edition, Pearson 2013.

Reference Book (s)

1. Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making", Addison Wesley, 2003.
2. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications, 2009.
3. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager"s Guide", Second Edition, 2012.
4. Cindi Howson, "Successful Business Intelligence: Secrets to Making BI a Killer App", McGraw-Hill, 2007.
5. Ralph Kimball , Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker, "The Data Warehouse Lifecycle Toolkit", Wiley Publication Inc.,2007.

Unit-1 Introduction to BI **8 hours**
Understanding the scope of today's BI solutions and how they fit into existing infrastructure Assessing new options such as SaaS and cloud-based technology. Describe BI, its components & architecture, previewing the future of BI Crafting a better experience for all business users, End User Assumptions, Setting Up Data for BI, The Functional Area of BI Tools, Query Tools and Reporting, OLAP and Advanced Analytics, Supporting the requirements of senior executives, including performance management.
Unit-2 Elements of Business Intelligence Solutions. **8 hours**
Reports & ad hoc queries; Analyze OLAP data; Dashboards & Scorecards development, Metadata Models; Automated tasks & events; Mobile & disconnected BI; Collaboration capabilities; Real time monitoring capabilities; Software development kit; Consume BI through portals, web applications, Desktop applications
Unit-3 Building the BI Project **8 hours**
Planning the BI project, Project Resources; Project Tasks, Risk Management and Mitigation, Cost-justifying BI solutions and measuring success, Collecting User Requirements, Requirements-Gathering Techniques; Prioritizing & Validating BI Requirements, Changing Requirements; BI Design and Development, Best Practices for BI Design; Post-Implementation Evaluations, Maintaining Your BI Environment
Unit-4 Reporting authoring **8 hours**
Building reports with relational vs Multidimensional data models ; Types of Reports - List, crosstabs, Statistics, Chart, map, financial etc; Data Grouping & Sorting, Filtering Reports, Adding Calculations to Reports,

Conditional formatting, Adding Summary Lines to Reports. Drill up, drill- down, drill-through capabilities. Run or schedule report, different output forms – PDF, excel, csv, xml etc.
Unit-5 BI Deployment, Administration & Security **8 hours**
Centralized Versus Decentralized Architecture, BI Architecture Alternatives, phased & incremental BI roadmap, System Sizing, Measurements, and Dependencies, System Sizing, Measurements, and Dependencies. Setting Early Expectations and Measuring the Results. End-User Provisos. OLAP Implementations. Expanding BI Authentication Authorization, Access Permissions, Groups and Roles, Single-sign on Server Administration, Manage Status & Monitoring, Audit, Mail server & Portal integration, Back Up and Restore.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (MTE)	Total Marks
20	30	50	100