HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)

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	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	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	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	Upon completion of this course, the students should be able to 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	PO10	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 probabi**lity**	
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	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	Upon completion of this course, the students will be able to 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 -1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO -10	PO-11	PO-12	PSO1	PSO2	PSO3
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**	**36th ACM 05-11-2022**	**LEARNING LEVEL**		**BTL-3**

ASSESSMENT SCHEME

First Periodical Assessment	**Second Periodical Assessment**	**Practical Assessment**	**Observations /Lab Records**	**Attendance**	**ESE**	
					Theory	**Practical**
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	1. To provides insights into the concepts of OOPs and Java Fundamentals 2. To understand the abstract classes ,interfaces and packages 3. To handle exceptions and to perform multitasking in Java 4. To perform I/O operations and to create GUI programs 5. To create networking applications in Java
Course Outcome	Upon completion of this course, the students should be able to 1. Design and solve real world problems using OOP techniques. 2. Implement Interfaces and Packages 3. Develop multithreaded applications and to handle exceptions. 4. Design GUI based applications and applets for web applications 5. Create networking applications

Prerequisites: C++ Programming Language

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	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)**
OOP concepts: Classes and objects, data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, procedural and object oriented programming-paradigm. 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 **Practical Component:** Write a Java program to demonstrate the concept of constructors, overloading methods , inheritance and polymorphism, **Suggested Readings**: Applications OOPs concepts in real time applications	**CO-1** **BTL-3**
MODULE 2: ABSTRACT CLASSES, INTERFACES AND PACKAGES	**(9L+6P)**
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 **Practical Component:** Interfaces and Packages in JAVA **Suggested Readings:** Abstract classes vs Interfaces, Built in packages	**CO-2** **BTL-3**
MODULE 3: EXCEPTION HANDLING AND MULTITHREADING	**(9L+6P)**
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. **Practical Component:** Multithreading in JAVA **Suggested Readings:** Multitasking using Threads	**CO-3** **BTL-4**

MODULE 4: I/O STREAMS, GUI PROGRAMMING AND APPLETS	(9L+6P)
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, 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	**CO-4** **BTL-3**
MODULE 5: NETWORKING WITH JAVA.NET	**(9L+6P)**
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	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Herbert Schildt (2019), *Java The complete reference*, 11th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
REFERENCE BOOKS	
1	Premchand S.Nair(2017),J ava Programming Fundamentals: Problem Solving Through Object Oriented Analysis and Design,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	1. To gain insights into the relevance of data communication and network fundamentals in current times. 2. To establish a strong foundation of networks concepts on Signals, Transmission Media, Errors in data communications and their correction, networks classes and devices. 3. To gain insight on network architectures, protocols and standards. 4. To acquire an in-depth knowledge of transfer of data, categories of network & different topology. 5. To develop a strong foundation of network technologies from the physical layer to application layer.
Course Outcome	Upon completion of this course, the students will be able to 1. Explain the basics of computer networks and comprehend the functioning of various layers of OSI Model & TCP/IP model. 2. Describe the functionality of Physical Layer and its relevance in data transmission. 3. Apply different Error detection and Error correction methods during data transmission and analyze the functions of data link layer. 4. Identify the analyze the various IEEE 802 Standards of Wired and Wireless LAN. 5. 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 **Suggested Readings**: Data Communication in Networks	**CO-1** **BTL-3**
MODULE 2: PHYSICAL LAYER	**(6L+3T)**
Introduction: Analog and Digital Data, Analog and Digital Signals, Periodic Analog Signals, Transmission Impairment, Data Rate limits, Performance. 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	**CO-2** **BTL-3**
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	**CO-5** **BTL-3**

Connection Management- Principles of Congestion control. **Suggested Readings:** ICMP and IPv6	
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=gbs_ge_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**	**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 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	1. To identify, formulate, and solve complex engineering problems by applying principles 2. To apply engineering design to produce solutions that meet specified needs 3. To function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, 4. To develop and conduct appropriate experimentation, analyze and interpret data. 5. 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 1. Describe the Software Engineering Process and Evaluation techniques. 2. Plan and manage requirements at each stage of the software develop the models. 3. Depict design activity planning and behavior management principles. 4. Develop skills to manage the various strategic phases involving testing techniques and various test methods. 5. Design software projects that support organization ‘s strategic and agile process

Prerequisites: Software Engineering Techniques

CO, PO AND PSO MAPPING

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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)**
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. **Suggested Readings:** Process Models **Practical Component** 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)**
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. **Suggested Readings:** UML creation **Practical Component** 1. Source code generators 2. Apply the following to typical application problems: a. Project Planning b. Software Requirement Analysis	**CO-2** **BTL-2**
MODULE 3: DESIGN CONCEPTS	**(9L)**
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	**CO-3** **BTL-3**

Components – Component level design for Web Apps – Designing Traditional Components – User Interface Design. **Suggested Readings:** Architectural Mapping **Practical Component** 1. Apply the following to typical application problems: a. Software Design b. Data Modeling & Implementation 2. Software Estimation	
MODULE 4: SOFTWARE TESTING STRATEGIES (9L)	
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 – 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.	**CO-4** **BTL-3**
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, 7th Edition.
REFERENCE BOOKS	
1.	I. Sommerville(2015), "*Software Engineering*" , 5th Edition : Addision 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	Observations/Lab Records	Attendance	ESE	
					Theory	Practical
15%	15%	10%	5%	5%	25%	25%

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	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	Upon completion of this course, the students Should be able to 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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,	**CO-1 BTL-2**

Queue, List. **Practical Components:** • 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. **Practical Components:** • List and its related operations. • Simulation of operations on stacks and queues. **Suggested Readings:** Red Black trees	**CO-2** **BTL-2**
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:** • 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:** • 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:** • 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), "*Data Structures and Algorithms in Python*", 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	
					Theory	Practical
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.
Course Objective	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
Course Outcome	Upon completion of this course, the students will be able to 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.

Prerequisites: Programming skills

CO, PO AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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 LANGUAGECOMPONENT	**(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,	**CO-5** **BTL-2**

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	
TEXT BOOKS	
1.	Mark Pilgrim(2012), *Dive into Python*, Mike,CreateSpace
REFERENCE BOOKS	
1.	Mark Lutz(2010) , *Programming Python*, 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**	**36th ACM 05-11-2022**	**LEARNING LEVEL**			**BTL-3**

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Practical Assessment	Observations /Lab Records	Attendance	ESE	
					Theory	Practical
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	1. To understand basics of AI and the need of Machine learning. 2. To acquire the knowledge of various classification techniques. 3. To study the various algorithms related to supervised and unsupervised learning. 4. To learn the theoretical and practical aspects of probabilistic graphical models. 5. To explore the applications of machine learning.
Course Outcome	Upon completion of this course, the students will be able to 1. Explain the need of machine learning and model building. 2. Understand the concept to apply the supervised algorithms. 3. Develop a skill to implement unsupervised algorithms for problem solving.

	4. Understand the concept of reassurance learning algorithms. 5. 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)**
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. **Practical Component :** Simple machine learning problems **Suggested Readings:** Basics of Machine learning	**CO-1** **BTL-1**
MODULE 2: SUPERVISED LEARNING	**(9L+6P)**
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. **Practical Component :** Supervised learning algorithms **Suggested Readings:** Fundamentals of supervised Learning	**CO-2** **BTL-2**
MODULE 3: UNSUPERVISED LEARNING	**(9L+6P)**
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. **Practical Component :** K -means clustering algorithm **Suggested Readings:** Basics of Unsupervised Learning	**CO-3** **BTL-3**
MODULE 4: REINFORCEMENT LEARNING	**(9L+6P)**
Reinforcement Learning Algorithms Reinforcement Machine Learning Algorithms, working of reinforcement machine learning algorithm, Finite Markov Decision Processes, Dynamic Programming, Monte Carlo Methods **Practical Component :** Dynamic programming **Suggested Readings:** Reinforcement learning algorithms	**CO-4** **BTL-3**

MODULE 5: APPLICATIONS AND USE CASE	(9L+6P)
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. **Practical Component:** Applications using ML **Suggested Readings:** Applications of machine learning	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Ethem Alpaydın(2020), *Introduction to Machine Learning*, The MIT Press Cambridge, Fourth Edition, MIT Press Hardcover.
2	Shai Shalev-Shwartz, Shai Ben-David(2014), *Understanding Machine Learning: From Theory to Algorithms*, Cambridge University Press.
REFERENCE BOOKS	
1.	V Kishore Ayyadevara(2018), *Pro Machine Learning Algorithms A Hands-On Approach to Implementing Algorithms in Python and R*, Apress
2	Kevin P. Murphy(2022) , *Probabilistic Machine Learning an Introduction*. 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	36th ACM 05-11-2022		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME						
First Periodical Assessment	Second Periodical Assessment	Practical Assessment	Observations /Lab Records	Attendance	ESE	
					Theory	Practical
15%	15%	10%	5%	5%	25%	25%

Course Description	This course gives insights into supporting development efforts form 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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 ,pargraphs, formatting text, lists and links, images and tables-CSS-Applying 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	**CO-5** **BTL-3**

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	
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**	**36th ACM 05-11-2022**		**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Practical Assessment	Observations /Lab Records	Attendance	ESE	
					Theory	Practical
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	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	Upon completion of this course, the students should be able to 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	**CO-4** **BTL-3**

Types – HIVE: Data types, Database Operations, Partitioning – HiveQL – OrientDB Graph database – OrientDB Features **Practical Component:** Perform table operations **Suggested Readings:** HiveQL	
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.	*Abraham Silberschatz, Henry F Korth, S. Sudharshan(2019), "Database System Concepts", Seventh Edition, McGraw Hill..*
2	Thomas M. Connolly and Carolyn Begg(2015), *Database Systems: A Practical Approach to Design, Implementation, and Managemen*t, 6th Edition, Pearson India
REFERENCE BOOKS	
1.	Ramez Elmasri & B. Navathe (2017*): Fundamentals of database systems*, 7th Edition, Addison Wesley.
E-BOOKS	
1.	https://theswissbay.ch/pdf/Gentoomen%20Library/Databases/Molina%2CUllman%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	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	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.Anlayze the research related information and new developments in IPR

Prerequisites: Research Basics

CO, PO AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	**CO-2 BTL-2**

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	
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 ,4th 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	36th 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	1. To function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, 2. To identify, formulate, and solve complex engineering problems by applying principles 3. To apply engineering design to produce solutions that meet specified needs 4. To develop and conduct appropriate experimentation, analyze and interpret data. 5. 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 1. Identify a real time work helpful for the society. 2. Analyze and solve the solution for the problem. 3. Create an application by using relevant computer application concepts. 4. Conduct appropriate experiment in different software design methods. 5. 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	PO10	PO11	PO 12	PSO1	PSO2	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	**CO-1** **BTL-3**

Tools used Any Application Software in the specific domain for solving the problem **Suggested Readings:** Application Strategy and Business Intelligence					
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	**15%**
Implementation /Demonstration	Implemented and demonstrated the project with all the details	Implemented and demonstrated the project	Partial implementation	Not implemented	

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%**

SEMESTER-III

<table>
<tr><td colspan="2">COURSE TITLE</td><td colspan="4">SOFTWARE TESTING AND QUALITY ASSURANCE</td><td>CREDITS</td><td>4</td></tr>
<tr><td colspan="2">COURSE CODE</td><td>CCA42010</td><td colspan="2">COURSE CATEGORY</td><td>PC</td><td>L-T-P-S</td><td>2-1-2-0</td></tr>
<tr><td>Version</td><td>1.0</td><td colspan="2">Approval Details</td><td colspan="2">36th ACM
05-11-2022</td><td>LEARNING LEVEL</td><td>BTL-3</td></tr>
<tr><td colspan="8">ASSESSMENT SCHEME</td></tr>
<tr><td rowspan="2">First Periodical Assessment</td><td rowspan="2">Second Periodical Assessment</td><td rowspan="2">Seminar/ Assignments/ Project</td><td rowspan="2">Surprise Test / Quiz</td><td rowspan="2">Attendance</td><td colspan="2">ESE</td></tr>
<tr><td>Theory</td><td>Practical</td></tr>
<tr><td>15%</td><td>15%</td><td>10%</td><td>5%</td><td>5%</td><td>25%</td><td>25%</td></tr>
<tr><td>Course Description</td><td colspan="7">This course introduces software testing processes by discussing all types of testing and how they relate to the Agile/Scrum model. It also Covers, integration, framework, and acceptance testing establish the connection between software development testing and product life cycle support. Verification, validation, techniques, and testing metrics are among the testing methods mentioned.</td></tr>
<tr><td>Course Objective</td><td colspan="7">1. To learn the core concepts of software testing.
2. To provide a knowledge on debugging.
3. To learn and implement automation techniques in software testing.
4. To understand the industry trends in testing.
5. To provide the knowledge on automation tools and quality assurance tools.</td></tr>
<tr><td>Course Outcome</td><td colspan="7">Upon completion of this course, the students should be able to

1. Describe the basic knowledge of errors and faults in software testing project
2. Identify the software testing fundamentals and Engineering methods.
3. Identify the various software testing types and methods.
4. Write various test cases and skills to communicate with their teammates to conduct their practice-oriented software testing projects
5. Apply automation testing and quality assurance tools for their testing projects.</td></tr>
</table>

Prerequisites: Software Engineering

CO, PO AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	3	2	3	2	2	1	1	1	1	1	1	1	1	2	1
CO-2	1	1	3	3	1	1	1	1	-	-	1	1	-	-	2
CO-3	1	-	-	1	-	1	1	1	2	1	-	1	2	2	2
CO-4	1	2	1	-	1	-	1	1	-	1	2	1	-	-	1
CO-5	1	-	1	2	1	2	1	1	1	1	1	2	2	2	1

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

MODULE 1: INTRODUCTION	**(9L+3P)**
Software Errors-Bugs- Cause of Bugs- Cost of Bugs- Software Tester- Software Development Process-Testing Axioms-Software testing Terms and Definitions **Suggested Readings:** Bugs, and role of software testing	**CO-1** **BTL-2**
MODULE 2: TESTING FUNDAMENTALS	**(9L+3P)**
Examining the Specifications-Black Box and White Box Testing-Static and Dynamic Testing-Low Level Specification Test Technique-Static and Dynamic Black Box testing-Equivalence Partitioning- Data Testing- State Testing-Other Black Box Testing Techniques-Static White Box Testing-Dynamic White Box Testing-Testing the Pieces-Data Coverage- Code Coverage. **Suggested Readings:** Types of testing	**CO-2** **BTL-3**
MODULE 3: TESTING TYPES AND APPROACHES	**(9L+3P)**
Configuration Testing-Compatibility Testing-Foreign Language Testing-Usability Testing-Testing the Documentation-Website Testing **Suggested Readings:** Compatibility testing	**CO-3** **BTL-3**
MODULE 4: TEST MANAGEMENT AND DOCUMENTATION	**(9L+3P)**
The Goal of Test Planning-Test Planning topics-Writing and Tracking Test Cases-Goal of Test Case Planning –Test Case Planning Overview- Test Case Tracking- Reporting what you find- A bug life cycle-Bug Tracking Systems-Metrics in Testing-Common Project Level Metrics.	**CO-4** **BTL-3**

Suggested Readings: Report preparation	
MODULE 5: AUTOMATION TESTING AND QUALITY ASSURANCE (9L+3P)	
Benefits of Automation and Tools-Test Tools-Software Test Automation-Random Testing-Software Quality Assurance-Testing and Quality Assurance in workspace-Test management and organizational structures- Capability Maturity Model-ISO 9000 **Suggested Readings:** Software Quality Assurance	**CO-5** **BTL-3**
TEXT BOOKS	
1.	Erik van Veenendaal(2015), Dorothy Graham, *Foundations of Software Testing ISTQB Certification*, Red Black.
REFERENCE BOOKS	
1.	Kshirasagar Naik, Priyadarshini Tripathy (2011*), Software Testing and Quality Assurance: Theory and Practice, John* Wiley & Sons.
E BOOKS	
1.	https://www.softwaretestinggenius.com/download/staqtpsn.pdf
MOOC	
1.	Introduction to software testing, Kevin Wendt, Coursera

COURSE TITLE	**CRYPTOGRAPHY AND NETWORK SECURITY**			**CREDITS**	**4**	
COURSE CODE	**CCA42011**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-0-2-1**	
Version	**1.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**	
ASSESSMENT SCHEME						
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**	
					Theory	**Practical**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**
Course Description	The course covers basics of network security, security architecture, security attacks, encryption techniques and principles of cryptography. The course focuses on vulnerabilities of network, mechanisms to implement security,					

	implementation of cipher techniques to solve real time problems and reliable network security systems.
Course Objective	1. To gain insight on Fundamentals of Network Security and acquire knowledge on various encryption techniques. 2. To develop an understanding on the principles of Cryptography. 3. To analyse the vulnerabilities of network and formulate the best mechanism to implement security. 4. To evaluate & Implement the most optimized cipher technique to solve a given problem. 5. To create a solution for an efficient & reliable network security system.
Course Outcome	Upon completion of this course, the students will be able to 1. Explore network architecture and DES algorithm of encryption and decryption process 2. Illustrate the principles of AES Algorithm techniques and apply on public-key Cryptosystem. 3. Understand and apply the authentication protocol, Cryptographic techniques & digital signatures as authentication function for digital certification. 4. Understand the IPSec architecture and the concept of the security association with various wireless network standards. 5. Classify the impact of different types of network breach & implement an efficient network security system.

Prerequisites: Computer Networks

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	1	1	2		2	2	3	1	2	2	1	1	2	2	2
CO-2	2	2	2	1	2	2	3	3	3	3	3	2	2	2	2
CO-3	2	3	3	3	3	3	3	2	2	2	2	1	2	3	3
CO-4	2	2	2	2	2	2	3	2	3	3	2	2	2	2	1
CO-5	2	2	2	2	3	3	3	1	2	2	1	1	2	2	3

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

MODULE 1: INTRODUCTION TO NETWORK SECURITY

Introduction, Security Trends, OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, A Model for Network Security. Classical Encryption Technique: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography.	**CO-1** **BTL-3**

Block Ciphers and the Data Encryption Standard: Introduction, Block Cipher Principles, The Data Encryption Standard (DES), The Strength of DES, Block Cipher Design Principles and Modes of operation. **Suggested Readings:** Relation between random key generation and encryption techniques	
MODULE 2: ADVANCED ENCRYPTION STANDARD	
Introduction, Evaluation Criteria for AES, AES Cipher: Encryption and Decryption, AES Data Structure, AES Encryption Round. Advanced Symmetric Ciphers: Multiple Encryption and Triple DES, Block Cipher Modes of Operation, Stream Ciphers, and RC4. Public Key Cryptography and Key Management, Principles of Public Key Cryptosystem, The RSA algorithm, Key management, Diffie-Hellman Key exchange. **Suggested Readings:** Advantage of AES over other encryption standards.	**CO-2** **BTL-3**
MODULE 3: MESSAGE AUTHENTICATION AND HASH FUNCTION	
Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions. Hash and MAC Algorithms: Secure Hash Algorithm, HMAC, CMAC, Digital Signatures, Authentication Protocols, Digital Signature Standard. Authentication Applications: Kerberos, X.509 Authentication Service, Public-Key Infrastructure **Suggested Readings:** Public key Cryptography standard	**CO-3** **BTL-3**
MODULE 4: WIRELESS NETWORK SECURITY	
Introduction, Wireless Security, Mobile Device Security, IEEE 802.11i Wireless LAN Security. Electronic Mail Security: Internet Mail Architecture, Email Formats, Email Threats and Comprehensive Email Security, S/MIME, Pretty Good Privacy, DNSSEC, DNS-Based Authentication of Named Entities, Sender Policy Framework, Domain Keys Identified Mail. IP Security: IP Security (IPSec) Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange. **Suggested Readings:** Case study on Security standards and policies for wireless network in various countries	**CO-4** **BTL-4**
MODULE 5: WEB SECURITY	
Introduction, Web security Considerations, Secure Socket layer (SSL) and Transport layer Security (TLS), Secure Electronic Transaction (SET). System Security - Malicious Software: Types of Malicious Software, Advanced Persistent Threat, Propagation: Viruses, Worms, Trojans. Payload: System	**CO-5** **BTL-4**

Corruption, Attack agents (Zombie and Bots), Information theft (Keyloggers, Phishing, Spyware) System Security - Intruders & Firewall. Intruders: Introduction, Intrusion Detection, Password Management. Firewall: Introduction, The need for Firewalls, Firewall Characteristics and access policy, Types of Firewall, Firewall Basing, Firewall Location, and Configuration. **Suggested Readings:** Case study on latest web attack by Malicious software.	
TEXT BOOKS	
1.	Cryptography and Network Security, 4e. (2019). (n.p.): McGraw-Hill Education.
2.	Achary, R. (2021). Cryptography and Network Security: An Introduction. United States: Mercury Learning and Information.
REFERENCE BOOKS	
1.	Wong, D. (2021). Real-World Cryptography. United States: Manning.
2.	Recent Advances in Cryptography and Network Security. (2018). United Kingdom: IntechOpen.
E BOOKS	
1.	https://www.researchgate.net/publication/305380338_Applied_Cryptography_and_Network_Security
MOOC	
1.	https://www.coursera.org/search?query=network%20security%20and%20cryptography&
2.	https://onlinecourses.nptel.ac.in/noc21_cs16/preview

COURSE TITLE	**COMMUNICATION SKILLS AND PROFESSIONAL DEVELOPMENT**			**CREDITS**	**3**	
COURSE CODE	**CEL42001**	**COURSE CATEGORY**	**BS**	**L-T-P-S**	**2-0-2-0**	
Version	**1.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-4**	
ASSESSMENT SCHEME						
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**	
					Theory	**Practical**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**

Course Description	This course has been designed to meet the student's professional development as well as the communication skills for the present and the future needs. This course aims at providing opportunities to involve in activities and practices for training the students into professionals.
Course Objective	1. To acquire self-confidence by which the learner can improve upon their informative listening skills by an enhanced acquisition of the English language 2. To provide an environment to Speak in English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate 3. To equip the students to Read, comprehend and answer questions based on literary, scientific and technological texts 4. To enhance the professional writing skills of the students in Job Application letters, Resume, Proposal Writing, letter-writing and report writing 5. To equip the learners in analysing and applying creative thinking skills and participate in Group Discussions, audiovisual activities and excel in Interview Skills
Course Outcome	Upon completion of this course, the students will be able to 1. Understand the basics of English grammar and vocabulary, construct grammatically correct sentences and articulate ideas using simple sentences to form short paragraphs 2. Responding to higher order English words, vocabulary, phrases, expressions, idioms, and proverbs 3. Organize and articulate ideas, concepts, and perceptions in a comprehensive manner in written business correspondence, and speaking in formal and informal situations 4. Analyze and transcode data, construct different types of letters, read complex passages and summarize ideas, create personal profiles in the form of a resume with a Job Application Letter 5. Induce critical and analytical thinking, participate in group discussion on general and technical topics, and transact information with an audience. Prepare students for interviews and presentation skills. Produce complex written documents such as reports, and project proposals

Prerequisites: Plus Two English-Intermediate Level

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	1	2	-	1	-	-	1	-	-	3	1	-	2	-	1
CO -2	-	1	-	1	-	2	-	1	2	3	-	-	-	-	-
CO -3	1	-	1	-	1	1	-	1	-	3	1	-	2	-	1
CO -4	1	-	1	-	1	-	1	-	-	3	1	-	1	-	1
CO -5	-	1	-	1	-	1	-	1	2	3	-	1	-	1	-

1: Weakly related, 2: Moderately related and 3: Strongly related	
MODULE 1: INTRODUCTION TO EFFECTIVE COMMUNICATION (6L+3L=9L)	
Basics of Communication – Importance of Communication in the 21st Century – Elements of Effective Communication – Characteristics of effective Communicator **Suggested Activities:** Listening and typing – Listening and sequencing of sentences – Listening and answering the questions - Cloze Exercises – Vocabulary building – Reading and answering questions **Suggested Reading:** 1. An Introduction to Professional English and Soft Skills with audio CD by Dr. Bikram K. Das et al. Published by Cambridge University Press. 2009 2. Professional Speaking Skills by ArunaKoneru, Oxford Press, 2015 3. Embark, English for Under Graduates by Steve Hart, Arvind Nair, VeenaBhambhani, Cambridge University Press 2016. 4. English for Life and the Workplace Through LSRW&T skills, by Dolly John, Pearson Publications, 2014 edition	CO-1 BTL-2
MODULE 2 – CORE COMPONENTS OF EFFECTIVE COMMUNICATION (6L+3L=9L)	
Verbal Communication – Non Verbal Communication – Importance of Tone – Effect and Impact of Words – Positive Communication – Words for Success – Words to Avoid **Suggested Activities:** Phonetics: Intonation – Ear Training – Correct Pronunciation – Sound recognition exercises - Common Errors in English - Conversations: Face to Face Conversation - Telephone conversation–Role play activities (Students take on roles and engage in conversation) **Suggested sources:** (Listening and Speaking Modules) – Language Lab Professional Speaking Skills by Aruna Koneru, Oxford Press English for Life and the Workplace Through LSRW&T skills, by Dolly John, Pearson Publications, 2014 edition	CO-2 BTL-3
MODULE – 3 : PROFESSIONAL WRITING AND PRESENTATION SKILLS (6L+3L=9L)	
Job Application Letter - Resume Writing - Structuring the resume – Letter writing - E-mail Writing – Report Writing – Proposal Writing - Presentation Skills - Elements of an effective presentation – Structure of a presentation – Presentation tools – Voice Modulation – Audience analysis – Body Language – Video Samples **Suggested Activities:** Preparation of Job Application letter with a resume for different designations, Letter writing for professional situations, Report and Proposal Writing – PPT Preparation for Presentations – Presentation Practices **Suggested sources:** John Seely, The Oxford Guide to writing and speaking. Oxford University Press, New Delhi (2004).	CO-4 BTL-4
MODULE – 4 : PROFESSIONAL DEVELOPMENT AND SOFT SKILLS (6L+3L=9L)	
Soft Skills - Time Management – Psychometrics – Innovation and Creativity – Stress Management & Poise – Group Discussion - Why is GD part of selection process? – Structure of a GD – Moderator-led and other GDs – Strategies in GD – Team work – Body Language – Mock GD – Video Samples	CO-3 BTL-5

Suggested Activities: Group Discussion – Activities based soft skills training **Suggested Readings:** Soft Skills for Everyone by Jeff Butterfield, Cengage Learning, 2010 edition	
MODULE 5 – INTERVIEW SKILLS (6L+3L=9L)	
Interview Skills - Kinds of Interviews – Required key Skills – Corporate culture – Mock Interviews – Video Samples **Suggested Activities:** Mock Interviews **Suggested Readings:** Soft Skills & Employability Skills by Sabina Pillai and Agna Fernandez published by Cambridge University Press 2018	CO-5 BTL-5

TEXT BOOKS	
1.	Soft Skills & Employability Skills by Sabina Pillai and Agna Fernandez published by Cambridge University Press 2018
2	English for Life and the Workplace through LSRW&T skills, by Dolly John, Pearson Publications, 2014 edition

REFERENCE BOOKS	
1.	Barker. A –Improve your communication Skills – Kogan Page India Pvt. Ltd., New Delhi (2006)
2.	Embark, English for Undergraduates by Steve Hart et al, Cambridge University Press, 2016, edition
3.	Skills for the TOEFL IBT Test, Collins, 2012 edition
4.	Soft Skills for Everyone by Jeff Butterfield, Cengage Learning, 2010 edition
5.	Professional Speaking Skills by ArunaKoneru, Oxford Publications, 2015

E BOOKS	
1	https://www.britishcouncil.in/english/courses-business
2	http://www.bbc.co.uk/learningenglish/english/features/pronunciation
3	http://www.bbc.co.uk/learningenglish/english/
4	http://www.cambridgeenglish.org/learning-english/free-resources/write-and-improve/
5	Oneshopenglish.com
6	Breakingnews.com

MOOC	
1	https://www.mooc-list.com/tags/english
2	https://www.mooc-list.com/course/adventures-writing-stanford-online
3	http://www.cambridgeenglish.org/learning-english/free-resources/mooc/

COURSE TITLE	RESEARCH PAPER REVIEW			CREDITS	3
COURSE CODE	CCA42800	COURSE CATEGORY	PC	L-T-P-S	0-0-6-1
VERSION	1.0	APPROVAL DETAILS		LEARNING LEVEL	BTL-4

ASSESSMENT SCHEME	
CIA	ESE
50%	50%

Course Description	The course provides students the opportunity to acquire and train skills and knowledge on how to independently assess the state of knowledge within a given narrow field of research. This course provides new insights or interpretation of a subject through thorough and systematic evaluation. In this project-based course, the students will outline a complete scientific paper.
Course Objective	1. To write brieflythe research and theories 2. To understand the basicsof the research 3. To integrate and evaluate the research and theories 4. To provide a justification for the research proposed based on the previous research.
Course Outcome	Upon completion of this course, the students will be able to 1. Identify theories and empirical results within a field of research 2. Evaluate research findings and implicit assumptions within a field of research 3. Present the theories and empirical results in a way that combines precision with readability 4. Design and write a literature review within the specified time limit 5. Organise and present the research findings for various audiences

Prerequisites: Research Methodology

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	PO11	PO12	PSO1	PSO2	PSO3
CO-1	3	3	3	3	1	-	-	1	-	-	-	1	1	1	2
CO-2	3	3	3	3	-	-	1	-	1	2	-	-	1	2	-
CO-3	3	3	3	3	-	1	-	-	-	-	-	-	1	1	2
CO-4	3	3	3	3	-	-	-	-	2	-	2	1	1	1	-
CO-5	3	3	3	3	-	-	-	-	-	-	-	-	1	1	2

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

RESEEARCH PAPER REVIEW

1. Find review articles and other basic information to use for background (outside of what is provided in textbook)
2. Find 3 empirical articles (papers have method/results sections)
3. Write the paper
    a. Background information to topic; research question/hypotheses
    b. Describe/summarize empirical articles
    c. Critically analyze topic; synthesize findings from articles

d. Propose future directions/research (be specific)

4. The paper must be written in APA format. There are 2 primary ways you will use APA formatting: referencing and use of section headers.
   a. Referencing must be in APA style. Please see below for details or my website for APA style information sheets. You can use your textbook as an example of how to reference. Any ideas or conclusions that are not your own (information that you have learned), you must cite – give credit to the person that had that idea!
   b. Section headers are required in your paper. These should be descriptive of the paragraph(s) in that section (e.g. "Overview of false memories and children" then "Theories for false memories" then "Examination of familiarity", etc.). The headers should be italicized and on their own line.
5. There is not a page requirement or limit, but typical papers are approximately 10 pages, double-spaced, 12-pt font, with additional, separate title page and reference page. Please include page numbers. Other APA style formatting, such as running heads or an abstract, are not required but welcomed.
6. Reference page: Only include references of papers that YOU have read. If you have any questions about how to correctly cite a source, please ask, but also see information below, on my website, or follow your textbook's examples at the back of the book!
7. Finally Proof read, revise ,check for plagiarism and publish in indexed journals

Remarks	Allocation of Marks
Tentative Area, Topic selection	10%
Abstract, Introduction, Literature Review, Gap Identification, Objectives	20%
Methodology, (Materials and Methods, Design/Modelling/Analysis/Fabrication/Testing)	20%
Results and Discussion, Conclusion, Future Scope, References and Draft Project Report submission	20%
Project Report submission, PPT Preparation	20%
Internal and External Examiners Evaluation	20%
Total	100%

TEXT BOOKS	
1	Chris A. Mack(2018), How to Write a Good Scientific Paper, SPIE publications.
REFERENCE BOOKS	
1	James D. Lester Jr.(2001), Writing Research Papers: A Complete Guide, Pearson Education
E BOOKS	
1.	http://thuvienso.bvu.edu.vn/bitstream/TVDHBRVT/15289/1/How-to-Write-a-Research-Paper.pdf

COURSE TITLE	INTERNSHIP			CREDITS	2
COURSE CODE	CCA42801	COURSE CATEGORY	PC	L-T-P-S	0-0-0-0
VERSION	1.0	APPROVAL DETAILS		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA	ESE
50%	50%

Course Description	The internship is guided by learning goals and reflective assignments. It is supervised academically by a faculty member and professionally by an internship supervisor. All academic internships must be approved in advance, and students must be concurrently enrolled in academic internship units
Course Objective	1. Gain an understanding of workplace dynamics, professional expectations, and the influence of culture on both. 2. Build proficiency in a range of industry skills appropriate to the field of the internship 3. Refine and clarify professional and career goals through critical analysis of the internship experience or research project
Course Outcome	Upon completion of the course the students will be able to 1. Describe main issues and challenges to be faced in the industry, both internally and on the market 2. Accomplish to unfamiliar work place, working culture and style 3. Draw skills from experience and process challenges 4. Develop an awareness of their skills and aspirations 5. Recognize more thoroughly on their company and sector as well as on their own experience, perceptions, and career goals

Prerequisites: Basics of database

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	PSO1	PSO2	PSO3
CO-1	3	3	3	3	1	-	-	1	-	-	-	1	1	1	-
CO-2	3	3	3	3	-	-	1	-	1	2	-	-	1	1	-
CO-3	3	3	3	3	-	1	-	-	-	-	-	-	1	1	-
CO-4	3	3	3	3	-	-	-	-	2	-	2	1	1	1	-
CO-5	3	3	3	3	-	-	-	-	-	-	-	-	1	1	-

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

INTERNSHIP

The internship is guided by learning goals and reflective assignments. It is supervised academically by a faculty member and professionally by an internship supervisor. All academic internships must be approved in advance, and students must be concurrently enrolled in academic internship units. Students evaluate the work site and supervisors evaluate the student's performance at the internship.

Procedure for applying for internships

For internship, look for the companies and organisations of the industry the students are interested in and search for training, internships or any links that allow to enter your details and upload professional resume with the website. If direct application is allowed, apply for the internship.

COURSE TITLE	PROJECT WORK			CREDITS	20
COURSE CODE	CCA42802	COURSE CATEGORY	PC	L-T-P-S	0-0-40-4
VERSION	1.0	APPROVAL DETAILS		LEARNING LEVEL	BTL-4

ASSESSMENT SCHEME	
CIA	ESE
50%	50%

Course Description	The project work is introduced to improve the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. The students in a group of 3 to 4, works on a topic under the guidance of a faculty member and prepares a comprehensive project report after completing the work. The progress of the project is evaluated based on a minimum of three reviews. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.
Course Objective	1. To perform a literature review 2. To undertake detailed technical work 3. Develop a solution for the problem and develop an application by using relevant computer application concepts 4. To produce progress reports or maintain a professional journal to establish work completed and deliver a seminar on the general area 5. To present the work in a forum involving poster presentations
Course Outcome	Upon successful completion of the course students will be able to: 1. Identify a issue and derive problem related to society, environment, economics, energy and technology 2. Formulate and Analyze the problem and determine the scope of the solution chosen 3. Design solutions to complex problems utilizing a systems approach. 4. Find solution by formulating proper methodology 5. Evaluate the solution by considering the standard data / Objective function and by using appropriate performance metric

Prerequisites: Software Engineering , 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	PSO1	PSO2	PSO3
CO1	2	1	3	1	-	1	-	-	-	-	-	3	3	1	2
CO2	1	1	3	1	-	-	1-	-	1	2	-	3	-	2	2
CO3	1	2	3	2	2	-	-	1	-	-	2	2	2	3	3
CO4	1	3	3	2	2	2	-	1	-	-	-	-	2	3	3
CO5	2	3	3	3	2	2	-	-	1	-	3	2	3	3	3

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

Project

The students should finalize their Project immediately before commencement of 4thsemester. The types of projects may include:

1. Industrial case study
2. Preparation of a feasibility report
3. Design and development of application
4. The overhauling of existing application
5. Creation of New facilities

Identification of Topic: The selection of topic is of crucial importance. It should be field of interest. It is advisable to choose the project can be completed on time and within the budget and resources. The topic should be clear, directional, focussed and feasible. The project should be challenging but manageable within the resources and time available. Students should undergo reviews during the internal assessment. Time table for IA should include project review. The guide should monitor the progress of Project work periodically and it should be finally evaluated. The IA marks will be evaluated based on oral presentation and assessment by the internal guide by adopting Rubrics given. Real time problems, Industry related problems, should be chosen and it is a Responsibilities of the project committee / Project coordinator.

Rubrics for Major Project Evaluation

Review #	Agenda	Criteria	Assessment	**Overall Weightage**
1	Synopsis and Proposal Evaluation	• Identification of Problem Domain and Detailed Analysis • Study of Existing systems and feasibility of project proposal • Objectives and methodology of the proposed work	10	**50%**
2	Midterm Assessment Project	• Design methodology • Planning of project work (time frame)	10	

	Evaluation	• Demonstration of the work done so far and presentation		
3	Project and Project Report Evaluation	• Incorporation of suggestions • Project demonstration presentation • Project report -description of concept and technical details • Conclusion and discussion	20	
4	Evaluation by guide	• Self-motivation and determination • Working within a team • Technical knowledge and awareness related to the project • Regularity	10	
5	ESE Examination	• Presentation • Viva voce	20	**50%**

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	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	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	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 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	2	2	-	3	2	-	1	3	2	2
CO2	-	3	2	-	1	-	-	3	2	-	-	3	2	1	-
CO3	-	-	1	-	1	-	-	-	1	-	-	-	1	2	-
CO4	1	1	-	1	1	1	1	1	-	1	1	1	-	-	1
CO5	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)**
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 **Practical Component**: Create a text document and store locally and also on cloud and share it **Suggested Readings:** Cloud Enabling Technology	**CO-1** **BTL-3**
MODULE 2: WEB SERVICES IN CLOUD	**(9L)**
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 **Practical Component**: Deploying a web service in cloud **Suggested Readings:** Web Service APIs – Web service Authentication	**CO-2** **BTL-3**
MODULE 3: MANAGEMENT OF CLOUD SERVICES	**(9L)**
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). **Practical Component**: Design and develop cloud based applications **Suggested Readings:** Economics of choosing a Cloud platform for an organization	**CO-3** **BTL-3**
MODULE 4: APPLICATION DEVELOPMENT	**(9L)**
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. **Practical Component:** Deploy a virtual machine on AWS - IaaS **Suggested Readings:** Amazon, Azure, Google App	**CO-4** **BTL-3**
MODULE 5: CLOUD SECURITY	**(9L)**
Threats and Risks – Security controls and mechanisms-security policies-Threat agents-cloud security threats- DOS-Virtualization attack- Risk Management **Practical Component**: Cloud Security Mechanisms -Encryption –Case study **Suggested Readings:** Flawed Implementations, Security policy disparity	**CO-5** **BTL-2**

TEXT BOOKS	
1	Sunilkumar Manvi, Gopal Shyam(2021)**,** *Cloud Computing Concepts and Technologies, CRC press*
2	Gautam Shroff, "*Enterprise Cloud Computing Technology Architecture Applications*", Cambridge University Press; 1 edition, [ISBN: 978-0521137355].
REFERENCE BOOKS	
1.	Thomas Erl, Zaigham Mahmood and Ricardo Puttini(2013), *Cloud Computing – concepts, Technology and Architecture*, 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**	**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 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	1. To identify, formulate, and solve complex engineering problems by applying principles 2. To provide leadership ability and create a collaborative and inclusive environment, 3. To apply engineering design to produce solutions that meet specified needs 4. To develop and conduct appropriate experimentation, analyze and interpret data. 5. 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 1. Recognize characteristics and physical design of IoT. 2. Identify suitable connectivity protocols. 3. Discuss IoT sensor networks at various use cases.

	4. 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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 TECHNOLGIES 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), *Internet of Things,Technologies and Applications for a New Age of Intelligence*	
2	Arshdeep Bahga, Vijay Madisetti(2015) "*Internet of Things – A hands-on approach*", Universities Press.	
3	Olivier Hersent, David Boswarthick, Omar Elloumi(2012) "*The Internet of Things – Key applications and Protocols"*, Wiley publisher	
E BOOKS		
1	ttps://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**	**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	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	1. To understand the Big Data Platform and its Use cases. 2. To provide an overview of Apache Hadoop. 3. To provide HDFS Concepts and Interfacing with HDFS. 4. To understand Map, Reduce Jobs. 5. Provide hands on Hadoop Eco System.
Course Outcome	Upon completion of this course, the students should be able to 1. Describe the basics of Big Data. 2. Implement the basic operations in Scala. 3. Develop custom Scala functions as per the requirement. 4. Understand the basics of RDDs. 5. Illustrate spark runtime environment.

Prerequisites: knowledge of Programming Language (Java preferably), SQL (queries and sub queries)

CO, PO AND PSO MAPPING

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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), *Programming in Scala: A comprehensive Step-by-Step Scala Programming Guide* , Third Edition. Artima Inc publisher
2.	Holden Karau, Andy Konwinski, Patrick Wendell, Matei Zaharia(2016), *Learning Spark* , o'reilly
REFERENCE BOOKS	
1.	Sandy Ryza, Uri Laserson, Sean Owen and Josh Wills , Advanced Analytics with Spark , o'reilly 2017.
E BOOKS	
1.	http://dhoto.lecturer.pens.ac.id/lecture_notes/internet_of_things/Big%20Data%20Principles%20and%20 Paradigms.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**	**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	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	1. To identify, formulate, and solve complex engineering problems by applying principles 2. To apply engineering design to produce solutions that meet specified needs 3. To function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, 4. To develop and conduct appropriate experimentation, analyze and interpret data. 5. 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 1. Describe the cloud and its techniques.

	2. Illustrate the different cloud delivery and deployment models 3. Identify and analyze cloud file systems and its related technologies 4. Describe how to access of Cloud File Systems and cloud workloads 5. Demonstrate the usage of various cloud tools

Prerequisites: Cloud Basics

CO, PO AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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 envrironment **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 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,	**CO-5** **BTL-2**

TEXT BOOKS	
1.	Thomas Erl, Zaigham Mahmood, and Ricardo Puttini(2013),"*Cloud Computing Concepts, Technology & Architecture*", Prentice Hall.
REFERENCE BOOKS	
1.	Rajkumar Buyya, James Broberg, Andrzej M. Goscinski(2011), *Cloud Computing: Principles and Paradigms*, 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 VISULALIZATION TECHNIQUES			CREDITS	3
COURSE CODE		CCA42504	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	
					Theory	Practical
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	1. To acquire the basic knowledge in statistics and scientific methods. 2. To understand the ways of collecting data 3. To summarize the data 4. To understand the fundamentals of various formulas in excel 5. To create aggregate reports using formula-based techniques.
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the statistics and scientific methods for data analysis 2. Compare and contrast the data and describe the data collection methods 3. Explain the ways of summarizing.

	4. Apply the various excel formulas 5. Generate reports using formulas

Prerequisites: Office tools

CO, PO AND PSO MAPPING

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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)**
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. **Practical component:** Analyzing qualitative and quantitative data **Suggested Reading :** Statistical methods for data analysis	**CO-1** **BTL-2**
MODULE 2: COLLECTING AND SUMMARIZING DATA	**(6L+3P)**
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 **Practical component:** Data collection and summarization methods **Suggested Readings:** Various designs of data collection	**CO-2** **BTL-2**
MODULE 3: STATISTICAL MEASURES	**(6L+3P)**
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 **Practical component:** Writing formulas in excel to aggregate the data **Suggested Readings:** Create ANOVA table	**CO-3** **BTL-3**
MODULE 4: DATA VISUALIZATION	**(6L+3P)**
Whyvisualize data? Visualizing data: Mapping data onto aesthetics, Aesthetics and types of data, Scales map data values onto aesthetics, Coordinate systems and axes, Color scales **Practical Component:** Implementing various ways of Data visualizations **Suggested Readings:** Visualization Techniques	**CO-4** **BTL-2**
MODULE 5: PLOTTING TA	**(6L+3P)**

Introduction-line plots-titles, labels and legends, plotting using CSV and TSV data source, scatter plot, Bar plots, Histograms, pie charts, stack plots **Practical component**: Plotting using matplotlib **Suggested Readings:** other plotting techniques	**CO-5** **BTL-2**

TEXT BOOKS	
1.	R.Lyman.ott (2022), *An Introduction to Statistical Methods and Data Analysis* 7th Edition, Cengage Learning, Inc
2	Claus O. Wilke(2019), *Fundamentals of Data Visualization*. OREILLY' publishers
REFERENCE BOOKS	
1	Wayne L. Winston (2011), *Microsoft Excel 2010 Data Analysis and Business Modeling ,* Microsoft Press publisher
2	Mario Dobler Tim Gromann(2019), *Data Visualization with Python: Create an impact with meaningful data insights using interactive and engaging visuals*, 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	
					Theory	Practical
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	1. To understand the basics of Blockchain 2. To Identify Consensus mechanism for Blockchain Application 3. To apply Artificial intelligence techniques for Blockchain usecases
Course Outcome	Upon completion of this course, the students will be able to 1. Apply Hyperledger Fabric and Ethereum platform to implement the Block Chain Application 2. Identify Consensus mechanism for Blockchain Application

	3. Recall the function of Blockchain & AI as a method of securing distributed ledgers. 4. Identify the major research challenges in crypto currency domain. 5. 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	PSO1	PSO-2	PSO-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)**
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, smart contracts. Introduction to Hyperledger - Overview of the project - Hyperledger Fabric - Hyperledger Saw tooth - Other Hyperledger frameworks and tools. **Practical Component:** Implement security for digital ledger **Suggested Readings:** Tools for Block chain	**CO-1** **BTL-2**
MODULE 2: CONSENSUS ALGORITHMS	**(6L+3P)**
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) **Practical Component:** Analyse how consensus algorithms works? **Suggested Readings:** Advantages and limitations of consensus algorithms	**CO-2** **BTL-2**
MODULE 3: BLOCKCHAIN AND AI	**(6L+3P)**
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	**CO-3** **BTL-3**

Practical Component: Applying AI and Block chain- A simple framework **Suggested Readings:** Big data and AI	
MODULE 4: CRYPTOCURRENCY AND AI	**(6L+3P)**
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 **Practical Component:** Applying AI and Block chain in crypto trading **Suggested Readings**: Cryptocurrency	**CO-4** **BTL-3**
MODULE 5: FUTURE OF AI WITH BLOCKCHAIN	**(6L+3P)**
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. **Practical Component:** Applications of block chain in enterprises and government **Suggested Readings**: Futre prospects of block chain	**CO-5** **BTL-3**

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	36th ACM 05-11-2022	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Practical Assessment	Observations /Lab Records	Attendance	ESE	
					Theory	Practical
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	PSO-1	PSO-2	PSO-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)
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 **Practical Component**: simple R programs to create lists, arrays and matrices **Suggested Readings:** Script File	**CO-1** **BTL-2**
MODULE 2: OPERATORS	**(6L+3P)**
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. **Practical Component:** R Programs using control structures and functions **Suggested Readings:** Decision making	**CO-2** **BTL-3**
MODULE 3: LISTS AND FRAMES	**(6L+3P)**
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 **Practical Component:** R Programs to manipulate arrays, extracting data from data frames etc. **Suggested Readings:** Accessing elements of a matrix	**CO-3** **BTL-3**
MODULE 4: FACTORS AND TABLES	**(6L+3P)**
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	**CO-4** **BTL-3**

Functions- The aggregate() Function- The cut() Function **Practical Component:** R programs for table manipulation and table related functions **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**
T BOOKS	
1.	Matloff, Norman (2011) The art of R programming: A tour of statistical software design. No Starch Press.
ERENCE 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	
					Theory	Practical
15%	15%	10%	5%	5%	25%	25%

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	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	Upon completion of this course, the students should be able to 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	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	**CO-1** **BTL-2**

Web Services cloud-based platform. **Suggested Readings:** Understanding Cloud ecosystems	
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 **Suggested Readings:** Building Ajax controls	**CO-3** **BTL-3**
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), "*Developing and Hosting Applications on the Cloud*", IBM Press.
2.	Chris Hay, Brian Prince(2018), *Azure in Action* [ISBN: 978-1935182481], Manning publisher
REFERENCE BOOKS	
1.	Thomas(2013), "*Cloud Computing: Concepts, Technology & Architecture*" 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	36th ACM 05-11-2022	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Practical Assessment	Observations/ Lab Records	Attendance	ESE	
					Theory	Practical
15%	15%	10%	5%	5%	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	1. To understand the concept of Cloud managed services and the sustainability objectives of cloud management. 2. To learn about various notification services and deployment models of cloud management. 3. To differentiate in-house and cloud-based management services 4. To understand the cloud in designing organizational strategies. 5. To understand and implement the resource management approaches and scheduling algorithms to optimize the utilization of resources.
Course Outcome	Upon completion of this course, the students will be able to 1. Able to differentiate cloud services with in-house services by understanding the basics. 2. Learn about the various cloud notification services. 3. Understand the various deployment models of cloud managed services 4. Analysis the cloud's strategies for organisational effectiveness. 5. 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	PSO-1	PSO-2	PSO-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. ohn 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

ELECTIVES-III

<table>
<tr><td colspan="2">COURSE TITLE</td><td colspan="3">NATURAL LANGUAGE PROCESSING</td><td>CREDITS</td><td colspan="2">3</td></tr>
<tr><td colspan="2">COURSE CODE</td><td>CCA42509</td><td colspan="2">COURSE CATEGORY</td><td>DE</td><td>L-T-P-S</td><td colspan="2">2-0-2-0</td></tr>
<tr><td>Version</td><td>1.0</td><td>Approval Details</td><td colspan="2">36th ACM 05-11-2022</td><td>LEARNING LEVEL</td><td colspan="2">BTL-3</td></tr>
<tr><td colspan="8">ASSESSMENT SCHEME</td></tr>
<tr><td rowspan="2">First Periodical Assessment</td><td rowspan="2">Second Periodical Assessment</td><td rowspan="2">Seminar/ Assignments/ Project</td><td rowspan="2">Surprise Test / Quiz</td><td rowspan="2">Attendance</td><td colspan="2">ESE</td></tr>
<tr><td>Theory</td><td>Practical</td></tr>
<tr><td>15%</td><td>15%</td><td>10%</td><td>5%</td><td>5%</td><td>25%</td><td>25%</td></tr>
<tr><td>Course Description</td><td colspan="7">This course covers the concepts of morphology, syntax, semantics and pragmatics of the language and the application based on natural language processing to show the points of syntactic, semantic and pragmatic processing.</td></tr>
<tr><td>Course Objective</td><td colspan="7">1. To understand to How key concepts from NLP are used to describe and analyze language ·
2. To label text for various applications like Named Entity Recognition.
3. To tag text using context free grammar for English language ·
4. To understand semantics and pragmatics of English language for processing ·
5. To describe the application based on natural language processing based on syntactic, semantic and pragmatic processing.</td></tr>
<tr><td>Course Outcome</td><td colspan="7">Upon completion of this course, the students should be able to

1. Describe the basic concepts related to language processing.
2. Analyze the language morphologically.
3. Illustrate various parsing techniques.
4. Analyze the semantic content of text.
5. Develop any one Natural Language Processing application.</td></tr>
<tr><td colspan="8">Prerequisites: Machine Learning</td></tr>
</table>

CO, PO AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	3	-	3	2	3	2	-	-	1	-	3	-	3	2	1
CO-2	1	-	-	1	3	2	-	-	-	2	1	-	-	1	-
CO-3	1	1	1	-	-	1	-	-	1	-	1	1	1	-	1
CO-4	1	1	1	-	1	-	-	-	-	-	1	1	1	-	2
CO-5	2	1	2	2	2	1	3	-	2	-	-	3	3	3	3

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

MODULE 1: INTRODUCTION	**(6L+3P)**
Introduction to NLP, NLP and its neighbours, Three Themes in Natural Language Processing, N gram Language Models, Smoothing and discounting, Recurrent Neural Network Language Models, Evaluating language Models, Out-of-Vocabulary words. **Suggested Readings:** Language modelling, English Grammar	**CO-1** **BTL-3**
MODULE 2: SEQUENCE LABELLING AND APPLICATIONS	**(6L+3P)**
Sequence Labelling as Classification - Sequence labelling as structure prediction - The Viterbi Algorithm - Hidden Markov Models - Discriminative Sequence labelling with features - Neural sequence labelling - Unsupervised sequence labelling - Part -of - Speech Tagging, Morphosyntactic Attributes - Named Entity Recognition - Tokenization - Code Switching - Dialogue Acts **Suggested Readings:** Word class, Markov Models	**CO-2** **BTL-3**
MODULE 3: PARSING METHODS	**(6L+3P)**
Context Free Parsing : Deterministic Bottom-up parsing - Ambiguity - Weighted Context-Free Grammars- Learning weighted Context- Free Grammars - Grammar Refinement Dependency parsing: Dependency Grammar - Graph-Based Dependency Parsing - Transition- Based Dependency parsing - Applications **Suggested Readings:** Context free grammars, Parsing	**CO-3** **BTL-3**
MODULE 4: SEMANTIC ANALYSIS	**(6L+3P)**
Logical Semantics: Meaning and Denotation - Logical Representations of Meaning - Semantic Parsing and the Lambda Calculus - Learning semantic parsers Predicate- Argument Semantics: Semantic Roles - Semantic Role Labeling -	**CO-4** **BTL-3**

Abstract meaning representations Distributional and Distributed Semantics: The distributional Hypothesis - Design decisions for word representations - Latent Semantic Analysis - Brown Clusters - Neural Word Embeddings - Evaluating Word Embeddings **Suggested Readings:** Semantic Role Labeling, Word Embeddings	
MODULE 5: APPLICATIONS	**(6L+3P)**
Sentiment and Opinion Analysis, Question Answering system, Dialog Systems and Chatbots, Word sense disambiguation **Suggested Readings:** NLP Applications	**CO-5** **BTL-3**
TEXT BOOKS	
1	Dan Jurafsky and James H. Martin(2017), *Speech and Language Processing* (3rd ed. draft). Pearson Education India
REFERENCE BOOKS	
1.	**Jacob Eisenstein(2018), *Natural Language Processing*, MIT Press.**
E BOOKS	
1	https://www.cs.vassar.edu/~cs366/docs/Manning_Schuetze_StatisticalNLP.pdf
MOOC	
1.	https://www.coursera.org/learn/language-processing

<table>
<tr><td colspan="2">COURSE TITLE</td><td colspan="3">PRINCIPLES OF DEEP LEARNING</td><td>CREDITS</td><td colspan="2">3</td></tr>
<tr><td colspan="2">COURSE CODE</td><td>CCA42510</td><td>COURSE CATEGORY</td><td>DE</td><td>L-T-P-S</td><td colspan="2">2-0-2-0</td></tr>
<tr><td>Version</td><td>1.0</td><td>Approval Details</td><td colspan="2">36th ACM
05-11-2022</td><td>LEARNING LEVEL</td><td colspan="2">BTL-3</td></tr>
<tr><td colspan="8">ASSESSMENT SCHEME</td></tr>
<tr><td rowspan="2">First Periodical Assessment</td><td rowspan="2">Second Periodical Assessment</td><td rowspan="2">Seminar/ Assignments/ Project</td><td rowspan="2">Surprise Test / Quiz</td><td rowspan="2">Attendance</td><td colspan="2">ESE</td></tr>
<tr><td>Theory</td><td>Practical</td></tr>
<tr><td>15%</td><td>15%</td><td>10%</td><td>5%</td><td>5%</td><td>25%</td><td>25%</td></tr>
<tr><td>Course Description</td><td colspan="7">Deep learning is a class of machine learning algorithms that uses multiple layers to progressively extract higher-level features from the raw input. For example, in image processing, lower layers may identify edges, while higher layers may identify the concepts relevant to a human such as digits or letters or faces.</td></tr>
<tr><td>Course Objective</td><td colspan="7">1. To function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment,
2. To identify, formulate, and solve complex engineering problems by applying principles
3. To apply engineering design to produce solutions that meet specified needs
4. To develop and conduct appropriate experimentation, analyze and interpret data.
5. To acquire and apply new knowledge as needed, using appropriate learning strategies.</td></tr>
<tr><td>Course Outcome</td><td colspan="7">Upon completion of this course, the students should be able to

1. Design a simple Neural Networks using Linear Perceptron.
2. Apply Convolutional Neural Networks using Tensor Flow.
3. Describe the Differentiable Neural Computers.
4. Apply Deep Reinforcement Learning.
5. Demonstrate the simple deep learning algorithms for the given applications.</td></tr>
<tr><td colspan="8">Prerequisites: Machine learning algorithms</td></tr>
</table>

CO, PO AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	3	-	3	2	3	2	-	2	3	3	-	3	2	3	2
CO-2	1	-	-	1	3	2	-	-	1	1	-	-	1	3	1
CO-3	1	1	1	-	-	1	-	-	1	1	1	1	-	-	2
CO-4	1	1	1	-	1	-	1	1	1	1	1	1	-	1	1
CO-5	2	1	2	2	2	1	1	2	2	1	2	1	3	1	1

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

MODULE 1: THE NEURAL NETWORK	**(6L+3P)**
Mechanics of Machine Learning, The Neuron, Linear Perceptron, Linear Neurons and Their Limitations, Sigmoid, Feed-Forward Neural Networks, Fast-Food Problem, The Delta Rule. **Suggested Readings:** Machine Learning Models	**CO-1** **BTL-2**
MODULE 2: CONVOLUTIONAL NEURAL NETWORKS & TENSORFLOW	**(6L+3P)**
Neurons in Human Vision, Convolutional Layer, Convolution Networks, Tensor Flow, Creating and Manipulating Tensor Flow Variables, Tensor Flow Operations, Implementing an Auto encoder in Tensor. **Suggested Readings:** Computer vision	**CO-2** **BTL-3**
MODULE 3: MEMORY AUGMENTED NEURAL NETWORKS	**(6L+3P)**
Neural Turing Machines, Attention-Based Memory Access, Differentiable Neural Computers (DNC) -Memory Reuse - Temporal Linking - Controller Network. **Suggested Readings:** Neural Networks	**CO-3** **BTL-3**
MODULE 4: DEEP REINFORCEMENT LEARNING	**(6L+3P)**
Deep Reinforcement Learning - Markov Decision Processes, Policy Versus Value Learning, Pole-Cart with Policy Gradients, Q-Learning **Suggested Readings:** Deep Learning	**CO-4** **BTL-3**
MODULE 5: APPLICATIONS	**(6L+3P)**
Deep learning for Real time applications, Deep Learning Applications at the Enterprise Scale, Deep Learning Models for Healthcare Applications. **Suggested Readings:** Applications of Deep learning in health care	**CO-5** **BTL-3**

TEXT BOOKS

1.	Nikhil Buduma, Nicholas Locascio(2017), "*Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms*", O'Reilly Media.

REFERENCE BOOKS

1.	Ian Goodfellow, YoshuaBengio, Aaron Courville(2017), "D*eep Learning (Adaptive Computation and Machine Learning series*", MIT Press.

E BOOKS

1.	http://www.deeplearningbook.org/

MOOC	
1.	https://www.coursera.org/learn/neural-networks-deep-learning
2.	https://in.udacity.com/course/deep-learning--ud730

COURSE TITLE		DATA CLASSIFICATION METHODS AND EVALUATION			CREDITS	3
COURSE CODE		CCA42511	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	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE	
					Theory	Practical
15%	15%	10%	5%	5%	25%	25%

Course Description	Data classification is broadly defined as the process of organizing data by relevant categories so that it may be used and protected more efficiently. On a basic level, the classification process makes data easier to locate and retrieve. Data classification is of particular importance when it comes to risk management, compliance, and data security. Data classification involves tagging data to make it easily searchable and trackable. It also eliminates multiple duplications of data, which can reduce storage and backup costs while speeding up the search process.
Course Objective	1. To introduce students to the basic concepts and techniques of Data Mining. 2. To introduce a wide range of clustering, estimation, prediction, and classification algorithms. 3. To introduce mathematical statistics foundations of the Data Mining Algorithms. 4. To introduce basic principles, concepts and applications of data warehousing. 5. To learn performance evaluation of classification algorithms.
Course Outcome	Upon completion of this course, the students should be able to 1. Illustrate the concepts of the Data Classification. 2. Apply Probabilistic Models for Classification. 3. Apply Rule-Based Classification. 4. Implement Support Vector Machines and Neural Networks. 5. Visualize the output of Big Data Classification using various tools.

Prerequisites: Basic Knowledge about Data Classification, 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	PSO3
CO-1	3	-	3	2	3	3	-	3	2	3	2	-	2	3	2
CO-2	1	-	-	1	3	1	-	-	1	3	2	-	-	1	1
CO-3	1	1	1	-	-	1	1	1	-	-	1	-	-	1	-
CO-4	1	1	1	-	1	1	1	1	-	1	-	1	1	1	1
CO-5	2	1	2	2	2	1	1	1	1	1	1	1	3	1	2

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

MODULE 1: AN INTRODUCTION TO DATA CLASSIFICATION (6L+3P)

Introduction: Common Techniques in Data Classification, Handing Different Data Types, Variations on Data Classification, Feature Selection for Classification: A Review: Introduction, Algorithms for Flat Features, Filter Models, Algorithms for Structured Features, Algorithms for Streaming Feature **Suggested Readings:** Common Techniques in Data Classification	**CO-1** **BTL-1**

MODULE 2: PROBABILISTIC MODELS FOR CLASSIFICATION (6L+3P)

Introduction, Naive Bayes Classification, Logistic Regression Classification, Probabilistic Graphical Models for Classification, Decision Trees: Theory and Algorithms : Introduction, Top-Down Decision Tree Induction, Case Studies with C4.5 and CART, Scalable Decision Tree Construction , Incremental Decision Tree Induction **Suggested Readings:** Logistic Regression Classification	**CO-2** **BTL-2**

MODULE 3: RULE-BASED CLASSIFICATION (6L+3P)

Introduction, Rule Induction, Classification Based on Association Rule Mining, Applications Instance Based Learning: A Survey: Introduction, Instance-Based Learning Framework, Lazy SVM Classification , Locally Weighted Regression, Lazy Naive Bayes, Lazy Decision Trees, Rule-Based Classification, Radial Basis Function Networks: Leveraging Neural Networks for Instance-Based Learning, Lazy Methods for Diagnostic and Visual Classification **Suggested Readings:** Leveraging Neural Networks for Instance-Based	**CO-3** **BTL-3**

Learning	
MODULE 4: SUPPORT VECTOR MACHINES AND NEURAL NETWORKS (6L+3P)	
Support Vector Machines, Neural Networks: A Review, Fundamental Concepts, Single-Layer Neural Network, Kernel Neural Network, Multi-Layer Feed Forward Network, Deep Neural Networks, Introduction, Generic Stream Classification Algorithms, Rare Class Stream Classification, Discrete Attributes: The Massive Domain Scenario, Other Data Domains **Suggested Readings:** Kernel Neural Network	**CO-4** **BTL-2**
MODULE 5: BIG DATA CLASSIFICATION (6L+3P)	
Introduction , Scale-Up on a Single Machine, Scale-Up by Parallelism, Text Classification: Introduction, Feature Selection for Text Classification, Decision Tree Classifiers, Rule-Based Classifiers, Probabilistic and Naive Bayes Classifiers, Linear Classifiers, Proximity-Based Classifiers, Classification of Linked and Web Data, Meta-Algorithms for Text Classification, Leveraging Additional Training Data, Multimedia Classification, Time Series Data Classification, Discrete Sequence Classification, Collective Classification of Network Data, Active Learning: A Survey **Suggested Readings:** Classification of Linked and Web Data	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Charu C. Aggarwal (2015) "*Data Classification: Algorithms and Applications*", CRC Press
REFERENCE BOOKS	
1.	Saman K. Halgamuge, Lipo Wang (Eds.)(2015) "*Classification and Clustering for Knowledge Discovery*" Springer.
E BOOKS	
1.	https://www.semanticscholar.org/paper/Data-Classification%3A-Algorithms-and-Applications-CoggeshallKlinkenberg/82076c 288b729fd87050e27a747 60ad5f6e164bf
MOOC	
1.	https://www.coursera.org/specializations/data-mining

<table>
<tr><td>COURSE TITLE</td><td colspan="3">CLOUD COMPUTING WITH WEB SERVICES</td><td>CREDITS</td><td colspan="2">3</td></tr>
<tr><td>COURSE CODE</td><td>CCA42512</td><td>COURSE CATEGORY</td><td>DE</td><td>L-T-P-S</td><td colspan="2">2-0-2-0</td></tr>
<tr><td>Version</td><td>1.0</td><td>Approval Details</td><td>36th ACM 05-11-2022</td><td>LEARNING LEVEL</td><td colspan="2">BTL-3</td></tr>
<tr><td colspan="7">ASSESSMENT SCHEME</td></tr>
<tr><td rowspan="2">First Periodical Assessment</td><td rowspan="2">Second Periodical Assessment</td><td rowspan="2">Seminar/ Assignments/ Project</td><td rowspan="2">Surprise Test / Quiz</td><td rowspan="2">Attendance</td><td colspan="2">ESE</td></tr>
<tr><td>Theory</td><td>Practical</td></tr>
<tr><td>15%</td><td>15%</td><td>10%</td><td>5%</td><td>5%</td><td>25%</td><td>25%</td></tr>
<tr><td>Course Description</td><td colspan="6">The course starts with history and console of AWS which cover schedule of the release of services, VPC, subnets, and elastic compute cloud, types of load balancers, target groups, health checks. the course also covers the electronic file system, monitoring of EBS volumes. Web application firewall concepts also covered.</td></tr>
<tr><td>Course Objective</td><td colspan="6">1. To gain insight into the core services offered by AWS.
2. To develop comprehension of IaaS application deployments.
3. To identify the characteristics and application of the various storage services available in AWS.
4. To determine how to deploy custom architectures on AWS.
5. To develop a skillset on how to secure resources and deployments on AWS.</td></tr>
<tr><td>Course Outcome</td><td colspan="6">Upon completion of this course, the students will be able to
1. Identify & interpret the AWS web console and familiarize yourself with the options available.
2. Implement & examine how elasticity & scaling are applied to EC2 instances.
3. Implement & learn how fault tolerance is applied in an IaaS deployment on AWS and authentication and authorization features of AWS.
4. Identify & analyze the relevance of the functions & uses of S3 storage.
5. Determine the role of Cloud Watch services and comprehend how they can be used to monitor AWS resources.</td></tr>
<tr><td colspan="7">Prerequisites: Cloud Computing and environment basics</td></tr>
</table>

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	**1**	**1**	**2**	**1**	**2**	**1**	**2**							**2**	
CO-2	**2**	**2**	**2**	**3**	**2**	**3**	**3**							**2**	
CO-3	**1**	**2**	**2**	**3**	**3**	**3**	**3**						**2**	**1**	
CO-4	**2**	**2**	**2**	**3**	**2**	**2**	**3**						**2**	**2**	
CO-5	**2**	**2**	**2**	**3**	**3**	**2**	**3**						**1**	**2**	**3**
1: Weakly related, 2: Moderately related and 3: Strongly related															

MODULE 1: HISTORY AND CONSOLE OF AWS	**(6L+3P)**
Birth and Growth of AWS, Schedule of the Release of Services, Challenges Faced, Outages of 2011-12, Present Market Position. Logging in to the AWS Console, Search Box. Navigating to Services, AWS Regions. **Suggested Readings:** Basic data centre design concept	**CO-1** **BTL-1**
MODULE 2: VPC, SUBNETS, AND ELASTIC COMPUTE CLOUD (EC2)	**(6L+3P)**
Default VPC and Subnets, CIDR Blocks, Availability Zones, Access Control Lists, Route Tables, Internet Gateways, Security Groups. Creating and Deploying EC2 Linux and Windows Instances, Amis, 7-Step Workflow, SSH and RDP Connections to Instances, Key pairs. Auto-scaling in EC2 Instances, Launch Templates, Self-Healing, Auto scaling Rules. **Suggested Readings:** Creating and deploying windows	**CO-2** **BTL-2**
MODULE 3: LOAD BALANCING, FAULT TOLERANCE AND ACCESS MANAGEMENT	**(6L+3P)**
Types of Load Balancers, Target Groups, Health Checks. Introduction to Fault tolerance and need, Single point of failures, Retrying on failure, Idempotent operations to achieve retry on failure. AWS Service guarantees. AWS Identity and Access Management (IAM) : Policies and Permissions, Managing IAM policies, Access analyzer findings: Working with Findings, Review findings, Filtering findings, Resolving Findings **Suggested Readings:** Different types of balancers and dada access management concepts	**CO-3** **BTL-3**

MODULE 4: AWS STORAGE SYSTEMS AND SERVICES	(6L+3P)
Electronic File System (EFS): Usage of EFS, Mounting to EC2 Instances, Use-Cases, and Drawbacks of EFS. Elastic Block Storage (EBS): Usage of EBS, Snapshots, and Restoring, Volumes, Monitoring of EBS volumes. Simple Storage Service (S3): S3 Buckets, Storage Classes, Lifecycle, Replications, Versioning, Metrics, Transition Options. **Suggested Readings:** Fundamental concepts about data storage information	**CO-4** **BTL-3**
MODULE 5: CLOUD WATCH AND WEB APPLICATION FIREWALL (WAF)	**(6L+3P)**
Namespaces, Alarms, Metrics, Dashboard, Using Cloud Watch with Load Balancers, Cloud Watch Agent in EC2 instances. Classic and Next-generation Firewalls, Using Firewalls with ACLs, AWS Firewall Manager. **Suggested Readings:** Purpose of firewalls	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Michael Wittig, A. W. (2018). Amazon Web Services in Action. Shelter Island, Newyork: Manning Publications Co
REFERENCE BOOKS	
1.	Mishra, A. (2018). Amazon Web Services for Mobile Developers. Indianapolis, Indiana: John Wiley & Sons, Inc.
E BOOKS	
1.	https://docs.aws.amazon.com/general/latest/gr/aws-general.pdf
2.	https://s3-ap-southeast-1.amazonaws.com/tv-prod/documents%2Fnull-Amazon+Web+Services+in+Action.pdf
MOOC	
1.	https://aws.amazon.com/training/
2.	https://www.edx.org/school/aws

ELECTIVES-IV

COURSE TITLE	AUGMENTED AND VIRTUAL REALITY			CREDITS	3
COURSE CODE	CCA42513	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	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE	
					Theory	Practical
15%	15%	10%	5%	5%	25%	25%

Course Description	This course covers the basics of AR and VR development. This course explores to integrate, animate, and overlay 3D objects on the camera feed, before moving on to implement sensor-based AR applications. It contains various concepts by creating an AR application using Vuforia for both macOS and Windows for Android and iOS devices.
Course Objective	1. To understand basics of virtual and augmented reality 2. To create 3D scenes to learn about world space and scale 3. To move around your scenes using locomotion and teleportation 4. To create social VR experiences with Unity networking 5. To write C# script to create buttons and layers to publish in VR devices
Course Outcome	Upon completion of this course, the students should be able to 1. Create Virtual reality and Augmented reality ideas 2. Perform navigation around 3D world 3. Describe to build VR Rigs 4. Perform ray casting by detecting colliding objects 5. Design applications for different XR Platforms

Prerequisites: Multimedia basics

CO, PO AND PSO MAPPING

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	2	3	3	-	1	-	-	-	1	-	3	-	3	2	2
CO-2	3	-	3	2	3	2	-	-	-	2	1	-	-	1	1
CO-3	1	-	-	1	3	2	-	1	-	-	1	1	1	-	1
CO-4	1	1	1	-	-	1	-	-	-	-	1	1	1	-	-
CO-5	1	1	1	-	1	-	1	2	1	-	3	-	3	3	-

1: Weakly related, 2: Moderately related and 3: Strongly related	
MODULE 1 – VIRTUAL REALITY AND VIRTUAL ENVIRONMENTS	**(6L+3P)**
Introduction - Virtual Reality – Types – Virtual Reality Vs Augmented Reality – Applications – 3D interfaces. VR Environment: Unity overview: Interface – Navigation – Game Objects – Hierarchy **Suggested Readings:** Desktop VR, Mobile VR	**CO-1** **BTL-2**
MODULE 2 – BUILDING SIMPLE SCENES	**(6L+3P)**
Parenting objects – Using Asset store – Importing plug-ins – Moving scaling objects – Creating terrains – Creating game objects – Physics **Suggested Readings:** Unity editor, creating 3D objects with blender	**CO-2** **BTL-2**
MODULE 3 – BUILDING VR RIGS	**(6L+3P)**
Open VR and Building a VR Rig – Coding movement in VR – Grabbing and Throwing objects **Suggested Readings:** Web and JavaScript based VR	**CO-3** **BTL-3**
MODULE 4 – RAYCASTING INTERACTIONS	**(6L+3P)**
C# Scripting of Events and delegates – Object Manipulations with Raycast – Scripting Animation & sound effects – Creating buttons, dials, levers and wheels – Publishing your application in VR devices **Suggested Readings:** Activating Buttons from the Script	**CO-4** **BTL-3**
MODULE 5 – AUGMENTED REALITY	**(6L+3P)**
AR Foundation – Introduction to Vuforia – Plane Tracking – Spatial Mapping – Occlusion – Design a simple UI in AR – Object interactions **Suggested Readings:** Setting up Vuforia, Setting up AR Toolkit	**CO-5** **BTL-3**
TEXT BOOKS	
1.	Jesse Glover, Jonathan Linowe(2019), *Complete Virtual Reality and Augmented Reality Development with Unity: Leverage the power of Unity and become a pro at creating mixed reality applications*, Packt publishing
2	Jonathan Linowes(2018), *Unity Virtual Reality Projects*, Packt, Second Edition
REFERENCE BOOKS	
1.	Erin Pangilinan, Steve Lukas, Vasanth Mohan(2019), *Creating Augmented and Virtual Realities: Theory and Practice for Next Generation Spatial Computing*,

	O'Reilly.
E BOOKS	
1.	https://www.springer.com/gp/book/9783030062453
MOOC	
1.	https://in.udacity.com/course/introduction-to-virtual-reality--ud1012

COURSE TITLE		**BIG DATA ANALYTICS**			**CREDITS**	**3**
COURSE CODE		**CCA42514**	**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	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE	
					Theory	Practical
15%	15%	10%	5%	5%	25%	25%

Course Description	The course begins with a basic introduction to big data and discusses what the analysis of these data entails, as well as associated technical, conceptual and ethical challenges. Strength and limitations of big data are discussed in depth using real-world examples. This includes practical exercises to familiarize students with the format of big data. It also provides a first hands-on experience in handling and analyzing large, complex data structures. The block course is designed as a primer for anyone interested in attaining a basic understanding of what big data analysis entails.
Course Objective	1. Understand the Big Data Platform and its Use cases 2. Provide an overview of Apache Hadoop 3. Provide HDFS Concepts and Interfacing with HDFS 4. Understand Map Reduce Jobs 5. Provide hands on Hadoop Eco System 6. Apply analytics on Structured, Unstructured Data.
Course Outcome	Upon completion of this course, the students should be able to 1. Describe the big data characteristics, challenges and use cases from selected business domains 2. Describe NoSQL big data management and the characteristics that distinguish them from traditional relational database management

	systems. 3. Configure and run Hadoop distributed file system Framework. 4. Analyze the Big Data using Map-reduce programming using Hadoop framework. 5. Apply Hadoop related tools such as HBase, Cassandra, and Hive for big data analytics

Prerequisites: Data Mining and Data Analysis

CO, PO AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	-	3	2	-	1	-	3	2	1	1	1	1	3	2	3
CO-2	-	-	1	-	1	-	-	-	3	2	-	1	-	-	3
CO-3	1	1	-	1	1	1	1	-	-	1	-	1	-	-	-
CO-4	3	3	1	1	3	3	3	1	1	-	1	1	1	1	1
CO-5	-	1	-	1	-	-	1	2	1	1	1	1	3	2	3

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

MODULE 1: INTRODUCTION	**(6L+3P)**
What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics. **Suggested Readings:** Big Data, Risk and Collaborative Systems.	**CO-1** **BTL-1**
MODULE 2: NoSQL	**(6L+3P)**
Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations. **Suggested Readings:** NoSQL, data models.	**CO-2** **BTL-2**

MODULE 3: HADOOP (6L+3P)	
Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures **Suggested Readings:** Introduction to Hadoop, Hadoop distributed file system (HDFS)	**CO-3** **BTL-3**
MODULE 4: MapReduce (6L+3P)	
MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats. **Suggested Readings:** Map Reduce functions, YARN.	**CO-4** **BTL-3**
MODULE 5: Big data Analysis (6L+3P)	
HBase, data model and implementations, HBase clients, HBase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration, Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries. **Suggested Readings:** Big data analytics, HBase and HiveQL.	**CO-5** **BTL-3**
TEXT BOOKS	
1.	Raj kamal, Preeti Saxena (2018), *Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning*, McGraw Hill.
REFERENCE BOOKS	
1.	Michael Minelli, Michele Chambers, Ambiga Dhiraj (2013) *Business Intelligence and Analytic Trends for Today's Businesses*", Wiley, 2013
2.	Tom White (2012), Hadoop*: The Definitive Guide*, Third Edition, O'Reilley.
E BOOKS	
1.	http://index-of.co.uk/Big Data Technologies/Data%20Science%20 and%20Big%20 Data %20Analytics.pdf
MOOC	
1.	https://www.coursera.org/specializations/big-data

COURSE TITLE	PREDICTIVE ANALYTICS			CREDITS	3
COURSE CODE	CCA42515	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	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE	
					Theory	Practical
15%	15%	10%	5%	5%	25%	25%

Course Description	This course deals with extensive data analysis and the concepts involved in prediction. Predictive analytics also includes the data mining and machine learning concepts which helps in predicting the unknown events.
Course Objective	1. To know the basics of predictive analytics and modeling. 2. To observe the insights of data visualization. 3. To understand the importance of descriptive modeling. 4. To comprehend the fundamentals of predictive modeling. 5. To learn about model ensembles and text mining.
Course Outcome	pon completion of this course, the students will be able to 1. Describe the basics of predictive analytics and modeling. 2. Brief the concepts of data visualization and data preparation. 3. Analyze the clustering algorithms and its importance. 4. Apply predictive modeling and its role in machine learning. 5. Compare the models ensembles and text mining.

Prerequisites: Machine learning algorithms

CO, PO AND PSO MAPPING

CO	PO1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO10	PO 11	PO 12	PSO1	PSO2	PSO3
CO-1	1	2	2	2	2	2	2	1	2	2	2	1	2	2	
CO-2	1	2	2	3	3	3	2	1	2	2	3	1	2	2	2
CO-3	2	2	3	3	3	3	3	2	2	3	3	2	2	2	3
CO-4	2	3	2	2	3	2	2	2	3	2	2	2	3	2	2
CO-5	2	3	2	2	2	3	3	2	3	2	2	2	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related	
MODULE 1: INTRODUCTION TO PREDICTIVE ANALYSIS AND MODELING	**(6L+3P)**
Overview of Predictive Analytics – About predictive analytics – Predictive analytics vs. Business Intelligence – Predictive Analytics vs. Statistics – Predictive Analytics vs. Data Mining – Challenges in Predictive Analytics – Predictive Analytics processing steps – Business understanding - Defining data for predictive modeling – Defining the target variable – Defining measures of success for predictive models – Predictive modeling out of order. **Suggested Readings:** Fundamentals of predictive analytics	**CO-1** **BTL-1**
MODULE 2: DATA VISUALIZATION AND DATA PREPARATION	**(6L+3P)**
Data Understanding – Single variable summaries – Data visualization in one dimension – Histograms – Multiple variable summaries – Data visualization two or higher dimensions – Value of statistical significance – Data Preparation – Variable cleaning – Feature creation. **Suggested Readings:** Overview of data visualization techniques	**CO-2** **BTL-2**
MODULE 3: DESCRIPTIVE MODELING	**(6L+3P)**
Data preparation issues with descriptive modelling – Principal component analysis – Clustering algorithms – Interpreting Descriptive Models – Standard cluster model interpretation. **Suggested Readings:** Introduction to clustering algorithms	**CO-3** **BTL-3**
MODULE 4: PREDICTIVE MODELING	**(6L+3P)**
Decision trees – Logistic regression – Neural networks – K-Nearest neighbour – Naïve Bayes – Regression models – Linear regression – Other regression algorithms – Assessing Predictive Models – Batch approach to model assessment – Assessing regression models. **Suggested Readings:** Machine learning algorithms for beginners	**CO-4** **BTL-3**
MODULE 5: MODEL ENSEMBLES AND TEXT MINING	**(6L+3P)**
Model ensembles – Motivation for ensembles – Bagging – Boosting – Improvements to bagging and boosting – Model ensembles and Occam's razor – Interpreting model ensembles - Text Mining – Motivation for text mining – Predictive modelling approach to text mining – Structured vs. unstructured data – Data preparation steps – Text mining features – Modelling with text mining features – Regular expressions – Model deployment. **Suggested Readings:** A guide to learning ensemble techniques	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Dean Abbott. (2014). *Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst*, John Wiley & Sons Inc., 1st Edition, pp. 1 – 432.
REFERENCE BOOKS	
1.	Anasse Bari, Mohamed Chaouchi, Tommy Jung. (2016). *Predictive Analytics for Dummies*, 2nd Edition, pp. 1 – 464.
E BOOKS	
1.	https://www.predictiveanalyticsworld.com/book/pdf/Predictive_Analytics_by_Eric_Siegel_Excerpts.pdf
2.	Learning_Data_Mining_Techniques_for_Better_Predictive_Modeling_and _Analysis _ of_Big_Data_Second_Edition
MOOC	
1.	https://www.edx.org/search?q=predictive%20analytics
2.	Top Predictive Analytics Courses - Learn Predictive Analytics Online | Coursera

<table>
<tr><td>COURSE TITLE</td><td colspan="3">CLOUD SECURITY</td><td>CREDITS</td><td colspan="2">3</td></tr>
<tr><td>COURSE CODE</td><td>CCA42515</td><td>COURSE CATEGORY</td><td>DE</td><td>L-T-P-S</td><td colspan="2">2-0-2-0</td></tr>
<tr><td>Version</td><td>1.0</td><td>Approval Details</td><td>36th ACM 05-11-2022</td><td>LEARNING LEVEL</td><td colspan="2">BTL-3</td></tr>
<tr><td colspan="7">ASSESSMENT SCHEME</td></tr>
<tr><td rowspan="2">First Periodical Assessment</td><td rowspan="2">Second Periodical Assessment</td><td rowspan="2">Seminar/ Assignments/ Project</td><td rowspan="2">Surprise Test / Quiz</td><td rowspan="2">Attendance</td><td colspan="2">ESE</td></tr>
<tr><td>Theory</td><td>Practical</td></tr>
<tr><td>15%</td><td>15%</td><td>10%</td><td>5%</td><td>5%</td><td>25%</td><td>25%</td></tr>
<tr><td>Course Description</td><td colspan="6">The course describes in detail about the cloud security and security service which cover identification Protocols, application security and security service on AWS. The course also covers the cloud adoption and migration. Application migration to cloud also covered.</td></tr>
<tr><td>Course Objective</td><td colspan="6">1. To understand the concept of information security.
2. To comprehend the process of encryption and decryption.
3. To identify the security principles of Cloud Architecture.
4. To escalate cloud-provider specific security measures.
5. To implement migration of application and database to cloud.</td></tr>
<tr><td>Course Outcome</td><td colspan="6">Upon completion of this course, the students will be able to
1. Learn about the various cybersecurity and digital identity terms.
2. Gain Knowledge inside the message encryption, identification protocols and cyberattacks in cryptography.
3. Understand the principles of cloud infrastructure and application security.
4. Analysis and Compare the security features available in the Azure ecosystem .
5. Analysis the guiding principles behind the migration of applications to the cloud and comprehend the workflow for migrating an application and a database to the cloud.</td></tr>
<tr><td colspan="7">Prerequisites: Cloud Fundamentals</td></tr>
</table>

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	**2**	**2**	**2**		**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**
CO-2	**2**	**2**	**2**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**
CO-3	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**1**	**2**	**2**
CO-4	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**3**
CO-5	**2**	**2**	**1**	**2**	**3**	**3**	**3**			**1**		**2**	**1**	**2**	**3**
1: Weakly related, 2: Moderately related and 3: Strongly related															

MODULE 1: OVERVIEW OF SECURITY AND DIGITAL IDENTITY	**(6L+3P)**
Malware, Worms, Trojan Horses, Botnets, DDOS Attacks, Phishing Attacks, Pen Testing, Social Engineering. Digital Identity: Authentication, Non-repudiation, Integrity, Confidentiality. **Suggested Readings:** Types of malware	**CO-1** **BTL-1**
MODULE 2: ENCRYPTION, IDENTIFICATION PROTOCOLS AND ATTACKS	**(6L+3P)**
Types of Encryption: Symmetric encryption, public keys, private keys, asymmetric encryption, AES, Diffie-Hellman. Identification Protocols: Kerberos, Fiat-Shamir Protocol, Guillou-Quisquater protocol. Cyber Attacks: Phishing, Man-in-the-middle attack, SQL Injection, Zero Day exploit. **Suggested Readings:** Protocols identification	**CO-2** **BTL-2**
MODULE 3: CLOUD SECURITY	**(6L+3P)**
Infrastructure Security: Account Hijacking, Network security control, user access management, resource deletion policies, Just-In-Time access, Bastion hosts, principle of least privilege. Application Security: Application misconfiguration, unauthorized access, Insecure APIs, firewall . Dealing with a breach: Incident response plan, breach containment, public communications. **Suggested Readings:** Principles of security	**CO-3** **BTL-3**

MODULE 4: CLOUD SECURITY SERVICES	(6L+3P)
Cloud Security Services on AWS: IAM, Security Groups, Trusted Advisor, Data encryption, Monitoring and Logging, Audit Trail. Cloud Security Services on Azure: Azure Security Centre, Role Based Access Control, Azure Key Vault, Service Principal, Managed Identities. **Suggested Readings:** Basic concepts of web services	**CO-4** **BTL-3**
MODULE 5: CLOUD ADOPTION AND MIGRATION	**(6L+3P)**
Migration Maturity Index, Cloud Adoption Strategies (Lift & Shift, Re-platform, Cloud Native), App Evaluation. Application Migration to Cloud: Application landscape discovery, lift & shift to the cloud, migration planning, AWS Server Migration Service, Overview of Application Migration. AWS Cloud Endure Migration Factory Solution: Automation of Large-Scale Migration Database Migration to Cloud : Database dumps, Differential backups, transaction log backups, failover database setup. **Suggested Readings:** Principles of migration	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Joshi, R. C., Pilli, E. S., Mishra, P. (2021). Cloud Security: Attacks, Techniques, Tools, and Challenges. United States: CRC Press.
2.	Gleb, T. (2021). Systematic Cloud Migration: A Hands-On Guide to Architecture, Design, and Technical Implementation. United States: Apress.
REFERENCE BOOKS	
1.	Abbadi, I. M. (2014). Cloud Management and Security. Germany: Wiley.
E BOOKS	
1.	https://cdn2.hubspot.net/hubfs/2854653/Digital%20Files/digital-knowledge-center/ebook/cloud-migration-ebook.pdf
2.	https://static.googleusercontent.com/media/sre.google/en//static/pdf/practical-guide-to-cloud-migration.pdf
MOOC	
1.	https://www.mooc-list.com/tags/cloud-migration
2.	https://www.coursera.org/learn/aws-fundamentals-cloud-migration

COURSE TITLE	CLOUD PLATFORM ESSENTIALS			CREDITS	3
COURSE CODE	CCA42515	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	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE	
					Theory	Practical
15%	15%	10%	5%	5%	25%	25%

Course Description	This course mainly focuses on the cloud services and infrastructure offered by google cloud platform and Azure. It provides insights into the basic building blocks of the cloud services and application of development operations tools in the cloud environment. It trains the students to build and deploy web applications in the cloud and also about the cloud storage services.
Course Objective	1. To understand the core services offered by both Azure and Google Cloud. 2. To develop comprehension of IAM application deployments. 3. To identify the characteristics and application of the various storage services available in Azure and Google Cloud. 4. To develop the skill set to deploy the SQL queries in the cloud environment. 5. To understand and application DevOps tools in Cloud.
Course Outcome	Upon completion of this course, the students will be able to 1. Understand the building blocks of the Google cloud and Azure Ecosystem 2. Learn to deploy containers on Kubernetes clusters on GCP. With managed Kubernetes explore how the complexity and operational overheads are minimized. 3. Understand the networking infrastructure used in GCP and deploy managed databases on GCP. 4. Analysis the functionality of load balance in Azure. 5. Describe and analyze DevOps tools and different monitoring systems available in the Azure ecosystem.
Prerequisites: Cloud Infrastructure	

CO, PO AND PSO MAPPING															
CO	**PO1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO-1	**1**	**1**	**2**	**2**	**3**	**2**	**1**						**1**		
CO-2	**1**	**2**	**2**	**2**	**3**	**2**	**2**						**1**		
CO-3	**1**	**2**	**2**	**2**	**3**	**2**	**3**						**1**	**2**	
CO-4	**2**	**2**	**2**	**2**	**3**	**2**	**3**						**1**	**2**	**3**
CO-5	**2**	**2**	**2**	**2**	**3**	**3**	**3**						**1**	**2**	**3**
1: Weakly related, 2: Moderately related and 3: Strongly related															

MODULE 1: BASIC CONCEPTS	**(9L+3P)**
Regions, Zones, GCP accounts, and console Learning Outcome: Understand the basic concepts of the Google Cloud. Azure Concepts, Components, and Azure Resource Manager. **Suggested Readings:** The services offered by Google cloud and Azure	**CO-1** **BTL-2**
MODULE 2: GOOGLE COMPUTE ENGINE AND GOOGLE KUBERNETES ENGINE	**(9L+3P)**
Deploying VMs using Google Compute Engine, Instance Groups. GKE overview, Registry setup and Process, launching the cluster, deploying the application, and building triggers. **Suggested Readings:** Building and Deploying applications in the cloud	**CO-2** **BTL-3**
MODULE 3: STORAGE SERVICES AND CLOUD SQL	**(9L+3LP)**
VPCs, Subnets, Firewall rules and policies, Routes, VPC Peering. Transactions, Consistency, Read policies. Creating databases, Encryption, Backups, and Recovery. **Suggested Readings:** Types of cloud storage services	**CO-3** **BTL-3**
MODULE 4: VIRTUAL NETWORKING AND LOAD BALANCERS IN AZURE	**(9L+3P)**
Network Security Groups, Point-to-site and site-to-site connections, VNET Peering Load Balancer types, components, and algorithms. **Suggested Readings:** Load balancing in the cloud environment	**CO-4** **BTL-3**
MODULE 5: AZURE DEVOPS AND AZURE MONITORING	**(9L+3P)**

Azure DevOps boards, repos, pipelines Monitoring Options, Activity Log, Metric, Service health, Log Analytics, Application Insights. **Suggested Readings** Metrics and measurements for monitoring the cloud	**CO-5** **BTL-3**
TEXT BOOKS	
1.	Hyman, J., Hyman, J. (2021). Microsoft Certified Azure Fundamentals All-in-One Exam Guide (Exam AZ-900). United States: McGraw-Hill Education.
2.	GEEWAX, J. (2019). Google Cloud Platform in Action. Shelter Island, Newyork: Manning Publications Co.
REFERENCE BOOKS	
1.	Collier M.S., S. R. (2018). Microsoft Azure Essentials: Fundamentals of Azure. New York.
E BOOKS	
1.	https://download.microsoft.com/download/6/6/2/662DD05E-BAD7-46EF-9431135F9BAE6332/9781509302963_Microsoft%20Azure%20Essentials%20Fundamentals%20of%20Azure%202nd%20ed%20pdf.pdf
MOOC	
1.	https://www.coursera.org/learn/gcp-fundamentals-azure
2.	https://www.careers360.com/courses-certifications/google-google-cloud-fundamentals-for-azure-professionals-core-infrastructure-course