



M.C.A - Master of Computer Applications

(Duration: 2 Years)

CURRICULUM & SYLLABI

((Inline with NEP)

Applicable for candidates admitted from 2022-23

DEPARTMENT OF COMPUTER APPLICATIONS

HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE

HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE

Motto:

To Make Every Man a Success and No Man a Failure

Vision:

To be an International Institute of Excellence, providing a conducive environment for education with a strong emphasis on innovation, quality, research and strategic partnership blended with values and commitment to society.

Mission:

- To create an ecosystem that promotes learning and world class research.
- To nurture creativity and innovation.
- To instill highest ethical standards and values.
- To pursue activities for the development of the Society.
- To develop national and international collaborations with institutes and industries of eminence.
- To enable graduates to become future leaders and innovators.

Value Statement:

Integrity, Innovation, Internationalization.

DEPARTMENT OF COMPUTER APPLICATIONS

VISION AND MISSION

VISION

The department of Computer Applications aims to transform aspiring students into software professionals with a high degree of technical skills and to inculcate a research mind set.

MISSION

- *To provide strong theoretical foundations complemented with extensive practical training.*
- *To design and deliver curricula to meet the changing needs of industry.*
- *To establish strong collaborations with industry, R&D and academic institutes for training and research.*
- *To promote all-round development of the students through interaction with alumni and industry*

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

The program is expected to enable the students to

PEO 1: *To prepare graduates to be successful professionals in industry, government, academia, **research**, entrepreneurial pursuit and consulting firms.*

PEO 2: *To prepare graduates to achieve peer-recognition, as an individual and as a team player, through demonstration of good analytical, design, implementation and interpersonal skills.*

PEO 3: *To prepare graduates to contribute to society as broadly educated, expressive, ethical and responsible citizens with proven expertise.*

PEO 4: *To prepare graduates to pursue life-long learning to fulfill their goals.*

PROGRAM OUTCOMES (PO'S)

At the end of this program, graduates will be able to

- PO 1 Computational Knowledge:** *Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.*
- PO 2 Problem Analysis:** *Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.*
- PO 3 Design /Development of Solutions:** *Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.*
- PO 4 Conduct Investigations of Complex Computing Problems:** *Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.*
- PO 5 Modern Tool Usage:** *Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.*
- PO 6 Professional Ethics:** *Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.*
- PO 7 Life-long Learning:** *Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.*

- PO 8** ***Project management and finance:** Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.*
- PO 9** ***Communication Efficacy:** Communicate effectively with the computing community, and with society, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.*
- PO 10** ***Societal and Environmental Concern:** Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.*
- PO 11** ***Individual and Team Work:** Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.*
- PO 12** ***Innovation and Entrepreneurship:** Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.*

PROGRAM SPECIFIC OUTCOMES (PSO)

M.C.A-Master of Computer Applications

- PSO 1:** *Apply algorithmic principles, computer science theory and practice and mathematical foundations to solve real world problems*
- PSO 2:** *Analyze, Design and Develop the problem-solving skills in the discipline of computer applications*
- PSO 3:** *Design, develop, test and maintain the software applications with latest computing tools and technology*

M.C.A-Master of Computer Applications (Specialization in Big Data Analytics)

- PSO 1:** *Design suitable data models, appropriate architectures and apply appropriate technology to find solutions for complex problems*
- PSO 2:** *Identify the impact of big data for business decisions and strategy and gain skills on large-scale analytics tools to solve some open big data problems*
- PSO 3:** *Design and build analytic models to derive intelligence for the specialized aspects of big data including big data application, and big data analytics*

M.C.A-Master of Computer Applications (Specialization in Cloud Computing)

- PSO 1:** *Design computing systems based on Cloud computing and develop tools incorporating the skills acquired in cloud computing domain.*
- PSO 2:** *Ability to develop a computing system using technologies and the standards relating to the real-time environments in the cloud market*
- PSO 3:** *Design, develop and manage security controls that protect identity, access, data, applications and networks in cloud and hybrid environments*

MCA - Master of Computer Applications
Curriculum

SEMESTER I									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	BS	CMA42001	Statistics for Computer Science	3	1	0	4	0	4
2	BS	CCM42001	Basics of Accounting	1	1	0	2	0	2
3	PC	CCA42001	Object Oriented Programming	3	0	2	4	0	5
4	PC	CCA42002	Data Communication and Networking	2	1	0	3	1	3
5	PC	CCA42003	Software Engineering Concepts	3	0	0	3	1	3
6	PC	CCA42004	Advanced Data Structures and Algorithms	3	0	2	4	0	5
7	PC	CCA42005	Python Programming	2	0	2	3	0	4
Total				17	3	6	23	2	26
L – Lecture; T – Tutorial; P – Practical; C – Credit; S- Self Study; TCH- Total Contact Hours									

SEMESTER II									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	CCA42006	Machine Learning	3	0	2	4	0	5
2	PC	CCA42007	Full Stack Web Development	2	0	2	3	0	4
3	PC	CCA42008	Advanced Database Technologies	2	0	2	3	1	4
4	BS	CCA42009	Research Methodology and IPR	3	0	0	3	1	3
5	DE	CCA425**	DE-1	3	0	0	3	0	3
6	DE	CCA425**	DE-2	2	0	2	3	0	4
7	PC	CCA42400	Software Design Project	0	0	4	2	1	4
Total				15	0	12	21	3	27
L – Lecture; T – Tutorial; P – Practical; C – Credit; S- Self Study; TCH- Total Contact Hours									

SEMESTER III									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	CCA42010	Software Testing and Quality Assurance	2	1	2	4	0	5
2	PC	CCA42011	Cryptography and Network Security	3	0	2	4	1	5
3	PC	CCA425**	Open Online Courses*	3	0	0	3	0	3
	BS	CEL42001	Communication Skills and Professional Development	2	0	2	3	0	3
4	DE	CCA425**	DE-3	2	0	2	3	0	4
5	DE	CCA425**	DE-4	2	0	2	3	0	4
6	PC	CCA42800	Research Paper Review	0	0	6	3	1	6
7	PC	CCA42801	Internship**	0	0	0	2	0	-
Total				14	1	16	25	2	30
L – Lecture; T – Tutorial; P – Practical; C – Credit; S- Self Study; TCH- Total Contact Hours									

*To be chosen at the time of offering the course **Internship carried out in the end of II Semester and evaluated in the III Semester

SEMESTER IV									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	CCA42802	Project Work	0	0	40	20	4	40
Total				0	0	40	20	4	40
L – Lecture; T – Tutorial; P – Practical; C – Credit; S- Self Study; TCH- Total Contact Hours									

Total Credits: 89

M.C.A-Master of Computer Applications

LIST OF DEPARTMENT ELECTIVES

SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
DEPARTMENT ELECTIVE-1(DE-1)									
2	DE	CCA42500	Cloud Computing Concepts	3	0	0	3	0	3
2	DE	CCA42501	Internet of Things	3	0	0	3	0	3
2	DE	CCA42502	Big data Framework	3	0	0	3	0	3
2	DE	CCA42503	Virtualization Techniques	3	0	0	3	0	3
DEPARTMENT ELECTIVE-2(DE-2)									
2	DE	CCA42504	Data Analysis and Visualization Techniques	2	0	2	3	0	4
2	DE	CCA42505	BlockChain Technology	2	0	2	3	0	4
2	DE	CCA42506	R Programming	2	0	2	3	0	4
2	DE	CCA42507	Cloud Application Development	2	0	2	3	0	4
2	DE	CCA42508	Cloud Managed Services	2	0	2	3	0	4
DEPARTMENT ELECTIVE-3(DE-3)									
3	DE	CCA42509	Natural Language Processing	2	0	2	3	0	4
3	DE	CCA42510	Principles of Deep Learning	2	0	2	3	0	4
3	DE	CCA42511	Data Classification Methods and Evaluation	2	0	2	3	0	4
3	DE	CCA42512	Cloud Computing with Web Services	2	0	2	3	0	4
DEPARTMENT ELECTIVE-4(DE-4)									
3	DE	CCA42513	Augmented and Virtual Reality	2	0	2	3	0	4
3	DE	CCA42514	Big Data Analytics	2	0	2	3	0	4
3	DE	CCA42515	Predictive Analytics	2	0	2	3	0	4
3	DE	CCA42516	Cloud Security	2	0	2	3	0	4
3	DE	CCA42517	Cloud Platform Essentials	2	0	2	3	0	4

M.C.A-Master of Computer Applications (Specialization in Big Data Analytics)

LIST OF DEPARTMENT ELECTIVES

	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
DEPARTMENT ELECTIVE-1(DE-1)									
2	DE	CCA42500	Cloud Computing Concepts	3	0	0	3	0	3
2	DE	CCA42502	Big data Framework	3	0	0	3	0	3
DEPARTMENT ELECTIVE-2(DE-2)									
2	DE	CCA42504	Data Analysis and Visualization Techniques	2	0	2	3	0	4
2	DE	CCA42506	R Programming	2	0	2	3	0	4
DEPARTMENT ELECTIVE-3(DE-3)									
3	DE	CCA42510	Principles of Deep Learning	2	0	2	3	0	4
3	DE	CCA42511	Data Classification Methods and Evaluation	2	0	2	3	0	4
DEPARTMENT ELECTIVE-4(DE-4)									
3	DE	CCA42514	Big data Analytics	2	0	2	3	0	4
3	DE	CCA42515	Predictive Analytics	2	0	2	3	0	4

M.C.A-Master of Computer Applications - (Specialization in Cloud Computing)

LIST OF DEPARTMENT ELECTIVES

SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
DEPARTMENT ELECTIVE-1(DE-1)									
2	DE	CCA42500	Cloud Computing Concepts	3	0	0	3	0	3
2	DE	CCA42503	Virtualization Techniques	3	0	0	3	0	3
DEPARTMENT ELECTIVE-2(DE-2)									
2	DE	CCA42507	Cloud Application Development	2	0	2	3	0	4
2	DE	CCA42508	Cloud Managed Services	2	0	2	3	0	4
DEPARTMENT ELECTIVE-3(DE-3)									
3	DE	CCA42510	Principles of Deep Learning	2	0	2	3	0	4
3	DE	CCA42512	Cloud Computing with Web Services	2	0	2	3	0	4
DEPARTMENT ELECTIVE-4(DE-4)									
3	DE	CCA42516	Cloud Security	2	0	2	3	0	4
3	DE	CCA42517	Cloud Platform Essentials	2	0	2	3	0	4

Syllabi

SEMESTER-1

COURSE TITLE		STATISTICS FOR COMPUTER SCIENCE				CREDITS	4								
COURSE CODE		CMA42001	COURSE CATEGORY		BS	L-T-P-S	3-1-0-0								
Version	1.0	Approval Details		36 th ACM 05-11-2022		LEARNING LEVEL	BTL-3								
ASSESSMENT SCHEME															
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project		Surprise Test / Quiz	Attendance	ESE									
15%	15%	10%		5%	5%	50%									
Course Description	Statistics plays a intrinsic role in computer science and this course provides the students a solid understanding of the methods and ways to apply statistical and probabilistic approaches to solve applications														
Course Objective	<ol style="list-style-type: none"> 1. To understand the basics of probability 2. To grasp the knowledge about random variables 3. To understand the theory of sampling and testing 4. To understand time series analysis 5. To learn about design of experiments 														
Course Outcome	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> 1. Develop statistical models for business analytics. 2. Apply forecasting methods to support managerial, financial, and operational statistics. 3. Perform marketing analytics using statistical models. 4. Analyze customer data for customer acquisition, retention, and profitability 5. Analyze the variance classification 														
Prerequisites: Probability and Statistics															
CO, PO AND PSO MAPPING															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	2	1	1	1	1	1	1	1	1	1	1	1	1	-	2
CO-2	2	1	-	-	1	-	1	1	1	-	-	1	2	1	2
CO-3	2	1	2	1	1	2	1	-	-	2	1	1	-	2	2
CO-4	2	1	-	-	1	-	1	2	1	-	-	1	1	1	2
CO-5	2	1	2	1	1	2	1	1	1	2	1	1	2	1	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: PROBABILITY													(9L+3T)		
Introduction to probability –Bayes Theorem-Random variables-discrete random variable (Binomial, Poisson, Geometric), Continues random variable (Uniform, Exponential and Normal distribution). Moment generating function.													CO-1 BTL-3		

Suggested Readings: Basic knowledge on probability, Introduction to probability		
MODULE 2: TWO DIMENSIONAL RANDOM VARIABLES		(9L+3T)
Joint distribution –Marginal and conditional distribution covariance –correlation and regression (linear and Multiple). Central limit theorem, Chebyshev’s inequality. Suggested Readings: Basic knowledge on probability Statistics and Random Processes-T. Veerarajan		CO-2 BTL-2
MODULE 3: THEORY OF SAMPLING AND TEST OF HYPOTHESIS		(9L+3T)
Introduction to hypothesis, large and small samples test -mean and variance (single and double), test, Independent of attributes and contingency table. Suggested Readings: Basic knowledge of sampling, probability, Statistics and Random Processes-T. Veerarajan		CO-3 BTL-3
MODULE 4: TIME SERIES ANALYSIS		(9L+3T)
Introduction to Stochastic process, Time series as a discrete stochastic process. Stationarity, Main characteristics of stochastic process (mean, auto covariation and auto correlation function). Autoregressive models AR (p), Yull-Worker equation Auto regressive moving average models ARMA. Seasonality in Box – Jenkins model. Suggested Readings: Basic knowledge of Time series analysis, Time series-Maurice George kendall, j.k.Ord		CO-4 BTL-3
MODULE 5: DESIGN OF EXPERIMENTS		(9L+3T)
Analysis of variance (one way & two ways) classification – completely randomized design – randomized block design – Lattin square design. Suggested Readings: Basic knowledge of design of experiments, Probability, Statistics and Random Processes-T. Veerarajan		CO-5 BTL-3
TEXT BOOKS		
1.	Hossein Pishro-Nik (2008), “Probability, Statistics and Random Processes” Tata McGraw-Hill, Education	
REFERENCE BOOKS		
1.	K. S. Trivedi. John(2016), “Probability and statistics with reliability, Queuing and computer Science Application”, Second edition, Wiley&Son.	
2.	Levin Richard and Rubin Davids(2016), “Statistics for Management “, Pearson Publications.	
E BOOKS		
1.	http://www.math.harvard.edu/~knill/teaching/math144_1994/probability.pdf	
2	http://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/book.pdf	
MOOC		
1.	https://nptel.ac.in/courses/IITMADRAS/Principles_of_Communication1/Pdfs/1_5.pdf	
2.	https://nptel.ac.in/courses/110104024/	

COURSE TITLE		BASICS OF ACCOUNTING						CREDITS	2							
COURSE CODE		CCM42001	COURSE CATEGORY			BS	L-T-P-S	1-1-0-0								
Version	1.0	Approval Details			36th ACM	05-11-2022	LEARNING LEVEL	BTL-3								
ASSESSMENT SCHEME																
First Periodical Assessment		Second Periodical Assessment		Seminar/ Assignments / Project		Surprise Test / Quiz		Attendance	ESE							
15%		15%		10%		5%		5%	50%							
Course Description		The course describes the basics of accounting, fundamentals of book keeping, accounting concepts and conventions. The course describes the process of accounting, from journal to preparation of trial balance and finally the Final Accounts. The course highlights the importance of balancing the cash balance between cash book and bank passbook. The course also highlights the importance of non-trading concerns, by preparing receipts and payments account and income and expenditure account.														
Course Objective		<ol style="list-style-type: none"> 1. To understand about the various forms of business and the features of each form of business and the differences among them 2. To understand the concept of marketing, scope and importance and approaches of marketing, and traditional and modern concept of marketing 3. To understand the fundamentals of book keeping, accounting concepts and conventions and the process of accounting and reconciling cash balance 4. To understand the preparation of final accounts, the adjustments involved 5. To understand the accounts of non-trading concerns, receipts and payments account and income and expenditure account 														
Course Outcome		<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Differentiate and appreciate the different forms of businesses 2. Apply the concepts of marketing in real world, and the application of traditional and modern concept of marketing 3. Design the process of accounting in real world. 4. Prepare final accounts incorporating the adjustments. 5. Formulate the accounts of non-trading concerns. 														
Prerequisites: NIL																
CO, PO AND PSO MAPPING																
CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PS	PS	PS

	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	O1	O2	O3
CO-1	3	3	3	-	1	-	2	-	2	1	-	2	2	1	-
CO-2	1	2	1	-	-	-	2	-		-	-	2	2	1	-
CO-3	3	1	2	1	-	-	1	1	2	-	-	1	2	2	-
CO-4	2	2	1	-	1	1	1	-		1	1	1	3	1	1
CO-5	3	1	1	-	-	-		-	2	1	-	2	3	1	-
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION TO BUSINESS (3L+3T)															
Commerce definition – Elements – Form of business – Sole Proprietor – Partnership – company – Private and Public – Public sector: Features and merits Suggested Readings: Differences between Private and Public Sector Enterprises Practical component: Preparation of ledgers													CO-1 BTL-2		
MODULE 2: INTRODUCTION TO MARKETING (3L+3T)															
Introduction to Marketing Definition, nature, scope and importance of marketing, Approaches to the study of marketing and economic development, traditional and modern concept of marketing, function of marketing Suggested Readings: Different Marketing approaches of different companies Practical Component: Preparation of Voucher													CO-2 BTL-2		
MODULE 3: ACCOUNTING PROCESS (3L+3T)															
Fundamentals of Bookkeeping – Accounting Concepts and Conventions – Journal – Ledger – Subsidiary books – Trial balance – Preparation of bank reconciliation statement – Errors and their rectification. Practical component: Problems on Journal, Ledger and Trial Balance Suggested Readings: Accounting Concepts and Conventions													CO-3 BTL-3		
MODULE 4: FINAL ACCOUNTS (3L+3T)															
Final Accounts: Opening, Closing and Adjustment entries – Manufacturing, Trading and Profit and Loss Accounts – Balance Sheet. Practical component: Problems on Final accounts Suggested Readings: Importance of Balance Sheets													CO-4 BTL-3		
MODULE 5: ACCOUNTS ON NON-TRADING CONCERNS (3L+3T)															
Accounts of non-profit organizations- receipts and payments and income and expenditure accounts and balance sheet. Practical component: Problems on Receipts and Payments account and Income and Expenditure account Suggested Readings: Features of Non-Trading Concerns													CO-5 BTL-3		
TEXT BOOKS															

1	Jain and Narang(2014),” Advanced Accounting”, Kalyani Publishers
2	Gupta R L and Radhaswamy M(2014), “Advanced Accountancy”, Sultan Chand & Sons
REFERENCE BOOKS	
1	Tulsian P C(2002), ”Financial Accounting”, Pearson Education
2.	Bhushan Y K(2000), “Fundamentals Of Business Organisation And Management”, Sultan Chand & Sons
E BOOKS	
1.	http://www.freebookcentre.net/Business/Accounting-Books.html
MOOC	
1.	https://www.coursera.org/learn/wharton-accounting

COURSE TITLE		OBJECT ORIENTED PROGRAMMING				CREDITS	4								
COURSE CODE		CCA42001	COURSE CATEGORY		PC	L-T-P-S	3-0-2-0								
Version	1.0	Approval Details		36 th ACM 05-11-2022	LEARNING LEVEL		BTL-3								
ASSESSMENT SCHEME															
First Periodical Assessment	Second Periodical Assessment	Practical Assessment	Observations /Lab Records	Attendance	ESE										
					Theory	Prac									
15%	15%	10%	5%	5%	25%	25%									
Course Description	This course introduces the object-oriented programming concepts using Java programming language. This course gives insights into the overview of Java features and benefits of OOPS concepts. Students will learn how to program in Java and use some of its most important APIs. Special importance will be assigned to the object-oriented nature of Java and its use of polymorphism.														
Course Objective	<ol style="list-style-type: none"> To provides insights into the concepts of OOPs and Java Fundamentals To understand the abstract classes ,interfaces and packages To handle exceptions and to perform multitasking in Java To perform I/O operations and to create GUI programs To create networking applications in Java 														
Course Outcome	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> Design and solve real world problems using OOP techniques. Implement Interfaces and Packages Develop multithreaded applications and to handle exceptions. Design GUI based applications and applets for web applications Create networking applications 														
Prerequisites: C++ Programming Language															
CO, PO AND PSO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO -10	PO 11	PO 12	PSO 1	PS O2	PSO 3

CO-1	1	1	1	1	2	2	2	3	2	3	1	1	1	1	1
CO-2	1	1	-	-	2	1	1	1	2	3	1	1	-	1	2
CO-3	3	1	1	1	2	1	-	-	2	3	1	-	1	3	-
CO-4	3	1	-	2	2	1	2	1	2	2	1	2	-	2	1
CO-5	1	1	1	2	2	2	2	3	2	1	3	1	3	3	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION (9L+6P)															
<p>OOP concepts: Classes and objects, data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, procedural and object oriented programming-paradigm.</p> <p>Java programming: History of java, comments data types, variables, constants, scope and life time of variables, operators, operator hierarchy, expressions, type conversion and casting, enumerated types, control flow statements, jump statements, simple java stand alone programs, arrays, console input and output, formatting output, constructors ,methods, parameter passing, static fields and methods, access control, this reference, overloading methods and constructors, recursion, garbage collection, exploring string class</p> <p>Practical Component: Write a Java program to demonstrate the concept of constructors, overloading methods , inheritance and polymorphism,</p> <p>Suggested Readings: Applications OOPs concepts in real time applications</p>													CO-1 BTL-3		
MODULE 2: ABSTRACT CLASSES, INTERFACES AND PACKAGES (9L+6P)															
<p>Abstract classes - Abstraction in Java- Ways to achieve abstraction-Rules for Java abstract classes- abstract methods- understanding real scenario of abstract classes- Interfaces- defining an interface, implementing and extending interfaces, Nested interfaces, applying interfaces, Packages-Defining a Package, CLASSPATH, Access protection, importing packages</p> <p>Practical Component: Interfaces and Packages in JAVA</p> <p>Suggested Readings: Abstract classes vs Interfaces, Built in packages</p>													CO-2 BTL-3		
MODULE 3: EXCEPTION HANDLING AND MULTITHREADING (9L+6P)															
<p>Fundamentals of exception handling, Exception types, Termination models, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built- in exceptions, creating own exception sub classes. Threading: Differences between thread-based multitasking and process-based multitasking, Java thread model, creating threads, thread priorities, synchronizing threads, inter thread communication.</p> <p>Practical Component: Multithreading in JAVA</p> <p>Suggested Readings: Multitasking using Threads</p>													CO-3 BTL-4		
MODULE 4: I/O STREAMS, GUI PROGRAMMING AND APPLETS (9L+6P)															
<p>I/O Streams : Byte stream and character stream- Java Byte stream classes-Java Character stream classes- Reading console input, characters and strings –Reading and writing from files.GUI Programming with Java: The AWT class hierarchy,</p>													CO-4 BTL-3		

<p>introduction to swing, swings Vs AWT, hierarchy for swing components. Containers: JFrame, JApplet, JDialog, JPanel, overview of some swing components: JButton, JLabel, JTextField, JTextArea, simple applications. Layout management: Layout manager types, border, grid and flow. Applets: Inheritance hierarchy for applets, differences between applets and applications, life cycle of an applet, passing parameters to applets. Practical Component: Write a Java program to demonstrate the concept of I/O streams, creating a GUI and applets. Suggested Readings: I/O Streams in Java, GUI controls</p>		
MODULE 5: NETWORKING WITH JAVA.NET		(9L+6P)
<p>Introduction to Networking - Networking Enhancements in Java SE 8, Client-Server Networking, Proxy Servers, Domain Name Service, Understanding Networking Interfaces and Classes in the java.net Package, Internet Addressing, Understanding Sockets in Java, Understanding the URL Class, Understanding the URI Class, Working with Datagrams. Practical Component: Client –Server Networking Suggested Readings: Java networking classes and interfaces</p>		CO-5 BTL-3
TEXT BOOKS		
1.	Herbert Schildt (2019), <i>Java The complete reference</i> , 11th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.	
REFERENCE BOOKS		
1	Premchand S.Nair(2017), <i>Java Programming Fundamentals: Problem Solving Through Object Oriented Analysis and Design</i> , CRC Press	
E BOOKS		
1.	https://freecomputerbooks.com/Object-Oriented-Programming-in-Java-by-Rick-Halterman.html	
MOOC		
1.	https://www.coursera.org/courses?query=java	

COURSE TITLE	DATA COMMUNICATION AND NETWORKING			CREDITS	3
COURSE CODE	CCA42002	COURSE CATEGORY	PC	L-T-P-S	2-1-0-1
Version	1.0	Approval Details	36th ACM 05-11-2022	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments / Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%
Course Description	The course focuses on network models with various protocols in each layer of model. The functionality of Physical layer, Transport layer and Network				

	layers are covered. The network is applicable for wireless medium also. The standards and models being followed in wireless networking also covered in this course														
Course Objective	<ol style="list-style-type: none"> To gain insights into the relevance of data communication and network fundamentals in current times. To establish a strong foundation of networks concepts on Signals, Transmission Media, Errors in data communications and their correction, networks classes and devices. To gain insight on network architectures, protocols and standards. To acquire an in-depth knowledge of transfer of data, categories of network & different topology. To develop a strong foundation of network technologies from the physical layer to application layer. 														
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> Explain the basics of computer networks and comprehend the functioning of various layers of OSI Model & TCP/IP model. Describe the functionality of Physical Layer and its relevance in data transmission. Apply different Error detection and Error correction methods during data transmission and analyze the functions of data link layer. Identify the analyze the various IEEE 802 Standards of Wired and Wireless LAN. Evaluate the purpose of Network Layer & transport layer and its importance in packet transmission using routing algorithms. 														
Prerequisites: Basics of Networking															
CO, PO AND PSO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO -10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	1	1			1	1	2			1	1		1		
CO-2	1		1		1		2		1					1	1
CO-3	1	1	2	2	2	2	2	2			1			2	
CO-4	2	2			2		3		1					2	2
CO-5	2	2			2		3			1		1	2	2	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION (6L+3T)															
Introduction to data communication and networking: Why study data communication?, Data Communication, Networks, Protocols and Standards, Standards Organizations. Line Configuration, Topology, Transmission Modes, Categories of Networks, Networks Models : Layered Tasks, The OSI model, Layers in the OSI Model, TCP/IP Protocol suite, Address in TCP/IP, TCP vs UDP														CO-1 BTL-3	
Suggested Readings: Data Communication in Networks															
MODULE 2: PHYSICAL LAYER (6L+3T)															
Introduction: Analog and Digital Data, Analog and Digital Signals, Periodic Analog Signals, Transmission Impairment, Data Rate limits, Performance.														CO-2 BTL-3	

Transmission Modes: Parallel and Serial Transmission; Serial Communication: Synchronous communication & Asynchronous Communication. Digital Transmission: Digital to Digital conversion, Digital to Analog conversion, Analog to Digital conversion. Suggested Reading: Frequency Modulation and Phase Modulation		
MODULE 3: DATA LINK LAYER –ERROR DETECTION AND CORRECTION		(6L+3T)
Links, Access Networks, and LANs- Introduction to the Link Layer, The Services Provided by the Link Layer, Types of errors, Redundancy, Detection vs Correction, Forward error correction Versus Retransmission Error-Detection and Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC) , Framing, Flow Control and Error Control protocols , Noisy less Channels and Noisy Channels, HDLC, Multiple Access Protocols, Random Access ,ALOHA, Controlled access, Channelization Protocols. 802.11 MAC Protocol, IEEE 802.11 Frame Suggested Readings: Multitasking using Threads		CO-3 BTL-4
MODULE 4: WIRED AND WIRELESS LAN		(6L+3T)
Bandwidth Utilization Bandwidth: Speed vs Bandwidth; Multiplexing: Frequency Division, Wavelength Division and Time Division Multiplexing; Spread Spectrum: Frequency Hopping Spread Spectrum and Direct Sequence Spread Spectrum; Transmission Media. Wired LANs Ethernet: IEEE Standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet; Wireless LANs: Introduction, IEEE 802.11, & Bluetooth, Zigbee Technology; Categories of Connecting devices, Virtual LANs; Suggested Readings: Other wireless Networks		CO-4 BTL-3
MODULE 5: NETWORK LAYER AND TRANSPORT LAYER		(6L+3T)
Introduction –Forwarding and Routing – Virtual circuit and Datagram Networks- Routing control plane-Internet protocol-Datagram format-IPv4-Overview of transport layer-Multiplexing and De-multiplexing- UDP- UDP Segment Structure, UDP checksum-principles of reliable data transfer protocols. Flow control- TCP Connection Management- Principles of Congestion control. Suggested Readings: ICMP and IPv6		CO-5 BTL-3
TEXT BOOKS		
1.	Larry L. Peterson & Bruce S. Davie (2021) Computer Networks – A systems Approach, Sixth Edition, Harcourt Asia / Morgan Kaufmann.	
2	Forouzan (2017) Data Communication and Networking Fifth Edition, Harcourt Asia / Morgan Kaufmann.	
REFERENCE BOOKS		
1	Andrew S.Tannenbaum David J. Wetherall (2011) Computer Networks, Fifth Edition, Pearson Education	
E BOOKS		
1	https://books.google.co.in/books?id=p7B2BAAAQBAJ&printsec=frontcover&source=gbg_summary_r&cad=0#v=onepage&q&f=false	

2	https://freecomputerbooks.com/Object-Oriented-Programming-in-Java-by-Rick-Halterman.html
MOOC	
1.	https://www.coursera.org/courses?query=computer%20network

COURSE TITLE		SOFTWARE ENGINEERING CONCEPTS				CREDITS		3							
COURSE CODE		CCA42003	COURSE CATEGORY		PC	L-T-P-S		3-0-0-1							
Version	1.0	Approval Details		36 th ACM 05-11-2022		LEARNING LEVEL		BTL-3							
ASSESSMENT SCHEME															
First Periodical Assessment		Second Periodical Assessment		Seminar/ Assignments/ Project		Surprise Test / Quiz		Attendance		ESE					
15%		15%		10%		5%		5%		50%					
Course Description		The course is designed to present software engineering concepts and principles in parallel with the software development life cycle. This course allows us to apply engineering and computer science concepts in the development and maintenance of reliable, usable, and dependable software.													
Course Objective		<ol style="list-style-type: none"> To identify, formulate, and solve complex engineering problems by applying principles To apply engineering design to produce solutions that meet specified needs To function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, To develop and conduct appropriate experimentation, analyze and interpret data. To acquire and apply new knowledge as needed, using appropriate learning strategies. 													
Course Outcome		<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> Describe the Software Engineering Process and Evaluation techniques. Plan and manage requirements at each stage of the software develop the models. Depict design activity planning and behavior management principles. Develop skills to manage the various strategic phases involving testing techniques and various test methods. Design software projects that support organization 's strategic and agile process 													
Prerequisites: Software Engineering Techniques															
CO, PO AND PSO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O 2	PS O 3

CO-1	3	1	1	3	1	3	1	1	3	1	3	1	1	2	1
CO-2	1	1	-	1	1	1	1	-	1	1	1	1	-	1	1
CO-3	1	-	2	1	1	1	-	2	1	-	1	-	2	1	2
CO-4	1	2	-	1	1	1	2	-	1	2	1	2	-	-	2
CO-5	3	2	2	2	-	1	-	3	1	-	3	1	2	1	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: SOFTWARE PROCESS (9L)															
<p>Process models – Defining a Framework Activity, Process Patterns, Process Assessment and improvement - Prescriptive Process Models – Specialized process models- The Unified Process – Personal and Team Process models – Process Technology – Product and Process.</p> <p>Suggested Readings: Process Models</p> <p>Practical Component</p> <ol style="list-style-type: none"> 1. Practicing the different types of case tools such as Rational Rose / other Open Source for all the phases of Software development life cycle. 2. Data modelling 														CO-1 BTL-2	
MODULE 2: UNDERSTANDING REQUIREMENTS (9L)															
<p>Requirements Engineering – Eliciting requirements – Developing use cases – Building the requirement model – Negotiating and validating requirements – Scenario Based Modelling – UML Models – Data modelling concepts – Class based modelling – Patterns for Requirement modelling.</p> <p>Suggested Readings: UML creation</p> <p>Practical Component</p> <ol style="list-style-type: none"> 1. Source code generators 2. Apply the following to typical application problems: <ol style="list-style-type: none"> a. Project Planning b. Software Requirement Analysis 														CO-2 BTL-2	
MODULE 3: DESIGN CONCEPTS (9L)															
<p>Design Process – Design concepts – Software Architecture – Architectural Styles and Design – Assessing alternative architectural designs – architectural Mapping Using Data Flow – Component Level Design – Designing Class Based Components – Component level design for Web Apps – Designing Traditional Components – User Interface Design.</p> <p>Suggested Readings: Architectural Mapping</p> <p>Practical Component</p> <ol style="list-style-type: none"> 1. Apply the following to typical application problems: <ol style="list-style-type: none"> a. Software Design b. Data Modeling & Implementation 2. Software Estimation 														CO-3 BTL-3	
MODULE 4: SOFTWARE TESTING STRATEGIES (9L)															
<p>Strategic approach for software testing – Test Strategies for Conventional Software – OO Software and testing – Validation testing – System Testing – The art of debugging – Internal and External views of testing – Basis path testing –</p>														CO-4 BTL-3	

White Box testing – Control structure testing – Block Box Testing – Model based Testing – Patterns for Software Testing. Suggested Readings: Testing types Practical Component 1. Software Testing A possible set of applications may be the following: a. Create a dictionary. b. Inventory System.	
MODULE 5: AGILE METHODOLOGY AND SOFTWARE PROCESS (9L)	
What is agility – Agility and cost of change – What is an agile process – Extreme programming – Agile Process models – Tool set for the agile process – Software Process Improvement – SPI Process – CMMI – People of CMM – SPI Framework – SPI Return on Investment – SPI Trends. Suggested Readings: CMMI Practical Component 1. Software Quality Checking A possible set of applications may be the following: a. Library System b. Student Marks Analyzing System	CO-5 BTL-3
TEXT BOOKS	
1.	Roger S Pressman(2014), “Software Engineering ”, Tata McGraw- Hill Publications, 7 th Edition.
REFERENCE BOOKS	
1.	I. Sommerville(2015), “Software Engineering” , 5 th Edition : Addison Wesley.
E BOOKS	
1.	http://www.ddegjust.ac.in/studymaterial/mca-3/ms-12.pdf
MOOC	
1.	https://www.coursera.org/courses?query=software%20engineering

COURSE TITLE		ADVANCED DATA STRUCTURES AND ALGORITHMS			CREDITS	4
COURSE CODE		CCA42004	COURSE CATEGORY	PC	L-T-P-S	3-0-2-0
Version	1.0	Approval Details	36th ACM 05-11-2022	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Practical Assessment	Observati ons/Lab Records	Attendance	ESE	
15%	15%	10%	5%	5%	Theory	Prac
Course Description	The course covers analysis and design of data structures and engages learners to use data structures as tools to algorithmically design efficient computer programs that will cope with the complexity of actual applications. The course focuses on basic and essential topics in data structures, including array-based lists, linked lists, skip lists, hash tables,					

	recursion, binary trees, scapegoat trees, red–black trees, heaps, sorting algorithms, graphs, and binary tree and the sue of python programming to solve the algorithms.														
Course Objective	<ol style="list-style-type: none"> 1. To understand the basics of algorithm analysis. 2. To demonstrate several searching and sorting algorithms. 3. To implement linear and non-linear data structures. 4. To demonstrate various tree and graph traversal algorithms. 5. To analyze and choose appropriate data structure to solve problems in real world. 														
Course Outcome	<p>Upon completion of this course, the students Should be able to</p> <ol style="list-style-type: none"> 1. Describe the basics of data structure. 2. Solve problems using lists, stacks and queues 3. Implement binary trees and perform searching and sorting operations 4. Design and develop graphs. 5. Implement and develop algorithms. 														
Prerequisites: Python															
CO, PO AND PSO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	3	2	2	1	1	1	1	1	1	1	1	1	1	1	2
CO-2	3	1	1	1	1	1	-	-	-	1	1	1	-	1	1
CO-3	3	1	-	-	-	1	2	1	1	1	1	1	2	1	2
CO-4	3	1	2	1	1	1	-	-	-	1	1	1	-	-	1
CO-5	3	1	-	-	-	1	2	1	1	1	1	1	3	2	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION TO ALGORITHMS AND DATA STRUCTURES (9L+6P)															
Algorithms, analyzing algorithms-designing algorithms –growth of functions-Asymptomatic notations-Standard notations and common functions-recurrences-substituion method, Problem solving concepts, ADT, Stack, Queue, List.													CO-1 BTL-2		
Practical Components:															
<ul style="list-style-type: none"> • Installation of python and its libraries. • Basic programs in pythons using functions 															
Suggested Readings: Measures of algorithm, Space and time complexity															
MODULE:2 LISTS, STACKS AND QUEUES (9L+6P)															
Preliminaries, Binary Trees Binary Search Trees, AVL Trees, Tree Traversals, Hashing, Hash Function, Hash families Separate Chaining, Open addressing.													CO-2 BTL-2		
Practical Components:															
<ul style="list-style-type: none"> • List and its related operations. • Simulation of operations on stacks and queues. 															
Suggested Readings: Red Black trees															
MODULE 3: TREES, SEARCHING AND SORTING (9L+6P)															

Preliminaries, Binary Trees, Array and linked Representation of Binary Trees, Binary Search Trees, AVL Trees, Tree Traversals, Preliminaries, Insertion Sort, Shells sort, Heap sort– Merge sort–Quick sort– External Sorting-Topological Sort. Practical Components: <ul style="list-style-type: none"> • Searching and Sorting in binary trees • Implement the types of sorting Suggested Readings: Recursive Bubble Sort, Radix Sort	CO-3 BTL-3
MODULE: GRAPHS (9L+6P)	
Graph connectivity, Random walks on graph, on line paging algorithm, adversary models. Practical Components: <ul style="list-style-type: none"> • Design and implement a graph and its connectivity. • Design and implement a model using on line paging algorithm Suggested Readings: Graph Representations, Depth First and Breadth First Search	CO-4 BTL-3
MODULE 5: ALGORITHMIC TECHNIQUES (9L+3P)	
Dynamic programming, - Elements of dynamic programming- greedy algorithms- Huffman codes, NP complete and NP hard- NP completeness-NP complete problems Practical Component: <ul style="list-style-type: none"> • Apply appropriate technique to solve a problem. Suggested Readings : Algorithm design techniques	CO-5 BTL-3
TEXT BOOKS	
1.	Peter Brass (2019) Advanced Data Structures, Cambridge University Press
2.	Rance D. Neclase (2016), " <i>Data Structures and Algorithms in Python</i> ", Wiley Publication
REFERENCE BOOKS	
1.	Goodrich Michael T,(2016) Data Structures and Algorithms in Python, Wiley publication.
E BOOKS	
1.	https://doc.lagout.org/Others/Data%20Structures/Advanced%20Data%20Structures%20%5BBrass%202008-09-08%5D.pdf
MOOC	
1.	https://www.mooc-list.com/tags/advanced-data-structures

COURSE TITLE		PYTHON PROGRAMMING				CREDITS	3
COURSE CODE		CCA42005	COURSE CATEGORY		PC	L-T-P-S	2-0-2-0
VERSION	1.0	APPROVAL DETAILS	36th ACM 05-11-2022		LEARNING LEVEL	BTL-3	

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Practical Assessment	Observations/Lab Records	Attendance	ESE	
					T	P
15%	15%	10%	5%	5%	25%	25%

Course Description	The course shows you how to use the free open-source Python to write basic programs and high-level applications using concepts such as Class, BIF of Python, functions, variables, If Else statements, For loops, While loops, iterative and recursive programs and algorithms such as the Insertion Sort algorithm. This course will be of great interest to all learners who would like to gain a thorough knowledge and understanding of the basic components of computer programming using the Python language – and might be a gentle introduction to programming for those who think they might have a longer-term interest in the subject area.
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Course Objective	<ol style="list-style-type: none"> 1. To understand the basic python programming 2. To understand the data collections and language components of the Python 3. To learn object-oriented concepts in Python. 4. To understand the concepts of functions and modules. 5. To understand I/O and Error Handling in Python
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Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Apply the principles python programming. 2. Write clear and effective python code. 3. Develop applications using python programming. 4. Implement functions and modules. 5. Describe the OOPS concepts in the Python.
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Prerequisites: Programming skills

CO, PO AND PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	3	3	3	-	1	-	2	-	2	3	3	3	-	1	-
CO-2	1	2	1	-	-	-	2	-	-	1	2	1	-	-	-
CO-3	3	1	2	1	-	-	1	1	2	3	1	2	1	-	-
CO-4	2	2	1	-	1	1	1	-	-	2	2	1	-	1	1
CO-5	3	1	1	-	-	-	-	-	2	3	1	1	-	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO PYTHON PROGRAMMING LANGUAGE (6L+3P)

Strengths and Weaknesses, IDLE, Dynamic Types, Naming Conventions, String Values, String Operations, String Slices, String Operators, Numeric Data Types, Conversions, Built in Functions Practical component: Implementation of various data types in Python Suggested Readings: Data types and structures	CO-1 BTL-2
MODULE 2: DATA COLLECTIONS AND LANGUAGE COMPONENT (6L+3P)	
Introduction, Control Flow and Syntax, Indenting, The if Statement, Relational Operators, Logical, Operators, True or False, Bit Wise Operators, The while Loop, break and continue, The for Loop, Lists, Tuples, Sets, Dictionaries, Sorting Dictionaries, Copying Collections. Practical component: Python 3 editor. Suggested Readings: Advances in data types	CO-2 BTL-2
MODULE 3: OBJECT AND CLASSES (6L+3P)	
Classes in Python, Principles of Object Orientation, Creating Classes, Instance Methods, File Organization, Special Methods, Class Variables, Inheritance, Polymorphism, Type Identification, Custom Exception Classes Practical component: Handling objects and classes in Python. Suggested Readings: Best practices for classes and classes	CO-3 BTL-3
MODULE 4: FUNCTIONS AND MODULES (6L+3P)	
Introduction, Defining Your Own Functions, Parameters, Function Documentation, Keyword and Optional Parameters, Passing Collections to a Function, Variable Number of Arguments, Scope, Functions - "First Class Citizens", Passing Functions to a Function, Mapping Functions in a Dictionary, Lambda, Modules, Standard Modules – sys, Standard Modules – math, Standard Modules – time, The dir. Function Practical component: Implementing functions and modules in Python. Suggested Readings: Functions and modules	CO-4 BTL-2
MODULE 5: I/O AND ERROR HANDLING IN PYTHON (6L+3P)	
Introduction, Data Streams, Creating Your Own Data Streams, Access Modes, Writing Data to a File, Reading Data from a File, Additional File Methods, Using Pipes as Data Streams, Handling IO Exceptions, Working with Directories, Metadata, Errors, Run Time Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions Practical component: I/O and error handling test in Python. Suggested Readings: Introduction to next level of Python programming language	CO-5 BTL-2
TEXT BOOKS	
1.	Mark Pilgrim(2012), <i>Dive into Python</i> , Mike, CreateSpace
REFERENCE BOOKS	
1.	Mark Lutz(2010) , <i>Programming Python</i> , O'Reilly Media, 4th Edition
E-BOOKS	

1.	https://docs.python.org/3/tutorial/
MOOC	
1.	https://www.mooc-list.com/course/learn-python-fundamentals-python-programming-language-skillshare
2.	https://www.mooc-list.com/course/python-basics-absolute-beginners-skillshare

COURSE TITLE		MACHINE LEARNING						CREDITS			4				
COURSE CODE		CCA42006	COURSE CATEGORY			PC	L-T-P-S	3-0-2-0							
VERSION	1.0	APPROVAL DETAILS		36 th ACM	05-11-2022	LEARNING LEVEL			BTL-3						
ASSESSMENT SCHEME															
First Periodical Assessment	Second Periodical Assessment	Practical Assessment	Observations /Lab Records	Attendance	ESE										
					Theory	Prac									
15%	15%	10%	5%	5%	25%	25%									
Course Description		Machine Learning is a method of data analysis that automates analytical model building. Intensive knowledge-oriented course provided to build business models for analytics. It is designed to give the participant enough exposure to the variety of applications that can be built using techniques													
Course Objective		<ol style="list-style-type: none"> To understand basics of AI and the need of Machine learning. To acquire the knowledge of various classification techniques. To study the various algorithms related to supervised and unsupervised learning. To learn the theoretical and practical aspects of probabilistic graphical models. To explore the applications of machine learning. 													
Course Outcome		<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> Explain the need of machine learning and model building. Understand the concept to apply the supervised algorithms. Develop a skill to implement unsupervised algorithms for problem solving. Understand the concept of reassurance learning algorithms. Able to apply the learning algorithms in real world problem solving. 													
Prerequisites: Data Mining															
CO, PO AND PSO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	2	1	1	3	3	1	1	1	1	1	1	1	3	2	2
CO-2	2	1	-	-	1	-	1	-	1	1	1	-	1	1	1
CO-3	2	1	2	1	-	1	-	1	1	-	-	-	1	-	-
CO-4	2	1	-	1	2	1	2	1	-	2	1	1	1	2	1

CO-5	3	2	2	3	3	1	1	-	1	1	1	1	3	2	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION TO AI AND MACHINE LEARNING															(9L+6P)
<p>Artificial Intelligence(AI) problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation. Introduction to Machine learning: Type of Learning and Examples, basic concepts in machine learning, Computational Learning theory, Introduction to Parametric Models – Non-Parametric Models –Probability Basics.</p> <p>Practical Component : Simple machine learning problems</p> <p>Suggested Readings: Basics of Machine learning</p>															CO-1 BTL-1
MODULE 2: SUPERVISED LEARNING															(9L+6P)
<p>Supervised Learning Algorithms Supervised Machine Learning Algorithms, working of supervised machine learning algorithm, Naive Bayes algorithm, decision tree, Support Vector Machines, KNN, Random Forest algorithm.</p> <p>Practical Component : Supervised learning algorithms</p> <p>Suggested Readings: Fundamentals of supervised Learning</p>															CO-2 BTL-2
MODULE 3: UNSUPERVISED LEARNING															(9L+6P)
<p>Clustering- K-means -EM Algorithm- Mixtures of Gaussians - Dimensionality Reduction - Factor analysis – Feature Selection - Principal Component Analysis - Probabilistic PCA - Independent components analysis - Singular Value Decomposition.</p> <p>Practical Component : K -means clustering algorithm</p> <p>Suggested Readings: Basics of Unsupervised Learning</p>															CO-3 BTL-3
MODULE 4: REINFORCEMENT LEARNING															(9L+6P)
<p>Reinforcement Learning Algorithms Reinforcement Machine Learning Algorithms, working of reinforcement machine learning algorithm, Finite Markov Decision Processes, Dynamic Programming, Monte Carlo Methods</p> <p>Practical Component : Dynamic programming</p> <p>Suggested Readings: Reinforcement learning algorithms</p>															CO-4 BTL-3
MODULE 5: APPLICATIONS AND USE CASE															(9L+6P)
<p>Ranking: Priority Inbox - Ordering Email Messages by Priority - Writing a Priority Inbox - Spam Filtering - Analyzing Social Graphs - Social Network Analysis - Hacking Twitter Social Graph Data - Analyzing Twitter Networks – Case Study.</p> <p>Practical Component: Applications using ML</p> <p>Suggested Readings: Applications of machine learning</p>															CO-5 BTL-3
TEXT BOOKS															

1.	Ethem Alpaydin(2020), <i>Introduction to Machine Learning</i> , The MIT Press Cambridge, Fourth Edition, MIT Press Hardcover.
2	Shai Shalev-Shwartz, Shai Ben-David(2014), <i>Understanding Machine Learning: From Theory to Algorithms</i> , Cambridge University Press.
REFERENCE BOOKS	
1.	V Kishore Ayyadevara(2018), <i>Pro Machine Learning Algorithms A Hands-On Approach to Implementing Algorithms in Python and R</i> , Apress
2	Kevin P. Murphy(2022) , <i>Probabilistic Machine Learning an Introduction</i> . The MIT Press.
E BOOKS	
1.	https://alex.smola.org/drafts/thebook.pdf
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc21_cs85/preview
2.	https://onlinecourses.nptel.ac.in/noc21_cs70

COURSE TITLE		FULL STACK WEB DEVELOPMENT			CREDITS	3
COURSE CODE		CCA42007	COURSE CATEGORY	PC	L-T-P-S	2-0-2-0
Version	1.0	Approval Details	36 th ACM 05-11-2022	LEARNING LEVEL		BTL-3
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Practical Assessment	Observations /Lab Records	Attendance	ESE	
15%	15%	10%	5%	5%	25%	25%
Course Description	This course gives insights into supporting development efforts from project conceptualization to launch , prototyping and building applications and websites. Full –stack development will helps to acquire a set of skills in HTML,CSS,JavaScript,MongoDB etc,					
Course Objective	1.Acquire knowledge and ability to develop web sites 2.Prototyping and building applications 3.provides knowledge of software development using javascript, Node.js etc 4 Provides skills on agile project management and soft skills 5.Build database backed APIs and web applications					
Course Outcome	Upon completion of this course, the students will be able to 1.Create a web page and apply style sheets for formatting the page 2.Create a simple Web App using Bootstrap 3. create a simple web page and validate the form using JavaScript 4. Explain and deploy the ReactJSApp 5.Create and manage MongoDB					
Prerequisites: Basics of web						

CO, PO and PSO Mapping															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	3	3	3	3	1	1	1	1	1	1	3	3	1	1	1
CO-2	2	1	2	1	2	1	2	1	1	-	-	1	-	1	-
CO-3	2	3	3	1	2	3	3	1	1	2	1	-	1	-	1
CO-4	2	1	2	1	2	1	2	-	1	-	1	2	1	2	1
CO-5	2	2	3	3	1	1	-	1	2	2	3	3	1	1	-
MODULE 1: HTML AND CSS												(6L+3P)			
HTML- Browsers and HTML-Tags-headings ,paragraphs, formatting text, lists and links, images and tables-CSS-Appling CSS to hTML-CSS colors and backgrounds-CSS Box model-CSS Margins- CSS Text and Font properties- Practical Component: Create and Format a web page using HTML and CSS Suggested Readings: CSS to apply styles													CO-1 BTL-2		
MODULE 2: BOOTSTRAP												(6L+3P)			
Introduction to Bootstrap-Bootstrap Introduction to Bootstrap - Bootstrap Basics - Bootstrap Grids - Bootstrap Themes - Bootstrap CSS - Bootstrap JS Practical Component: Create a simple webApp using Bootstrap Suggested Readings: BootStrap Components													CO-2 BTL-3		
MODULE 3: JAVASCRIPT												(6L+3P)			
Introduction to Javascript-JS syntax-introduction to document and window object- variables and operators-string manipulation- conditional and looping statements- type conversion-debugging-objects-forms-HTML DOMS- Practical Component: create a simple web page and validate the form using JavaScript Suggested Readings: Javascript commands													CO-3 BTL-3		
MODULE 4 : ReactJS AND NodeJS												(6L+3P)			
Introduction-templating using JSX-components-state and props-lifecycle of components-rendering list and portals-error handling-routers-service side rendering-Basics and setup-console-command utitlies- js modules-Node js Events-Node js database access Practical Component: Deploying ReactJS App Suggested Readings: Types of Hooks													CO-4 BTL-3		
MODULE 5: MongoDB												(6L+3P)			
SQL and NoSQL concepts-Create and Manage MongoDB- Collections in MongoDB-Dcouments in MongoDB- Difference between MySQL and NoSQL- Inserting data into Database- Migration of Data into MongoDB-MongoDB with PHP-Mongo DB with NodeJS- services offered by MongoDB. Connect Mongo with python Practical Component: Connecting MongoDB with python Suggested Readings: Embedded document in MongoDB													CO-5 BTL-3		
TEXT BOOKS															

1.	Chris Nothwood(2018), "The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer", Apress Publisher
REFERENCE BOOKS	
1.	Laura Lemay , Rafe Colburn , Jennifer Kyrnin Mastering Html, CSS(2019) & Javascript Web Publishing, BPB Publications
E BOOKS	
1.	https://www.pdfdrive.com/the-full-stack-developer-your-essential-guide-to-the-everyday-skills-expected-of-a-modern-full-stack-web-developer-e187214497.html
MOOC	
1.	https://www.coursera.org/professional-certificates/ibm-full-stack-cloud-developer

COURSE TITLE		ADVANCED DATABASE TECHNOLOGIES			CREDITS	3		
COURSE CODE		CCA42008	COURSE CATEGORY		PC	L-T-P-S	2-0-2-1	
Version	1.0	Approval Details		36 th ACM 05-11-2022	LEARNING LEVEL	BTL-3		
ASSESSMENT SCHEME								
First Periodical Assessment		Second Periodical Assessment		Practical Assessment	Observations /Lab Records	Attendance	ESE	
							Theory	Prac
15%		15%		10%	5%	5%	25%	25%
Course Description		The course focuses on the uses of relational and object-oriented databases for storing and managing information. Topics covered include computer database terminology and the evolution of the modern database. Database management systems (DBMS) such as Oracle, MySQL, Microsoft SQL Server, and Microsoft Access are introduced along with query languages. This also includes the creation of simple databases, inputting data, and developing basic queries.						
Course Objective		<ol style="list-style-type: none"> 1. To understand Database Base Management System both in terms of use and implementation. 2. To utilize a wide range of features available in a DBMS package. 3. To develop the logical design of the database using data modeling concepts such as entity-relationship diagrams. 4. To create a relational database using a relational database package. 5. To provide skills to work with Structured Query Language. 						
Course Outcome		<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> 1. Implement database design techniques. 2. Apply normalization. 3. Implement object relational database. 4. Employ distributed and parallel DBMS. 5. Create a design structured and unstructured DB and multimedia database. 						
Prerequisites: Database basics								
CO, PO AND PSO MAPPING								

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	2	1	1	3	3	1	1	1	1	1	1	1	3	2	2
CO-2	2	1	-	-	1	-	1	-	1	1	1	-	1	1	1
CO-3	2	1	2	1	-	1	-	1	1	-	-	-	1	-	-
CO-4	2	1	-	1	2	1	2	1	-	2	1	1	1	2	1
CO-5	3	2	2	3	3	1	1	-	1	1	1	1	3	2	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION TO DATABASE SYSTEMS													(6L+3P)		
Introduction to Database Systems, DBMS Architecture, Introduction to Data Modeling, ER Model, EER Model -Specialization/Generalization, Aggregation, Composition, Relational model algebra operations, ER, EER to Relational Model. Normalization – Informal Guidelines, Functional dependencies, decomposition algorithms, Normal Forms up to 5NF, SQL - Basic & Advanced Operations, Query Processing, Query optimization, Storage and File organization Practical Component: Suggested Readings: Entity Relationship Model, Relational Algebra													CO-1 BTL-3		
MODULE 2: DISTRIBUTED, SPATIAL AND TEMPORAL DATABASES													(6L+3P)		
Distributed systems-Architecture-Distributed database concepts-distributed data storage-distributed transactions-Active Databases Model – Design and Implementation Issues - Temporal Databases - Temporal Querying - Spatial Databases: Spatial Data Types, Spatial Operators and Queries – Spatial Indexing and Mining – Applications Practical Component: Create a distributed database for any application (ex. book store) and access it using Python Suggested Readings: Distributed Query Processing													CO-2 BTL-3		
MODULE 3: OBJECT RELATIONAL DBMS													(6L+3P)		
Introduction to Object Oriented Data Bases - Approaches - Modeling and Design - Persistence - Transaction - Concurrency - Recovery - Database Administration. Overview, Complex Data Types, ODBMS & ORDBMS, Structured Types and Inheritance in SQL, Table Inheritance, Object-Identity and Reference Types in SQL Suggested Readings: Object Database management system													CO-3 BTL-3		
MODULE 4: NOSQL DATABASES													(6L+3P)		
NoSQL – CAP Theorem – Sharding - Document based – MongoDB Operation: Insert, Update, Delete, Query, Indexing, Application, Replication, Sharding– Cassandra: Data Model, Key Space, Table Operations, CRUD Operations, CQL Types – HIVE: Data types, Database Operations, Partitioning – HiveQL – OrientDB Graph database – OrientDB Features Practical Component: Perform table operations Suggested Readings: HiveQL													CO-4 BTL-3		

MODULE 5: XML DATABASES		(6L+3P)
Structured, Semi structured, and Unstructured Data – XML Hierarchical Data Model – XML Documents – Document Type Definition – XML Schema – XML Documents and Databases – XML Querying – XPath – XQuery , Practical Component: Creating XML Documents, Document Type Definition and XML Schema for any e- commerce website Suggested Readings: Query Language for XML		CO-5 BTL-3
TEXT BOOKS		
1.	<i>Abraham Silberschatz, Henry F Korth, S. Sudharshan(2019), "Database System Concepts", Seventh Edition, McGraw Hill..</i>	
2	Thomas M. Connolly and Carolyn Begg(2015), <i>Database Systems: A Practical Approach to Design, Implementation, and Management</i> , 6th Edition, Pearson India	
REFERENCE BOOKS		
1.	Ramez Elmasri & B. Navathe (2017): <i>Fundamentals of database systems</i> , 7th Edition, Addison Wesley.	
E-BOOKS		
1.	https://theswissbay.ch/pdf/Gentoomen%20Library/Databases/Molina%20Cullman%20-%20Database%20Systems%20The%20Complete%20Book.pdf	
MOOC		
1.	https://swayam.gov.in/courses/4598-database-and-content-organisation	

COURSE TITLE		RESEARCH METHODOLOGY AND IPR			CREDITS	2
COURSE CODE		CCA42009	COURSE CATEGORY	BS	L-T-P-S	2-0-0-1
Version	1.0	Approval Details	36 th ACM 05-11-2022	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE	
15%	15%	10%	5%	5%	50%	
Course Description	This course gives an overview of the research methodology and the techniques of researches. This course also discusses the various forms of intellectual property rights					
Course Objective	1. To gain insights into various approaches in research 2. To provide a wide knowledge in the area of research 3. To explain the tests of hypotheses 4. To understand the various forms of intellectual property rights 5. To know the new developments on IPR					
Course Outcome	Upon completion of this course, the students should be able to 1. Explain and define the research problem					

	2. Develop theoretical and conceptual framework 3. Apply the various data collection methods 4. Explain IPR 5. Analyze the research related information and new developments in IPR														
Prerequisites: Research Basics															
CO, PO AND PSO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O 2	PS O 3
CO-1	3	1	1	3	1	3	1	1	3	1	3	1	1	2	1
CO-2	1	1	-	1	1	1	1	-	1	1	1	1	-	1	1
CO-3	1	-	2	1	1	1	-	2	1	-	1	-	2	1	2
CO-4	1	2	-	1	1	1	2	-	1	2	1	2	-	-	2
CO-5	3	2	2	2	-	1	-	3	1	-	3	1	2	1	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION															(6L)
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. Defining the Research Problem: Research Problem, Selecting t Technique Involved in Defining a Problem, An Illustration														CO-1 BTL-2	
MODULE 2: REVIEWING THE LITERATURE															(6L)
Place of the literature review in research, Bringing clarity and focus to research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed														CO-2 BTL-2	
MODULE 3 DATA ANALYSIS AND INTERPRETATION															(6L)
Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method, Hypothesis, Hypothesis testing, Data processing software (e.g. SPSS etc.), statistical inference, Interpretation of results.														CO-3 BTL-3	
MODULE 4: NATURE OF INTELLECTUAL PROPERTY															(6L)
Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.														CO-4 BTL-3	
MODULE 5: PATENT RIGHTS AND NEW DEVELOPMENTS IN IPR															(6L)
Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.														CO-5 BTL-3	

TEXT BOOKS	
1.	C.R. Kothari, Gaurav Garg(2018), Research Methodology:Methods and Techniques ,4 th Edition, New Age International
REFERENCE BOOKS	
1.	Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016
E BOOKS	
1.	https://ccsuniversity.ac.in/bridge-library/pdf/Research-Methodology-CR-Kothari.pdf
MOOC	
1.	https://www.coursera.org/learn/research-methods

COURSE TITLE		SOFTWARE DESIGN PROJECT			CREDITS	2
COURSE CODE		CCA42400	COURSE CATEGORY	PC	L-T-P-S	0-0-4-1
Version	1.0	Approval Details	36 th ACM 05-11-2022	LEARNING LEVEL		BTL-3
ASSESSMENT SCHEME						
First Periodical Assessment		Second Periodical Assessment	Assignment /Observation and Lab Records	Surprise Test / Quiz	Attendance	ESE
15%		15%	10%	5%	5%	50%
Course Description	A Software Project is the complete procedure of software development from requirement gathering to testing and maintenance, carried out according to the execution methodologies, in a specified period of time to achieve intended software product.					
Course Objective	<ol style="list-style-type: none"> To function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, To identify, formulate, and solve complex engineering problems by applying principles To apply engineering design to produce solutions that meet specified needs To develop and conduct appropriate experimentation, analyze and interpret data. To acquire and apply new knowledge as needed, using appropriate learning strategies. 					
Course Outcome	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> Identify a real time work helpful for the society. Analyze and solve the solution for the problem. Create an application by using relevant computer application concepts. Conduct appropriate experiment in different software design methods. Create Real time scenario-based software project design. 					
Prerequisites: Software Engineering concepts and Programming Skills						

CO, PO AND PSO MAPPING															
CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
CO-1	3	1	1	3	1	3	1	1	3	1	1	3	1	1	-
CO-2	1	1	-	1	1	1	1	-	1	1	-	1	1	-	2
CO-3	1	-	2	1	-	1	-	2	1	-	2	1	-	2	-
CO-4	1	2	-	1	2	1	2	-	1	2	-	1	2	1	-
CO-5	3	3	3	1	1	3	1	1	3	1	1	3	3	-	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
SOFTWARE DESIGN PROJECT															
Identify a real time work helpful for the society. Develop a solution for the problem Develop an application by using relevant computer application concepts Tools used Any Application Software in the specific domain for solving the problem Suggested Readings: Application Strategy and Business Intelligence														CO-1 BTL-3	
Rubrics for Grading the Software Design Project															
Component		Grading criteria												Total	
		Exemplary (20)			Competent (15)			Partially correct – Needs to work (10)			Unsatisfactory (5)				
First Periodical Assessment															
Project objective formulation		All major objectives are identified and methodology clearly identified based on the existing system			Most of the objectives were identified but one or two were not identified			Only few objectives were identified			Objectives are not identified			15%	
Methodology to be followed		Methodology clearly identified based on the existing system			Methodology chosen and some are not adequately addressed			Partially identified			Not identified				
Second Periodical Assessment															

Use of Software Engineering techniques	Employ appropriate tools and software engineering techniques	Employ appropriate tools and software engineering techniques in his course of study	Employ some tools and software engineering techniques	Not used	
Implementation /Demonstration	Implemented and demonstrated the project with all the details	Implemented and demonstrated the project	Partial implementation	Not implemented	15%
Assignment/ Observation/lab records/Quiz					15%
Attendance					5%
End Semester Examination					
Project Report	Report is well organized and clearly written Diagrams are consistent Sentences are grammatical and free from spelling errors	Report is well organized and clearly written some of the parts Sentences are mostly grammatical and only a few spelling errors are present	Report is organized Some diagrams are not well explained. Grammar errors that impede the flow of communication	Report lacks an overall organization. Diagrams are not drawn , grammatial spelling errors etc,	10%
Presentation	Presentation, demonstration with all the project details & viva voce	Presentation well organized with demonstration	Presentation is not organized and partial demonstration	Presentation lacks content and not demonstrated	40%
				Total	100%

List of Electives

COURSE TITLE		CLOUD COMPUTING CONCEPTS				CREDITS	3								
COURSE CODE		CCA42500	COURSE CATEGORY		DE	L-T-P-S	3-0-0-0								
Version	1.0	Approval Details		36 th ACM 05-11-2022		LEARNING LEVEL	BTL-3								
ASSESSMENT SCHEME															
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments / Project		Surprise Test / Quiz	Attendance	ESE									
15%	15%	10%		5%	5%	50%									
Course Description	This course will equip the students to master significant concepts of Cloud Computing and implement its various services. It explores the best practices and strategies around securing access to cloud services and infrastructure. The students can use se tools and methods available with public cloud ecosystems - such as AWS														
Course Objective	<ol style="list-style-type: none"> 1. To provide students with the fundamentals and essentials of cloud computing 2. To provide students a sound foundation of the Cloud computing so that they are able to start using and adopting Cloud Computing services and tools in their real-life scenarios. 3. To enable students exploring some important cloud computing driven commercial systems and applications. 4. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research. 5. To research state-of-the-art in Cloud Computing fundamental issues, technologies, applications and implementations. 														
Course Outcome	Upon completion of this course, the students should be able to <ol style="list-style-type: none"> 1. Describe the cloud computing fundamentals. 2. Analyze the various cloud applications. 3. Describe the management of cloud services. 4. Develop a skill for application development. 5. Implement cloud IT model. 														
Prerequisites: Cloud Computing															
CO, PO AND PSO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	3	2	2	1	2	2	2	-	3	2	-	1	3	2	2
CO-2	-	3	2	-	1	-	-	3	2	-	-	3	2	1	-
CO-3	-	-	1	-	1	-	-	-	1	-	-	-	1	2	-
CO-4	1	1	-	1	1	1	1	1	-	1	1	1	-	-	1

CO-5	3	3	1	1	3	3	3	3	1	1	3	1	3	1	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: CLOUD COMPUTING FUNDAMENTALS															(9L)
<p>Fundamental concepts and models- Benefits and challenges of cloud computing – Cloud consumers and Cloud providers- Scaling- Cloud Enabling Technology - IaaS, PaaS, SaaS., Role of virtualization in enabling the cloud; Business Agility: Benefits and challenges to Cloud architecture. Application availability, performance, security and disaster recovery; next generation Cloud Applications - Cloud computing Architecture – Cloud containers</p> <p>Practical Component: Create a text document and store locally and also on cloud and share it</p> <p>Suggested Readings: Cloud Enabling Technology</p>															CO-1 BTL-3
MODULE 2: WEB SERVICES IN CLOUD															(9L)
<p>Web Service Architecture – Web Service APIs – Web service Authentication - Web service authentication methods - Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages</p> <p>Practical Component: Deploying a web service in cloud</p> <p>Suggested Readings: Web Service APIs – Web service Authentication</p>															CO-2 BTL-3
MODULE 3: MANAGEMENT OF CLOUD SERVICES															(9L)
<p>Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics: Cloud Computing infrastructures available for implementing cloud-based services. Economics of choosing a Cloud platform for an organization, based on application requirements, economic constraints and business needs (e.g., Amazon, Microsoft and Google, Salesforce.com, Ubuntu and Red hat).</p> <p>Practical Component: Design and develop cloud based applications</p> <p>Suggested Readings: Economics of choosing a Cloud platform for an organization</p>															CO-3 BTL-3
MODULE 4: APPLICATION DEVELOPMENT															(9L)
<p>Programming Models for Cloud Computing - Software Development in Cloud - Service creation environments to develop cloud-based applications. Development environments for service development; Amazon, Azure, Google App.</p> <p>Practical Component: Deploy a virtual machine on AWS - IaaS</p> <p>Suggested Readings: Amazon, Azure, Google App</p>															CO-4 BTL-3
MODULE 5: CLOUD SECURITY															(9L)
<p>Threats and Risks – Security controls and mechanisms-security policies-Threat agents-cloud security threats- DOS-Virtualization attack- Risk Management</p> <p>Practical Component: Cloud Security Mechanisms -Encryption –Case study</p> <p>Suggested Readings: Flawed Implementations, Security policy disparity</p>															CO-5 BTL-2

TEXT BOOKS	
1	Sunilkumar Manvi, Gopal Shyam(2021), <i>Cloud Computing Concepts and Technologies</i> , CRC press
2	Gautam Shroff, “ <i>Enterprise Cloud Computing Technology Architecture Applications</i> ”, Cambridge University Press; 1 edition, [ISBN: 978-0521137355].
REFERENCE BOOKS	
1.	Thomas Erl, Zaigham Mahmood and Ricardo Puttini(2013), <i>Cloud Computing – concepts, Technology and Architecture</i> , Prentice Hall.
E BOOKS	
1.	https://www.springer.com/us/book/9789811328282
MOOC	
1.	https://www.mooc-list.com/course/cloud-computing-security-edx

COURSE TITLE		INTERNET OF THINGS			CREDITS	3
COURSE CODE		CCA42501	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details	36 th ACM 05-11-2022	LEARNING LEVEL		BTL-3
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments / Project	Surprise Test / Quiz	Attendance	ESE	
15%	15%	10%	5%	5%	50%	
Course Description	“The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.”					
Course Objective	<ol style="list-style-type: none"> To identify, formulate, and solve complex engineering problems by applying principles To provide leadership ability and create a collaborative and inclusive environment, To apply engineering design to produce solutions that meet specified needs To develop and conduct appropriate experimentation, analyze and interpret data. To acquire and apply new knowledge as needed, using appropriate learning strategies. 					
Course Outcome	Upon completion of this course, the students should be able to <ol style="list-style-type: none"> Recognize characteristics and physical design of IoT. Identify suitable connectivity protocols. Discuss IoT sensor networks at various use cases. Demonstrate the functionalities of Arduino and Machine to Machine communication 					

5. Develop IoT enabled hardware setup to execute domain specific IoT application.															
Prerequisites: Networking with Internet															
CO, PO AND PSO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	3	2	2	1	2	2	2	-	3	2	-	1	2	-	1
CO-2	-	3	2	-	2	-	1	2	-	1	-	3	1	-	1
CO-3	-	2	-	1	1	-	1	1	-	1	-	-	2	-	1
CO-4	1	1	-	1	2	-	1	2	-	1	1	1	1	-	1
CO-5	3	3	1	1	3	3	3	3	1	1	3	1	3	1	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION													(9L)		
Introduction: Definition & Characteristics of IoT – Physical Design of IoT – Logical Design of IoT- IoT Enabling Technologies –IoT Applications – IoT Challenges- Sensors- Actuators- An emerging Industrial Structure around IoT, Industrial IoT-consumer IoT Practical component: An IoT Framework for approaching market development Suggested Readings: Building an IoT architecture													CO-1 BTL-3		
MODULE 2:IOT TECHNOLOGIES AND ARCHITECTURES													(9L)		
Devices and Gateways-NFC, RFID and Tags-local and wide area networking-Data management-Business process in IoT Practical component: Networking, RFID with Internet Suggested Readings: Zigbee, Bluetooth and NFC													CO-2 BTL-3		
MODULE 3: IOT PROTOCOLS AND WSN													(9L)		
6LoWPAN, MQTT, CoAP, XMAP, AMQP, IEEE 802.15.4, RFID, Zigbee, Bluetooth, NFC. Wireless Sensor Networks: Application of WSN in IoT, WSN in Agriculture, wireless multimedia sensor networks, WSN challenges Practical component: RFID with Internet - WSN in IoT Suggested Readings: Wireless Sensors and Multimedia Sensor													CO-3 BTL-3		
MODULE 4: ARDUINO INTERFACING& M2M COMMUNICATION													(9L)		
Arduino Programming: Features, Types, Board details, IDE. Setup, Function Libraries, Examples programs. M2M :Machine to Machine Communication Introduction- Difference between IoT and M2M- Software Defined Networking (SDN) Practical component: Board Setup , Arduino programming Suggested Readings: Arduino Interfacing& Machine													CO-4 BTL-3		
MODULE 5 IoT APPLICATIONS													(9L)		
Industrial automation-Smart Lighting- Intrusion Detection - Weather monitoring- Indoor Air Quality Monitoring- Smart Irrigation-logistics-smart grid. Practical component: Framework or prototype of Smart lighting													CO-5 BTL-3		

Suggested Readings: Weather monitoring	
TEXT BOOKS	
1	Vlasios Tsiatsis, Stamatis Karnouskos, Jan Holler, David Boyle, Catherine Mulligan, (2018), <i>Internet of Things, Technologies and Applications for a New Age of Intelligence</i>
2	Arshdeep Bahga, Vijay Madiseti(2015) " <i>Internet of Things – A hands-on approach</i> ", Universities Press.
3	Olivier Hersent, David Boswarthick, Omar Elloumi(2012) " <i>The Internet of Things – Key applications and Protocols</i> ", Wiley publisher
E BOOKS	
1	https://drive.google.com/file/d/1VMQdwIjDw-an9KA3Jwiw16hB1mhJ411m/view
MOOC	
1.	https://nptel.ac.in/courses/106105166/

COURSE TITLE		BIG DATA FRAMEWORK			CREDITS	3
COURSE CODE		CCA42502	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details		36 th ACM 05-11-2022	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignment s/ Project	Surprise Test / Quiz	Attendance	ESE	
15%	15%	10%	5%	5%	50%	
Course Description	This course provides an overview of Big data Platform to explore, analyze, and leverage data. The students will be introduced to tools and algorithms which is used to create models that learn from data, and to scale those models to solve big data problems.					
Course Objective	<ol style="list-style-type: none"> To understand the Big Data Platform and its Use cases. To provide an overview of Apache Hadoop. To provide HDFS Concepts and Interfacing with HDFS. To understand Map, Reduce Jobs. Provide hands on Hadoop Eco System. 					
Course Outcome	Upon completion of this course, the students should be able to <ol style="list-style-type: none"> Describe the basics of Big Data. Implement the basic operations in Scala. Develop custom Scala functions as per the requirement. Understand the basics of RDDs. Illustrate spark runtime environment. 					
Prerequisites: knowledge of Programming Language (Java preferably), SQL (queries and sub queries)						
CO, PO AND PSO MAPPING						

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	2	3	-	3	2	3	2	-	2	3	-	3	2	3	2
CO-2	-	1	-	-	1	3	2	-	-	1	-	-	1	3	1
CO-3	-	1	1	1	2	3	-	3	2	3	2	1	-	-	1
CO-4	1	1	1	1	-	1	-	-	1	3	2	1	-	1	2
CO-5	2	2	1	2	2	2	1	1	1	1	1	1	3	1	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION TO BIG DATA													(9L)		
What is big data, the four Vs of big data, Distributed File System, functional programming vs object-oriented programming, advantages of Scala, spark streaming. Practical Component: Simple programs in Scala Suggested Readings: Distributed File System													CO-1 BTL-2		
MODULE 2: BASIC OPERATIONS IN SCALA													(9L)		
Variables and functions in Scala, looping in Scala, importance of values, sets and maps, understanding classes and singleton objects, rich wrappers, objects and variables, for expression, try expression, match expression Practical Component: Scala program to define and create objects Suggested Readings: Variables and functions in Scala													CO-2 BTL-3		
MODULE 3: FUNCTIONS AND CONTROL STATEMENTS IN SCALA													(9L)		
Nested functions-first class functions-placeholder syntax-closures-repeated parameters-tail recursion-reducing code duplication-currying-by name parameters-writing new control structures. Practical Component: Scala programs using functions and control statements Suggested Readings: writing new control structures													CO-3 BTL-3		
MODULE 4: RDD BASICS													(9L)		
RDD basics, creating RDD,RDD transformations, passing functions to spark, aggregation on pair RDD, grouping data on pair RDD, joins on pair RDD, sorting data in pair RDD, data partitioning in RDDs. Practical Component: Programs using functions and control statements Suggested Readings: joins on pair RDD, sorting data in pair RDD													CO-4 BTL-2		
MODULE 5: SAVING DATA, COMPRESSIONS, SPARK RUNTIME ARCHITECTURE													(9L)		
Saving data into various formats like text, json, csv, sequence files, object files etc. compression, spark SQL, accumulators, fault tolerance, broadcast variables, Numeric RDD operations, spark runtime architecture, cluster managers. Practical Component: Saving data in various formats and RDD Operations Suggested Readings: spark runtime architecture, cluster managers													CO-5 BTL-2		
TEXT BOOKS															
1.	Martin Odersky, Lex Spoon, Bill Venners(2016), <i>Programming in Scala: A comprehensive Step-by-Step Scala Programming Guide</i> , Third Edition. Artima Inc publisher														

2.	Holden Karau, Andy Konwinski, Patrick Wendell, Matei Zaharia(2016), <i>Learning Spark</i> , o'reilly
REFERENCE BOOKS	
1.	Sandy Ryza, Uri Laserson, Sean Owen and Josh Wills , <i>Advanced Analytics with Spark</i> , o'reilly 2017.
E BOOKS	
1.	http://dphoto.lecturer.pens.ac.id/lecture_notes/internet_of_things/Big%20Data%20Principles%20and%20Paradigms.pdf
MOOC	
1.	https://www.coursera.org/specializations/big-data

COURSE TITLE		VIRTUALIZATION TECHNIQUES			CREDITS	3
COURSE CODE		CCA42503	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details	36 th ACM 05-11-2022	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE	
15%	15%	10%	5%	5%	50%	
Course Description	Full virtualization is a virtualization technique used to provide a VME that completely simulates the underlying hardware. In this type of environment, any software capable of execution on the physical hardware can be run in the VM, and any OS supported by the underlying hardware can be run in each individual VM.					
Course Objective	<ol style="list-style-type: none"> To identify, formulate, and solve complex engineering problems by applying principles To apply engineering design to produce solutions that meet specified needs To function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, To develop and conduct appropriate experimentation, analyze and interpret data. To acquire and apply new knowledge as needed, using appropriate learning strategies. 					
Course Outcome	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> Describe the cloud and its techniques. Illustrate the different cloud delivery and deployment models Identify and analyze cloud file systems and its related technologies Describe how to access of Cloud File Systems and cloud workloads Demonstrate the usage of various cloud tools 					
Prerequisites: Cloud Basics						
CO, PO AND PSO MAPPING						

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	2	2	2	3	-	3	2	-	1	-	3	2	1	1
CO-2	-	3	2	-	1	-	-	1	-	1	-	-	1	-	2
CO-3	-	-	1	-	1	1	1	-	1	1	1	1	-	1	1
CO-4	1	1	-	1	1	1	1	-	1	1	3	3	1	1	-
CO-5	3	2	2	2	3	2	2	2	1	1	-	1	-	1	1
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: CLOUD COMPUTING FUNDAMENTALS (9L)															
Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud provider, SLA, Virtualization, Types of virtualizations, Server virtualization, storage virtualization, Network Virtualization and application virtualization, Importance of virtualization in cloud, Study of hypervisors. Practical component: Implementation of virtualization in cloud computing Suggested Readings: Study of hypervisors.														CO-1 BTL-3	
MODULE 2: CLOUD IMPLEMENTATIONS (9L)															
Cloud deployment models: Public cloud, Private cloud and Hybrid cloud- Organizational scenarios of clouds, Deploy application over cloud-Workload distribution, Resource pooling, dynamic scalability, elasticity, Service load balancing, Cloud bursting, Service Technology: SOAP and REST Web services, AJAX and mashups Web services, Service Middleware Practical component: Deploying application in cloud environment Suggested Readings: SOAP and REST Web services, AJAX and mashups														CO-2 BTL-3	
MODULE 3: MANAGEMENT OF CLOUD SERVICES (9L)															
Overview, Infrastructure as a Service (IaaS) Cloud Delivery Model, Platform as a Service (PaaS) Cloud Delivery Model, Software as a Service (SaaS) Cloud Delivery Model- Administering & Monitoring cloud services, benefits and limitations- Cloud computing platforms: Infrastructure as a service: Amazon EC2, Platform as a Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing. Practical component: Creating aws account and setting up your environment Suggested Readings: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing														CO-3 BTL-3	
MODULE 4: CLOUD FILE SYSTEMS AND WORKLOADS (9L)															
GFS and HDFS, BigTable, HBase and Dynamo, Map-Reduce: The Map-Reduce model- Cloud Workload Overview, Workloads most suitable for Cloud, Workloads not suitable for Cloud. Practical component: Monitoring the audit logs for errors Suggested Readings: HDFS, Big Table, H Base and Dynamo, Map-Reduce:														CO-4 BTL-2	
MODULE 5: CLOUD TOOLS AND FUTURE CLOUD (9L)															
Tools and Technologies for Cloud, Cloud Computing Platform: Eucalyptus, Nimbus, Open Nebula, Cloud Mashups, Cloud Tools: VMWare, Eucalyptus, Cloud Sim, implementing real time application over cloud platform, QOS Issues in														CO-5 BTL-2	

Cloud, data migration, streaming in Cloud, Concepts in Mobile Cloud Computing, Fog Computing, Dockers, Green Cloud, Cloud Computing, IoT Cloud. Practical component: Tools and Technologies for Cloud Suggested Readings: Mobile Cloud Computing, Fog Computing, Dockers,	
TEXT BOOKS	
1.	Thomas Erl, Zaigham Mahmood, and Ricardo Puttini(2013),” <i>Cloud Computing Concepts, Technology & Architecture</i> ”, Prentice Hall.
REFERENCE BOOKS	
1.	Rajkumar Buyya, James Broberg, Andrzej M. Goscinski(2011), <i>Cloud Computing: Principles and Paradigms</i> , Wiley Publishers
E BOOKS	
1.	https://www.manning.com/books/exploring-cloud-computing
MOOC	
1.	https://www.mooc-list.com/course/cloud-computing-concepts-part-2-coursera

COURSE TITLE		DATA ANALYSIS AND VISUALIZATION TECHNIQUES			CREDITS	3
COURSE CODE		CCA42504	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0
VERSION	1.0	APPROVAL DETAILS	36 th ACM 05-11-2022	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Practical Assessment	Observations /Lab Records	Attendance	ESE	
15%	15%	10%	5%	5%	25%	25%
Course Description	The ability to analyze data is a powerful skill that helps you make better decisions. This course focuses on data analysis techniques to solve and explore decision -making based on available data.					
Course Objective	<ol style="list-style-type: none"> To acquire the basic knowledge in statistics and scientific methods . To understand the ways of collecting data To summarize the data To understand the fundamentals of various formulas in excel To create aggregate reports using formula-based techniques. 					
Course Outcome	Upon completion of this course, the students will be able to <ol style="list-style-type: none"> Describe the statistics and scientific methods for data analysis Compare and contrast the data and describe the data collection methods Explain the ways of summarizing. Apply the various excel formulas Generate reports using formulas 					
Prerequisites: Office tools						

CO, PO AND PSO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	2	1	2	3	2	2	1	2	3	2	2	1	3
CO2	-	3	2	-	2	-	3	2	-	2	-	3	2	-	-
CO3	-	2	-	1	1	-	2	-	1	1	-	2	-	1	-
CO4	1	1	-	1	2	1	1	-	1	2	1	1	-	1	1
CO5	3	3	1	1	3	3	3	1	1	3	3	3	1	1	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION														(6L+3P)	
<p>Statistics and scientific methods, why study statistics? Current applications of statistics, Types of data, Data analysis as a process, Data Analysis as a cycle, Ways of analyzing qualitative data and quantitative data.</p> <p>Practical component: Analyzing qualitative and quantitative data</p> <p>Suggested Reading : Statistical methods for data analysis</p>													CO-1 BTL-2		
MODULE 2: COLLECTING AND SUMMARIZING DATA														(6L+3P)	
<p>Using surveys and experimental studies to gather data -Introduction to abstract research study -observational studies-Sampling designs for survey-Experimental Studies-Designs for experimental studies-Research study Describing data on a single variable-Graphical methods ,measures of central tendency-measures of variability-summarizing data from more than one variable</p> <p>Practical component: Data collection and summarization methods</p> <p>Suggested Readings: Various designs of data collection</p>													CO-2 BTL-2		
MODULE 3: STATISTICAL MEASURES														(6L+3P)	
<p>Statistical measures – Mean, Variance, Percentiles, Quartiles - Pearson correlation – Spearman’s Rank correlation – Parametric tests – test for single population mean , equality of mean for two independent sample , paired t test, testing correlation coefficient, Non parametric tests – Mann Whitney U test, Wilcoxon signed rank test – Kruskal Wallis test – One way ANOVA – Simple and Multiple Linear regression</p> <p>Practical component: Writing formulas in excel to aggregate the data</p> <p>Suggested Readings: Create ANOVA table</p>													CO-3 BTL-3		
MODULE 4: DATA VISUALIZATION														(6L+3P)	
<p>Why visualize data? Visualizing data: Mapping data onto aesthetics, Aesthetics and types of data, Scales map data values onto aesthetics, Coordinate systems and axes, Color scales</p> <p>Practical Component: Implementing various ways of Data visualizations</p> <p>Suggested Readings: Visualization Techniques</p>													CO-4 BTL-2		
MODULE 5: PLOTTING DATA														(6L+3P)	
<p>Introduction-line plots-titles, labels and legends, plotting using CSV and TSV data source, scatter plot, Bar plots, Histograms, pie charts, stack plots</p> <p>Practical component: Plotting using matplotlib</p>													CO-5 BTL-2		

Suggested Readings: other plotting techniques	
TEXT BOOKS	
1.	R.Lyman.ott (2022), <i>An Introduction to Statistical Methods and Data Analysis</i> 7th Edition, Cengage Learning, Inc
2	Claus O. Wilke(2019), <i>Fundamentals of Data Visualization</i> . OREILLY' publishers
REFERENCE BOOKS	
1	Wayne L. Winston (2011), <i>Microsoft Excel 2010 Data Analysis and Business Modeling</i> , Microsoft Press publisher
2	Mario Dobler Tim Gromann(2019), <i>Data Visualization with Python: Create an impact with meaningful data insights using interactive and engaging visuals</i> , Packt Publishing.
E BOOKS	
1.	https://spreadsheetplanet.com/best-excel-books/
MOOC	
1.	https://www.edx.org/course/spreadsheet
2.	https://www.coursera.org/courses?query=spreadsheet

COURSE TITLE	BLOCKCHAIN TECHNOLOGY				CREDITS	3
COURSE CODE	CCA42505	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0	
VERSION	1.0	APPROVAL DETAILS	36th ACM 05-11-2022	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Practical Assessment	Observations/ Lab Records	Attendance	ESE	
15%	15%	10%	5%	5%	Theory	Prac
15%	15%	10%	5%	5%	25%	25%
Course Description	The course will enable the students to understand the basics of Blockchain, use appropriate consensus mechanism for Blockchain applications and apply AI techniques for Blockchain use-cases.					
Course Objective	<ol style="list-style-type: none"> To understand the basics of Blockchain To Identify Consensus mechanism for Blockchain Application To apply Artificial intelligence techniques for Blockchain usecases 					
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> Apply Hyperledger Fabric and Ethereum platform to implement the Block Chain Application Identify Consensus mechanism for Blockchain Application Recall the function of Blockchain & AI as a method of securing distributed ledgers. Identify the major research challenges in crypto currency domain. Develop techniques in information science applications by applying 					

Computational intelligence and appropriate machine learning techniques in Blockchain															
Prerequisites: Artificial Intelligence															
CO, PO AND PSO MAPPING															
CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PS O1	PS O-2	PS O-3
CO-1	3	2	2	2	1	-	1	-	-	1	2	2	2	2	1
CO-2	2	1	1	1	1	-	2	-	1	-	2	1	1	1	1
CO-3	2	1	1	1	2	-	1	-	-	-	1	2	1	2	1
CO-4	2	1	1	2	2	-	2	-	-	-	1	2	2	2	2
CO-5	2	2	2	3	3	1	3	2	2	-	1	3	3	3	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION TO BLOCKCHAIN												(6L+3P)			
<p>Blockchain-Introduction, distributed ledger technology versus distributed databases - Comparing the technologies with examples – Structure of Blockchain, Building blocks of Blockchain, Public versus private, permissionless versus permissioned Blockchain - Comparing usage scenarios - Privacy in Blockchain - Understanding Bitcoin and Ethereum, smartcontracts. Introduction to Hyperledger - Overview of the project - Hyperledger Fabric - Hyperledger Saw tooth - Other Hyperledger frameworks and tools.</p> <p>Practical Component: Implement security for digital ledger</p> <p>Suggested Readings: Tools for Block chain</p>												CO-1 BTL-2			
MODULE 2: CONSENSUS ALGORITHMS												(6L+3P)			
<p>Introduction to Consensus Methods-Proof of Work(PoW)-Proof of Stake(PoS)-Delegated Proof of Stake(DPoS)- Proof of Capacity- Proof of Burn(PoB)-Proof of Activity(PoA)-Proof of Identity- Proof of Authority- Proof of Elapsed Time(PoET)</p> <p>Practical Component: Analyse how consensus algorithms works?</p> <p>Suggested Readings: Advantages and limitations of consensus algorithms</p>												CO-2 BTL-2			
MODULE 3: BLOCKCHAIN AND AI												(6L+3P)			
<p>Domain Specific Applications - Applying AI & Blockchain: Healthcare, Supply chain, Financial Services, Information Security, Document management, AI & Blockchain Driven Databases - Centralized versus distributed data, Big data for AI analysis, Data Management in a DAO, Emerging patterns for Database Solutions</p> <p>Practical Component: Applying AI and Block chain- A simple framework</p> <p>Suggested Readings: Big data and AI</p>												CO-3 BTL-3			

MODULE 4: CRYPTOCURRENCY AND AI		(6L+3P)
<p>Role of AI in Cryptocurrency - Cryptocurrency Trading: Issues & Considerations, Benefits of AI in Crypto Trading - Making Price Predictions with AI: Issues with Price Prediction, Benefits of AI in Prediction, Time series forecasting with ARIMA, Applications of algorithmic or quant trading in Cryptocurrency</p> <p>Practical Component: Applying AI and Block chain in crypto trading</p> <p>Suggested Readings: Cryptocurrency</p>		<p>CO-4 BTL-3</p>
MODULE 5: FUTURE OF AI WITH BLOCKCHAIN		(6L+3P)
<p>Applying SDLC practices in Blockchain: Introduction to DIApp - Architecture of a DIApp - Developing a DIApp - Testing a DIApp - Deploying DIApp - Monitoring a DIApp, Implementing DIApp - Evolution of decentralized applications, building a sample DIApp, Developing Smart Contracts, Solution approach with AI, Developing: Client code, Backend, Frontend, Future of converging AI & Blockchain in enterprises & Government.</p> <p>Practical Component: Applications of block chain in enterprises and government</p> <p>Suggested Readings: Futre prospects of block chain</p>		<p>CO-5 BTL-3</p>
TEXT BOOKS		
1.	Ganesh Prasad Kumble(2020), "Practical Artificial Intelligence and Blockchain", First Edition. Packt Publishing Lts, July.	
2.	Imran Bashir(2018), "Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained", 2nd Edition, Packt Publishing Ltd.	
REFERENCE BOOKS		
1.	Andreas M. Antonopoulos(2015) , "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media Inc.	
2.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder(2016), "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press.	
E BOOKS		
1.	https://www.velmie.com/practical-blockchain-study	
MOOC		
1.	https://www.udemy.com/course/build-your-blockchain-az/	
2.	https://www.coursera.org/learn/blockchain-business-models	

COURSE TITLE		R PROGRAMMING						CREDITS		3					
COURSE CODE		CCA42506		COURSE CATEGORY		DE		L-T-P-S		2-0-2-0					
Version		1.0		Approval Details		36 th ACM 05-11-2022		LEARNING LEVEL		BTL-3					
ASSESSMENT SCHEME															
First Periodical Assessment	Second Periodical Assessment	Practical Assessment	Observations /Lab Records	Attendance	ESE										
					Theory	Prac									
15%	15%	10%	5%	5%	25%	25%									
Course Description	This course will teach you how to write a Programme in R and introduces students to the R statistical environment. This course is intended to explain on basics concepts of R, Operators, Conditional statement, factors, matrices, list, frames, functions etc.														
Course Objective	To understand the different data types and data structures in R To understand how to create and manipulate data frames in R To write user-defined functions using R To implement control statements using R To write Loop constructs in R														
Course Outcome	Upon completion of this course, the students will be able to Explain about R fundamentals Implement R operator and R functions Implement Lists and Frames Create and perform table manipulation Explain the basic Programming Structures														
Prerequisites: Basic Programming															
CO, PO AND PSO MAPPING															
CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PS O-1	PS O-2	PS O-3
CO-1	1	1	1	2	2	2	2	3	2	3	1	3	1	-	-
CO-2	1	1	1	1	2	1	2	3	2	3	1	2	1	-	-
CO-3	1	1	1	2	2	2	2	3	2	2	3	2	1	-	-
CO-4	1	2	2	2	2	2	2	3	2	3	3	1	3	2	2
CO-5	1	1	1	2	2	2	2	3	2	1	3	1	3	3	3
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION											(6L+3P)				

<p>R – OVERVIEW-Evolution of R -Features of R 2. R – ENVIRONMENT SETUP -Local Environment Setup- BASIC SYNTAX -R Command Prompt - Script File - R – DATA TYPES -Vectors -Lists -Matrices -Arrays-Factors - Data Frames - R – VARIABLES -Variable Assignment -Data Type of a Variable Finding Variables -Deleting Variables</p> <p>Practical Component: simple R programs to create lists, arrays and matrices</p> <p>Suggested Readings: Script File</p>	<p>CO-1 BTL-2</p>
<p>MODULE 2: OPERATORS (6L+3P)</p>	
<p>R – OPERATORS -Types of Operators -Arithmetic Operators-Relational Operators-Logical Operators Assignment Operators-Miscellaneous Operators - R – DECISION MAKING -R - If Statement-R – If...Else Statement -The if...else if...else -Switch Statement - R – LOOP-R - Repeat LoopR - While Loop -R – For Loop -Loop Control Statements-R-Break statement -R – Next Statement. R – FUNCTION -Function Definition -Function Components -Built-in Function –User-defined Function -Calling a Function -Lazy Evaluation of Function –User-defined Function -Calling a Function.</p> <p>Practical Component: R Programs using control structures and functions</p> <p>Suggested Readings: Decision making</p>	<p>CO-2 BTL-3</p>
<p>MODULE 3: LISTS AND FRAMES (6L+3P)</p>	
<p>LISTS- LISTS -Creating a -Naming List Elements - Accessing List Elements -Manipulating List Elements -Merging Lists Converting List to Vector - R – MATRICES -Accessing Elements of a Matrix - Matrix Computation- ARRAYS -Naming Columns and Rows -Accessing Array Elements- Manipulating Array Elements - R – FACTORS -Factors in Data Frame - Changing the Order of Levels -Generating Factor Levels 16. R – DATA FRAMES -Extract Data from Data Frame</p> <p>Practical Component: R Programs to manipulate arrays, extracting data from data frames etc.</p> <p>Suggested Readings: Accessing elements of a matrix</p>	<p>CO-3 BTL-3</p>
<p>MODULE 4: FACTORS AND TABLES (6L+3P)</p>	
<p>Common Functions Used with Factors- The tapply() Function - The split() Function -The by() Function - Working with Tables- Matrix/Array-Like Operations on Tables- Extended Example: Extracting a Subtable- Extended Example: Finding the Largest Cells in a Table- Table-Related Functions- The aggregate() Function- The cut() Function</p> <p>Practical Component: R programs for table manipulation and table related functions</p>	<p>CO-4 BTL-3</p>

Suggested Readings: Extracting a sub table		
MODULE 5: R PROGRAMMING STRUCTURES		(6L+3P)
Control Statements- Loops- Looping Over Nonvector Sets - if-else- Arithmetic and Boolean Operators and Values- Default Values for Argument- Return Values- Deciding Whether to Explicitly Call return() - Returning Complex Object- Functions Are Objects. Practical Component: R Programs with default values, return values Suggested Readings: Default values, Return values		CO-5 BTL-3
BOOKS		
1.	Matloff, Norman (2011) The art of R programming: A tour of statistical software design. No Starch Press.	
REFERENCE BOOKS		
1.	Crawley, Michael J (2012) The R book. John Wiley & Sons.	
E BOOKS		
1.	https://cran.r-project.org/doc/contrib/Paradis-rdebuts_en.pdf	
MOOC		
1.	R Programming Coursera –Johns Hopkins university	

COURSE TITLE		CLOUD APPLICATION DEVELOPMENT			CREDITS	3
COURSE CODE		CCA42507	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0
Version	1.0	Approval Details	36th ACM 05-11-2022		LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Practical Assessment	Observations /Lab Records	Attendance	ESE	
15%	15%	10%	5%	5%	Theory	Prac
Course Description	A cloud application, or cloud app, is a software program where cloud-based and local components work together. This model relies on remote servers for processing logic that is accessed through a web browser with a continual internet connection. Cloud application servers typically are located in a remote data center operated by a third-party cloud services infrastructure provider. Cloud-based application tasks may encompass email, file storage and sharing, order entry, inventory management, word processing, customer					

	relationship management (CRM), data collection, or financial accounting features
Course Objective	<ol style="list-style-type: none"> 1. Understand the concepts, characteristics, delivery models and benefits of cloud computing. 2. Understand the key security and compliance challenges of cloud computing. 3. Understand the key technical and organizational challenges
Course Outcome	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> 1. Describe the applications of cloud computing 2. Design a cloud infrastructure 3. Deploy cloud framework 4. Build an application using LAMP 5. Develop an application in Cloud

Prerequisites: Basics of Cloud Computing

CO, PO AND PSO MAPPING

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO-1	3	3	2	2	1	2	2	1	1	1	1	1	3	2	1
CO-2	3	3	3	2	1	2	2	1	1	1	1	1	2	-	2
CO-3	3	3	2	2	3	2	2	1	1	1	1	1	1	1	1
CO-4	3	3	3	2	1	2	2	1	1	1	1	1	1	2	1
CO-5	3	3	3	2	3	2	2	1	1	1	1	1	3	2	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 : CLOUD BASED APPLICATIONS

(6L+3P)

Introduction, Contrast traditional software development and development for the cloud. Public v private cloud apps. Understanding Cloud ecosystems – what is SaaS/PaaS, popular APIs, mobile
Practical Component: Application software or programs within the Amazon Web Services cloud-based platform.
Suggested Readings: Understanding Cloud ecosystems

**CO-1
BTL-2**

MODULE 2: DESIGNING CODE FOR THE CLOUD

(6L+3P)

Class and Method design to make best use of the Cloud infrastructure; Web Browsers and the Presentation Layer: Understanding Web browsers attributes and differences. Building blocks of the presentation layer: HTML, HTML5, CSS, Silverlight, and Flash.
Practical Component: AWS Development Kit
Suggested Readings: Understanding Web browsers attributes and differences

**CO-2
BTL-3**

MODULE 3 - INTRODUCTION TO JAVASCRIPT

(6L+3P)

Building Ajax controls, introduction to JavaScript using jQuery, working with JSON, XML, REST. Application development Frameworks e.g., Ruby on Rails , .Net, Java API's or JSF; Deployment Environments – Platform as A Service (PAAS) ,Amazon, vmForce, Google App Engine, Azure, Heroku, AppForce
Practical Component: Deployment environments

**CO-3
BTL-3**

Suggested Readings: Building Ajax controls		
MODULE 4 – LAMP STACK		(6L+3P)
Building an application using the LAMP stack: Setting up a LAMP development environment. Building a simple Web app demonstrating an understanding of the presentation layer and connectivity with persistence Practical Component: Deployment environments Suggested Readings: Building an application using the LAMP stack		CO-4 BTL-2
MODULE 5 –DEPLOYING APPLICATION IN CLOUD		(6L+3P)
Developing and Deploying an Application in the Cloud : Building on the experience of the first project students will study the design, development, testing and deployment of an application in the cloud using a development framework and deployment platform Practical Component: Deploying an Application in the Cloud Suggested Readings: Developing and Deploying an Application in the Cloud		CO-5 BTL-3
TEXT BOOKS		
1.	Guo Ning Liu, Qiang Guo Tong, Harm Sluiman, Alex Amies(2012), " <i>Developing and Hosting Applications on the Cloud</i> ", IBM Press.	
2.	Chris Hay, Brian Prince(2018), <i>Azure in Action</i> [ISBN: 978-1935182481], Manning publisher	
REFERENCE BOOKS		
1.	Thomas(2013), " <i>Cloud Computing: Concepts, Technology & Architecture</i> " Prentice Hall of India	
E BOOKS		
1.	https://www.oreilly.com/library/view/cloud-computing/9789332537439/	
2.	https://studytm.files.wordpress.com/2014/03/hand-book-of-cloud-computing.pdf	
MOOC		
1.	https://www.coursera.org/specializations/cloud-computing	

COURSE TITLE		CLOUD MANAGED SERVICES						CREDITS		3					
COURSE CODE		CCA42508		COURSE CATEGORY		DE		L-T.P-S		2-0-2-0					
Version		1.0		Approval Details			36 th ACM 05-11-2022		LEARNING LEVEL		BTL-3				
ASSESSMENT SCHEME															
First Periodical Assessment		Second Periodical Assessment		Practical Assessment		Observations/ Lab Records		Attendance		ESE					
15%		15%		10%		5%		5%		Theory	Prac				
25%		25%													
Course Description		The course explains about the basics, benefits , features of cloud managed services . The course explains about the cloud based management services and also compare with in-house management services.The course also explains about the cloud notification services, cloud models and the cloud organisational strategies.													
Course Objective		<ol style="list-style-type: none"> To understand the concept of Cloud managed services and the sustainability objectives of cloud management. To learn about various notification services and deployment models of cloud management. To differentiate in-house and cloud-based management services To understand the cloud in designing organizational strategies. To understand and implement the resource management approaches and scheduling algorithms to optimize the utilization of resources. 													
Course Outcome		<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> Able to differentiate cloud services with in-house services by understanding the basics. Learn about the various cloud notification services. Understand the various deployment models of cloud managed services Analysis the cloud's strategies for organisational effectiveness. Analysis the scheduling algorithm used for cloud services 													
Prerequisites: Cloud Computing															
CO, PO AND PSO MAPPING															
CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PS O-1	PS O-2	PS O-3
CO-1	-	1	3	2	2	1	2	-	1	3	2	-	1	3	2
CO-2	1		3	2	2	2	2	1		3	2	1		3	2
CO-3	1	2	2	2	2	3	3	1	2	2	2	1	2	2	2
CO-4	2	2	3	3	3	3	3	2	2	3	3	2	2	3	3

CO-5	1	2	2	2	2	2	3	-	1	3	2	-	1	3	2
1: Weakly related, 2: Moderately related and 3: Strongly related															
MODULE 1: INTRODUCTION TO CLOUD MANAGED SERVICES														(6L+3P)	
Origin of Cloud, Definition of cloud managed services, benefits and features. Differences between Cloud and In-house services. Commoditization of a Cloud, sustainability objectives of cloud-managed services. Practical Component: Suggested Readings: Basics of internet, wireless managed services														CO-1 BTL-3	
MODULE 2: CLOUD NOTIFICATION SERVICES														(6L+3P)	
Subscriptions, FIFO and Standard topics, redrive policies, dead letter queues, message attributes, Serverless queries, tables, databases, data sources, namespaces, metrics, dimensions, and statistics. Practical Component: Suggested Readings: Cloud Notification Services														CO-2 BTL-3	
MODULE 3: CLOUD DEPLOYMENT MODELS														(6L+3P)	
Introduction to deployment of cloud services, Process of deployment. Types of deployment models: Public cloud, community cloud, private cloud, and hybrid cloud. Practical Component: Suggested Readings: Different wireless deployment models														CO-3 BTL-3	
MODULE 4: CLOUD IN ORGANISATIONAL STRATEGIES														(6L+3P)	
Cloud's role in organisational strategy, the traditional and modern view of the digital strategy of cloud. Setting the Strategic Scope: Greenfield (or 'born in the cloud'), migrating existing services, Strategic positioning of cloud, Cloud Review, outcomes. Practical Component: Suggested Readings: Understanding of an organisation and its strategy, migrating existing services provided within organization														CO-4 BTL-4	
MODULE 5: RESOURCE MANAGEMENT AND SCHEDULING IN CLOUDS														(6L+3P)	
Basic concepts, Cloud service models, cloud types, scheduling: Independent and dependant tasks, Random and round-robin adoption for clouds, dependant task scheduling in clouds with deadline constraints. Practical Component: Suggested Readings: Resource types and scheduling of resources in a management service of an organization .														CO-5 BTL-4	
TEXT BOOKS															

1.	Abdabi, I. M. (2020). Cloud Management and Security. John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, United Kingdom: John Wiley & Sons, Ltd.
REFERENCE BOOKS	
1.	Nelson L.S.da Fonseca, R. B. (2020). Cloud Services, Networking and Management. New Jersey.: John Wiley & Sons, Inc., Hoboken,.
E BOOKS	
1.	https://download.microsoft.com/download/9/A/2/9A2E0BB3-623A-4E22-ACC9-564DE9AF5857/MSP_Playbook_SI_070817_v2.pdf
MOOC	
1.	https://www.mooc-list.com/tags/cloud-management
2.	https://www.coursera.org/learn/cloud-based-network-design-and-management