



**M.C.A -MASTER OF COMPUTER APPLICATIONS**  
**Specialization in Big Data Analytics/Cloud Computing**

**(Duration: 2 Years)**

**CURRICULUM**

**(Applicable for Students admitted from Academic Year 2019-2020)**

**DEPARTMENT OF COMPUTER APPLICATIONS**  
**SCHOOL OF COMPUTING SCIENCES**  
**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

*Design, develop, test and maintain the software applications with latest*

**PSO 3:** 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

M.C.A-MASTER OF COMPUTER APPLICATIONS									
Curriculum									
SEMESTER- I									
S NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	CAA3701	Advanced Data Structures and Algorithms using Python	3	0	2	4	1	5
2	PC	MAA3706	Statistics for Computer Science	4	0	0	4	1	4
3	PC	CAA3702	Database Technology	3	1	0	4	1	4
4	PC	CAA3703	Object Oriented Programming using Java	3	0	2	4	1	5
5	PC	CAA3704	Computer Networks	3	0	0	3	1	3
PRACTICAL									
6	PC	CAA3781	Software Design Project	0	0	4	2	0	4
			<b>Total</b>	<b>16</b>	<b>1</b>	<b>8</b>	<b>21</b>	<b>5</b>	<b>25</b>
<b>L – Lecture; T – Tutorial; P – Practical; S- Self Study; C – Credit; TCH -Total Credit Hours</b>									

SEMESTER -II									
S NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	CAA3705	Web Design and Development	3	0	2	4	1	5
2	PC	CAA3706	Data Warehousing and Data Mining	3	1	0	4	1	4
3	PC	CAA3707	Machine Learning	3	0	2	4	1	5
4	PC	CAA3708	Software Engineering	3	1	0	4	1	4
5	DE	CA*****	Elective-1(Specialization)	3	0	0	3	1	3
6	DE	CA*****	Elective-2 (Specialization)	3	0	0	3	1	3
PRACTICAL									
7	PC	CAA3782	Software Development Laboratory	0	0	2	1	0	2
8	PC	CAA3783	Web Programming Laboratory	0	0	2	1	0	2
			<b>Total</b>	<b>18</b>	<b>2</b>	<b>8</b>	<b>24</b>	<b>6</b>	<b>28</b>
<b>L – Lecture; T – Tutorial; P – Practical; S- Self Study; C – Credit; TCH -Total Credit Hours</b>									

M.C.A – MASTER OF COMPUTER APPLICATIONS									
SEMESTER – III									
S NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	CAA3709	Software Testing and Quality Assurance	3	0	2	4	1	5
2	PC	CAA3710	DevOps	3	0	2	4	1	5
3	PC	CAA3711	MOOC (Specialization)	0	0	0	2	3	0
4	DE	CA*****	Elective -3 (Specialization)	3	0	0	3	1	3
5	DE	CA*****	Elective -4 (Specialization)	3	0	0	3	1	3
6	NDE	*****	Non-Department Elective	3	0	0	3	1	3
PRACTICAL									
7	PC	ELA4383	Presentation Skills and Academic writing	0	0	2	1	0	2
8	PC	CAA3784	Project Phase-I	0	0	6	3	0	6
			<b>Total</b>	<b>15</b>	<b>0</b>	<b>12</b>	<b>23</b>	<b>8</b>	<b>27</b>
<b>L – Lecture; T – Tutorial; P – Practical; S- Self Study; C – Credit; TCH -Total Credit Hours</b>									

SEMESTER – IV									
S NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
PRACTICAL									
1	PC	CAA3785	Project Work - Phase – II	0	0	24	12	0	24
			<b>Total</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>	<b>0</b>	<b>24</b>
<b>L – Lecture; T – Tutorial; P – Practical; S- Self Study; C – Credit; TCH -Total Credit Hours</b>									

**Total Credits: 80**

**M.C.A-Master of Computer Applications**  
**LIST OF DEPARTMENTAL ELECTIVES WITH GROUPING - SEMESTER WISE**

SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
<b>Elective I</b>									
2	DE	CAD3721	Software Process and metrics	3	0	0	3	0	3
2	DE	CAD3722	.Net / ASP Programming	3	0	0	3	0	3
2	DE	CAB3721	Web Analytics	3	0	0	3	0	3
2	DE	CAB3722	Big Data Analytics	3	0	0	3	0	3
2	DE	CAC3721	Cloud Architecture	3	0	0	3	0	3
2	DE	CAC3722	Virtualization Techniques	3	0	0	3	0	3
<b>Elective II</b>									
2	DE	CAD3723	Agile Methods	3	0	0	3	0	3
2	DE	CAD3724	Internet of Things	3	0	0	3	0	3
2	DE	CAB3723	R Programming	3	0	0	3	0	3
2	DE	CAB3724	Big Data Framework	3	0	0	3	0	3
2	DE	CAC3723	Cloud Application Development	3	0	0	3	0	3
2	DE	CAC3724	Cloud Analytics	3	0	0	3	0	3
<b>Elective III</b>									
3	DE	CAD3725	Image processing	3	0	0	3	0	3
3	DE	CAD3726	Block Chain Technology	3	0	0	3	0	3
3	DE	CAB3725	Semantic Web	3	0	0	3	0	3
3	DE	CAB3726	Data Visualization Techniques and Tools	3	0	0	3	0	3
3	DE	CAC3725	Cloud Security	3	0	0	3	0	3
3	DE	CAC3726	Cloud Storage and Security	3	0	0	3	0	3
<b>Elective IV</b>									
3	DE	CAD3727	Natural Language Processing	3	0	0	3	0	3
3	DE	CAD3728	Distributed Computing	3	0	0	3	0	3
3	DE	CAD3729	Augmented and Virtual Reality	3	0	0	3	0	3
3	DE	CAB3727	Data Classification Methods and Evaluation	3	0	0	3	0	3
3	DE	CAB3728	Principles of Deep Learning	3	0	0	3	0	3
3	DE	CAC3727	Private Cloud Deployment and Management	3	0	0	3	0	3
3	DE	CAC3728	Back up and Disaster Recovery	3	0	0	3	0	3



**M.C.A-Master of Computer Applications (Specialization in Big Data Analytics)**  
**LIST OF DEPARTMENTAL ELECTIVES WITH GROUPING - SEMESTER WISE**

SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
<b>Elective I</b>									
2	DE	CAB3721	Web Analytics	3	0	0	3	0	3
2	DE	CAB3722	Big Data Analytics	3	0	0	3	0	3
<b>Elective II</b>									
2	DE	CAB3723	R Programming	3	0	0	3	0	3
2	DE	CAB3724	Big Data Framework	3	0	0	3	0	3
<b>Elective III</b>									
3	DE	CAB3725	Semantic Web	3	0	0	3	0	3
3	DE	CAB3726	Data Visualization Techniques and Tools	3	0	0	3	0	3
<b>Elective IV</b>									
3	DE	CAB3727	Data Classification Methods and Evaluation	3	0	0	3	0	3
3	DE	CAB3728	Principles of Deep Learning	3	0	0	3	0	3

**M.C.A-Master of Computer Applications - (Specialization in Cloud Computing)**  
**LIST OF DEPARTMENTAL ELECTIVES WITH GROUPING - SEMESTER WISE**

SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
<b>Elective I</b>									
2	DE	CAC3721	Cloud Architecture	3	0	0	3	0	3
2	DE	CAC3722	Virtualization Techniques	3	0	0	3	0	3
<b>Elective II</b>									
2	DE	CAC3723	Cloud Application Development	3	0	0	3	0	3
2	DE	CAC3724	Cloud Analytics	3	0	0	3	0	3
<b>Elective III</b>									
3	DE	CAC3725	Cloud Security	3	0	0	3	0	3
3	DE	CAC3726	Cloud Storage and Security	3	0	0	3	0	3
<b>Elective IV</b>									
3	DE	CAC3727	Private Cloud Deployment and Management	3	0	0	3	0	3
3	DE	CAC3728	Back up and Disaster Recovery	3	0	0	3	0	3

**SEMESTER – I**

<b>COURSE TITLE</b>		<b>ADVANCED DATA STRUCTURES AND ALGORITHMS USING PYTHON</b>					<b>CREDITS</b>		<b>4</b>						
<b>COURSE CODE</b>		<b>CAA3701</b>	<b>COURSE CATEGORY</b>		<b>PC</b>	<b>L-T-P-S</b>		<b>3-0-2-1</b>							
<b>Version</b>	<b>1.0</b>	<b>Approval Details</b>		<b>26<sup>th</sup> ACM 23-03-2019</b>		<b>LEARNING LEVEL</b>		<b>BTL-3</b>							
<b>ASSESSMENT SCHEME</b>															
<b>First Periodical Assessment</b>		<b>Second Periodical Assessment</b>		<b>Seminar/ Assignments/ Project</b>		<b>Surprise Test / Quiz</b>		<b>Attendance</b>		<b>ESE</b>					
<b>15%</b>		<b>15%</b>		<b>10%</b>		<b>5%</b>		<b>5%</b>		<b>50%</b>					
<b>Course Description</b>		The course covers analysis and design of fundamental 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.													
<b>Course Objective</b>		<ol style="list-style-type: none"> <li>1. To understand the basic techniques of algorithm analysis.</li> <li>2. To demonstrate several searching and sorting algorithms.</li> <li>3. To implement linear and non-linear data structures.</li> <li>4. To demonstrate various tree and graph traversal algorithms.</li> <li>5. To analyze and choose appropriate data structure to solve problems in real world.</li> </ol>													
<b>Course Outcome</b>		<p>Upon completion of this course, the students Should be able to</p> <ol style="list-style-type: none"> <li>1. Describe the basics of data structure.</li> <li>2. Solve problems using trees.</li> <li>3. Implement the sorting.</li> <li>4. Design and develop graphs.</li> <li>5. Implement and develop algorithms.</li> </ol>													
<b>Prerequisites: Python</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PS O1</b>	<b>PS O2</b>	<b>PS O3</b>
<b>CO-1</b>	3	2	2	1	1	1	1	1	1	1	1	1	1	1	2
<b>CO-2</b>	3	1	1	1	1	1	-	-	-	1	1	1	-	1	1
<b>CO-3</b>	3	1	-	-	-	1	2	1	1	1	1	1	2	1	2
<b>CO-4</b>	3	1	2	1	1	1	-	-	-	1	1	1	-	-	1
<b>CO-5</b>	3	1	-	-	-	1	2	1	1	1	1	1	3	2	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION TO ALGORITHMS AND DATA STRUCTURE (9L+3P)</b>															
Problem solving concepts, ADT, Stack, Queue, List.														<b>CO-1 BTL-2</b>	
<b>Practical Components:</b>															
<ul style="list-style-type: none"> <li>• Installation of python and its libraries.</li> <li>• Basic programs in pythons using functions</li> </ul>															
<b>Suggested Readings:</b> Measures of algorithm, Space and time complexity															
<b>MODULE 2: TREES</b>														<b>(9L+3P)</b>	

Preliminaries, Binary Trees Binary Search Trees, AVL Trees, Tree Traversals, Hashing, Hash Function, Hash families Separate Chaining, Open addressing. <b>Practical Components:</b>		<b>CO-2</b> <b>BTL-2</b>
<ul style="list-style-type: none"> <li>List and its related operations.</li> <li>Simulation of operations on stacks and queues.</li> </ul> <b>Suggested Readings:</b> Red Black trees		
<b>MODULE 3: SORTING</b>		<b>(9L+3P)</b>
Preliminaries, Insertion Sort, Shells sort, Heap sort– Merge sort–Quick sort– External Sorting–Topological Sort. <b>Practical Components:</b>		<b>CO-3</b> <b>BTL-3</b>
<ul style="list-style-type: none"> <li>Explore the types of sorting</li> </ul> <b>Suggested Readings:</b> Recursive Bubble Sort, Radix Sort		
<b>MODULE: GRAPHS</b>		<b>(9L+3P)</b>
Graph connectivity, Random walks on graph, on line paging algorithm, adversary models. <b>Practical Components:</b>		<b>CO-4</b> <b>BTL-3</b>
<ul style="list-style-type: none"> <li>Design a graph and its connectivity.</li> <li>Design a model using on line paging algorithm</li> </ul> <b>Suggested Readings:</b> Graph Representations, Depth First and Breadth First Search		
<b>MODULE 5: ALGORITHM</b>		<b>(9L+3P)</b>
Randomized algorithm, a min-cut algorithm, Random treaps, Markov's chains. <b>Practical Component:</b>		<b>CO-5</b> <b>BTL-3</b>
<ul style="list-style-type: none"> <li>Explore the randomized algorithm.</li> <li>Implementation of Markovs and its chain rule.</li> </ul> <b>Suggested Readings:</b> Randomized Algorithms		
<b>TEXT BOOKS</b>		
1.	Goodrich Michael T (2016), <i>"Data Structures and Algorithms in Python"</i> , Wiley publication	
2.	Rance D. Neclase (2016), <i>"Data Structures and Algorithms in Python"</i> , Wiley Publication	
<b>REFERENCE BOOKS</b>		
1.	E. Horowitz, S. Sahni and Dinesh Mehta (2009), <i>Fundamentals of Data structures in C++</i> , University Press	
<b>E BOOKS</b>		
1.	<a href="https://doc.lagout.org/Others/Data%20Structures/Advanced%20Data%20Structures%20%5BBrass%202008-09-08%5D.pdf">https://doc.lagout.org/Others/Data%20Structures/Advanced%20Data%20Structures%20%5BBrass%202008-09-08%5D.pdf</a>	
<b>MOOC</b>		
1.	<a href="https://www.mooc-list.com/tags/advanced-data-structures">https://www.mooc-list.com/tags/advanced-data-structures</a>	

COURSE TITLE		STATISTICS FOR COMPUTER SCIENCE				CREDITS	4								
COURSE CODE		MAA3706	COURSE CATEGORY		PC	L-T-P-S	4-0-0-1								
Version	1.0	Approval Details		26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL	BTL-3								
<b>ASSESSMENT SCHEME</b>															
First Periodical Assessment		Second Periodical Assessment		Seminar/ Assignments/ Project		Surprise Test / Quiz	Attendance	ESE							
15%		15%		10%		5%	5%	50%							
<b>Course Description</b>		To make the students learn and apply statistical and probabilistic approaches.													
<b>Course Objective</b>		<ol style="list-style-type: none"> <li>1. To understand the basics of probability</li> <li>2. To grasp the knowledge about random variables</li> <li>3. To understand the theory of sampling and testing</li> <li>4. To understand time series analysis</li> <li>5. To learn about design of experiments</li> </ol>													
<b>Course Outcome</b>		<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>1. Develop statistical models for business analytics.</li> <li>2. Apply forecasting methods to support managerial, financial, and operational statistics.</li> <li>3. Perform marketing analytics using statistical models.</li> <li>4. Analyze customer data for customer acquisition, retention, and profitability</li> <li>5. Analyze the variance classification</li> </ol>													
<b>Prerequisites: Probability and Statistics</b>															
<b>CO, PO AND PSO MAPPING</b>															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	2	1	1	1	1	1	1	1	1	1	1	1	1	-	2
CO-2	2	1	-	-	1	-	1	1	1	-	-	1	2	1	2
CO-3	2	1	2	1	1	2	1	-	-	2	1	1	-	2	2
CO-4	2	1	-	-	1	-	1	2	1	-	-	1	1	1	2
CO-5	2	1	2	1	1	2	1	1	1	2	1	1	2	1	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: PROBABILITY</b>												<b>(12L)</b>			
Introduction to probability –Bayes Theorem-Random variables-discrete random variable (Binomial, Poisson, Geometric), Continues random variable (Uniform, Exponential and Normal distribution). Moment generating function.														<b>CO-1</b>	
<b>Suggested Readings:</b> Basic knowledge on probability, Introduction to probability														<b>BTL-3</b>	
<b>MODULE 2: TWO DIMENSIONAL RANDOM VARIABLES</b>												<b>(12 L)</b>			
Joint distribution –Marginal and conditional distribution covariance –correlation and regression (linear and Multiple). Central limit theorem, Chebyshev’s inequality.														<b>CO-2</b>	
<b>Suggested Readings:</b> Basic knowledge on probability Statistics and Random Processes-T. Veerarajan														<b>BTL-2</b>	
<b>MODULE 3: THEORY OF SAMPLING AND TEST OF HYPOTHESIS</b>												<b>(12 L)</b>			

Introduction to hypothesis, large and small samples test -mean and variance (single and double), test, Independent of attributes and contingency table. <b>Suggested Readings:</b> Basic knowledge of sampling, probability, Statistics and Random Processes-T. Veerarajan	<b>CO-3 BTL-3</b>
<b>MODULE 4: TIME SERIES ANALYSIS</b>	<b>(12 L)</b>
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. <b>Suggested Readings:</b> Basic knowledge of Time series analysis, Time series-Maurice George kendall, j.k.Ord	<b>CO-4 BTL-3</b>
<b>MODULE 5: DESIGN OF EXPERIMENTS</b>	<b>(12 L)</b>
Analysis of variance (one way & two ways) classification – completely randomized design – randomized block design – Lattin square design. <b>Suggested Readings:</b> Basic knowledge of design of experiments, Probability, Statistics and Random Processes-T. Veerarajan	<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>	
1. Hossein Pishro-Nik, <i>“Probability, Statistics and Random Processes”</i> Tata McGraw-Hill, Education	
<b>REFERENCE BOOKS</b>	
1. K. S. Trivedi. John(2016), <i>“Probability and statistics with reliability, Queuing and computer Science Application”</i> , Second edition, Wiley&Son.	
2. Levin Richard and Rubin Davids(2016), <i>“Statistics for Management “</i> , Pearson Publications.	
<b>E BOOKS</b>	
1. <a href="http://www.math.harvard.edu/~knill/teaching/math144_1994/probability.pdf">http://www.math.harvard.edu/~knill/teaching/math144_1994/probability.pdf</a>	
2. <a href="http://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/book.pdf">http://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/book.pdf</a>	
<b>MOOC</b>	
1. <a href="https://nptel.ac.in/courses/IITMADRAS/Principles_of_Communication1/Pdfs/1_5.pdf">https://nptel.ac.in/courses/IITMADRAS/Principles_of_Communication1/Pdfs/1_5.pdf</a>	
2. <a href="https://nptel.ac.in/courses/110104024/">https://nptel.ac.in/courses/110104024/</a>	

<b>COURSE TITLE</b>		<b>DATABASE TECHNOLOGY</b>			<b>CREDITS</b>	<b>4</b>
<b>COURSE CODE</b>		<b>CAA3702</b>	<b>COURSE CATEGORY</b>	<b>PC</b>	<b>L-T-P-S</b>	<b>3-1-0-1</b>
<b>Version</b>	<b>1.0</b>	<b>Approval Details</b>	<b>26<sup>th</sup> ACM 23-03-2019</b>		<b>LEARNING LEVEL</b>	<b>BTL-3</b>
<b>ASSESSMENT SCHEME</b>						
<b>First Periodical Assessment</b>	<b>Second Periodical Assessment</b>	<b>Seminar/ Assignments/ Project</b>	<b>Surprise Test / Quiz</b>	<b>Attendance</b>	<b>ESE</b>	
<b>15%</b>	<b>15%</b>	<b>10%</b>	<b>5%</b>	<b>5%</b>	<b>50%</b>	
<b>Course Description</b>	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.														
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>1. To understand Database Base Management System both in terms of use and implementation.</li> <li>2. To utilize a wide range of features available in a DBMS package.</li> <li>3. To develop the logical design of the database using data modeling concepts such as entity-relationship diagrams.</li> <li>4. To create a relational database using a relational database package.</li> <li>5. To provide skills to work with Structured Query Language.</li> </ol>														
<b>Course Outcome</b>	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>1. Implement database design techniques.</li> <li>2. Apply normalization.</li> <li>3. Implement object relational database.</li> <li>4. Employ distributed and parallel DBMS.</li> <li>5. Create a design structured and unstructured DB and multimedia database.</li> </ol>														
<b>Prerequisites: Database basics</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>CO-1</b>	2	1	1	3	3	1	1	1	1	1	1	1	3	2	2
<b>CO-2</b>	2	1	-	-	1	-	1	-	1	1	1	-	1	1	1
<b>CO-3</b>	2	1	2	1	-	1	-	1	1	-	-	-	1	-	-
<b>CO-4</b>	2	1	-	1	2	1	2	1	-	2	1	1	1	2	1
<b>CO-5</b>	3	2	2	3	3	1	1	-	1	1	1	1	3	2	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: DATABASE INTRODUCTION &amp; DESIGN TECHNIQUES</b>													<b>(9L+3T)</b>		
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. <b>Suggested Readings:</b> Entity Relationship Model, Relational Algebra													<b>CO-1 BTL-3</b>		
<b>MODULE 2: ADVANCED DESIGN TECHNIQUE -NORMALIZATION</b>													<b>(9L+3T)</b>		
Normalization – Informal Guidelines, Functional dependencies, decomposition algorithms, Normal Forms up to 5NF, SQL - Basic & Advanced Operations, Query Processing, Query optimization, Storage and File organization. <b>Suggested Readings:</b> Storage and File Organization.													<b>CO-2 BTL-3</b>		
<b>MODULE 3: OBJECT RELATIONAL DBMS</b>													<b>(9L+3T)</b>		
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 <b>Suggested Readings:</b> Object Database management system													<b>CO-3 BTL-3</b>		
<b>MODULE 4: DISTRIBUTED DATABASE AND PARALLEL DBMS</b>													<b>(9L+3T)</b>		

<p>Concepts, advantages, types, functions, architecture, data allocation, fragmentation, replication, transparencies, Date's rules, transaction management, concurrency control, dead lock, recovery 2PC, 3PC. Partition techniques, Architecture, Parallel algorithms for sorting, Parallel join, Parallel Queries.</p> <p><b>Suggested Readings:</b> Difference between Parallel and Distributed Database</p>	<b>CO-4</b> <b>BTL-3</b>
<b>MODULE 5: SEMI STRUCTURED, UNSTRUCTURED DATA BASE (9L+3T)</b>	
<p>OEM, Overview of XML, DTD, XML schema, XML query languages, XML related technologies, XML and databases, Unstructured database – NOSQL – Overview – Definition – Types of NoSQL DB</p> <p><b>Suggested Readings:</b> Query Language for XML</p>	<b>CO-5</b> <b>BTL-3</b>
<b>TEXT BOOKS</b>	
1.	Thomas M. Connolly and Carolyn Begg(2015), <i>Database Systems: A Practical Approach to Design, Implementation, and Management</i> , 6th Edition, Pearson India
2.	Saeed K. Rahimi, Frank S. Haug (2015): <i>Distributed Database Management system</i> , Wiley-IEEE Computer Society Press.
<b>REFERENCE BOOKS</b>	
1.	Ramez Elmasri & B. Navathe (2014): <i>Fundamentals of database systems</i> , 7th Edition, Addison Wesley.
<b>E-BOOKS</b>	
1.	<a href="https://theswissbay.ch/pdf/Gentoomen%20Library/Databases/Molina%20Ullman%20-%20Database%20Systems%20The%20Complete%20Book.pdf">https://theswissbay.ch/pdf/Gentoomen%20Library/Databases/Molina%20Ullman%20-%20Database%20Systems%20The%20Complete%20Book.pdf</a>
<b>MOOC</b>	
<u>1.</u>	<a href="https://swayam.gov.in/courses/4598-database-and-content-organisation">https://swayam.gov.in/courses/4598-database-and-content-organisation</a>

COURSE TITLE		OBJECT ORIENTED PROGRAMMING USING JAVA			CREDITS	4
COURSE CODE		CAA3703	COURSE CATEGORY	PC	L-T-P-S	3-0-2-1
Version	1.0	Approval Details	26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL	BTL-4
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 deals about object-oriented programming concepts, overview of java features of Java and benefits of OOPS concepts. Object-oriented programming (OOP) is at the core of Java. In fact, all Java programs are to at least some extent object-oriented. OOP is so integral to Java that it is best to understand its basic principles before you begin writing even simple Java programs. Therefore, this module begins with a discussion of the theoretical aspects of OOP.					
Course Objective	<ol style="list-style-type: none"> <li>To learn about OOPS concepts</li> <li>To learn about Java fundamentals</li> </ol>					

	<ol style="list-style-type: none"> <li>3. To learn about Classes and Objects with simple programs</li> <li>4. To learn about Networking, I/O packages with simple programs</li> <li>5. To implement real time problems using OOPS concepts</li> </ol>														
<b>Course Outcome</b>	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>1. Solve real world problems using OOP techniques.</li> <li>2. Solve problems using java collection framework and I/O classes.</li> <li>3. Implement Interfaces and Packages</li> <li>4. Develop multithreaded applications with synchronization.</li> <li>5. Develop applets for web applications and able to design GUI based application</li> </ol>														
<b>Prerequisites: C++ Programming Language</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO -10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>CO-1</b>	1	1	1	1	2	2	2	3	2	3	1	1	1	1	1
<b>CO-2</b>	1	1	-	-	2	1	1	1	2	3	1	1	-	1	2
<b>CO-3</b>	3	1	1	1	2	1	-	-	2	3	1	-	1	3	-
<b>CO-4</b>	3	1	-	2	2	1	2	1	2	2	1	2	-	2	1
<b>CO-5</b>	1	1	1	2	2	2	2	3	2	1	3	1	3	3	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION TO JAVA</b>														<b>(9L+3P)</b>	
<p>Classes and Instances, Class Hierarchies- Inheritance, Method binding, Overriding and Exceptions, Overview of Java, Data types, Variables and Arrays, operators, expressions, control statements, Introducing classes, Methods and Classes, String handling, Inheritance concept, Inheritance basics, Member access, Constructors, Inheritance and its types, Object class, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance.</p> <p><b>Practical Component:</b> Inheritance in JAVA</p> <p><b>Suggested Readings:</b> Features of OOPS</p>														<b>CO-1 BTL-4</b>	
<b>MODULE 2: PACKAGES, INTERFACES AND I/O STREAMS</b>														<b>(9L+3P)</b>	
<p>Defining a Package, CLASSPATH, Access protection, importing packages. <b>Interfaces-</b> defining an interface, implementing interfaces, Nested interfaces, applying interfaces, variables in interfaces and extending interfaces. Introduction to Stream - Introduction to NIO, working with Stream Classes, working with Files, working with Buffers, working with Character Arrays, working with the Print Writer Class, working with the Stream Tokenizer Class, implementing the Serializable Interface, working with the Console Class, Printing with the Formatter Class, scanning Input with the Scanner class.</p> <p><b>Practical Component:</b> Interfaces and Packages in JAVA</p> <p><b>Suggested Readings:</b> Working with Interfaces in JAVA</p>														<b>CO-2 BTL-4</b>	
<b>MODULE 3: EXCEPTION HANDLING AND MULTITHREADING</b>														<b>(9L+3P)</b>	
<p>Fundamentals of exception handling, Exception types, Termination models, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built- in exceptions, creating own exception sub classes. Threading: Differences between thread-based multitasking and</p>														<b>CO-3 BTL-4</b>	



process-based multitasking, Java thread model, creating threads, thread priorities, synchronizing threads, inter thread communication. <b>Practical Component:</b> Multithreading in JAVA <b>Suggested Readings:</b> Multitasking using Threads	
<b>MODULE 4: NETWORKING WITH JAVA.NET (9L+3P)</b>	
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. <b>Practical Component:</b> Client –Server Networking <b>Suggested Readings:</b> Java networking classes and interfaces	<b>CO-4 BTL-4</b>
<b>MODULE 5: COLLECTION FRAMEWORK AND FUNCTIONAL PROGRAMMING (9L+3P)</b>	
Collection’s overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Accessing a Collection via an Iterator, Using an Iterator, The For-Each alternative, Map Interfaces and Classes, Comparators, Collection algorithms, Arrays, The Legacy Classes and Interfaces- Dictionary, Hash table, Properties, Stack, Vector More Utility classes, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner <b>Practical Component:</b> Functional Programming, Pure functional programming- No State, Immutable variables, favor recursion over looping. <b>Suggested Readings:</b> Functional Programming in JAVA script	<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>	
1.	Herbert Schildt (2019), <i>Java The complete reference</i> , 11th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
<b>REFERENCE BOOKS</b>	
1	S. Malhotra, S. Chudhary(2013), <i>Programming in Java,,</i> 2nd edition, Oxford University Press
<b>E BOOKS</b>	
1.	<a href="https://bookboon.com/en/java-programming-language-ebooks">https://bookboon.com/en/java-programming-language-ebooks</a>
<b>MOOC</b>	
1.	<a href="https://www.coursera.org/courses?query=java">https://www.coursera.org/courses?query=java</a>

COURSE TITLE		COMPUTER NETWORKS			CREDITS	3
COURSE CODE		CAA3704	COURSE CATEGORY	PC	L-T-P-S	3-0-0-1
Version	1.0	Approval Details	26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE	
15%	15%	10%	5%	5%	50%	
<b>Course Description</b>	Computer networks enable the communication in multiple aspects. The communication takes place through various layers based on the type of protocol being followed. The routing technique in network layer optimizes the communication path. Different type of network architecture					

	compartmentalizes various network devices. The security assurance of data being travel over the network is also the aspect of network layer functionality.														
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>1. To understand computer network organization and implementation.</li> <li>2. To provide knowledge on network protocols.</li> <li>3. To obtain a theoretical understanding of data communication and computer networks.</li> <li>4. To acquire the knowledge on functionality of each layer in network.</li> <li>5. To gain practical experience in installation, monitoring, and troubleshooting of current LAN systems</li> </ol>														
<b>Course Outcome</b>	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>1. Illustrate the flow of information from one node to another node in the networks.</li> <li>2. Identify the components required to build different types of networks.</li> <li>3. Relate the functionalities needed for data communication into layers</li> <li>4. Comprehend the working principles of various application protocols.</li> <li>5. Acquire knowledge about security issues and services available.</li> </ol>														
<b>Prerequisites: Network addressing, Network protocols</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>CO-1</b>	3	3	1	1	3	1	1	3	1	2	3	1	1	1	1
<b>CO-2</b>	3	1	1	-	3	1	-	3	1	3	1	1	-	2	2
<b>CO-3</b>	1	1	-	2	2	1	2	2	-	1	1	-	2	2	-
<b>CO-4</b>	1	-	2	-	3	1	-	3	1	1	-	2	-	2	1
<b>CO-5</b>	1	2	-	3	3	1	1	3	1	2	1	1	3	1	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: NETWORK FUNDAMENTALS (9L)</b>															
Uses of Networks – Categories of Networks -Communication model –Data transmission concepts and terminology – Protocol architecture – Protocols – OSI – TCP/IP – LAN Topology – Transmission media. <b>Suggested Readings:</b> Protocol architecture														<b>CO-1 BTL-2</b>	
<b>MODULE 2: DATA LINK LAYER (9L)</b>															
Data link control - Flow Control – Error Detection and Error Correction - MAC – Ethernet, Token ring, Wireless LAN MAC – Blue Tooth - Bridges. <b>Suggested Readings:</b> Wireless network														<b>CO-2 BTL-2</b>	
<b>MODULE 3:NETWORK LAYER (9L)</b>															
Network layer – Switching concepts – Circuit switching – Packet switching –IP — Datagrams – IP addresses- IPV6– ICMP – Routing Protocols – Distance Vector – Link State- BGP. <b>Suggested Readings:</b> Switching concepts														<b>CO-3 BTL-3</b>	
<b>MODULE 4: TRANSPORT LAYER (9L)</b>															
Transport layer –service –Connection establishment – Flow control – Transmission control protocol – Congestion control and avoidance – User datagram protocol. -Transport for Real Time Applications (RTP). <b>Suggested Readings:</b> UDP, IP														<b>CO-4 BTL-3</b>	
<b>MODULE 5: APPLICATION LAYER (9L)</b>															

Applications - DNS- SMTP – WWW –SNMP- Security –threats and services – Dynamic domain name system – Encapsulation - web security –SSL. <b>Suggested Readings:</b> DNS, SSL	<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>	
1.	Larry L. Peterson & Bruce S. Davie(2011), “ <i>Computer Networks – A systems Approach</i> ”, Fourth Edition, Harcourt Asia / Morgan Kaufmann.
2.	William Stallings(2007), “ <i>Data and Computer Communications</i> ”, Ninth Edition, Prentice Hall.
<b>REFERENCE BOOKS</b>	
1.	Forouzan, “ <i>Data Communication and Networking</i> ”, Fifth Edition, TMH
<b>E BOOKS</b>	
1.	<a href="https://www.amazon.in/Computer-Networks-Andrew-S...ebook/dp/B0756WH82M">https://www.amazon.in/Computer-Networks-Andrew-S...ebook/dp/B0756WH82M</a>
2.	<a href="http://intronetworks.cs.luc.edu/current/ComputerNetworks.pdf">http://intronetworks.cs.luc.edu/current/ComputerNetworks.pdf</a>
<b>MOOC</b>	
1.	<a href="https://www.class-central.com">https://www.class-central.com</a> › Subjects › Computer Science

COURSE TITLE		SOFTWARE DESIGN PROJECT			CREDITS	2
COURSE CODE		CAA3781	COURSE CATEGORY	PC	L-T-P-S	0-0-4-1
Version	1.0	Approval Details	26 <sup>th</sup> ACM 23-03-2019	LEARNING LEVEL		BTL-4
<b>ASSESSMENT SCHEME</b>						
CIA					ESE	
80%					20%	
<b>Course Description</b>	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.					
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>To function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment,</li> <li>To identify, formulate, and solve complex engineering problems by applying principles</li> <li>To apply engineering design to produce solutions that meet specified needs</li> <li>To develop and conduct appropriate experimentation, analyze and interpret data.</li> <li>To acquire and apply new knowledge as needed, using appropriate learning strategies.</li> </ol>					
<b>Course Outcome</b>	Upon completion of this course, the students should be able to <ol style="list-style-type: none"> <li>Identify a real time work helpful for the society.</li> <li>Analyze and solve the solution for the problem.</li> <li>Create an application by using relevant computer application concepts.</li> <li>Conduct appropriate experiment in different software design methods.</li> <li>Create Real time scenario-based software project design.</li> </ol>					
<b>Prerequisites: Programming Knowledge</b>						
<b>CO, PO AND PSO MAPPING</b>						

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	PSO 2	PSO 3
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
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MINI PROJECT</b>															
1. Identify a real time work helpful for the society. 2. Develop a solution for the problem 3. Develop an application by using relevant computer application concepts <b>Any Application Software</b> <b>Suggested Readings:</b> Application Strategy and Business Intelligence													<b>CO-1 BTL-4</b>		

**Semester II**

COURSE TITLE		WEB DESIGN AND DEVELOPMENT				CREDITS		4							
COURSE CODE		CAA3705	COURSE CATEGORY		PC	L-T-P-S		3-0-2-1							
Version	1.0	Approval Details		26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL		BTL-3							
<b>ASSESSMENT SCHEME</b>															
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project		Surprise Test / Quiz		Attendance		ESE							
15%	15%	10%		5%		5%		50%							
<b>Course Description</b>	The user interface with Graphical User Interface is main key design aspect to be implemented in web page design. The interface with good look and feels with dynamic content another main aspect. Along with appropriate design the value in the client side has to be validated before send it to server, in order to reduce the server load. For all these the client-side style sheet and validation script are essential. The Cascading Style Sheet and Java Script is covered in this course. The server-side script language PHP is covered to implement server-side scripting.														
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>1. To learn HTML tags.</li> <li>2. To learn Cascading Style Sheet.</li> <li>3. To develop user interface page using HTML and CSS.</li> <li>4. To learn java script to develop dynamic web page.</li> <li>5. To develop interactive web page with server-side script.</li> </ol>														
<b>Course Outcome</b>	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>1. Describe the markup languages features and create interactive web pages using them.</li> <li>2. Design Client-side validation using scripting languages.</li> <li>3. Acquire knowledge about Open-source JavaScript libraries.</li> <li>4. Design front end web page and connect to the back-end databases.</li> <li>5. Describe the features of various platforms and frameworks used in web applications development.</li> </ol>														
<b>Prerequisites: Basics of web</b>															
<b>CO, PO AND PSO MAPPING</b>															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	3	1	1	3	1	1	3	1	3	1	1	3	1	1	1
CO-2	1	1	-	1	1	-	1	1	1	1	-	1	1	-	1
CO-3	1	-	2	1	-	2	1	-	1	-	2	1	-	2	-
CO-4	1	2	-	1	2	-	1	2	1	2	-	1	2	-	2
CO-5	3	1	1	3	1	1	3	1	3	1	1	3	1	1	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: UI DESIGN</b>										<b>(9L+3P)</b>					
<p>Markup Language (HTML): Introduction to HTML and HTML5 - Formatting and Fonts – Commenting Code – Anchors – Backgrounds – Images – Hyperlinks – Lists – Tables – Frames - HTML Forms.</p> <p><b>Suggested Readings:</b> Basic Tags</p> <p><b>Practical Components:</b></p>										<b>CO-1 BTL-3</b>					

<p>1. Create a web page with the following.</p> <ol style="list-style-type: none"> <li>a. Cascading style sheets.</li> <li>b. Embedded style sheets.</li> <li>c. Inline style sheets. Use our college information for the web pages.</li> </ol>	
<p><b>MODULE 2: CASCADING STYLE SHEET (CSS)</b> <span style="float: right;"><b>(9L+3P)</b></span></p>	
<p>Introduction to Cascading Style Sheet (CSS): The need for CSS, Introduction to CSS – Basic syntax and structure - Inline Styles – Embedding Style Sheets - Linking External Style Sheets – Backgrounds - Manipulating text - Margins and Padding - Positioning using CSS.</p> <p><b>Suggested Readings:</b> Embedding style sheets</p> <p><b>Practical Component</b></p> <ol style="list-style-type: none"> <li>1. Create a HTML form for reading Name, Age, Gender, Address, Payment Options, Phone number, Email address, preferred user name, various Area of Interest etc. from the user.</li> <li>2. Create a simple webpage using HTML frames to Include Images and Videos.</li> </ol>	<p><b>CO-2</b> <b>BTL-3</b></p>
<p><b>MODULE 3: INTRODUCTION TO JAVASCRIPT</b> <span style="float: right;"><b>(9L+3P)</b></span></p>	
<p>Introduction - Core features - Data types and Variables - Operators, Expressions, and Statements - Functions - Objects - Array, Date and Math related Objects - Document Object Model - Event Handling - Controlling Windows &amp; Frames and Documents - Form handling and validations.</p> <p><b>Suggested Readings:</b> Operators using JavaScript</p> <p><b>Practical Components</b></p> <ol style="list-style-type: none"> <li>1. Write a Java Script program to validate the data including the email id entered by the user in the above form are in correct format. Display error message if input is not in correct format. Call the script when the page is submitted.</li> <li>2. Create web page to display the rule and regulations for University Examination. Include the content from a separate file. Also display the information like last modified time size of file. Use SSI concept for the above task.</li> </ol>	<p><b>CO-3</b> <b>BTL-3</b></p>
<p><b>MODULE 4: ADVANCED JAVASCRIPT</b> <span style="float: right;"><b>(9L+3P)</b></span></p>	
<p>Browser Management and Media Management – Classes – Constructors – Object-Oriented Techniques in JavaScript – Object constructor and Prototyping - Sub classes and Super classes – JSON - jQuery: Selectors, DOM Manipulation with jQuery, AJAX with jQuery, and AJAX - Other JavaScript Frameworks.</p> <p><b>Suggested Readings: AJAX</b></p> <p><b>Practical Component:</b></p> <ol style="list-style-type: none"> <li>1. Simple application to demonstrate Servlets.</li> <li>2. Design a simple online test web page in PHP</li> </ol>	<p><b>CO-4</b> <b>BTL-3</b></p>
<p><b>MODULE 5: PHP</b> <span style="float: right;"><b>(9L+3P)</b></span></p>	
<p>Introduction - How web works - Setting up the environment (LAMP server) - Programming basics - Print/echo - Variables and constants – Strings and Arrays – Operators, Control structures and looping structures – JS: Angular JS – Node JS - Functions – Reading Data in Web Pages - ZEND Framework - Embedding PHP within HTML - Establishing connectivity with MySQL database.</p> <p><b>Suggested Readings:</b> Implementation of Control Structures</p>	<p><b>CO-5</b> <b>BTL-3</b></p>

<b>Practical Component</b>	
1.	Write a PHP program to implement a session-based counter.
2.	Write a PHP program to input previous reading and present reading and prepare an electricity bill
<b>TEXT BOOKS</b>	
1.	Deitel, Deitel and Neito(2012), " <i>Internet and World Wide Web – How to program</i> ", Pearson Education Asia, 5th Edition
<b>REFERENCE BOOKS</b>	
1.	Thomas A Powell, Fritz Schneider(2013), " <i>JavaScript: The Complete Reference</i> ", Third Edition, Tata McGraw Hill.
<b>E BOOKS</b>	
	<a href="https://www.tutorialspoint.com/web_developers_guide/web_developers_guide_tutorial.pdf">https://www.tutorialspoint.com/web_developers_guide/web_developers_guide_tutorial.pdf</a>
	<a href="http://www.intuc.net/office_meeting_report/Ajax_SampleChapter.pdf">http://www.intuc.net/office_meeting_report/Ajax_SampleChapter.pdf</a>
<b>MOOC</b>	
1.	<a href="https://www.coursera.org/courses?query=web%20design%20for%20everybody%20(basics%20of%20web%20development%20and%20coding">https://www.coursera.org/courses?query=web%20design%20for%20everybody%20(basics%20of%20web%20development%20and%20coding</a>

COURSE TITLE		DATA WAREHOUSING AND DATA MINING			CREDITS	4
COURSE CODE		CAA3706	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1
Version	1.0	Approval Details	26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>						
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 introductions to database and data mining concepts with particular emphasis on data analysis. It then covers in a chapter-by-chapter tour the concepts and techniques that underline classification, prediction, association, and clustering.					
Course Objective	<ol style="list-style-type: none"> <li>To identify the scope and essentiality of Data Mining</li> <li>To design the scope and essentiality of Data Warehousing</li> <li>To identify the frequent items and to mine association rules.</li> <li>To choose relevant classification models and algorithms for respective applications.</li> <li>To analyze data and to cluster data using clustering algorithms.</li> </ol>					
Course Outcome	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>Describe about Data Mining fundamentals</li> <li>Design data warehouse with dimensional modeling and apply OLAP operations</li> <li>Detect the frequent items and association mining rules.</li> <li>Evaluate different data mining techniques like classification and prediction.</li> <li>Categorizing data using clustering algorithms.</li> </ol>					
<b>Prerequisites: Database Technology</b>						

CO, PO AND PSO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	3	1	1	3	1	1	3	1	1	3	1	1	3	1	-
CO-2	1	1	-	1	1	-	1	1	-	1	1	-	1	1	2
CO-3	1	-	2	1	-	2	1	-	2	1	-	2	1	-	-
CO-4	1	2	-	1	2	-	1	2	-	1	2	-	1	2	1
CO-5	3	1	1	3	1	1	3	1	1	3	1	1	3	1	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION</b>													<b>(9L+3T)</b>		
Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining. Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation. <b>Practical component:</b> Data preprocessing techniques <b>Suggested Readings:</b> Data mining functions													<b>CO-1 BTL-3</b>		
<b>MODULE 2: DATA WAREHOUSING</b>													<b>(9L+3T)</b>		
Data Warehouse and OLAP Technology for Data Mining: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Further Development of Data Cube Technology, From Data Warehousing to Data Mining Data Cube Computation and Data Generalization: Efficient Methods for Data Cube Computation, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction. <b>Practical component:</b> OLAP operations <b>Suggested Readings:</b> Data cube Technology and Cube Computation													<b>CO-2 BTL-3</b>		
<b>MODULE 3: ASSOCIATION MINING</b>													<b>(9L+3T)</b>		
Mining Frequent Patterns, Associations and Correlations: Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods, Mining various kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining <b>Practical component:</b> Apriori Algorithm, FP-Growth Algorithm <b>Suggested Readings:</b> Mining Patterns													<b>CO-3 BTL-3</b>		
<b>MODULE 4: CLASSIFICATION</b>													<b>(9L+3T)</b>		
Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines, Prediction, Accuracy and Error measures, Evaluating the accuracy of a Classifier or a Predictor, Ensemble Methods. <b>Practical component:</b> Implementation Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines <b>Suggested Readings:</b> Types of Classification													<b>CO-4 BTL-3</b>		
<b>MODULE 5: CLUSTERING METHODS</b>													<b>(9L+3T)</b>		
Cluster Analysis Introduction: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods,													<b>CO-5 BTL-3</b>		



Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis. <b>Practical component:</b> KNN, K-metroids <b>Suggested Readings:</b> Cluster Analysis	
<b>TEXT BOOKS</b>	
1.	Jiawei Han & Micheline Kamber (2012), <i>Data Mining – Concepts and Techniques</i> , Morgan Kaufmann Publishers, Elsevier,3rd Edition,
<b>REFERENCE BOOKS</b>	
1.	Arun K Pujari(2010), <i>Data Mining Techniques</i> ,2nd edition, Universities Press
2.	<a href="http://charuaggarwal.net/Data-Mining.pdf">http://charuaggarwal.net/Data-Mining.pdf</a>
<b>MOOC</b>	
1.	<a href="https://nptel.ac.in/courses/106105174/">https://nptel.ac.in/courses/106105174/</a>

COURSE TITLE		MACHINE LEARNING			CREDITS	4
COURSE CODE		CAA3707	COURSE CATEGORY	PC	L-T-P-S	3-0-2-1
Version	1.0	Approval Details	26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL	BTL-4
<b>ASSESSMENT SCHEME</b>						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE	
15%	15%	10%	5%	5%	50%	
<b>Course Description</b>	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. This course will cover many popular machine learning techniques, in particular focusing the core concepts of supervised and unsupervised learning.					
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>To introduce students to the basic concepts and techniques of Machine Learning.</li> <li>To become familiar with regression methods, classification methods, clustering methods.</li> <li>To become familiar with Clustering methods and Dimensionality reduction Techniques.</li> <li>To gain experience of doing independent study and research.</li> <li>To develop skills of using recent machine learning software for solving practical problems.</li> </ol>					
<b>Course Outcome</b>	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>Apply multilayer perceptron using simple machine learning techniques.</li> <li>Implement decision trees and statistics models.</li> <li>Compute data analysis for machine learning.</li> <li>Implement Genetic algorithm and reinforced learning for appropriate applications.</li> <li>Execute the Python programming for machine learning.</li> </ol>					
<b>Prerequisites: Advanced Data Structures using Python</b>						

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	PO1 2	PSO 1	PSO 2	PSO 3
CO-1	3	1	1	2	3	1	1	2	2	3	1	3	1	2	1
CO-2	1	1	-	2	1	1	-	2	1	1	1	1	1	2	-
CO-3	1	-	2	3	1	-	2	2	1	1	-	1	-	2	2
CO-4	1	2	-	2	3	1	1	2	1	1	2	1	2	-	-
CO-5	2	2	2	2	1	1	-	2	1	1	1	1	3	2	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION (9L+3P)</b>															
Learning - Types of machine learning - Supervised learning - The brain and the neurons, Linear Discriminants -Perceptron - Linear Separability -Linear Regression - Multilayer perceptron - Examples of using MLP - Back propagation of error. <b>Suggested Readings:</b> Enrico C, Simon W, Jay R, Machine Learning Techniques for Space Weather, Elsevier, 2018														<b>CO-1 BTL-4</b>	
<b>MODULE 2: CLASSIFICATION ALGORITHMS (9L+3P)</b>															
Decision trees - Constructing decision trees - Classification of regression trees - Regression example - Probability and Learning: Turning data into probabilities - Some basic statistics - Gaussian mixture models - Nearest Neighbor methods. <b>Suggested Readings:</b> Norman Matlof, "Statistical Regression and Classification: From Linear Models to Machine Learning", CRC Press, 2017.														<b>CO-2 BTL-4</b>	
<b>MODULE 3: ANALYSIS (9L+3P)</b>															
The k-Means algorithm - Vector Quantization's - Linear Discriminant Analysis - Principal component analysis - Factor Analysis - Independent component analysis - Locally Linear embedding – Isomap - Least squares optimization - Simulated annealing. <b>Suggested Readings:</b> L.M. Rasdi, Simulated Annealing Algorithm for Deep Learning, Procedia Computer Science, Volume: 72, 2015.														<b>CO-3 BTL-4</b>	
<b>MODULE 4: OPTIMIZATION TECHNIQUES (9L+3P)</b>															
The Genetic algorithm - Genetic operators - Genetic programming - Combining sampling with genetic programming - Markov Decision Process - Markov Chain Monte Carlo methods: sampling - Monte carlo - Proposal distribution. <b>Suggested Readings</b> Harsh_Bhasin, Application of Genetic Algorithms in Machine learning,, International Journal of Computer Science and Information Technologies, Vol. 2 (5), 2011.														<b>CO-4 BTL-3</b>	
<b>MODULE 5: PYTHON FOR MACHINE LEARNING (9L+3P)</b>															
Baysean Networks - Markov Random moFields - Hidden Markov Models -Tracking methods. Python: Installation - Python for MATLAB AND R users - Code Basics - Using NumPy and MatPolitB. <b>Suggested Readings :</b> <u>RakshithVasudev</u> , Introduction to Numpy -1 : An absolute beginners guide to Machine Learning and Data science., 2017.														<b>CO-5 BTL-4</b>	
<b>TEXT BOOKS</b>															
1.	Kevin P. Murphy(2016), " <i>Machine Learning – A probabilistic Perspective</i> ", MIT Press.														
2.	Randal S(2016), " <i>Python Machine Learning</i> , PACKT Publishing.														
<b>REFERENCE BOOKS</b>															
1.	Ethem Alpaydin(2016), " <i>Machine Learning: The New AI</i> ", MIT Press.														

2	Sebastian Raschka(2015), “Python Machine Learning”, Packt Publishing Ltd.
<b>E- BOOKS</b>	
1.	<a href="https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/understanding-machine-learning-theory-algorithms.pdf">https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/understanding-machine-learning-theory-algorithms.pdf</a>
2.	<a href="http://www.mlyearning.org/">http://www.mlyearning.org/</a>
<b>MOOC</b>	
1.	<a href="https://www.coursera.org/learn/practical-machine-learning">https://www.coursera.org/learn/practical-machine-learning</a>
2.	<a href="https://www.coursera.org/learn/python-machine-learning">https://www.coursera.org/learn/python-machine-learning</a>

COURSE TITLE		SOFTWARE ENGINEERING				CREDITS	4								
COURSE CODE		CAA3708	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1									
Version	1.0	Approval Details		26 <sup>th</sup> ACM 23-03-2019	LEARNING LEVEL	BTL-3									
<b>ASSESSMENT SCHEME</b>															
First Periodical Assessment		Second Periodical Assessment		Seminar/ Assignments / Project	Surprise Test / Quiz	Attendance	ESE								
15%		15%		10%	5%	5%	50%								
<b>Course Description</b>		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.													
<b>Course Objective</b>		<ol style="list-style-type: none"> <li>To identify, formulate, and solve complex engineering problems by applying principles</li> <li>To apply engineering design to produce solutions that meet specified needs</li> <li>To function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment,</li> <li>To develop and conduct appropriate experimentation, analyze and interpret data.</li> <li>To acquire and apply new knowledge as needed, using appropriate learning strategies.</li> </ol>													
<b>Course Outcome</b>		<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>Describe the Software Engineering Process and Evaluation techniques.</li> <li>Plan and manage requirements at each stage of the software develop the models.</li> <li>Depict design activity planning and behavior management principles.</li> <li>Develop skills to manage the various strategic phases involving testing techniques and various test methods.</li> <li>Design software projects that support organization ‘s strategic and agile process</li> </ol>													
<b>Prerequisites: Software Engineering Techniques</b>															
<b>CO, PO AND PSO MAPPING</b>															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
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
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: SOFTWARE PROCESS (9L+3T)</b>															
<p>Process models – Defining a Framework Activity, Process Patterns, Process Assessment and improvement - Prescriptive Process Models – Specialized process models- The Unified Process – Personal and Team Process models – Process Technology – Product and Process.</p> <p><b>Suggested Readings:</b> Process Models</p> <p><b>Practical Component</b></p> <ol style="list-style-type: none"> <li>1. Practicing the different types of case tools such as Rational Rose / other Open Source for all the phases of Software development life cycle.</li> <li>2. Data modelling</li> </ol>														<b>CO-1 BTL-2</b>	
<b>MODULE 2: UNDERSTANDING REQUIREMENTS (9L+3T)</b>															
<p>Requirements Engineering – Eliciting requirements – Developing use cases – Building the requirement model – Negotiating and validating requirements – Scenario Based Modelling – UML Models – Data modelling concepts – Class based modelling – Patterns for Requirement modelling.</p> <p><b>Suggested Readings:</b> UML creation</p> <p><b>Practical Component</b></p> <ol style="list-style-type: none"> <li>1. Source code generators</li> <li>2. Apply the following to typical application problems: <ol style="list-style-type: none"> <li>a. Project Planning</li> <li>b. Software Requirement Analysis</li> </ol> </li> </ol>														<b>CO-2 BTL-2</b>	
<b>MODULE 3: DESIGN CONCEPTS (9L+3T)</b>															
<p>Design Process – Design concepts – Software Architecture – Architectural Styles and Design – Assessing alternative architectural designs – architectural Mapping Using Data Flow – Component Level Design – Designing Class Based Components – Component level design for Web Apps – Designing Traditional Components – User Interface Design.</p> <p><b>Suggested Readings:</b> Architectural Mapping</p> <p><b>Practical Component</b></p> <ol style="list-style-type: none"> <li>1. Apply the following to typical application problems: <ol style="list-style-type: none"> <li>a. Software Design</li> <li>b. Data Modeling &amp; Implementation</li> </ol> </li> <li>2. Software Estimation</li> </ol>														<b>CO-3 BTL-3</b>	
<b>MODULE 4: SOFTWARE TESTING STRATEGIES (9L+3T)</b>															
<p>Strategic approach for software testing – Test Strategies for Conventional Software – OO Software and testing – Validation testing – System Testing – The art of debugging – Internal and External views of testing – Basis path testing – White Box testing – Control structure testing – Block Box Testing – Model based Testing – Patterns for Software Testing.</p> <p><b>Suggested Readings:</b> Testing types</p> <p><b>Practical Component</b></p> <ol style="list-style-type: none"> <li>1. Software Testing</li> </ol>														<b>CO-4 BTL-3</b>	

A possible set of applications may be the following: a. Create a dictionary. b. Telephone directory. c. Inventory System.		
<b>MODULE 5: AGILE METHODOLOGY AND SOFTWARE PROCESS IMPROVEMENT (9L+3T)</b>		
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. <b>Suggested Readings:</b> CMMI <b>Practical Component</b> 1. Software Quality Checking A possible set of applications may be the following: a. Library System b. Student Marks Analyzing System c. Text Editor.		<b>CO-5</b> <b>BTL-3</b>
<b>TEXT BOOKS</b>		
1.	Roger S Pressman(2014), “Software Engineering”, Tata McGraw- Hill Publications, 7 <sup>th</sup> Edition.	
<b>REFERENCE BOOKS</b>		
1.	I. Sommerville(2015), “Software Engineering”, 5 <sup>th</sup> Edition : Addison Wesley.	
<b>E BOOKS</b>		
1.	<a href="http://www.ddegjust.ac.in/studymaterial/mca-3/ms-12.pdf">http://www.ddegjust.ac.in/studymaterial/mca-3/ms-12.pdf</a>	
<b>MOOC</b>		
1.	<a href="https://www.coursera.org/courses?query=software%20engineering">https://www.coursera.org/courses?query=software%20engineering</a>	

COURSE TITLE		SOFTWARE DEVELOPMENT LAB			CREDITS	1
COURSE CODE		CAA3782	COURSE CATEGORY	PC	L-T-P-S	0-0-2-1
Version	1.0	Approval Details	26 <sup>th</sup> ACM 23-03-2019	LEARNING LEVEL		BTL-4
<b>ASSESSMENT SCHEME</b>						
CIA					ESE	
80%					20%	
<b>Course Description</b>	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.					
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>1. To function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment,</li> <li>2. To identify, formulate, and solve complex engineering problems by applying principles</li> <li>3. To apply engineering design to produce solutions that meet specified needs</li> <li>4. To develop and conduct appropriate experimentation, analyze and interpret data.</li> </ol>					

	5. To acquire and apply new knowledge as needed, using appropriate learning strategies.
<b>Course Outcome</b>	Upon completion of this course, the students will 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 and Programming Knowledge**

**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	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO-1	3	1	3	1	3	3	1	2	2	1	2	3	2	2	2
CO-2	1	2	-	1	2	-	2	1	-	3	1	2	-	2	1
CO-3	-	1	1	-	1	2	1	1	-	1	1	1	1	3	1
CO-4	1	2	1	2	1	-	1	-	2	1	-	2	-	3	2
CO-5	3	-	3	2	1	-	1	2	-	1	2	1	1	3	2

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

**MINI PROJECT**

Design and develop practical solutions to real life problems related to application domain. The software engineering knowledge gained from the subject should be applied to develop effective solutions to various computing problems. Submit a complete report of the project work carried out

COURSE TITLE		WEB PROGRAMMING LAB			CREDITS	1
COURSE CODE		CAA3783	COURSE CATEGORY	PC	L-T-P-S	0-0-2-0
Version	1.0	Approval Details		26 <sup>th</sup> ACM 23-03-2019	LEARNING LEVEL	BTL-4
<b>ASSESSMENT SCHEME</b>						
CIA					ESE	
80%					20%	
<b>Course Description</b>	This course will cover the fundamentals of publishing content on the World Wide Web. This includes HTML, the basics of how the Internet and the Web work, a fundamental understanding of graphic production with a focus on making graphics for the Web, and a general grounding introduction to more advanced topics including programming and scripting.					
<b>Course Objective</b>	1. To have a better understanding of the web's structure. 2. To learn and implement the Hypertext Markup Language (HTML). 3. To learn and implement the basics of Cascading Style Sheets 4. To learn and implement the basics of servlet 5. To learn and implement the basics of php					
<b>Course Outcome</b>	Upon completion of this course, the students will be able to 1. Create simple three tier applications 2. Create Simple web pages using HTML & DHTML 3. Create client-side validation scripts.					

	4. Create Web pages using HTML5 tags 5. Create Web applications using Java Servlets.														
<b>Prerequisites: Basic Programming</b>															
<b>CO, PO AND PSO MAPPING</b>															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO-1	3	1	3	1	3	3	1	3	1	3	1	3	3	2	2
CO-2	1	2	-	1	2	1	2	-	1	1	2	-	1	2	1
CO-3	-	1	1	-	1	-	1	1	-	-	1	1	1	2	2
CO-4	1	2	1	2	1	1	2	1	2	1	2	1	-	2	-
CO-5	3	2	3	2	1	3	2	3	2	1	1	1	3	2	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>LAB EXERCISES</b>															
<ol style="list-style-type: none"> <li>Create a web page with the following. <ol style="list-style-type: none"> <li>Cascading style sheets.</li> <li>Embedded style sheets.</li> <li>Inline style sheets. Use our college information for the web pages.</li> </ol> </li> <li>Create a HTML form for reading Name, Age, Gender, Address, Payment Options, Phone number, Email address, preferred user name, various Area of Interest etc. from the user.</li> <li>Create a simple webpage using HTML frames to Include Images and Videos.</li> <li>Write a Java Script program to validate the data including the email id entered by the user in the above form are in correct format. Display error message if input is not in correct format. Call the script when the page is submitted.</li> <li>Create web page to display the rule and regulations for University Examination. Include the content from a separate file. Also display the information like last modified time size of file. Use SSI concept for the above task.</li> <li>Simple application to demonstrate Servlets.</li> <li>Design a simple online test web page in PHP</li> <li>Write a PHP program to implement a session-based counter.</li> <li>Write a PHP program to input previous reading and present reading and prepare an electricity bill.</li> </ol>															
<b>TEXT BOOKS</b>															
1.	Deitel, Deitel and Neito(2012), <i>"Internet and World Wide Web – How to program"</i> , Pearson Education Asia, 5th Edition														
<b>REFERENCE BOOKS</b>															
1.	Thomas A Powell, Fritz Schneider(2013), <i>"JavaScript: The Complete Reference"</i> , Third Edition, Tata McGraw Hill														
<b>E BOOKS</b>															
1.	<a href="https://www.tutorialspoint.com/web_developers_guide/web_developers_guide_tutorial.pdf">https://www.tutorialspoint.com/web_developers_guide/web_developers_guide_tutorial.pdf</a>														
2.	<a href="http://www.intuc.net/office_meeting_report/Ajax_SampleChapter.pdf">http://www.intuc.net/office_meeting_report/Ajax_SampleChapter.pdf</a>														
<b>MOOC</b>															
1.	<a href="https://www.coursera.org/courses?query=web%20design%20for%20everybody%20(basics%20of%20web%20development%20and%20coding">https://www.coursera.org/courses?query=web%20design%20for%20everybody%20(basics%20of%20web%20development%20and%20coding</a>														

**Semester III**

<b>COURSE TITLE</b>		<b>SOFTWARE TESTING AND QUALITY ASSURANCE</b>						<b>CREDITS</b>		<b>4</b>					
<b>COURSE CODE</b>		<b>CAA3709</b>		<b>COURSE CATEGORY</b>		<b>PC</b>		<b>L-T-P-S</b>		<b>3-0-2-1</b>					
<b>Version</b>	<b>1.0</b>	<b>Approval Details</b>		<b>26<sup>th</sup> ACM 23-03-2019</b>		<b>LEARNING LEVEL</b>		<b>BTL-3</b>							
<b>ASSESSMENT SCHEME</b>															
<b>First Periodical Assessment</b>		<b>Second Periodical Assessment</b>		<b>Seminar/ Assignments/ Project</b>		<b>Surprise Test / Quiz</b>		<b>Attendance</b>		<b>ESE</b>					
<b>15%</b>		<b>15%</b>		<b>10%</b>		<b>5%</b>		<b>5%</b>		<b>50%</b>					
<b>Course Description</b>		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.													
<b>Course Objective</b>		<ol style="list-style-type: none"> <li>1. To learn the core concepts of software testing.</li> <li>2. To provide a knowledge on debugging.</li> <li>3. To learn and implement automation techniques in software testing.</li> <li>4. To understand the industry trends in testing.</li> <li>5. To provide the knowledge on automation tools and quality assurance tools.</li> </ol>													
<b>Course Outcome</b>		Upon completion of this course, the students should be able to <ol style="list-style-type: none"> <li>1. Describe the basic knowledge of errors and faults in software testing project</li> <li>2. Identify the software testing fundamentals and Engineering methods.</li> <li>3. Identify the various software testing types and methods.</li> <li>4. Write various test cases and skills to communicate with their teammates to conduct their practice-oriented software testing projects</li> <li>5. Apply automation testing and quality assurance tools for their testing projects.</li> </ol>													
<b>Prerequisites: Software Engineering</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PS O1</b>	<b>PS O2</b>	<b>PS O3</b>
<b>CO-1</b>	3	2	3	2	2	1	1	1	1	1	1	1	1	2	1
<b>CO-2</b>	1	1	3	3	1	1	1	1	-	-	1	1	-	-	2
<b>CO-3</b>	1	-	-	1	-	1	1	1	2	1	-	1	2	2	2
<b>CO-4</b>	1	2	1	-	1	-	1	1	-	1	2	1	-	-	1
<b>CO-5</b>	1	-	1	2	1	2	1	1	1	1	1	2	2	2	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION</b>											<b>(9L+3P)</b>				
Software Errors-Bugs- Cause of Bugs- Cost of Bugs- Software Tester- Software Development Process-Testing Axioms-Software testing Terms and Definitions <b>Suggested Readings:</b> Bugs, and role of software testing											<b>CO-1 BTL-2</b>				
<b>MODULE 2: TESTING FUNDAMENTALS</b>											<b>(9L+3P)</b>				



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. <b>Suggested Readings:</b> Types of testing	<b>CO-2 BTL-3</b>
<b>MODULE 3: TESTING TYPES AND APPROACHES (9L+3P)</b>	
Configuration Testing-Compatibility Testing-Foreign Language Testing-Usability Testing-Testing the Documentation-Website Testing <b>Suggested Readings:</b> Compatibility testing	<b>CO-3 BTL-3</b>
<b>MODULE 4: TEST MANAGEMENT AND DOCUMENTATION (9L+3P)</b>	
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. <b>Suggested Readings:</b> Report preparation	<b>CO-4 BTL-3</b>
<b>MODULE 5: AUTOMATION TESTING AND QUALITY ASSURANCE (9L+3P)</b>	
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 <b>Suggested Readings:</b> Software Quality Assurance	<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>	
1.	Erik van Veenendaal(2015), Dorothy Graham, <i>Foundations of Software Testing ISTQB Certification</i> , Red Black.
<b>REFERENCE BOOKS</b>	
1.	Kshirasagar Naik, Priyadarshini Tripathy (2011), <i>Software Testing and Quality Assurance: Theory and Practice</i> , John Wiley & Sons.
<b>E BOOKS</b>	
1.	<a href="https://www.softwaretestinggenius.com/download/staqtpsn.pdf">https://www.softwaretestinggenius.com/download/staqtpsn.pdf</a>
<b>MOOC</b>	
1.	Introduction to software testing, Kevin Wendt, Coursera

COURSE TITLE		DEVOPS			CREDITS	4
COURSE CODE		CAA3710	COURSE CATEGORY	PC	L-T-P-S	3-0-2-1
Version	1.0	Approval Details		26 <sup>th</sup> ACM 23-03-2019	LEARNING LEVEL	BTL-4
<b>ASSESSMENT SCHEME</b>						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project		Surprise Test / Quiz	Attendance	ESE
15%	15%	10%		5%	5%	50%
<b>Course Description</b>		The DevOps course syllabus spans several topics which are considered vital for the fundamental understanding of the domain. It is designed to cover the intrinsic segments as well, such as the history of DevOps, objectives, software development life cycle, virtual development and management				

	tools. The learning process usually begins with the identification of the problem and then, making use of the typical DevOps workflow to address the relevant problem. The course is designed to offer deep insights and knowledge into various tools such as Ansible, Puppet, Nagios, Jenkins and Docker. With the adept learning of DevOps course syllabus, a student will be able to become a trained practitioner in the integration and monitoring of software throughout their development cycle.														
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>To understand the benefits of DevOps over other software development processes.</li> <li>To gain insights into the DevOps environment.</li> <li>To get an overview of different DevOps Tools.</li> <li>To get a picture of the working of the DevOps Delivery Pipeline.</li> </ol>														
<b>Course Outcome</b>	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>Compare and contrast the differences between Agile and other conventional project management methodologies.</li> <li>Interpret and apply various principles, phases of Version Control System.</li> <li>Illustrate and integrate all the builds with new features and plugins available using various Building tools</li> <li>Compare and contrast the differences between Test driven development approaches and Behavior driven development approach.</li> <li>Illustrate the concepts of test automation, infrastructure automation, and deployment of various Configuration management tools.</li> </ol>														
<b>Prerequisites: Basic Programming Knowledge.</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>CO-1</b>	1	1	3	3	1	1	1	3	3	1	1	1	1	1	2
<b>CO-2</b>	1	-	-	1	-	1	-	-	1	-	1	1	2	-	1
<b>CO-3</b>	1	2	1	-	1	1	2	1	-	1	-	1	1	2	2
<b>CO-4</b>	1	-	1	2	1	1	-	1	2	1	2	1	-	-	1
<b>CO-5</b>	2	2	3	3	1	2	2	3	3	1	1	1	1	3	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION</b>												<b>(9L+3P)</b>			
<p>Learning Objectives – DevOps Overview – Relationship between Agile and DevOps – DevOps Tool chain - Challenges with the traditional approach – Addressing challenges through DevOps – DevOps approach to the challenges – Overview of the DevOp tools – workflow of DevOps – JIRA</p> <p><b>Suggested Readings:</b></p> <ul style="list-style-type: none"> <li>Introduction to DevOps</li> <li>Benefits of working in a DevOps environment Preview</li> <li>DevOps Lifecycle</li> <li>DevOps Stages</li> </ul> <p><b>Practical Component:</b></p> <ul style="list-style-type: none"> <li>DevOps Delivery Pipeline</li> </ul>															<b>CO-1</b> <b>BTL-2</b>
<b>MODULE 2: VERSION CONTROL SYSTEMS</b>												<b>(9L+3P)</b>			

<p>Overview of version control systems – role of version control systems – Types of control systems and their supporting tools – Overview of Git – Overview of Source code and Version Control hosts – Deploy the files to GitHub.</p> <p><b>Suggested Readings:</b></p> <ul style="list-style-type: none"> <li>• Git Introduction</li> <li>• Commonly used commands in Git</li> <li>• Working with Remote repository</li> </ul> <p><b>Practical Component:</b></p> <ul style="list-style-type: none"> <li>• Installing Git</li> <li>• Common commands</li> </ul>	<p><b>CO-2</b> <b>BTL-3</b></p>
<p><b>MODULE 3: CONTINUOUS INTEGRATION AND BUILDING TOOL (9L+3P)</b></p>	
<p>Importance of continuous Integration – Overview and Features of Jenkins – Set up Jenkins – Overview and Features of Maven - Setup Maven- Overview and Features of TeamCity – Setup TeamCity.</p> <p><b>Suggested Readings:</b></p> <ul style="list-style-type: none"> <li>• Introduction to Maven</li> <li>• Maven Architecture</li> <li>• Introduction to Continuous Integration</li> <li>• Introduction to Jenkins</li> </ul> <p><b>Practical Component:</b></p> <ul style="list-style-type: none"> <li>• Workflows</li> <li>• Branching and Merging</li> <li>• Adding a slave node</li> </ul>	<p><b>CO-3</b> <b>BTL-3</b></p>
<p><b>MODULE 4: SOFTWARE AND AUTOMATION TESTING FRAMEWORKS (9L+3P)</b></p>	
<p>Software Testing overview – Testing levels Approach and Automation Tools – Test driven development approaches and JUnit5 – Behaviour driven development approach with cucumber.</p> <p><b>Suggested Readings:</b></p> <ul style="list-style-type: none"> <li>• Test driven development</li> </ul> <p><b>Practical Component:</b></p> <ul style="list-style-type: none"> <li>• Port Binding</li> <li>• Starting Containers in Different Modes</li> </ul>	<p><b>CO-4</b> <b>BTL-4</b></p>
<p><b>MODULE 5: CONFIGURATION MANAGEMENT TOOLS (9L+3P)</b></p>	
<p>Overview of configuration management tools – overview of puppet – puppet configuration –overview of Chef – Chef configuration - overview of Ansible – Ansible configuration- containerization and docker.</p> <p><b>Suggested Readings:</b></p> <ul style="list-style-type: none"> <li>• Introduction to Configuration Management</li> <li>• Infrastructure as Code</li> </ul> <p><b>Practical Component:</b></p> <ul style="list-style-type: none"> <li>• Ad-Hoc Commands</li> <li>• Running a Simple Playbook</li> <li>• Using Variables and handlers</li> </ul>	<p><b>CO-5</b> <b>BTL-3</b></p>
<p><b>TEXT BOOKS</b></p>	
<p>1</p>	<p>Jennifer Davis, Katherine Daniels(2016), <i>Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale</i>, O'Reilly.</p>
<p><b>REFERENCE BOOKS</b></p>	

1.	Gene Kim, Jez Humble, Patrick Debois, and John Willis(2016), <i>THE DEVOPS HANDBOOK How to Create World-Class Agility, Reliability, &amp; Security in Technology Organizations</i> , IT Revolution Press.
<b>E BOOKS</b>	
1.	<a href="https://www.atlassian.com/software/jira/guides/use-cases/what-is-jira-used-for">https://www.atlassian.com/software/jira/guides/use-cases/what-is-jira-used-for</a>
2.	<a href="https://www.jenkins.io/doc/">https://www.jenkins.io/doc/</a>
<b>MOOC</b>	
1.	<a href="https://www.coursera.org/learn/data-structures">https://www.coursera.org/learn/data-structures</a>
2.	<a href="https://www.coursera.org/specializations/data-structures-algorithms">https://www.coursera.org/specializations/data-structures-algorithms</a>

COURSE TITLE		PRESENTATION SKILLS AND ACADEMIC WRITING			CREDITS	1
COURSE CODE		ELA4383	COURSE CATEGORY	PC	L-T-P-S	0-0-2-0
Version	1.0	Approval Details	26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>						
CIA					ESE	
80%					20%	
<b>Course Description</b>		Academic works such as paper, term paper, report, thesis and final thesis, annotation, abstract, review as well as their presentation belong to the area of scientific works; therefore, they have to meet general requirements of structure and content. Academic works have to be in high quality of scientific style. This course presents the structure of academic works, and analyzes scientific texts (composing sentences, paragraphs, and the whole text, referring and quotation, etc.). First part of this course is about theoretical requirements of academic writing and the second is about practical training in writing				
<b>Course Objective</b>		<ol style="list-style-type: none"> <li>1. Communicate effectively in specific writing situations, which may include various academic, professional, or civic situations.</li> <li>2. Understand and respond appropriately to the critical elements that shape communication situations, such as audience, purpose, and genre.</li> <li>3. Critique their own writing and provide effective and useful feedback to enable other students to improve their writing.</li> <li>4. Demonstrate critical and evaluative thinking skills in locating, analyzing, synthesizing, and using information in writing activities.</li> </ol>				
<b>Course Outcome</b>		<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>1. Develop effective communication skills with emphasis on Listening, Speaking, Reading and Writing.</li> <li>2. Acquire presentation skills and enhance competence in scholarly communications.</li> <li>3. Develop the syntax and improve the writing skills.</li> <li>4. Enhance the core features of the scientific writing style in projects, technical reports.</li> <li>5. Understand the techniques to participate and excel in group discussions.</li> </ol>				

Prerequisites: Basic English															
CO, PO AND PSO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	3	3	-	1	-	3	2	-	1	3	1	1	3	-	3
CO-2	-	1	-	1	-	-	1	-	1	-	-	1	-	2	1
CO-3	1	-	1	1	1	1	-	1	1	1	1	1	1	1	-
CO-4	1	2	1	1	3	3	1	1	3	1	1	1	1	-	2
CO-5	3	3	1	2	-	1	-	1	-	3	1	2	3	1	3
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: LISTENING &amp; READING SKILLS</b>														<b>(6P)</b>	
Importance of Listening Skills-Listening to native speakers,-Listening and sequencing of sentences – Listening and answering the questions - Cloze Exercises – Vocabulary building –Reading Skills & Comprehension													<b>CO-1 BTL-3</b>		
<b>MODULE 2: PRESENTATION SKILLS</b>														<b>(6P)</b>	
Presentation techniques-tips of how to be an effective presenter-Preparation – how to deal with fear and anxiety 2) Voice, pace and gesture – how to speak, stand and move. 3) Getting live feedback – how to interact with the audience – Practical session on technical presentations													<b>CO-2 BTL-3</b>		
<b>MODULE 3: GROUP DISCUSSION</b>														<b>(6P)</b>	
Group Discussion - Strategies in GD – Team work – Body Language – Mock GD – Video Samples													<b>CO-3 BTL-3</b>		
<b>MODULE 4: PROFESSIONAL COMMUNICATION &amp; ETIQUETTE</b>														<b>(6P)</b>	
Professional Speaking – Conversation Practice- Role Plays - Use of appropriate and ethical language in professional contexts- Netiquette--Email etiquette- Mobile phone etiquette													<b>CO-4 BTL-3</b>		
<b>MODULE 5: ACADEMIC WRITING</b>														<b>(6P)</b>	
Techniques of effective writing – Elements of Writing- Writing Clear and Effective Sentences and Paragraphs, Developing Unity, Coherence - Writing Technical Reports - Project Writing.													<b>CO-5 BTL-3</b>		
<b>TEXT BOOKS</b>															
1.	Sabina Pillai and Agna Fernandez (2018), <i>Soft Skills &amp; Employability Skills</i> , published by Cambridge University Press.														
<b>REFERENCE BOOKS</b>															
1.	Aruna Koneru (2015), <i>Professional Speaking Skills</i> , Oxford Publications.														
<b>E BOOKS</b>															
1.	<a href="https://www.britishcouncil.in/english/courses-business">https://www.britishcouncil.in/english/courses-business</a>														
2.	<a href="http://www.bbc.co.uk/learningenglish/english/features/pronunciation">http://www.bbc.co.uk/learningenglish/english/features/pronunciation</a>														
<b>MOOC</b>															
1.	<a href="https://www.mooc-list.com/tags/english">https://www.mooc-list.com/tags/english</a>														
2.	<a href="https://www.mooc-list.com/course/adventures-writing-stanford-online">https://www.mooc-list.com/course/adventures-writing-stanford-online</a>														
3.	<a href="http://www.cambridgeenglish.org/learning-english/free-resources/mooc/">http://www.cambridgeenglish.org/learning-english/free-resources/mooc/</a>														

<b>COURSE TITLE</b>		<b>PROJECT PHASE -1</b>						<b>CREDITS</b>	<b>3</b>						
<b>COURSE CODE</b>		<b>CAA3784</b>	<b>COURSE CATEGORY</b>			<b>PC</b>		<b>L-T-P-S</b>	<b>0-0-6-1</b>						
<b>Version</b>	<b>1.0</b>	<b>Approval Details</b>			<b>26<sup>th</sup> ACM 23-05-2019</b>			<b>LEARNING LEVEL</b>		<b>BTL-4</b>					
<b>ASSESSMENT SCHEME</b>															
<b>CIA</b>										<b>ESE</b>					
<b>80%</b>										<b>20%</b>					
<b>Course Description</b>		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													
<b>Course Objective</b>		<ol style="list-style-type: none"> <li>To perform a literature review</li> <li>To undertake detailed technical work</li> <li>Develop a solution for the problem and develop an application by using relevant computer application concepts</li> <li>To acquire and apply new knowledge as needed, using appropriate learning strategies.</li> </ol>													
<b>Course Outcome</b>		<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> <li>Identify an issue and derive problem related to society, environment, economics, energy and technology</li> <li>Formulate the problem and write a project proposal</li> <li>Determine the scope of the solution chosen and methodology</li> <li>Design the methodology to be used</li> <li>Design solutions to problems utilizing a systems approach method.</li> </ol>													
<b>Prerequisites: Software engineering and Programming Knowledge</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>CO-1</b>	3	1	3	1	3	3	1	2	2	1	2	3	2	2	2
<b>CO-2</b>	1	2	-	1	2	-	2	1	-	3	1	2	-	2	1
<b>CO-3</b>	-	1	1	-	1	2	1	1	-	1	1	1	1	3	2
<b>CO-4</b>	1	2	1	2	1	-	1	-	2	1	-	2	-	3	2
<b>CO-5</b>	3	-	3	2	1	-	1	2	-	1	2	1	1	3	3
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>PROJECT-PHASE-1</b>															
Design and develop practical solutions to real life problems related to application domain. The software engineering knowledge gained from the subject should be applied to develop effective solutions to various computing problems. Submit a complete report of the project work carried out															
Phase -1 Literature study and feasibility study, Partial demonstration															

**SEMESTER- IV**

<b>COURSE TITLE</b>		<b>PROJECT WORK- PHASE -II</b>					<b>CREDITS</b>		<b>12</b>						
<b>COURSE CODE</b>		<b>CAA3785</b>	<b>COURSE CATEGORY</b>			<b>PC</b>	<b>L-T-P-S</b>		<b>0-0-24-2</b>						
<b>Version</b>	<b>1.0</b>	<b>Approval Details</b>		<b>26<sup>th</sup> ACM 23-05-2019</b>		<b>LEARNING LEVEL</b>		<b>BTL-4</b>							
<b>ASSESSMENT SCHEME</b>															
<b>CIA</b>								<b>ESE</b>							
<b>80%</b>								<b>20%</b>							
<b>Course Description</b>	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														
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>1. Develop a solution for the problem and develop an application by using relevant computer application concepts</li> <li>2. To produce progress reports or maintain a professional journal to establish work completed and deliver a seminar on the general area</li> <li>3. To present the work in a forum involving poster presentations</li> <li>4. To acquire and apply new knowledge as needed, using appropriate learning strategies.</li> </ol>														
<b>Course Outcome</b>	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> <li>1. Design the methodology to be used</li> <li>2. Design solutions to problems utilizing a systems approach method.</li> <li>3. Find solution by formulating proper methodology</li> <li>4. Evaluate the solution by considering the standard data / Objective function and by using appropriate performance metric</li> <li>5. Write a scientific paper</li> </ol>														
<b>Prerequisites: Software engineering and Programming Knowledge</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>CO-1</b>	3	1	3	1	3	3	1	2	2	1	2	3	2	2	3
<b>CO-2</b>	1	2	-	1	2	-	2	1	-	3	1	2	-	2	1
<b>CO-3</b>	-	1	1	-	1	2	1	1	-	1	1	1	1	3	2
<b>CO-4</b>	1	2	1	2	1	-	1	-	2	1	-	2	-	3	-
<b>CO-5</b>	3	-	3	2	1	-	1	2	-	1	2	1	1	3	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>PROJECT</b>															
Design and develop practical solutions to real life problems related to application domain. The software engineering knowledge gained from the subject should be applied to develop effective solutions to various computing problems. Submit a complete report of the project work carried out. Phase -II Demonstration, Results, Analysis, Report and paper publications															

**ELECTIVE-1**

<b>COURSE TITLE</b>		<b>SOFTWARE PROCESS AND METRICS</b>				<b>CREDITS</b>		<b>3</b>							
<b>COURSE CODE</b>		<b>CAD3721</b>	<b>COURSE CATEGORY</b>		<b>DE</b>	<b>L-T-P-S</b>		<b>3-0-0-0</b>							
<b>Version</b>	<b>1.0</b>	<b>Approval Details</b>		<b>26<sup>th</sup> ACM 23-03-2019</b>		<b>LEARNING LEVEL</b>		<b>BTL-3</b>							
<b>ASSESSMENT SCHEME</b>															
<b>First Periodical Assessment</b>	<b>Second Periodical Assessment</b>	<b>Seminar/ Assignments/ Project</b>			<b>Surprise Test / Quiz</b>		<b>Attendance</b>		<b>ESE</b>						
<b>15%</b>	<b>15%</b>	<b>10%</b>			<b>5%</b>		<b>5%</b>		<b>50%</b>						
<b>Course Description</b>	This course helps to understand the machine metrics. It covers basics of measurement theory, models of software engineering measurement, software product metrics, software process metrics, and management measurement and Control of measurement.														
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>To give a solid background knowledge about software metrics.</li> <li>To instruct various metrics and models to assess software.</li> <li>To deliver hands on experience on using and implementing metrics.</li> <li>To explain the issues of software metrics</li> </ol>														
<b>Course Outcome</b>	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>Define and relate the fundamentals of Measurement theory to software process metrics.</li> <li>Analyze a real time scenario and apply the appropriate metric tool to assess the quality of software</li> <li>Recognize the different quality management models and the metrics associated with them</li> <li>Perform testing and apply in-process metrics appropriately.</li> <li>Apply complexity metrics on simple real time software projects.</li> </ol>														
<b>Prerequisites: Software Engineering</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO1 1</b>	<b>PO1 2</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>CO-1</b>	-	3	2	-	2	-	3	2	-	1	-	-	3	2	1
<b>CO-2</b>	-	-	1	-	3	-	-	1	-	1	-	-	-	1	1
<b>CO-3</b>	1	1	-	1	3	1	1	-	1	1	1	1	1	-	1
<b>CO-4</b>	3	3	1	-	3	2	-	1	1	-	3	2	-	1	-
<b>CO-5</b>	-	1	-	1	2	1	1	1	1	1	1	-	1	-	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1 – FUNDAMENTALS OF MEASUREMENT THEORY</b>										<b>(9L)</b>					
Software Quality, TQM, Measurement, levels of measurement, Reliability and validity, Measurement errors, criteria for causality, Software development process models, Process maturity framework and quality standards													<b>CO-1 BTL- 2</b>		
<b>Suggested Readings:</b> Measurement Errors															
<b>MODULE 2: SOFTWARE QUALITY METRICS &amp; QUALITY TOOLS</b>										<b>(9L)</b>					
Product quality metrics, In-process quality metrics, Metrics for software maintenance, Real time examples, Application of Seven basic tools in software quality development													<b>CO-2 BTL- 2</b>		
<b>Suggested Readings:</b> Quality Metrics															



<b>MODULE 3 : DEFECT REMOVAL EFFECTIVENESS AND QUALITY MANAGEMENT MODELS(9L)</b>	
Defect removal effectiveness, Quality planning, Phase based defect removal model, cost effectiveness, Defect removal, process maturity level, Rayleigh model framework, Code integration pattern, Reliability growth models, In-process metrics and reports, orthogonal defect classification <b>Suggested Readings:</b> cost effectiveness	<b>CO-3 BTL-3</b>
<b>MODULE – 4 IN-PROCESS METRICS AND AVAILABILITY METRICS (9L)</b>	
In-process metrics for software testing, In-process metrics and quality management, Metrics for acceptance, Measurements of system availability, In-process metrics for outage and availability. <b>Suggested Readings:</b> Software testing metrics	<b>CO-4 BTL-3</b>
<b>MODULE 5 – COMPLEXITY METRICS AND ADVANCED METRICS (9L)</b>	
Lines of code, Halstead’s science, Cyclomatic complexity, Syntactic constructs, Structure metrics, Design and complexity metrics, Productivity metrics, Quality and quality management metrics <b>Suggested Readings:</b> Structure metrics	<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>	
1.	Stephen H. Kan (2015), “ <i>Metrics and Models in Software Quality Engineering</i> ”, Second edition, Pearson education India, ISBN-13: 978-9332551602
<b>REFERENCE BOOKS</b>	
1.	Norman Fenton and James Bieman (2014), “ <i>Software Metrics: A Rigorous and Practical Approach</i> , CRC Press, Third Edition, ISBN-13: 978-1439838228
2.	Anirban Basu (2015), “ <i>Software Quality Assurance, Testing and Metrics</i> ”, PHI Learning, ISBN-13: 978-8120350687
<b>E BOOKS</b>	
1	<a href="https://www.springer.com/la/book/9783824465187">https://www.springer.com/la/book/9783824465187</a>
2	<a href="https://kupdf.net/download/crcpresssoftwaremetricspdf_5a43fbd6e2b6f55c6ad538da_pdf">https://kupdf.net/download/crcpresssoftwaremetricspdf_5a43fbd6e2b6f55c6ad538da_pdf</a>
<b>MOOC</b>	
1	<a href="https://www.coursera.org/learn/reviews-and-metrics-for-software-improvements">https://www.coursera.org/learn/reviews-and-metrics-for-software-improvements</a>

<b>COURSE TITLE</b>		<b>.NET/ASP PROGRAMMING</b>			<b>CREDITS</b>	<b>3</b>
<b>COURSE CODE</b>		<b>CAD3722</b>	<b>COURSE CATEGORY</b>	<b>DE</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>
<b>Version</b>	<b>1.0</b>	<b>Approval Details</b>	<b>26<sup>th</sup> ACM 23-03-2019</b>		<b>LEARNING LEVEL</b>	<b>BTL-3</b>
<b>ASSESSMENT SCHEME</b>						
<b>First Periodical Assessment</b>	<b>Second Periodical Assessment</b>	<b>Seminar/ Assignments / Project</b>	<b>Surprise Test / Quiz</b>	<b>Attendance</b>	<b>ESE</b>	
<b>15%</b>	<b>15%</b>	<b>10%</b>	<b>5%</b>	<b>5%</b>	<b>50%</b>	
<b>Course Description</b>	Provides hands-on experience creating software for Microsoft's .NET (Windows platform) using the Visual Studio development environment. Starting with the most fundamental elements of computer programming, the training evolves to leverage development techniques sufficient to produce a complete web application including the user interface, business logic and data					

	access layers. You learn how to write code using Visual Basic (VB) and C#; create ASP.NET Web applications and process Web forms and build SQL Server databases and access them using ADO.NET.														
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>To demonstrate the fundamental aspects of modern computer programming.</li> <li>To design and implement .NET web and Windows applications.</li> <li>To write object-oriented logic using C# and Visual Basic (classes and libraries).</li> <li>To leverage Visual Studio for code generation, user interface design, testing, and debugging.</li> <li>To build SQL Server databases and access them using the Entity Framework (EF).</li> </ol>														
<b>Course Outcome</b>	Upon completion of this course, the students should be able to <ol style="list-style-type: none"> <li>Create programs using .net.</li> <li>Describe the use of object-oriented concepts.</li> <li>Implement data sources.</li> <li>Create an application to connect with the backend.</li> <li>Generate reports.</li> </ol>														
<b>Prerequisites: C Language is basic language along with HTML &amp; CSS</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PS O1</b>	<b>PS O2</b>	<b>PS O3</b>
<b>CO-1</b>	-	3	-	3	2	2	1	3	2	-	1	-	3	2	2
<b>CO-2</b>	-	-	-	-	1	-	1	-	3	2	-	1	-	1	1
<b>CO-3</b>	1	1	1	1	-	1	1	-	-	1	-	1	1	-	-
<b>CO-4</b>	3	3	3	3	1	1	3	1	1	-	1	1	3	1	1
<b>CO-5</b>	-	1	-	1	-	1	-	1	-	1	-	-	1	-	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION OF .NET</b>															<b>(9L)</b>
Introduction/Overview of .Net - .Net Framework [Advanced] - Visual C#.Net Language - Introduction to Windows Forms - Event Handling – User Defined Controls – Tool-Box. <b>Practical component:</b> Implement a Simple Calculator in windows .net - C# Environment. <b>Suggested Readings:</b> .Net Framework [Advanced]														<b>CO-1</b> <b>BTL-2</b>	
<b>MODULE 2: Object Oriented Concepts</b>															<b>(9L)</b>
Object Oriented Concepts (Basic) - Object Oriented Concepts (Advanced) - Object Oriented Concepts (Implementation Oriented) - Error Handling - ADO.Net Components – Programming with ADO.Net. <b>Practical component:</b> Using ADO.Net Connectivity execute a simple login and redirect to another Window using windows C#. <b>Suggested Readings:</b> ADO.Net Components – Programming with ADO.Net														<b>CO-2</b> <b>BTL-3</b>	
<b>MODULE 3: Introduction to ASP.Net</b>															<b>(9L)</b>
Introduction to Web Forms – Controls : Web, Server, Client, Navigation – Master Page – Advance ASP .Net : AJAX – WPF – Web Services – Silverlight – Java Script Validations. <b>Practical component:</b> Create a web based form using Silverlight’s and Ajax Control with a Login page Validation.														<b>CO-3</b> <b>BTL-3</b>	

<b>Suggested Readings:</b> AJAX & Java Script Validations		
<b>MODULE 4: Introduction to MSSQL Server 2016</b>		<b>(9L)</b>
Introduction to Databases - Structured Query Language - Stored Procedures – Functions – Triggers – Rollback. <b>Practical component:</b> Create a database and establish a connectivity with Windows based C# application for signup Form. <b>Suggested Readings:</b> Structured Query Language		<b>CO-4 BTL-2</b>
<b>MODULE 5: SAP Crystal Reports XI &amp; Project Work – Windows Application</b>		<b>(9L)</b>
Introduction : Crystal Reports XI – Database Connectivity – Connectivity between C# Forms and SAP Crystal Reports <b>Practical component:</b> Implementation of windows based C# Application with Database and Crystal Report. <b>Suggested Readings:</b> Database Connectivity		<b>CO-5 BTL-2</b>
<b>TEXT BOOKS</b>		
1.	Imar Spaanjaars(2016), <i>Beginning ASP.NET 4: in C# and VB</i> (Wrox Programmer to Programmer) ISBN: 978-0-470-50221-1	
<b>REFERENCE BOOKS</b>		
1.	Raef, Meeuwisse(2017), <i>Cyber security for Beginners</i> , Cyber Simplicity Ltd. Publications, 2nd Edition, pp.410-440, 2017	
2.	William, Stalling(2018), <i>Effective Cyber security: A Guide to Using Best Practices and Standards</i> , Addison - Wesley Professional Publishers, 1st Edition, 2018	
<b>E BOOKS</b>		
1.	<a href="http://www.uou.ac.in/sites/default/files/slm/Introduction-cyber-security.pdf">http://www.uou.ac.in/sites/default/files/slm/Introduction-cyber-security.pdf</a>	
<b>MOOC</b>		
1.	<a href="https://www.edx.org/course/.net-fundamentals">https://www.edx.org/course/.net-fundamentals</a>	
2.	<a href="https://www.coursera.org/specializations/.net">https://www.coursera.org/specializations/.net</a>	

COURSE TITLE		WEB ANALYTICS			CREDITS	3
COURSE CODE		CAB3721	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details	26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE	
15%	15%	10%	5%	5%	70%	
<b>Course Description</b>	Website analytics is the science of analysis that focuses on the World Wide Web. Web analytics focuses on optimizing an organization’s digital ecosystem by collecting, analyzing and enabling the making of data-informed decisions.					
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>To Learn how to use and deploy web/social/mobile analytics platforms such as Adobe Analytics, ComScore combined with an introduction to Mobile Analytics, Geo-Tracking and Geo-Location services.</li> <li>A grounded understanding of web intelligence and business analytics terminology related to the above.</li> </ol>					

	<ol style="list-style-type: none"> <li>3. How to deploy web intelligence to improve the outcomes of your marketing or business plan.</li> <li>4. How Analysts impact the bottom line (their role) within various businesses and lines of business.</li> <li>5. Growth potentials for Web Analysts and Big Data professionals.</li> </ol>														
<b>Course Outcome</b>	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>1. Describe the concepts of web analytics.</li> <li>2. Apply the web analytics basics.</li> <li>3. Relate the strategies of web analytics.</li> <li>4. Apply the concepts of web analytics into various websites like Google, social media and mobile.</li> <li>5. Implement Mobile Analytics basics.</li> </ol>														
<b>Prerequisites: Statistics, Math &amp; Scientific methods</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO1 1</b>	<b>PO1 2</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>CO-1</b>	-	3	2	-	1	-	3	2	1	1	1	1	3	2	2
<b>CO-2</b>	-	-	1	-	1	-	-	-	3	2	-	1	-	2	-
<b>CO-3</b>	1	1	-	1	1	1	1	-	-	1	-	1	-	2	1
<b>CO-4</b>	3	3	1	1	3	3	3	1	1	-	1	1	1	2	2
<b>CO-5</b>	-	1	-	1	-	-	1	2	1	1	1	1	3	2	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION</b>															<b>(9L)</b>
Introduction: Web analytics, History, current landscape and challenges, Five ‘Whys’ of web analytics. Data Collection: Clickstream data, web logs, web beacons, packet sniffing, java Script tags, Types of data: outcomes data, Research data, competitive data <b>Suggested Readings:</b> web logs														<b>CO-1 BTL-2</b>	
<b>MODULE 2: FUNDAMENTALS OF WEB ANALYTICS AND DATA ANALYSIS</b>															<b>(9L)</b>
Capturing data, Type and size of data, Innovation, Integration, selection of web analytic tool, web analytic dashboard, types of metrics to track the data, Key Performance Indicators (KPI), identification of audience, site referrers and most important pages. Qualitative Analysis: Essence of Customer Centricity, Lab usability testing, Heuristic evaluations, Site Visits and surveys <b>Suggested Readings:</b> Key Performance Indicators (KPI)														<b>CO-2 BTL-3</b>	
<b>MODULE 3: WEB ANALYTICS CONCEPTS AND STRATEGIES</b>															<b>(9L)</b>
URI, URL parameters, Cookies, Geotargeting, Geotagging, mobile phone tracking, Focus on Customer Centricity, solve for business questions, follow the 10/90 rule, Hire great web analytics, Identify optimal organizational structure and responsibilities, Centralization, Decentralization, centralized decentralization <b>Suggested Readings:</b> URL parameters														<b>CO-3 BTL-3</b>	
<b>MODULE 4: GOOGLE WEB ANALYTICS</b>															<b>(9L)</b>
Installing Google web analytics, setting up: Account, property, view, users’ profiles and filters, tracking traffic channels, E-commerce tracking, On-site search tracking, On-page interacting tracking, Analyzing data through Google Analytics. Google analytics vs Crazy Egg. <b>Case study:</b> Make website and apply web analytics strategies. <b>Suggested Readings:</b> On-site search tracking, On-page interacting tracking														<b>CO-4 BTL-2</b>	

<b>MODULE 5: SOCIAL MEDIA AND MOBILE ANALYTICS</b>		<b>(9L)</b>
Social Media Analytics: Measure, Analyze, Interpret, the conundrum of social media, targeting your customers, online social intelligence, Friends, Fans and Followers, Influence, score carding, monitoring tools and technologies. Mobile Analytics: Mobile Market places, triangulating mobiles, mobile sites, mobile apps, mining mobiles <b>Suggested Readings:</b> Next-generation digital forensics		<b>CO-5 BTL-2</b>
<b>TEXT BOOKS</b>		
1.	Avinash Kaushik (2009), <i>Web Analytics 2.0: The Art of Online Accountability and Science of Customer</i> Wiley Publishing.	
2.	Justin Cutroni, <i>Google Analytics: Understanding Visitor Behavior</i> 1st Edition, O'Reilly Media publisher	
<b>REFERENCE BOOKS</b>		
1.	Marshall Sponder, <i>Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics</i> , Mc Graw Hill.	
<b>E BOOKS</b>		
1.	<a href="http://alvarestech.com/temp/smar/Smar/Book2021/Industry4.0/2019/">http://alvarestech.com/temp/smar/Smar/Book2021/Industry4.0/2019/</a>	
<b>MOOC</b>		
1.	<a href="https://www.coursera.org/courses?query=web%20analytics">https://www.coursera.org/courses?query=web%20analytics</a>	

<b>COURSE TITLE</b>		<b>BIG DATA ANALYTICS</b>			<b>CREDITS</b>	<b>3</b>
<b>COURSE CODE</b>		<b>CAB3722</b>	<b>COURSE CATEGORY</b>	<b>DE</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>
<b>Version</b>	<b>1.0</b>	<b>Approval Details</b>	<b>26<sup>th</sup> ACM 23-03-2019</b>		<b>LEARNING LEVEL</b>	<b>BTL-3</b>
<b>ASSESSMENT SCHEME</b>						
<b>First Periodical Assessment</b>	<b>Second Periodical Assessment</b>	<b>Seminar/ Assignments/ Project</b>	<b>Surprise Test / Quiz</b>	<b>Attendance</b>	<b>ESE</b>	
<b>15%</b>	<b>15%</b>	<b>10%</b>	<b>5%</b>	<b>5%</b>	<b>50%</b>	
<b>Course Description</b>	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.					
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>1. Understand the Big Data Platform and its Use cases</li> <li>2. Provide an overview of Apache Hadoop</li> <li>3. Provide HDFS Concepts and Interfacing with HDFS</li> <li>4. Understand Map Reduce Jobs</li> <li>5. Provide hands on Hadoop Eco System</li> <li>6. Apply analytics on Structured, Unstructured Data.</li> </ol>					
<b>Course Outcome</b>	Upon completion of this course, the students should be able to <ol style="list-style-type: none"> <li>1. Describe the big data characteristics, challenges and use cases from selected business domains</li> </ol>					

	<ol style="list-style-type: none"> <li>2. Describe NoSQL big data management and the characteristics that distinguish them from traditional relational database management systems.</li> <li>3. Configure and run Hadoop distributed file system Framework.</li> <li>4. Analyze the Big Data using Map-reduce programming using Hadoop framework.</li> <li>5. Apply Hadoop related tools such as HBase, Cassandra, and Hive for big data analytics</li> </ol>														
<b>Prerequisites: Data Mining and Data Analysis</b>															
<b>CO, PO AND PSO MAPPING</b>															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	-	3	2	-	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
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION (9L)</b>															
<p>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.</p> <p><b>Suggested Readings:</b> Big Data, Risk and Collaborative Systems.</p>														<b>CO-1 BTL-2</b>	
<b>MODULE 2: NoSQL (9L)</b>															
<p>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.</p> <p><b>Suggested Readings:</b> NoSQL, data models.</p>														<b>CO-2 BTL-3</b>	
<b>MODULE 3: HADOOP (9L)</b>															
<p>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</p> <p><b>Suggested Readings:</b> Introduction to Hadoop, Hadoop distributed file system (HDFS)</p>														<b>CO-3 BTL-3</b>	
<b>MODULE 4: MapReduce (9L)</b>															
<p>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.</p>														<b>CO-4 BTL-3</b>	

<b>Suggested Readings:</b> Map Reduce functions, YARN.		
<b>MODULE 5: Big data Analysis</b>		<b>(9L)</b>
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. <b>Suggested Readings:</b> Big data analytics, HBase and HiveQL.		<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>		
1.	Raj kamal, Preeti Saxena (2018), <i>Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning</i> , McGraw Hill.	
<b>REFERENCE BOOKS</b>		
1.	Michael Minelli, Michele Chambers, Ambiga Dhiraj (2013) <i>Business Intelligence and Analytic Trends for Today's Businesses"</i> , Wiley, 2013	
2.	Tom White (2012), <i>Hadoop: The Definitive Guide</i> , Third Edition, O'Reilley.	
<b>E BOOKS</b>		
1.	<a href="http://index-of.co.uk/Big+Data+Technologies/Data%20Science%20and%20Big%20Data+%20Analytics.pdf">http://index-of.co.uk/Big Data Technologies/Data%20Science%20and%20Big%20 Data %20Analytics.pdf</a>	
<b>MOOC</b>		
1.	<a href="https://www.coursera.org/specializations/big-data">https://www.coursera.org/specializations/big-data</a>	

COURSE TITLE		CLOUD ARCHITECTURE			CREDITS	3
COURSE CODE		CAC3721	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details	26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments / Project	Surprise Test / Quiz	Attendance	ESE	
15%	15%	10%	5%	5%	50%	
<b>Course Description</b>	You will explore best practices and strategies around securing access to cloud services and infrastructure. You will also use tools and methods available with public cloud ecosystems - such as AWS - to ensure that data stored in the cloud is protected.					
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>To provide students with the fundamentals and essentials of cloud architecture.</li> <li>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.</li> <li>To enable students exploring some important cloud computing driven commercial systems and applications.</li> <li>To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.</li> <li>To research state-of-the-art in Cloud Computing fundamental issues, technologies, applications and implementations.</li> </ol>					



<b>Course Outcome</b>	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.														
<b>Prerequisites: Cloud Computing</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PS O1</b>	<b>PS O2</b>	<b>PS O3</b>
<b>CO-1</b>	3	2	2	1	2	2	2	-	3	2	-	1	3	2	2
<b>CO-2</b>	-	3	2	-	1	-	-	3	2	-	-	3	2	1	-
<b>CO-3</b>	-	-	1	-	1	-	-	-	1	-	-	-	1	2	-
<b>CO-4</b>	1	1	-	1	1	1	1	1	-	1	1	1	-	-	1
<b>CO-5</b>	3	3	1	1	3	3	3	3	1	1	3	1	3	1	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: CLOUD COMPUTING FUNDAMENTALS</b>															<b>(9L)</b>
Cloud Computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds, 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 <b>Suggested Readings:</b> Cloud computing Architecture – Cloud containers													<b>CO-1 BTL-3</b>		
<b>MODULE 2: CLOUD APPLICATIONS</b>															<b>(9L)</b>
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 <b>Suggested Readings:</b> Web Service APIs – Web service Authentication													<b>CO-2 BTL-3</b>		
<b>MODULE 3: MANAGEMENT OF CLOUD SERVICES</b>															<b>(9L)</b>
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). <b>Suggested Readings:</b> Economics of choosing a Cloud platform for an organization													<b>CO-3 BTL-3</b>		
<b>MODULE 4: APPLICATION DEVELOPMENT</b>															<b>(9L)</b>
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. <b>Suggested Readings:</b> Amazon, Azure, Google App													<b>CO-4 BTL-3</b>		
<b>MODULE 5: CLOUD IT MODEL</b>															<b>(9L)</b>



Analysis of Case Studies when deciding to adopt cloud computing architecture. How to decide if the cloud is right for your requirements. Cloud based service, applications and development platform deployment so as to improve the total cost of ownership (TCO). <b>Suggested Readings:</b> Total cost of ownership	<b>CO-5 BTL-2</b>
<b>TEXT BOOKS</b>	
1.	Gautam Shroff, "Enterprise Cloud Computing Technology Architecture Applications", Cambridge University Press; 1 edition, [ISBN: 978-0521137355].
<b>REFERENCE BOOKS</b>	
1.	Dimitris N. Chorafas(2010), "Cloud Computing Strategies" CRC Press; 1 edition [ISBN: 1439834539].
<b>E BOOKS</b>	
1.	<a href="https://www.springer.com/us/book/9789811328282">https://www.springer.com/us/book/9789811328282</a>
<b>MOOC</b>	
1.	<a href="https://www.mooc-list.com/course/cloud-computing-security-edx">https://www.mooc-list.com/course/cloud-computing-security-edx</a>

COURSE TITLE		VIRTUALIZATION TECHNIQUES			CREDITS	3
COURSE CODE		CAC3722	COURSE CATEGORY		DE	L-T-P-S
Version	1.0	Approval Details		26 <sup>th</sup> ACM 23-03-2019	LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project		Surprise Test / Quiz	Attendance	ESE
15%	15%	10%		5%	5%	50%
<b>Course Description</b>	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.					
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>To identify, formulate, and solve complex engineering problems by applying principles</li> <li>To apply engineering design to produce solutions that meet specified needs</li> <li>To function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment,</li> <li>To develop and conduct appropriate experimentation, analyze and interpret data.</li> <li>To acquire and apply new knowledge as needed, using appropriate learning strategies.</li> </ol>					
<b>Course Outcome</b>	Upon completion of this course, the students should be able to <ol style="list-style-type: none"> <li>Describe the cloud and its techniques.</li> <li>Illustrate the different cloud delivery and deployment models</li> <li>Identify and analyze cloud file systems and its related technologies</li> <li>Describe how to access of Cloud File Systems and cloud workloads</li> <li>Demonstrate the usage of various cloud tools</li> </ol>					
<b>Prerequisites: Cloud Basics</b>						

CO, PO AND PSO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	2	2	2	3	-	3	2	-	1	-	3	2	1	1
CO-2	-	3	2	-	1	-	-	1	-	1	-	-	1	-	2
CO-3	-	-	1	-	1	1	1	-	1	1	1	1	-	1	1
CO-4	1	1	-	1	1	1	1	-	1	1	3	3	1	1	-
CO-5	3	2	2	2	3	2	2	2	1	1	-	1	-	1	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: CLOUD COMPUTING FUNDAMENTALS (9L)</b>															
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. <b>Practical component:</b> Network with Internet <b>Suggested Readings:</b> Study of hypervisors.													<b>CO-1 BTL-3</b>		
<b>MODULE 2: CLOUD IMPLEMENTATIONS (9L)</b>															
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 <b>Practical component:</b> Network Server with Internet <b>Suggested Readings:</b> SOAP and REST Web services, AJAX and mashups													<b>CO-2 BTL-3</b>		
<b>MODULE 3: MANAGEMENT OF CLOUD SERVICES (9L)</b>															
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. <b>Practical component:</b> Cloud Network with Internet <b>Suggested Readings:</b> Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing													<b>CO-3 BTL-3</b>		
<b>MODULE 4: CLOUD FILE SYSTEMS AND WORKLOADS (9L)</b>															
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. <b>Practical component:</b> Cloud Network with Internet <b>Suggested Readings:</b> HDFS, Big Table, H Base and Dynamo, Map-Reduce:													<b>CO-4 BTL-2</b>		
<b>MODULE 5: CLOUD TOOLS AND FUTURE CLOUD (9L)</b>															
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. <b>Practical component:</b> Cloud Network with Internet <b>Suggested Readings:</b> Mobile Cloud Computing, Fog Computing, Dockers,													<b>CO-5 BTL-2</b>		
<b>TEXT BOOKS</b>															

1.	Thomas Erl, Zaigham Mahmood, and Ricardo Puttini(2013),” <i>Cloud Computing Concepts, Technology &amp; Architecture</i> ”, Prentice Hall.
<b>REFERENCE BOOKS</b>	
1.	Rajkumar Buyya, James Broberg, Andrzej M. Goscinski(2011), <i>Cloud Computing: Principles and Paradigms</i> , Wiley Publishers
<b>E BOOKS</b>	
1.	<a href="https://www.manning.com/books/exploring-cloud-computing">https://www.manning.com/books/exploring-cloud-computing</a>
<b>MOOC</b>	
1.	<a href="https://www.mooc-list.com/course/cloud-computing-concepts-part-2-coursera">https://www.mooc-list.com/course/cloud-computing-concepts-part-2-coursera</a>

**ELECTIVE II**

COURSE TITLE		AGILE METHODS				CREDITS	3								
COURSE CODE		CAD3723	COURSE CATEGORY		DE	L-T-P-S	3-0-0-0								
Version	1.0	Approval Details		26 <sup>th</sup> ACM 23-03-2019	LEARNING LEVEL	BTL-3									
<b>ASSESSMENT SCHEME</b>															
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project		Surprise Test / Quiz	Attendance	ESE									
15%	15%	10%		5%	5%	50%									
Course Description	Agile methodologies are approaches to product development that are aligned with the values and principles described in the Agile Manifesto for software development. Agile methodologies aim to deliver the right product, with incremental and frequent delivery of small chunks of functionality, through small cross-functional self-organizing teams, enabling frequent customer feedback and course correction as needed. In doing so, Agile aims to right the challenges faced by the traditional “waterfall” approaches of delivering large products in long periods of time, during which customer requirements frequently changed, resulting in the wrong products being delivered.														
Course Objective	<ol style="list-style-type: none"> <li>To understand the philosophy and principles of Agile.</li> <li>To acquire knowledge on Agile project, including alternative configurations.</li> <li>To explore the purpose of agile project.</li> <li>To understand the techniques used and their benefits and limitations.</li> </ol>														
Course Outcome	Upon completion of this course, the students should be able to <ol style="list-style-type: none"> <li>Develop techniques and tools for improving team collaboration and software quality</li> <li>Perform iterative software development processes: how to plan them, how to execute them</li> <li>Perform Software process improvement as an ongoing task for development teams</li> <li>Illustrate how agile approaches can be scaled up to the enterprise level.</li> <li>Describe the agile principles, practices, and roles of Scrum</li> </ol>														
<b>Prerequisites: Software Engineering</b>															
<b>CO, PO AND PSO MAPPING</b>															
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	2	2	3	-	3	2	3	2	-	2	-	2	-	1
CO-2	3	2	-	1	-	-	1	3	2	-	3	2	-	2	2
CO-3	-	1	-	1	1	1	-	-	1	-	-	1	-	-	1
CO-4	1	-	1	1	1	1	-	1	-	1	1	-	1	2	-
CO-5	3	2	2	2	1	2	2	2	1	1	1	1	3	2	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1 - INTRODUCTION TO AGILE METHODOLOGY</b>													<b>(9L)</b>		
Theories for Agile Management, Classification and methods -Traditional Model vs. Agile Model, Overview of Scrum, Agile Project Management – Agile													<b>CO-1 BTL-2</b>		

Team Interactions – Ethics in Agile Teams Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values <b>Suggested Readings:</b> Traditional Model vs. Agile Model	
<b>MODULE 2 - AGILE TESTING</b>	<b>(9L)</b>
The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), Unit framework and tools for TDD, testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester <b>Suggested Readings:</b> Test-Driven Development (TDD),	<b>CO-2 BTL-2</b>
<b>MODULE 3 - AGILITY AND KNOWLEDGE MANAGEMENT</b>	<b>(9L)</b>
Agile Information Systems – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment, leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM). <b>Suggested Readings:</b> Agile Information Systems	<b>CO-3 BTL-3</b>
<b>MODULE 4 - AGILE DEVELOPMENT AND REQUIREMENTS</b>	<b>(9L)</b>
Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation <b>Suggested Readings:</b> Requirements Management in Agile Environment	<b>CO-4 BTL-2</b>
<b>MODULE 5 - AGILE INDUSTRY TRENDS</b>	<b>(9L)</b>
Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies <b>Suggested Readings:</b> Agile projects on Cloud	<b>CO-5 BTL-2</b>
<b>TEXT BOOKS</b>	
1.	David J. Anderson and Eli Schragenheim(2003), <i>Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results</i> , Prentice Hall.
2.	Hazza and Dubinsky (2008), <i>Agile Software Engineering, Series: Undergraduate Topics in Computer Science</i> , Springer.
<b>REFERENCE BOOKS</b>	
1.	Craig Larman(2003), <i>Agile and Iterative Development: A Managers Guide</i> , Addison-Wesley,
<b>E BOOKS</b>	
1.	The Agile Guide to Agile Development-by infopro Learning
<b>MOOC</b>	
1.	Agile Development specialization-Coursera

COURSE TITLE		INTERNET OF THINGS				CREDITS		3							
COURSE CODE		CAD3724	COURSE CATEGORY		DE	L-T-P-S		3-0-0-0							
Version	1.0	Approval Details		26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL		BTL-3							
<b>ASSESSMENT SCHEME</b>															
First Periodical Assessment		Second Periodical Assessment		Seminar/ Assignments/ Project		Surprise Test / Quiz		Attendance		ESE					
15%		15%		10%		5%		5%		50%					
Course Description		<p>“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.”</p>													
Course Objective		<ol style="list-style-type: none"> <li>To identify, formulate, and solve complex engineering problems by applying principles</li> <li>To function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment,</li> <li>To apply engineering design to produce solutions that meet specified needs</li> <li>To develop and conduct appropriate experimentation, analyze and interpret data.</li> <li>To acquire and apply new knowledge as needed, using appropriate learning strategies.</li> </ol>													
Course Outcome		<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>Recognize characteristics and physical design of IoT.</li> <li>Identify suitable connectivity protocols.</li> <li>Discuss IoT sensor networks at various use cases.</li> <li>Demonstrate the functionalities of Arduino and Machine to Machine communication</li> <li>Develop IoT enabled hardware setup to execute domain specific IoT application.</li> </ol>													
<b>Prerequisites: Networking with Internet</b>															
<b>CO, PO AND PSO MAPPING</b>															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	2	3	-	3	2	3	2	3	-	3	2	2	3	-	1
CO-2	-	1	-	-	1	3	-	1	-	-	1	-	1	-	2
CO-3	-	1	1	1	-	-	-	1	1	1	-	-	1	1	1
CO-4	1	1	1	1	-	1	1	1	1	1	-	1	1	1	2
CO-5	2	2	1	2	2	2	2	2	1	2	2	2	2	1	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: FUNDAMENTALS OF IOT</b>										<b>(9L)</b>					
<p>Introduction: Definition &amp; Characteristics of IoT – Physical Design of IoT – Logical Design of IoT- IoT Enabling Technologies –IoT Applications – IoT Challenges- Sensors- Actuators.</p> <p><b>Practical component: Networking with Internet</b></p>										<b>CO-1 BTL-3</b>					

<b>Suggested Readings:</b> Sensors and Actuators		
<b>MODULE 2:IOT PROTOCOLS</b>		<b>(9L)</b>
6LoWPAN, MQTT, CoAP, XMAP, AMQP, IEEE 802.15.4, RFID, Zigbee, Bluetooth, NFC. <b>Practical component:</b> Networking, RFID with Internet <b>Suggested Readings:</b> Zigbee, Bluetooth and NFC		<b>CO-2 BTL-3</b>
<b>MODULE 3: SENSOR NETWORKS</b>		<b>(9L)</b>
Wireless Sensor Networks: Application of WSN in IoT, WSN in Agriculture, wireless multimedia sensor networks, WSN challenges <b>Practical component:</b> Networking with Internet <b>Suggested Readings:</b> Wireless Sensors and Multimedia Sensor		<b>CO-3 BTL-3</b>
<b>MODULE 4: ARDUINO INTERFACING&amp; MACHINE-TO-MACHINE COMMUNICATION( 9L)</b>		
Arduino Programming: Features, Types, Board details, IDE. Setup, Function Libraries, Examples programs. M2M : Introduction- Difference between IoT and M2M- Software Defined Networking (SDN) <b>Practical component:</b> Networking with Internet <b>Suggested Readings:</b> Arduino Interfacing& Machine		<b>CO-4 BTL-3</b>
<b>MODULE 5 DOMAIN SPECIFIC IOTS</b>		<b>(9L)</b>
Smart Lighting- Intrusion Detection - Weather monitoring- Indoor Air Quality Monitoring- Smart Irrigation. <b>Practical component:</b> Networking with Internet <b>Suggested Readings:</b> Weather monitoring		<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>		
1.	Arshdeep Bahga, Vijay Madiseti(2015) " <i>Internet of Things – A hands-on approach</i> ", Universities Press.	
2	Olivier Hersent, David Boswarthick, Omar Elloumi(2012) " <i>The Internet of Things – Key applications and Protocols</i> ", Wiley publisher	
<b>E BOOKS</b>		
1	<a href="https://drive.google.com/file/d/1VMQdwIjDw-an9KA3Jwiw16hB1mhJ411m/view">https://drive.google.com/file/d/1VMQdwIjDw-an9KA3Jwiw16hB1mhJ411m/view</a>	
<b>MOOC</b>		
1.	<a href="https://nptel.ac.in/courses/106105166/">https://nptel.ac.in/courses/106105166/</a>	

COURSE TITLE		R PROGRAMMING			CREDITS	3
COURSE CODE		CAB3723	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details	26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>						
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 teach you how to write a Program 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.					

<b>Course Objective</b>	<ol style="list-style-type: none"> <li>To understand the different data types and data structures in R</li> <li>To understand how to create and manipulate data frames in R</li> <li>To write user-defined functions using R</li> <li>To implement control statements using R</li> <li>To write Loop constructs in R</li> </ol>														
<b>Course Outcome</b>	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>Apply the programming knowledge using R fundamentals</li> <li>Implement R operator and R functions</li> <li>Implement Lists and Frames</li> <li>Implement Tables</li> <li>Apply the programming Structures in R.</li> </ol>														
<b>Prerequisites: Basic Programming</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>CO-1</b>	3	3	2	3	-	3	2	3	2	3	-	3	2	3	1
<b>CO-2</b>	3	3	-	1	-	-	1	3	-	1	-	-	1	3	2
<b>CO-3</b>	3	2	-	1	1	1	-	-	-	1	1	1	-	-	1
<b>CO-4</b>	3	2	1	1	1	1	-	1	1	1	1	1	-	1	-
<b>CO-5</b>	3	2	2	2	1	2	2	2	2	2	1	2	2	2	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION</b>															<b>(9L)</b>
<p>R – OVERVIEW-Evolution of R -Features of R 2. R – ENVIRONMENT SETUP -Local Environment Setup- BASIC SYNTAX -R Command Prompt - Script File - R – DATA TYPES -Vectors -Lists -Matrices -Arrays-Factors -Data Frames - R – VARIABLES - Variable Assignment -Data Type of a Variable Finding Variables -Deleting Variables</p> <p><b>Suggested Readings:</b> Script File</p>															<b>CO-1 BTL-2</b>
<b>MODULE 2: OPERATORS</b>															<b>(9L)</b>
<p>R – OPERATORS -Types of Operators -Arithmetic Operators-Relational Operators-Logical Operators Assignment Operators-Miscellaneous Operators - R – DECISION MAKING -R - If Statement-R – If...Else Statement -The if...else if...else -Switch Statement - R – LOOP-R - Repeat LoopR - While Loop -R – For Loop -Loop Control Statements-R-Break statement -R – Next Statement. R – FUNCTION -Function Definition -Function Components -Built-in Function –User-defined Function - Calling a Function -Lazy Evaluation of Function –User-defined Function -Calling a Function.</p> <p><b>Suggested Readings:</b> Decision making</p>															<b>CO-2 BTL-3</b>
<b>MODULE 3: LISTS AND FRAMES</b>															<b>(9L)</b>
<p>LISTS- LISTS -Creating a -Naming List Elements - Accessing List Elements - Manipulating List Elements -Merging Lists Converting List to Vector - R – MATRICES -Accessing Elements of a Matrix - Matrix Computation-ARRAYS - Naming Columns and Rows -Accessing Array Elements-Manipulating Array Elements - R – FACTORS -Factors in Data Frame -Changing the Order of Levels - Generating Factor Levels 16. R – DATA FRAMES -Extract Data from Data Frame</p> <p><b>Suggested Readings:</b> Accessing elements of a matrix</p>															<b>CO-3 BTL-3</b>
<b>MODULE 4: FACTORS AND TABLES</b>															<b>(9L)</b>



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 Sub table- Extended Example: Finding the Largest Cells in a Table- Table-Related Functions- The aggregate() Function- The cut() Function <b>Suggested Readings:</b> Extracting a sub table		<b>CO-4 BTL-3</b>
<b>MODULE 5: R PROGRAMMING STRUCTURES (9L)</b>		
Control Statements- Loops- Looping Over Non-Vector 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. <b>Suggested Readings:</b> Default values, Return values		<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>		
1.	Matloff, Norman(2011). <i>The art of R programming: A tour of statistical software design</i> . No Starch Press	
<b>REFERENCE BOOKS</b>		
1.	Crawley, Michael J(2012). <i>The R book</i> . John Wiley & Sons.	
<b>E BOOKS</b>		
1.	<a href="https://cran.r-project.org/doc/contrib/Paradis-rdebuts_en.pdf">https://cran.r-project.org/doc/contrib/Paradis-rdebuts_en.pdf</a>	
<b>MOOC</b>		
1.	R Programming Coursera –Johns Hopkins university	

COURSE TITLE		BIG DATA FRAMEWORK			CREDITS	3
COURSE CODE		CAB3724	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details	26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignment s/ Project	Surprise Test / Quiz		Attendance	ESE
15%	15%	10%	5%		5%	50%
Course Description	This course provides an overview of machine learning techniques to explore, analyze, and leverage data. You will be introduced to tools and algorithms you can use to create machine learning models that learn from data, and to scale those models up to big data problems.					
Course Objective	<ol style="list-style-type: none"> <li>To understand the Big Data Platform and its Use cases.</li> <li>To provide an overview of Apache Hadoop.</li> <li>To provide HDFS Concepts and Interfacing with HDFS.</li> <li>To understand Map, Reduce Jobs.</li> <li>Provide hands on Hadoop Eco System.</li> </ol>					
Course Outcome	Upon completion of this course, the students should be able to <ol style="list-style-type: none"> <li>Describe the basics of Big Data.</li> <li>Implement the basic operations in Scala.</li> <li>Develop custom Scala functions as per the requirement.</li> <li>Understand the basics of RDDs.</li> </ol>					

5. Illustrate spark runtime environment.															
<b>Prerequisites: Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment</b>															
<b>CO, PO AND PSO MAPPING</b>															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	2	3	-	3	2	3	2	-	2	3	-	3	2	3	2
CO-2	-	1	-	-	1	3	2	-	-	1	-	-	1	3	1
CO-3	-	1	1	1	2	3	-	3	2	3	2	1	-	-	1
CO-4	1	1	1	1	-	1	-	-	1	3	2	1	-	1	2
CO-5	2	2	1	2	2	2	1	1	1	1	1	1	3	1	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION TO BIG DATA</b>														<b>(9L)</b>	
What is big data, the four Vs of big data, Distributed File System, functional programming vs object-oriented programming, advantages of Scala, spark streaming. <b>Suggested Readings:</b> Distributed File System														<b>CO-1 BTL-2</b>	
<b>MODULE 2: BASIC OPERATIONS IN SCALA</b>														<b>(9L)</b>	
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 <b>Suggested Readings:</b> Variables and functions in Scala														<b>CO-2 BTL-3</b>	
<b>MODULE 3: FUNCTIONS AND CONTROL STATEMENTS IN SCALA</b>														<b>(9L)</b>	
Nested functions-first class functions-placeholder syntax-closures-repeated parameters-tail recursion-reducing code duplication-currying-by name parameters-writing new control structures. <b>Suggested Readings:</b> writing new control structures														<b>CO-3 BTL-3</b>	
<b>MODULE 4: RDD BASICS</b>														<b>(9L)</b>	
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. <b>Suggested Readings:</b> joins on pair RDD, sorting data in pair RDD														<b>CO-4 BTL-2</b>	
<b>MODULE 5: SAVING DATA, COMPRESSIONS, SPARK RUNTIME ARCHITECTURE</b>														<b>(9L)</b>	
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. <b>Suggested Readings:</b> spark runtime architecture, cluster managers														<b>CO-5 BTL-2</b>	
<b>TEXT BOOKS</b>															
1.	Martin Odersky, Lex Spoon, Bill Venner(2016), <i>Programming in Scala: A comprehensive Step-by-Step Scala Programming Guide</i> , Third Edition. Artima Inc publisher														
2.	Holden Karau, Andy Konwinski, Patrick Wendell, Matei Zaharia(2016), <i>Learning Spark</i> , o'reilly														

REFERENCE BOOKS	
1.	Sandy Ryza, Uri Laserson, Sean Owen and Josh Wills , Advanced Analytics with Spark , o'reilly 2017.
E BOOKS	
1.	<a href="http://dphoto.lecturer.pens.ac.id/lecture_notes/internet_of_things/Big%20Data%20Principles%20and%20Paradigms.pdf">http://dphoto.lecturer.pens.ac.id/lecture_notes/internet_of_things/Big%20Data%20Principles%20and%20Paradigms.pdf</a>
MOOC	
1.	<a href="https://www.coursera.org/specializations/big-data">https://www.coursera.org/specializations/big-data</a>

COURSE TITLE		CLOUD APPLICATION DEVELOPMENT			CREDITS	3
COURSE CODE		CAC3723	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details	26 <sup>th</sup> ACM 23-03-2019		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**  
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	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO1 2	PSO 1	PSO 2	PSO 3
CO-1	3	3	2	2	1	2	2	1	1	1	1	1	3	2	1
CO-2	3	3	3	2	1	2	2	1	1	1	1	1	2	-	2
CO-3	3	3	2	2	3	2	2	1	1	1	1	1	1	1	1
CO-4	3	3	3	2	1	2	2	1	1	1	1	1	1	2	1

CO-5	3	3	3	2	3	2	2	1	1	1	1	1	3	2	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1 : CLOUD BASED APPLICATIONS</b>															<b>(9L)</b>
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 <b>Suggested Readings:</b> Understanding Cloud ecosystems														<b>CO-1 BTL-2</b>	
<b>MODULE 2: DESIGNING CODE FOR THE CLOUD</b>															<b>(9L)</b>
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. <b>Suggested Readings:</b> Understanding Web browsers attributes and differences														<b>CO-2 BTL-3</b>	
<b>MODULE 3 - INTRODUCTION TO JAVASCRIPT</b>															<b>(9L)</b>
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 <b>Suggested Readings:</b> Building Ajax controls														<b>CO-3 BTL-3</b>	
<b>MODULE 4 - USE CASE 1</b>															<b>(9L)</b>
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 <b>Suggested Readings:</b> Building an application using the LAMP stack														<b>CO-4 BTL-2</b>	
<b>MODULE 5 – USE CASE</b>															<b>(9L)</b>
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 <b>Suggested Readings:</b> Developing and Deploying an Application in the Cloud														<b>CO-5 BTL-3</b>	
<b>TEXT BOOKS</b>															
1.	Guo Ning Liu, Qiang Guo Tong, Harm Sluiman, Alex Amies(2012), " <i>Developing and Hosting Applications on the Cloud</i> ", IBM Press.														
2.	Chris Hay, Brian Prince(2018), <i>Azure in Action</i> [ISBN: 978-1935182481], Manning publisher														
<b>REFERENCE BOOKS</b>															
1.	Thomas(2013), " <i>Cloud Computing: Concepts, Technology &amp; Architecture</i> " Prentice Hall of India														
<b>E BOOKS</b>															
1.	<a href="https://www.oreilly.com/library/view/cloud-computing/9789332537439/">https://www.oreilly.com/library/view/cloud-computing/9789332537439/</a>														
2.	<a href="https://studytm.files.wordpress.com/2014/03/hand-book-of-cloud-computing.pdf">https://studytm.files.wordpress.com/2014/03/hand-book-of-cloud-computing.pdf</a>														
<b>MOOC</b>															
1.	<a href="https://www.coursera.org/specializations/cloud-computing">https://www.coursera.org/specializations/cloud-computing</a>														

<b>COURSE TITLE</b>		<b>CLOUD ANALYTICS</b>					<b>CREDITS</b>		<b>3</b>						
<b>COURSE CODE</b>		<b>CAC3724</b>	<b>COURSE CATEGORY</b>			<b>DE</b>		<b>L-T-P-S</b>		<b>3-0-0-0</b>					
<b>Version</b>	<b>1.0</b>	<b>Approval Details</b>			<b>26<sup>th</sup> ACM 23-03-2019</b>		<b>LEARNING LEVEL</b>		<b>BTL-3</b>						
<b>ASSESSMENT SCHEME</b>															
<b>First Periodical Assessment</b>		<b>Second Periodical Assessment</b>		<b>Seminar/ Assignments/ Project</b>		<b>Surprise Test / Quiz</b>		<b>Attendance</b>		<b>ESE</b>					
<b>15%</b>		<b>15%</b>		<b>10%</b>		<b>5%</b>		<b>5%</b>		<b>50%</b>					
<b>Course Description</b>		This course will give you an introduction to the concept of analytics on the cloud, and the different cloud services popularly used for processing and analyzing data. It will help you understand the design and business considerations to be kept in mind, and choose the best tools and alternatives for analytics, based on your requirements													
<b>Course Objective</b>		<ol style="list-style-type: none"> <li>To understand the basic concepts to analytics on the cloud platform</li> <li>To analyze the different cloud services</li> <li>To analyze tools available in GCP</li> <li>To choose the right services to build an end-to-end analytics pipeline on the cloud</li> <li>To understand the utility, architecture, and use cases.</li> </ol>													
<b>Course Outcome</b>		<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>Describe the fundamental concepts of cloud analytics.</li> <li>Describe the architecture and cloud computing concepts.</li> <li>Analyze analytical tools in Google Cloud Platform.</li> <li>Apply processing tools and visualizing API.</li> <li>Apply Google cloud functions.</li> </ol>													
<b>Prerequisites: CAC3721 Cloud Architecture</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PS O1</b>	<b>PS O2</b>	<b>PS O3</b>
<b>CO-1</b>	2	3	-	-	1	2	3	-	-	-	-	2	3	-	2
<b>CO-2</b>	-	1	-	-	-	-	1	-	1	1	-	-	1	-	1
<b>CO-3</b>	-	1	1	2	3	-	1	-	-	-	-	-	1	1	1
<b>CO-4</b>	1	1	1	2	3	-	2	1	-	-	1	1	1	1	2
<b>CO-5</b>	3	1	3	2	3	-	3	-	-	-	-	2	2	1	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION</b>											<b>(9L)</b>				
Cloud computing- Major benefits of cloud computing - Cloud computing deployment models - Types of cloud computing services - PaaS, IaaS, and SaaS - Emerging cloud technologies and services - Different ways to secure the cloud - Risks and challenges with the cloud - major cloud vendors in the world.											<b>CO-1 BTL-2</b>				
<b>Suggested Readings: Cloud Application Deployment</b>															
<b>MODULE 2 – DESIGN AND BUSINESS CONSIDERATIONS</b>											<b>(9L)</b>				
Cloud computing and migration - Parameters before adopting cloud strategy - Prerequisites for an application to be moved to the cloud - Infrastructure contemplation for cloud - Available deployment models while moving to cloud											<b>CO-2 BTL-2</b>				

- Cloud migration checklist - Architecture of a cloud computing ecosystem - Applications of cloud computing - Preparing a plan for moving to cloud computing - Technologies utilized by cloud computing. <b>Suggested Readings:</b> Cloud Architecture		
<b>MODULE – 3 : UNDERSTANDING OF GCP</b>		<b>(9L)</b>
Different services offered by typical cloud vendors - Understanding cloud categories -Cloud Compute - Cloud Storage and databases - Cloud storage - Cloud Networking -Cloud Big Data - Cloud Data transfer - Cloud AI - Cloud IoT Core beta- cloud Management tools - cloud Developer tools. <b>Suggested Readings:</b> Interacting with Google Cloud Platform		<b>CO-3 BTL-3</b>
<b>MODULE – 4: DATA PROCESSING AND VISUALIZING</b>		<b>(9L)</b>
Cloud Dataflow - Cloud Pub/Sub - Cloud storage - Cloud storage classes - Cloud SQL - Cloud BigTable - Cloud Spanner - Cloud Datastore - Persistent disks. Google Big Query - Cloud Dataproc - Google Cloud Data lab - Data Studio - Google Compute Engine - Advantages of Compute Engine - Types of Compute Engine <b>Suggested Readings:</b> Querying and transforming data with BigQuery		<b>CO-4 BTL-4</b>
<b>MODULE 5: CASE STUDY</b>		<b>(9L)</b>
Google App Engine - Google Container Engine - Google Cloud Functions <b>Suggested Readings:</b> Troubleshooting Cloud		<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>		
1.	Sanket Thodge(2018), " <i>Cloud analytics with Google platform</i> ", Packt publishing	
<b>REFERENCE BOOKS</b>		
1.	John Myers(2015), " <i>Analytics in the Cloud</i> ", Red Paper, An Enterprise Management Associates® (EMATM) End-User Research Report.	
2.	Brendan Gregg(2014), " <i>Systems Performance: Enterprise and the Cloud</i> ", Prentice Hall.	
<b>E BOOKS</b>		
1.	<a href="https://smartbridge.com/cloud-analytics-ebook-accelerate-future-state/">https://smartbridge.com/cloud-analytics-ebook-accelerate-future-state/</a>	
2	<a href="https://azure.microsoft.com/en-in/resources/cloud-analytics-with-microsoft-azure/">https://azure.microsoft.com/en-in/resources/cloud-analytics-with-microsoft-azure/</a>	
<b>MOOC</b>		
1.	<a href="https://cloud.google.com/training">https://cloud.google.com/training</a>	

**ELECTIVE III**

COURSE TITLE		IMAGE PROCESSING					CREDITS		3						
COURSE CODE		CAD3725	COURSE CATEGORY			DE	L-T-P-S		3- 0- 0 -0						
Version	1.0	Approval Details		26 <sup>th</sup> ACM 23-03-2019			LEARNING LEVEL		BTL-3						
<b>ASSESSMENT SCHEME</b>															
First Periodical Assessment		Second Periodical Assessment		Seminar/ Assignments/ Project		Surprise Test / Quiz		Attendance		ESE					
15%		15%		10%		5%		5%		50%					
<b>Course Description</b>		This course covers the investigation, creation and manipulation of digital images by computer. The course consists of theoretical material introducing the mathematics of images and imaging. Topics include representation of two-dimensional data, time and frequency domain representations, filtering and enhancement, the Fourier transform, convolution, interpolation. The student will become familiar with Image Enhancement, Image Restoration, Image Compression, Morphological Image Processing, Image Segmentation etc.,													
<b>Course Objective</b>		<ol style="list-style-type: none"> <li>1. To develop a theoretical foundation of Digital Image Processing concepts.</li> <li>2. To understand the digital image fundamentals.</li> <li>3. To perform simple image processing techniques.</li> <li>4. To provide mathematical foundations for digital manipulation of images; image acquisition; pre-processing; segmentation; Fourier domain processing; and compression.</li> <li>5. To understand the image segmentation and representation techniques.</li> </ol>													
<b>Course Outcome</b>		<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>1. Describe the digital image fundamentals.</li> <li>2. Apply image enhancement and filtering techniques</li> <li>3. Implement image restoration and compression techniques</li> <li>4. Perform Color Image processing and Morphological Image processing</li> <li>5. Describe to segment and represent features of images and perform recognition.</li> </ol>													
<b>Prerequisites: Image Basics</b>															
<b>CO, PO AND PSO MAPPING</b>															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	2	3	-	3	2	3	2	2	3	-	3	2	3	2	1
CO-2	-	1	-	-	1	3	2	-	1	-	-	1	3	1	2
CO-3	-	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	2	1	2	2	2	1	2	2	1	2	2	2	1	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1 – DIGITAL IMAGE INTRODUCTION &amp; FUNDAMENTALS (9L)</b>															
Introduction to Digital Image Processing (DIP) - Fields that use Digital Image Processing, Fundamental Steps in Digital Image Processing – Components of an														<b>CO-1 BTL-3</b>	



Image processing System- Image acquisition –Image formation model- Image sampling and quantization - Relationship between pixels- Basic Intensity Transformation Function, Histogram processing. <b>Suggested Readings:</b> Components of an Image processing System		
<b>MODULE 2 – FILTERING IN SPATIAL AND FREQUENCY DOMAIN</b>		<b>(9L)</b>
Spatial Filters for Image enhancement: Fundamentals of Spatial Filtering - Smoothing and Sharpening Spatial Filters - Combining Spatial Enhancement Methods- Filtering in the Frequency Domain: Basics of Filtering in the Frequency Domain - Image Smoothing Using Frequency Domain Filters - Image Sharpening Using Frequency Domain Filters - Selective Filtering - Implementation. <b>Suggested Readings:</b> Image Sharpening, Spatial Enhancement		<b>CO-2 BTL-3</b>
<b>MODULE 3 – IMAGE RESTORATION AND COMPRESSION</b>		<b>(9L)</b>
Image Restoration: A model of the Image Degradation/Restoration Process - Noise Models, Restoration in the presence of Noise–Only Spatial Filtering - Periodic Noise Reduction by Frequency Domain Filtering- Linear Position-Invariant Degradations, Estimation of Degradation Function, Inverse Filtering - Weiner Filtering - Constrained Least Squares Filtering. Image Compression: Fundamentals, Compression Methods, Digital Image Watermarking. <b>Suggested Readings:</b> Image Restoration , Spatial Filtering		<b>CO-3 BTL-3</b>
<b>MODULE 4 – COLOR IMAGE AND MORPHOLOGICAL IMAGE PROCESSING</b>		<b>(9L)</b>
Color Image Processing: Color Fundamentals- Color Models- Pseudo Color Image Processing- Basics of Full–Color Image Processing - Color Transformations - Smoothing and Sharpening- Image Segmentation Based on Color. Morphological Image Processing: Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transformation, Morphological Algorithms, Gray-Scale Morphology. <b>Suggested Readings:</b> Erosion and Dilation , Smoothing and Sharpening		<b>CO-4 BTL-3</b>
<b>MODULE 5 – SEGMENTATION, REPRESENTATION AND RECOGNITION</b>		<b>(9L)</b>
Image Segmentation: Fundamentals - Point, Line, and Edge Detection- Thresholding - Region-Based Segmentation. Representation and Description: Representation- Boundary and Regional Descriptors - Use of Principal Components for Description. Object Recognition: Patterns and Pattern classes - Recognition based on Decision–Theoretic Methods- Structural methods. <b>Suggested Readings:</b> Thresholding Segmentation, Object Recognition		<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>		
1.	Rafael C. Gonzalez, Richard E.Woods(2017), " <i>Digital Image Processing</i> ," Pearson, Fourth Edition.	
<b>REFERENCE BOOKS</b>		
1	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, " <i>Digital Image Processing Using MATLAB</i> ", Third Edition Tata Mc Graw Hill Pvt. Ltd.	
<b>E BOOKS</b>		
1	Prof. P.K. Biswas, <i>Video lecture on Digital Image Processing, Centre for Educational Technology, IITKharagpur</i>	
2	<a href="http://nptel.ac.in/syllabus/syllabus.php?subjectId=117105079">http://nptel.ac.in/syllabus/syllabus.php?subjectId=117105079</a> .	
<b>MOOC</b>		
1.	<a href="https://www.coursera.org/learn/digital">https://www.coursera.org/learn/digital</a>	



COURSE TITLE		BLOCK CHAIN TECHNOLOGY				CREDITS	3								
COURSE CODE		CAD3726	COURSE CATEGORY		DE	L-T-P-S	3- 0- 0-0								
Version	1.0	Approval Details		26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL	BTL-3								
<b>ASSESSMENT SCHEME</b>															
First Periodical Assessment		Second Periodical Assessment		Seminar/ Assignments/ Project		Surprise Test / Quiz	Attendance	ESE							
15%		15%		10%		5%	5%	50%							
<b>Course Description</b>		Decentralized blockchain-based systems, such as Bitcoin and Ethereum, are successful beyond all expectations. Although still in their infancy, they promise to revolutionize how we think of financial, information, and other infrastructures. This course covers the technical aspects of public distributed ledgers, blockchain systems, cryptocurrencies, and smart contracts. Students will learn how these systems are built, how to interact with them, how to design and build secure distributed applications.													
<b>Course Objective</b>		<ol style="list-style-type: none"> <li>1. Understand how blockchain systems (mainly Bitcoin and Ethereum) work,</li> <li>2. To securely interact with them,</li> <li>3. Design, build, and deploy smart contracts and distributed applications,</li> <li>4. Integrate ideas from blockchain technology into their own projects</li> </ol>													
<b>Course Outcome</b>		<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>1. Describe the concepts of Cryptography and Basics of Blockchain.</li> <li>2. Design and implement a Hyperledger</li> <li>3. Describe the concept of cryptocurrencies and analyze the different types of Wallets.</li> <li>4. Analyze the various cryptocurrencies.</li> <li>5. Create smart contracts in Ethereum.</li> </ol>													
<b>Prerequisites: Basics of AI</b>															
<b>CO, PO AND PSO MAPPING</b>															
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	3	-	3	2	3	2	-	2	3	-	1	3	1	1
CO-2	-	1	-	-	1	3	2	-	-	1	2	3	-	3	2
CO-3	-	1	1	1	-	-	1	-	-	1	-	1	-	-	1
CO-4	1	1	1	1	-	1	-	1	1	1	-	1	1	1	2
CO-5	2	2	1	2	2	2	1	1	2	2	1	1	1	1	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1 – BLOCKCHAIN: INTRODUCTION</b>								<b>(9L)</b>							
Introduction to Cryptographic Concepts and cryptocurrencies, Blockchain: Defining the terms, Building blocks of Blockchain Frameworks, Fundamentals of the secure transaction processing protocol, Decentralization of Information, Centralized vs. Distributed Systems, Distributed vs. Decentralized Systems, Benefits of Decentralization, Business and Technology Considerations for choosing blockchain framework, Distributed Consensus, Blockchain Applications.														<b>CO-1</b>	
<b>Suggested Readings:</b> Cryptocurrencies, Distributed Systems, Decentralized Systems														<b>BTL-2</b>	

<b>MODULE 2 – HYPERLEDGER FABRIC</b>		<b>(9L)</b>
Exploring Hyperledger Fabric-Building on the foundation of open computing, Hyperledger frameworks, tools and building blocks, Hyperledger Fabric component design, sample transaction, governance in business networks powered by blockchain. <b>Suggested Readings:</b> Hyperledger frameworks		<b>CO-2 BTL-3</b>
<b>MODULE 3 – CRYPTOCURRENCY FUNDAMENTALS</b>		<b>(9L)</b>
History, Commonly Used Concepts, Cryptography, Wallets, Public and Private Keys in Cryptocurrency, Transactions, Hashes, Custodial vs. Non-custodial Wallets, Security Fundamentals, Pros and Cons of Different Types of Wallets, Mining, Block generation, Proof-of-Work, Proof-of-Stake, Other PoW, Brokerages, Exchanges, Custody, Analytics Information. <b>Suggested Readings:</b> Cryptocurrency, Different Types of Wallets.		<b>CO-3 BTL-3</b>
<b>MODULE 4 – Cryptocurrencies</b>		<b>(9L)</b>
Beginnings of Altcoins, Novel Concepts, Litecoin, Fun and Bad Experiments, Scaling debate, SegWit, Lightning, The Bitcoin Cash Fork, Bitcoin SV, NXT, Counterparty, ZCash, Other Privacy-Focused Cryptocurrencies, Drawbacks of Existing Consensus, Ripple, Stellar, Centralization Concerns. <b>Suggested Readings:</b> Altcoins, Litecoin , Bitcoin		<b>CO-4 BTL-3</b>
<b>MODULE 5: ETHEREUM</b>		<b>(9L)</b>
Evolution of Bitcoin, Colored Coins, Master coin, Omni Layer, Tether, Colored Coins and Tokens, Master coin, Understanding Omni Layer. Ethereum-Cryptocurrency, Smart contracts, Use cases, Decentralized autonomous organizations (DAO), Key Organizations in Ethereum Ecosystem. Dapps-Use cases, State of Ethereum Dapps, Challenges developing Dapps, Deploying and Executing Smart Contracts in Ethereum, Ethereum Virtual Machine, Read and Write Contract. Tokens on the Ethereum Platform. <b>Suggested Readings:</b> Ethereum , Master coin , Decentralized autonomous organizations		<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>		
1.	Lorne Lantz, Daniel Cawrey(2019), <i>Mastering Blockchain: Unlocking the power of Cryptocurrencies and Smart contracts</i> , O'Reilly Media, Inc.	
<b>REFERENCE BOOKS</b>		
1.	Arvind Narayanan, Joseph Bonneau(2016), <i>Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction</i> , Princeton University Press.	
<b>E BOOKS</b>		
1.	<a href="https://www.velmie.com/practical-blockchain-study">https://www.velmie.com/practical-blockchain-study</a>	
<b>MOOC</b>		
1.	<a href="https://nptel.ac.in/courses/106105184/">https://nptel.ac.in/courses/106105184/</a>	

COURSE TITLE		SEMANTIC WEB				CREDITS	3								
COURSE CODE		CAB3725	COURSE CATEGORY		DE	L-T-P-S	3-0-0-0								
Version	1.0	Approval Details		26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL	BTL-3								
<b>ASSESSMENT SCHEME</b>															
First Periodical Assessment		Second Periodical Assessment		Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE								
15%		15%		10%	5%	5%	50%								
<b>Course Description</b>		This course covers the fundamental concepts, advantages and limits of the semantic web; understand and use ontologies in the context of Computer Science and the semantic web; use the RDF framework and associated technologies.													
<b>Course Objective</b>		<ol style="list-style-type: none"> <li>1. To understand the basic concepts behind Semantic Web.</li> <li>2. To model ontologies using Resource Description Framework (RDF).</li> <li>3. To model and design ontologies using Web Ontology Language (OWL).</li> <li>4. To query ontologies using SPARQL</li> <li>5. To understand and reflect on the principles of Ontology Engineering.</li> </ol>													
<b>Course Outcome</b>		<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>1. Describe the knowledge Representation for the Semantic Web</li> <li>2. Design Resource design framework schemas</li> <li>3. Model Ontology using SPARQL and OWL</li> <li>4. Illustrate various rules for ontology.</li> <li>5. Describe the principles of Ontology Engineering.</li> </ol>													
<b>Prerequisites: Computer Network</b>															
<b>CO, PO AND PSO MAPPING</b>															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO-1	3	2	3	-	3	2	3	2	-	2	3	-	3	1	2
CO-2	3	3	1	-	-	1	3	2	3	-	3	2	3	2	1
CO-3	3	2	1	1	1	-	-	1	1	-	-	1	3	2	2
CO-4	2	2	1	1	1	-	1	-	1	1	1	-	-	1	1
CO-5	3	2	3	2	1	1	1	1	1	1	1	-	1	-	3
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: SEMANTIC WEB VISION (9L)</b>															
Motivation for the Semantic Web - Design Decisions for the Semantic Web - Basic Technology for the Semantic Web - The Web Architecture of the Semantic Web - Semantic Web Technologies - A Layered Approach							<b>CO-1 BTL-3</b>								
<b>Suggested Readings: Architecture of the Semantic Web</b>															
<b>MODULE 2: DESCRIBING WEB RESOURCES: RDF (9L)</b>															
Introduction - RDF: Data Model - RDF Syntaxes - RDFS: Adding Semantics - RDF Schema: The Language - RDF and RDF Schema in RDF Schema - An Axiomatic Semantics for RDF and RDF Schema - A Direct Inference System for RDF and RDFS							<b>CO-2 BTL-3</b>								
<b>Suggested Readings: RDF Schema</b>															
<b>MODULE 3: SPARQL and OWL (9L)</b>															
SPARQL Infrastructure - Basics: Matching Patterns - Filters - Constructs for Dealing with an Open World - Organizing Result Sets - Other Forms of SPARQL Queries -							<b>CO-3 BTL-3</b>								

Querying Schemas - Adding Information with SPARQL Update - The Follow Your Nose Principle - Requirements for Ontology Languages - Compatibility of OWL2 with RDF/RDFS - The OWL Language - OWL2 Profiles <b>Suggested Readings:</b> SPARQL Queries, OWL Language		
<b>MODULE 4: LOGIC AND INTERFACES: RULES</b>		<b>(9L)</b>
Introduction - Example of Monotonic Rules: Family Relationships - Monotonic Rules: Syntax - Monotonic Rules: Semantics - OWL2 RL: Description Logic Meets Rules - Rule Interchange Format: RIF - Semantic Web Rules Language (SWRL) - Rules in SPARQL: SPIN - Nonmonotonic Rules: Motivation and Syntax - Example of Nonmonotonic Rules: Brokered Trade - Rule Markup Language (RuleML) <b>Suggested Readings:</b> Rule Markup Language		<b>CO-4 BTL-3</b>
<b>MODULE 5: ONTOLOGY ENGINEERING</b>		<b>(9L)</b>
Constructing Ontologies Manually - Reusing Existing Ontologies - Semiautomatic Ontology Acquisition - Ontology Mapping - Exposing Relational Databases - Semantic Web Application Architecture <b>Suggested Readings:</b> Ontology Populating		<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>		
1.	Grigoris Antoniou Paul Groth Frank van Harmelen Rinke Hoekstra(2012), " <i>A Semantic Web Primer</i> ", Third edition, MIT Press .	
2.	Peter Mika(2007), <i>Social Networks and the Semantic Web</i> , Springer Publications	
<b>REFERENCE BOOKS</b>		
1.	J. Davies, R. Studer, P. Warren(2006), <i>Semantic Web Technologies, Trends and Research in Ontology Based Systems</i> , John Wiley & Sons.	
2.	Liyang Lu Chapman and Hall(2006), <i>Semantic Web and Semantic Web Services</i> , CRC Publishers,(Taylor & Francis Group)	
<b>E BOOKS</b>		
1.	<a href="http://ebooks.iospress.nl/volume/ontology-and-the-semantic-web">http://ebooks.iospress.nl/volume/ontology-and-the-semantic-web</a>	
2.	<a href="https://link.springer.com/book/10.1007/978-1-84628-710-7">https://link.springer.com/book/10.1007/978-1-84628-710-7</a>	
<b>MOOC</b>		
1.	<a href="http://videlectures.net/iswc08_hendler_ittsw/">http://videlectures.net/iswc08_hendler_ittsw/</a>	
2.	<a href="https://www.coursera.org/learn/web-data#syllabus">https://www.coursera.org/learn/web-data#syllabus</a>	

COURSE TITLE		DATA VISUALIZATION TECHNIQUES AND TOOLS			CREDITS	3
COURSE CODE		CAB3726	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details	26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE	
15%	15%	10%	5%	5%	50%	
Course Description	Data visualization is the graphical representation of information and data. By using visual elements like charts, graphs, and maps, data visualization tools provide an accessible way to see and understand trends, outliers, and patterns in data.					

<b>Course Objective</b>	<ol style="list-style-type: none"> <li>1. To identify, formulate, and solve complex engineering problems by applying principles</li> <li>2. To apply engineering design to produce solutions that meet specified needs</li> <li>3. To function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment,</li> <li>4. To develop and conduct appropriate experimentation, analyze and interpret data.</li> <li>5. To acquire and apply new knowledge as needed, using appropriate learning strategies.</li> </ol>														
<b>Course Outcome</b>	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>1. Describe Data visualization, process and its relationships</li> <li>2. Apply the Use of visualization applications to explore the data</li> <li>3. Implement Layout and Mapping process to create effective visualizations</li> <li>4. Create and motivate the story telling principles and interaction methods</li> <li>5. Generate web-based visualizations using D3 and Java script.</li> </ol>														
<b>Prerequisites: Python and R</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>CO-1</b>	3	-	3	2	3	2	-	2	3	3	-	3	2	3	1
<b>CO-2</b>	1	-	-	1	3	2	-	-	1	1	-	-	1	3	3
<b>CO-3</b>	1	1	1	-	-	1	-	-	1	1	1	1	-	-	1
<b>CO-4</b>	1	1	1	-	1	-	1	1	1	1	1	1	-	1	2
<b>CO-5</b>	2	1	2	2	2	1	1	2	2	2	1	2	2	2	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION (9L)</b>															
Data Visualization-Introduction, Data to visualization, Data Visualization process - Data Types and Dataset Types, relationships and visualization formats- Basic Principles for data visualization - Spatial Data, Graphic Design, Graphical Integrity. <b>Suggested Readings:</b> Data Visualization														<b>CO-1 BTL-2</b>	
<b>MODULE 2: DATA-DRIVEN DOCUMENTS (D3) (9L)</b>															
HTML, CSS, DOM, JavaScript and SVG method chaining, D3: introduction, D3 Key Features- Data – Binding Data. Drawing with Data- Setting Attributes, Setting Styles Sketching, Drawing SVGs, Making Bar Charts, Making Scatter plots, Scales, Statistical Graphs, Axes, HD data, filtering, updates, transition and motion, paths, Brushing & Linking. Animation. Aggregation, Tree and Network <b>Suggested Readings:</b> Data driven document generation														<b>CO-2 BTL-3</b>	
<b>MODULE 3: LAYOUT AND MAPPING (9L)</b>															
Layouts: Pie Layout, Stack Layout, Force Layout Maps. Dot density maps, Geomapping: JSON, Projection, Choropleth Maps, data by country, Symbol Maps, Panning, Cartograms, Zooming, Visual Channels, Value labels, Acquiring and preparing raw Geodata, Exporting. <b>Suggested Readings:</b> Layout and mapping														<b>CO-3 BTL-3</b>	
<b>MODULE 4: COLOR PROCESSING (9L)</b>															
Color: Introduction, Color Processing. Human color perception, Color blindness,														<b>CO-4</b>	

opponent process theory Color Spaces. Uniform color spaces, simultaneous contrast, Reflection and absorption, Colors for Visualization- Cognition. Looking vs. Seeing. Image Gist. Gestalt Principles. Visual Attention. Visual Working & Long-Term Memory. <b>Suggested Readings:</b> Color Layout descriptor		<b>BTL-3</b>
<b>MODULE 5: INTERACTION, TABLES AND PRESENTATIONS (9L)</b>		
Types of interaction- feedback/animation, Visual Story Telling. Selection, details and highlighting, zooming, semantic zooming, van Wijk smooth zooming, Views: Reducing attributes, Multiple views Multiform views small multiples, interaction with Multiform and small multiples, Brushing navigation, navigation constraints. Messaging. Effective Presentations. <b>Suggested Readings:</b> Multiple visualization techniques.		<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>		
1	Claus O Wilke(2019), " <i>Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures</i> ", 1st Edition, O'Reilly Media.	
<b>REFERENCE BOOKS</b>		
1.	Ben Fry(2007), " <i>Visualizing Data: Exploring and Explaining Data with the Processing Environment</i> " O'Reilly Media.	
2.	Scott Murray(2013), " <i>Interactive Data Visualization for the Web</i> " O'Reilly Media.	
<b>E BOOKS</b>		
1	<a href="https://www.ebooks.com/en-af/book/209748129/learn-d3-js/helder-da-rocha/">https://www.ebooks.com/en-af/book/209748129/learn-d3-js/helder-da-rocha/</a>	
2.	<a href="https://www.netquest.com/en/download-ebook-data-visualization">https://www.netquest.com/en/download-ebook-data-visualization</a>	
<b>OOC</b>		
1.	<a href="https://www.edx.org/course/cybersecurity-fundamentals">https://www.edx.org/course/cybersecurity-fundamentals</a>	
2.	<a href="https://www.coursera.org/specializations/cyber-security">https://www.coursera.org/specializations/cyber-security</a>	

COURSE TITLE		CLOUD SECURITY			CREDITS	3
COURSE CODE		CAC3725	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details	26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE	
15%	15%	10%	5%	5%	50%	
Course Description	To provide students with the fundamentals and essentials of Cloud Computing. 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.					
Course Objective	<ol style="list-style-type: none"> <li>To provide students with the fundamentals and essentials of Cloud Computing.</li> <li>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.</li> </ol>					

	<ol style="list-style-type: none"> <li>To enable students exploring some important cloud computing driven commercial systems and applications.</li> <li>To design security architectures that assures secure isolation of physical and logical infrastructures.</li> <li>To expose the students to frontier areas of Cloud Computing and information systems</li> </ol>														
<b>Course Outcome</b>	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>Describe the security architecture of cloud computing and security service models.</li> <li>Analyze the Strategies for Secure Operation the cloud architecture and list the security requirements.</li> <li>Describe different key strategies for data security and apply the best practice models in real time application.</li> <li>Apply the security model for cloud application with network, data and security considerations.</li> <li>Develop an information security framework model for cloud operation.</li> </ol>														
<b>Prerequisites: Network Security</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PS O1</b>	<b>PS O2</b>	<b>PS O3</b>
<b>CO-1</b>	3	-	3	2	3	2	-	2	3	-	3	-	3	2	1
<b>CO-2</b>	1	-	-	1	3	2	-	-	1	2	1	-	-	2	3
<b>CO-3</b>	1	1	1	-	-	1	-	-	1	-	1	1	1	1	1
<b>CO-4</b>	1	1	1	-	1	-	1	1	1	-	1	1	1	2	-
<b>CO-5</b>	2	1	2	2	2	1	1	2	2	1	2	1	2	2	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION</b>														<b>(9L)</b>	
Introduction to Cloud Computing and Security: Understanding Cloud Computing - The IT Foundation for Cloud- overview of Security Architecture, Cloud Computing Architecture: Cloud Reference Architecture-Control over Security in the Cloud Model- Cloud Deployment & Services Models- Key Examples. <b>Suggested Readings:</b> Overview of Security Architecture														<b>CO-1 BTL-2</b>	
<b>MODULE 2: SECURING THE CLOUD: ARCHITECTURE</b>														<b>(9L)</b>	
Cloud Computing: Security Concerns- Risk Tolerance- Legal and Regulatory Issues, Security Requirements for the Architecture-Security Patterns and Architectural Elements-Cloud Security Architecture-Key Strategies for Secure Operation. <b>Suggested Readings:</b> Security Requirements for the Architecture														<b>CO-2 BTL-3</b>	
<b>MODULE 3: DATA SECURITY AND KEY STRATEGIES</b>														<b>(9L)</b>	
Overview of Data Security in Cloud Computing-Common Risks with Cloud Data Security- Data Encryption: Applications and Limits- Errors with Data Encryption-Cloud Data Security: Sensitive Data Categorization, Cloud Data Storage-Roach Motel Syndrome, Overall Strategy: Effectively Managing Risk, Overview of Security Controls, Overview of Security Controls, The Limits of Security Controls, Best Practices, Security Monitoring. <b>Suggested Readings:</b> Cloud Data Security														<b>CO-3 BTL-3</b>	
<b>MODULE 4: SECURITY CRITERIA</b>														<b>(9L)</b>	
Private Clouds: Motivation and Overview-Security Implications: Shared versus Dedicated Resources, Security Criteria for Ensuring a Private Cloud - Network														<b>CO-4 BTL-3</b>	



Considerations- Data Center Considerations- Operational Security Considerations- Regulation, Selecting a CSP: Overview of Assurance, Overview of Risks, Security Criteria- Revisiting Defense-in-depth- Additional Security-relevant Criteria. <b>Suggested Readings:</b> Operational Security Considerations		
<b>MODULE 5: INFORMATION SECURITY FRAMEWORK AND CLOUD OPERATION (9L)</b>		
Evaluating Cloud Security, Checklists for Evaluating Cloud Security- Foundational Security- Business Considerations- Defense-in-depth- Operational Security, operating a Cloud: From Architecture to Efficient and Secure Operations, Bootstrapping Secure Operations, Security Operations Activities- Business Continuity, Backup, and Recovery- Managing Changes in Operational Environments - Information Security Management - Vulnerability and Penetration Testing, Security Monitoring and Response. <b>Suggested Readings:</b> Security Operations Activities		<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>		
1.	Vic (J.R.) Winkler(2011), " <i>Securing the Cloud: Cloud Computer Security Techniques and Tactics</i> ", Elsevier publications.	
<b>REFERENCE BOOKS</b>		
1	Curtis Franklin, Jr. ,Brian J. S. Chee(2019), " <i>Securing the Cloud: Security Strategies for the Ubiquitous Data Center</i> ", CRC Press.	
<b>E BOOKS</b>		
1.	<a href="https://solutionsreview.com/cloud-platforms/free-cloud-computing-ebooks/">https://solutionsreview.com/cloud-platforms/free-cloud-computing-ebooks/</a>	
<b>MOOC</b>		
1.	<a href="https://www.coursera.org/learn/cloud-computing-security">https://www.coursera.org/learn/cloud-computing-security</a>	

COURSE TITLE		CLOUD STORAGE AND SECURITY			CREDITS	3
COURSE CODE		CAC3726	COURSE CATEGORY	DE	L-T-P-S	3- 0- 0-0
Version	1.0	Approval Details	26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>						
First Periodical Assessment		Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%		15%	10%	5%	5%	50%
<b>Course Description</b>		This course provides a comprehensive view of storage and networking infrastructures for highly virtualized cloud ready deployments. The course discusses the concepts and features related to Virtualized datacenter and cloud, Information storage security and design, storage network design and cloud optimized storage. The issues related multi tenancy operation, virtualized infrastructure security and methods to improve virtualization security are also dealt with in this course				
<b>Course Objective</b>		<ol style="list-style-type: none"> <li>To critically appraise the opportunities and challenges of information management in complex business environments</li> <li>To evaluate information storage management design in a cloud environment and how it relates to the business objectives of an organization</li> <li>To analyze the role technology plays in the design of a storage solution in a cloud architecture</li> </ol>				



	<ol style="list-style-type: none"> <li>4. To compare modern security concepts as they are applied to cloud computing</li> <li>5. To assess the security of virtual systems</li> <li>6. To evaluate the security issues related to multi-tenancy</li> </ol>														
<b>Course Outcome</b>	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>1. Describe the basics of data storage, Virtualization and storage services</li> <li>2. Analyze the infrastructures for Cloud and Virtual Environments</li> <li>3. Evaluate the storage network security</li> <li>4. Analyze the role technology plays in the design of a storage solution in a cloud architecture</li> <li>5. Describe server Virtualization and Connectivity</li> </ol>														
<b>Prerequisites: Cloud Computing</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PS O1</b>	<b>PS O2</b>	<b>PS O3</b>
<b>CO-1</b>	3	-	3	2	3	2	3	-	3	2	3	2	3	2	1
<b>CO-2</b>	1	-	-	1	3	2	1	-	-	1	3	2	1	-	2
<b>CO-3</b>	1	1	1	-	-	1	1	1	1	-	-	1	-	-	1
<b>CO-4</b>	1	1	1	-	1	-	1	1	1	-	1	-	1	1	2
<b>CO-5</b>	2	1	2	2	2	1	2	1	2	2	2	1	1	2	2
<b>CO-1</b>	3	-	3	2	3	2	3	-	3	2	3	2	3	2	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1 – INTRODUCTION</b>														<b>(9L)</b>	
<p>Importance of data storage - Business issues and IT challenges - Business and IT opportunities - opportunity for Cloud, Virtualization and Data Storage Networking - Server and Storage I/O Fundamentals - I/O connectivity and Networking Fundamentals - IT Clouds - Virtualization - Virtualization and Storage Services - Data and Storage Access.</p> <p><b>Suggested Readings:</b> Data Storage Networking, Networking Fundamentals.</p>														<b>CO-1 BTL-2</b>	
<b>MODULE 2 – INFRASTRUCTURE RESOURCE MANAGEMENT</b>														<b>(9L)</b>	
<p>Managing Data Infrastructures for Cloud and Virtual Environments - Introduction to Infrastructure resource management - understanding and managing IT Resources - Service offerings - Categories - and Technology Alignment - Gaining Situational Awareness and control - From SRM - E2E SRA - Search and eDiscovery - Performance and Capacity Planning - Data Movement and Migration. <b>Suggested Readings:</b> Data Infrastructures, Data Movements.</p>														<b>CO-2 BTL-3</b>	
<b>MODULE 3 – DATA AND STORAGE NETWORK SECURITY</b>														<b>(9L)</b>	
<p>Being Secure without Being Scared - Eliminating Blind Spots, Gaps in Coverage, or Dark Territories - Security Threat Risks Challenges - Taking Action to resources - Securing Networks- Securing Storage - Virtual Servers, Physical Servers and Desktops - Security Clouds - Disposing of Digital Assets and Technology - Security Checklist. <b>Suggested Readings:</b> Blind Spots, Dark Territories, Physical Servers</p>														<b>CO-3 BTL-3</b>	
<b>MODULE 4 – STORAGE SERVICES AND SYSTEMS</b>														<b>(9L)</b>	

Tiered Storage - storage Reliability - Availability - Serviceability (RAS) - Storage Services and Functionalities - Storage System Architectures - Storage Virtualization and Virtual Storage. <b>Suggested Readings:</b> Storage Services		<b>CO-4 BTL-3</b>
<b>MODULE 5 - SERVER VIRTUALIZATION AND CONNECTIVITY</b>		<b>(9L)</b>
Virtual Servers - Inside Virtual Servers and Virtual Machines - Virtual Desktop Infrastructures - Cloud and Virtual Servers - Networking Challenges - I/O and Networking Bits and Bytes, Decoding Encoding, I/O and Networking Fundamentals - Virtual Servers - I/O Networking Devices - Converged and Unified Networking - Local Networking - Enabling Distance - Cloud virtualization and management topics - Configuring for reliability, availability and Serviceability (RAS). <b>Suggested Readings:</b> Virtual Servers, Unified Networking.		<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>		
1.	Greg Schulz(2012) <i>"Cloud and Virtual Data Storage Networking"</i> , Auerbach Publications [ISBN: 978-1439851739].	
2.	EMC Education Services (2012), <i>"Information Storage and Management"</i> Wiley; 2 edition [ISBN: 978- 0470294215],2012.	
<b>REFERENCE BOOKS</b>		
1.	Volker Herminghaus, Albrecht Scriba(2009), <i>"Storage Management in Data Centers"</i> Springer; edition [ISBN: 978-3540850229].	
<b>E BOOKS</b>		
1.	<a href="https://solutionsreview.com/cloud-platforms/free-cloud-computing-ebooks/">https://solutionsreview.com/cloud-platforms/free-cloud-computing-ebooks/</a>	
<b>MOOC</b>		
1.	<a href="https://nptel.ac.in/courses/106/105/106105167/#">https://nptel.ac.in/courses/106/105/106105167/#</a>	

**ELECTIVE IV**

<b>COURSE TITLE</b>		<b>NATURAL LANGUAGE PROCESSING</b>				<b>CREDITS</b>	<b>3</b>								
<b>COURSE CODE</b>		<b>CAD3727</b>	<b>COURSE CATEGORY</b>		<b>DE</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>								
<b>Version</b>	<b>1.0</b>	<b>Approval Details</b>		<b>26<sup>th</sup> ACM 23-03-2019</b>		<b>LEARNING LEVEL</b>	<b>BTL-3</b>								
<b>ASSESSMENT SCHEME</b>															
<b>First Periodical Assessment</b>		<b>Second Periodical Assessment</b>		<b>Seminar/ Assignments/ Project</b>		<b>Surprise Test / Quiz</b>	<b>Attendance</b>								
<b>15%</b>		<b>15%</b>		<b>10%</b>		<b>5%</b>	<b>5%</b>								
<b>ESE</b>		<b>50%</b>													
<b>Course Description</b>		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.													
<b>Course Objective</b>		<ol style="list-style-type: none"> <li>To understand to How key concepts from NLP are used to describe and analyze language ·</li> <li>To label text for various applications like Named Entity Recognition.</li> <li>To tag text using context free grammar for English language ·</li> <li>To understand semantics and pragmatics of English language for processing ·</li> <li>To describe the application based on natural language processing based on syntactic, semantic and pragmatic processing.</li> </ol>													
<b>Course Outcome</b>		<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>Describe the basic concepts related to language processing.</li> <li>Analyze the language morphologically.</li> <li>Illustrate various parsing techniques.</li> <li>Analyze the semantic content of text.</li> <li>Develop any one Natural Language Processing application.</li> </ol>													
<b>Prerequisites: Machine Learning</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PS O1</b>	<b>PS O2</b>	<b>PS O3</b>
<b>CO-1</b>	3	-	3	2	3	2	-	-	1	-	3	-	3	2	1
<b>CO-2</b>	1	-	-	1	3	2	-	-	-	2	1	-	-	1	-
<b>CO-3</b>	1	1	1	-	-	1	-	-	1	-	1	1	1	-	1
<b>CO-4</b>	1	1	1	-	1	-	-	-	-	-	1	1	1	-	2
<b>CO-5</b>	2	1	2	2	2	1	3	-	2	-	-	3	3	3	3
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: INTRODUCTION</b>							<b>(9L)</b>								
Introduction to NLP, NLP and its neighbors, 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. <b>Suggested Readings:</b> Language modeling, English Grammar							<b>CO-1 BTL-3</b>								
<b>MODULE 2: SEQUENCE LABELLING AND APPLICATIONS</b>							<b>(9L)</b>								
Sequence Labeling as Classification - Sequence labeling as structure prediction - The Viterbi Algorithm - Hidden Markov Models - Discriminative Sequence labeling with							<b>CO-2</b>								

features - Neural sequence labeling - Unsupervised sequence labeling - Part -of - Speech Tagging, Morphosyntactic Attributes - Named Entity Recognition - Tokenization - Code Switching - Dialogue Acts <b>Suggested Readings:</b> Word class, Markov Models	<b>BTL-3</b>
<b>MODULE 3: PARSING METHODS (9L)</b>	
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 <b>Suggested Readings:</b> Context free grammars, Parsing	<b>CO-3 BTL-3</b>
<b>MODULE 4: SEMANTIC ANALYSIS (9L)</b>	
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 - 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 <b>Suggested Readings:</b> Semantic Role Labeling, Word Embeddings	<b>CO-4 BTL-3</b>
<b>MODULE 5: APPLICATIONS (9L)</b>	
Sentiment and Opinion Analysis, Question Answering system, Dialog Systems and Chatbots, Word sense disambiguation <b>Suggested Readings:</b> NLP Applications	<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>	
1. Dan Jurafsky and James H. Martin(2017), <i>Speech and Language Processing</i> (3rd ed. draft). Pearson Education India	
<b>REFERENCE BOOKS</b>	
1. Jacob Eisenstein(2018), <i>Natural Language Processing</i> , MIT Press.	
<b>E BOOKS</b>	
1. <a href="https://www.cs.vassar.edu/~cs366/docs/Manning_Schuetze_StatisticalNLP.pdf">https://www.cs.vassar.edu/~cs366/docs/Manning_Schuetze_StatisticalNLP.pdf</a>	
<b>MOOC</b>	
1. <a href="https://www.coursera.org/learn/language-processing">https://www.coursera.org/learn/language-processing</a>	

COURSE TITLE		DISTRIBUTED COMPUTING			CREDITS	4
COURSE CODE		CAD3728	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details	26 <sup>th</sup> ACM 23-03-2019		LEARNING LEVEL	BTL-3
<b>ASSESSMENT SCHEME</b>						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments / Project	Surprise Test / Quiz	Attendance	ESE	
15%	15%	10%	5%	5%	50%	
Course Description	This course introduces about the main concepts of underlying distributed systems namely processes, communication, naming, synchronization, consistency, fault tolerance, and security.					
Course Objective	1. To provide a support for hardware and software problems in modern distributed systems.					

	2. To expose students to both the abstraction and details of file systems 3. To provide knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, Deadlock, security, and distributed file systems. 4. To give the knowledge on Checkpoint and recovery algorithms														
<b>Course Outcome</b>	Upon completion of this course, the students should be able to 1. Describe the Distributed Computation Models. 2. Describe Message passing paradigms in distributed environment 3. Sketch the Mutual Exclusive algorithms 4. Describe Deadlock detection algorithms 5. Perform Checkpoint and Recovery algorithms.														
<b>Prerequisites: Database</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PS O1</b>	<b>PS O2</b>	<b>PS O3</b>
<b>CO-1</b>	3	-	3	2	3	2	-	3	-	3	2	3	2	-	2
<b>CO-2</b>	1	-	-	1	3	2	-	1	-	-	1	3	2	-	2
<b>CO-3</b>	1	1	1	-	-	1	-	1	1	1	-	-	1	-	-
<b>CO-4</b>	1	1	1	-	1	-	1	1	1	1	-	1	-	1	1
<b>CO-5</b>	2	1	2	2	2	1	1	2	1	2	2	2	1	1	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1 – DISTRIBUTED COMPUTATIONS (9L)</b>															
Distributed Systems - Global State, Model of Distributed Executions, Models of communication networks, Models of process communications, Logical Time – Framework, Scalar Time, Vector Time, Jard–Jourdan’s adaptive technique, Matrix Time, Virtual Time, Physical clock synchronization. <b>Suggested Readings:</b> Synchronization														<b>CO-1 BTL-2</b>	
<b>MODULE 2 – MESSAGE ORDERING AND GROUP COMMUNICATION (9L)</b>															
Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Multicast algorithms, Fault-tolerant group communication. <b>Suggested Readings:</b> Fault-tolerant group communication														<b>CO-2 BTL- 3</b>	
<b>MODULE 3 – DISTRIBUTED MUTUAL EXCLUSION ALGORITHMS (9L)</b>															
Lodha and Kshemkalyani’s fair mutual exclusion algorithm, Agarwal–El Abbadi quorum-based algorithm, Token-based algorithms, Suzuki–Kasami’s broadcast algorithm, distributed shared memory - Memory consistency models, Shared memory mutual exclusion, Wait-freedom method. <b>Suggested Readings:</b> Mutual exclusion algorithm														<b>CO-3 BTL-3</b>	
<b>MODULE 4 – DEADLOCK DETECTION IN DISTRIBUTED SYSTEMS (9L)</b>															
Models of deadlocks - Knapp’s classification of distributed deadlock detection algorithms, Mitchell and Merritt’s algorithm for the singlere source model, Chandy–Misra–Haas algorithm for the AND model, Chandy–Misra–Haas algorithm for the OR model, Kshemkalyani–Singhal algorithm for the P-out-of-Q model. <b>Suggested Readings:</b> Chandy–Misra–Haas algorithm														<b>CO-4 BTL-3</b>	

<b>MODULE 5 – CHECKPOINTING AND ROLLBACK RECOVERY (9L)</b>	
Failure recovery – Issues, Checkpoint-based recovery - Asynchronous checkpointing and recovery, Synchronous checkpointing algorithm, Log-based rollback recovery, Unreliable failure detectors, An adaptive failure detection protocol. <b>Suggested Readings:</b> Checkpointing algorithm	<b>CO-5 BTL-3</b>
<b>TEXT BOOKS</b>	
1	Ajay D. Kshemkalyani, Mukesh Singhal(2017), “ <i>Distributed Computing Principles, Algorithms, and Systems</i> ”, Cambridge University Press.
<b>REFERENCE BOOKS</b>	
1.	Hagit Attiya, Jennifer Welch(2015), “ <i>Distributed Computing, Fundamentals, Simulations and Advanced Topics</i> , Wiley Publishers
<b>E BOOKS</b>	
1.	<a href="https://eclass.uoa.gr/modules/document/file.php/D245/2015/DistrComp.pdf">https://eclass.uoa.gr/modules/document/file.php/D245/2015/DistrComp.pdf</a>
<b>MOOC</b>	
1.	<a href="https://www.coursera.org/learn/distributed-programming-in-java">https://www.coursera.org/learn/distributed-programming-in-java</a>

<b>COURSE TITLE</b>		<b>AUGMENTED AND VIRTUAL REALITY</b>			<b>CREDITS</b>	<b>3</b>									
<b>COURSE CODE</b>		<b>CAD3729</b>	<b>COURSE CATEGORY</b>	<b>DE</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>									
<b>Version</b>	<b>1.0</b>	<b>Approval Details</b>		<b>26<sup>th</sup> ACM 23-03-2019</b>	<b>LEARNING LEVEL</b>	<b>BTL-3</b>									
<b>ASSESSMENT SCHEME</b>															
<b>First Periodical Assessment</b>	<b>Second Periodical Assessment</b>	<b>Seminar/ Assignments/ Project</b>	<b>Surprise Test / Quiz</b>	<b>Attendance</b>	<b>ESE</b>										
<b>15%</b>	<b>15%</b>	<b>10%</b>	<b>5%</b>	<b>5%</b>	<b>50%</b>										
<b>Course Description</b>	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.														
<b>Course Objective</b>	<ol style="list-style-type: none"> <li>1. To understand basics of virtual and augmented reality</li> <li>2. To create 3D scenes to learn about world space and scale</li> <li>3. To move around your scenes using locomotion and teleportation</li> <li>4. To create social VR experiences with Unity networking</li> <li>5. To write C# script to create buttons and layers to publish in VR devices</li> </ol>														
<b>Course Outcome</b>	Upon completion of this course, the students should be able to <ol style="list-style-type: none"> <li>1. Create Virtual reality and Augmented reality ideas</li> <li>2. Perform navigation around 3D world</li> <li>3. Describe to build VR Rigs</li> <li>4. Perform ray casting by detecting colliding objects</li> <li>5. Design applications for different XR Platforms</li> </ol>														
<b>Prerequisites: Multimedia basics</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PS O1</b>	<b>PS O2</b>	<b>PS O3</b>

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	-
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1 – VIRTUAL REALITY AND VIRTUAL ENVIRONMENTS</b>															<b>(9L)</b>
Introduction - Virtual Reality – Types – Virtual Reality Vs Augmented Reality – Applications – 3D interfaces. VR Environment: Unity overview: Interface – Navigation – Game Objects – Hierarchy <b>Suggested Readings:</b> Desktop VR, Mobile VR														<b>CO-1 BTL-2</b>	
<b>MODULE 2 – BUILDING SIMPLE SCENES</b>															<b>(9L)</b>
Parenting objects – Using Asset store – Importing plug-ins – Moving scaling objects – Creating terrains – Creating game objects – Physics <b>Suggested Readings:</b> Unity editor, creating 3D objects with blender														<b>CO-2 BTL-2</b>	
<b>MODULE 3 – BUILDING VR RIGS</b>															<b>(9L)</b>
Open VR and Building a VR Rig – Coding movement in VR – Grabbing and Throwing objects <b>Suggested Readings:</b> Web and JavaScript based VR														<b>CO-3 BTL-3</b>	
<b>MODULE 4 – RAYCASTING INTERACTIONS</b>															<b>(9L)</b>
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 <b>Suggested Readings:</b> Activating Buttons from the Script														<b>CO-4 BTL-3</b>	
<b>MODULE 5 – AUGMENTED REALITY</b>															<b>(9L)</b>
AR Foundation – Introduction to Vuforia – Plane Tracking – Spatial Mapping – Occlusion – Design a simple UI in AR – Object interactions <b>Suggested Readings:</b> Setting up Vuforia, Setting up AR Toolkit														<b>CO-5 BTL-3</b>	
<b>TEXT BOOKS</b>															
1.	Jesse Glover, Jonathan Linowe(2019), <i>Complete Virtual Reality and Augmented Reality Development with Unity: Leverage the power of Unity and become a pro at creating mixed reality applications</i> , Packt publishing														
2	Jonathan Linowes(2018), <i>Unity Virtual Reality Projects</i> , Packt, Second Edition														
<b>REFERENCE BOOKS</b>															
1.	Erin Pangilinan, Steve Lukas, Vasanth Mohan(2019), <i>Creating Augmented and Virtual Realities: Theory and Practice for Next Generation Spatial Computing</i> , O'Reilly.														
<b>E BOOKS</b>															
1.	<a href="https://www.springer.com/gp/book/9783030062453">https://www.springer.com/gp/book/9783030062453</a>														
<b>MOOC</b>															
1.	<a href="https://in.udacity.com/course/introduction-to-virtual-reality--ud1012">https://in.udacity.com/course/introduction-to-virtual-reality--ud1012</a>														

COURSE TITLE		DATA CLASSIFICATION METHODS AND EVALUATION						CREDITS		3					
COURSE CODE		CAB3727		COURSE CATEGORY			DE	L-T-P-S		3-0-0-0					
Version	1.0	Approval Details		26 <sup>th</sup> ACM 23-03-2019			LEARNING LEVEL		BTL-3						
<b>ASSESSMENT SCHEME</b>															
<b>First Periodical Assessment</b>		<b>Second Periodical Assessment</b>		<b>Seminar/ Assignments/ Project</b>			<b>Surprise Test / Quiz</b>		<b>Attendance</b>		<b>ESE</b>				
15%		15%		10%			5%		5%		50%				
<b>Course Description</b>		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.													
<b>Course Objective</b>		<ol style="list-style-type: none"> <li>To introduce students to the basic concepts and techniques of Data Mining.</li> <li>To introduce a wide range of clustering, estimation, prediction, and classification algorithms.</li> <li>To introduce mathematical statistics foundations of the Data Mining Algorithms.</li> <li>To introduce basic principles, concepts and applications of data warehousing.</li> <li>To learn performance evaluation of classification algorithms.</li> </ol>													
<b>Course Outcome</b>		<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>Illustrate the concepts of the Data Classification.</li> <li>Apply Probabilistic Models for Classification.</li> <li>Apply Rule-Based Classification.</li> <li>Implement Support Vector Machines and Neural Networks.</li> <li>Visualize the output of Big Data Classification using various tools.</li> </ol>													
<b>Prerequisites: Basic Knowledge about Data Classification, Data mining</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PS O1</b>	<b>PS O2</b>	<b>PS O3</b>
<b>CO-1</b>	3	-	3	2	3	3	-	3	2	3	2	-	2	3	2
<b>CO-2</b>	1	-	-	1	3	1	-	-	1	3	2	-	-	1	1
<b>CO-3</b>	1	1	1	-	-	1	1	1	-	-	1	-	-	1	-
<b>CO-4</b>	1	1	1	-	1	1	1	1	-	1	-	1	1	1	1
<b>CO-5</b>	2	1	2	2	2	1	1	1	1	1	1	1	3	1	2
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: AN INTRODUCTION TO DATA CLASSIFICATION (9L)</b>															
Introduction: Common Techniques in Data Classification, Handling Different Data Types, Variations on Data Classification, Feature Selection for												<b>CO-1</b> <b>BTL-2</b>			



Classification: A Review: Introduction, Algorithms for Flat Features, Filter Models, Algorithms for Structured Features, Algorithms for Streaming Feature		
<b>Suggested Readings:</b> Common Techniques in Data Classification		
<b>MODULE 2: PROBABILISTIC MODELS FOR CLASSIFICATION</b>		<b>(9L)</b>
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		<b>CO-2 BTL-2</b>
<b>Suggested Readings:</b> Logistic Regression Classification		
<b>MODULE 3: RULE-BASED CLASSIFICATION</b>		<b>(9L)</b>
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		<b>CO-3 BTL-3</b>
<b>Suggested Readings:</b> Leveraging Neural Networks for Instance-Based Learning		
<b>MODULE 4: SUPPORT VECTOR MACHINES AND NEURAL NETWORKS</b>		<b>(9L)</b>
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		<b>CO-4 BTL-2</b>
<b>Suggested Readings:</b> Kernel Neural Network		
<b>MODULE 5: BIG DATA CLASSIFICATION</b>		<b>(9L)</b>
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		<b>CO-5 BTL-3</b>
<b>Suggested Readings:</b> Classification of Linked and Web Data		
<b>TEXT BOOKS</b>		
1.	Charu C. Aggarwal (2015) <i>"Data Classification: Algorithms and Applications"</i> , CRC Press	
<b>REFERENCE BOOKS</b>		
1.	Saman K. Halgamuge, Lipo Wang (Eds.)(2015) <i>"Classification and Clustering for Knowledge Discovery"</i> Springer.	
<b>E BOOKS</b>		
1.	<a href="https://www.semanticscholar.org/paper/Data-Classification%3A-Algorithms-and-Applications-CoggeshallKlinkenberg/82076c288b729fd87050e27a74760ad5f6e164bf">https://www.semanticscholar.org/paper/Data-Classification%3A-Algorithms-and-Applications-CoggeshallKlinkenberg/82076c288b729fd87050e27a74760ad5f6e164bf</a>	
<b>MOOC</b>		
1.	<a href="https://www.coursera.org/specializations/data-mining">https://www.coursera.org/specializations/data-mining</a>	

COURSE TITLE		PRINCIPLES OF DEEP LEARNING				CREDITS	3								
COURSE CODE		CAB3728	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0									
Version	1.0	Approval Details		26 <sup>th</sup> ACM 23-03-2019	LEARNING LEVEL	BTL-3									
<b>ASSESSMENT SCHEME</b>															
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project		Surprise Test / Quiz	Attendance	ESE									
15%	15%	10%		5%	5%	50%									
Course Description	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.														
Course Objective	<ol style="list-style-type: none"> <li>To function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment,</li> <li>To identify, formulate, and solve complex engineering problems by applying principles</li> <li>To apply engineering design to produce solutions that meet specified needs</li> <li>To develop and conduct appropriate experimentation, analyze and interpret data.</li> <li>To acquire and apply new knowledge as needed, using appropriate learning strategies.</li> </ol>														
Course Outcome	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>Design a simple Neural Networks using Linear Perceptron.</li> <li>Apply Convolutional Neural Networks using Tensor Flow.</li> <li>Describe the Differentiable Neural Computers.</li> <li>Apply Deep Reinforcement Learning.</li> <li>Demonstrate the simple deep learning algorithms for the given applications.</li> </ol>														
<b>Prerequisites: Machine learning algorithms</b>															
<b>CO, PO AND PSO MAPPING</b>															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	3	-	3	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
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: THE NEURAL NETWORK (9L)</b>															
Mechanics of Machine Learning, The Neuron, Linear Perceptron, Linear Neurons and Their Limitations, Sigmoid, Feed-Forward Neural Networks, Fast-Food Problem, The Delta Rule.														<b>CO-1 BTL-2</b>	

<b>Suggested Readings:</b> Machine Learning Models		
<b>MODULE 2: CONVOLUTIONAL NEURAL NETWORKS &amp; TENSORFLOW</b>		<b>(9L)</b>
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.		<b>CO-2 BTL-3</b>
<b>Suggested Readings:</b> Computer vision		
<b>MODULE 3: MEMORY AUGMENTED NEURAL NETWORKS</b>		<b>(9L)</b>
Neural Turing Machines, Attention-Based Memory Access, Differentiable Neural Computers (DNC) -Memory Reuse - Temporal Linking - Controller Network.		<b>CO-3 BTL-3</b>
<b>Suggested Readings:</b> Neural Networks		
<b>MODULE 4: DEEP REINFORCEMENT LEARNING</b>		<b>(9L)</b>
Deep Reinforcement Learning - Markov Decision Processes, Policy Versus Value Learning, Pole-Cart with Policy Gradients, Q-Learning		<b>CO-4 BTL-3</b>
<b>Suggested Readings:</b> Deep Learning		
<b>MODULE 5: APPLICATIONS</b>		<b>(9L)</b>
Deep learning for Real time applications, Deep Learning Applications at the Enterprise Scale, Deep Learning Models for Healthcare Applications.		<b>CO-5 BTL-3</b>
<b>Suggested Readings:</b> Applications of Deep learning in health care		
<b>TEXT BOOKS</b>		
1.	Nikhil Buduma, Nicholas Locascio(2017), <i>"Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms"</i> , O'Reilly Media.	
<b>REFERENCE BOOKS</b>		
1.	Ian Goodfellow, YoshuaBengio, Aaron Courville(2017), <i>"Deep Learning (Adaptive Computation and Machine Learning series)"</i> , MIT Press.	
<b>E BOOKS</b>		
1.	<a href="http://www.deeplearningbook.org/">http://www.deeplearningbook.org/</a>	
<b>MOOC</b>		
1.	<a href="https://www.coursera.org/learn/neural-networks-deep-learning">https://www.coursera.org/learn/neural-networks-deep-learning</a>	
2.	<a href="https://in.udacity.com/course/deep-learning--ud730">https://in.udacity.com/course/deep-learning--ud730</a>	

<b>COURSE TITLE</b>		<b>PRIVATE CLOUD DEPLOYMENT AND MANAGEMENT</b>			<b>CREDITS</b>	<b>3</b>
<b>COURSE CODE</b>		<b>CAC3727</b>	<b>COURSE CATEGORY</b>	<b>DE</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>
<b>Version</b>	<b>1.0</b>	<b>Approval Details</b>	<b>26<sup>th</sup> ACM 23-03-2019</b>	<b>LEARNING LEVEL</b>	<b>BTL-3</b>	
<b>ASSESSMENT SCHEME</b>						
<b>First Periodical Assessment</b>	<b>Second Periodical Assessment</b>	<b>Seminar/ Assignments/ Project</b>	<b>Surprise Test / Quiz</b>	<b>Attendance</b>	<b>ESE</b>	
<b>15%</b>	<b>15%</b>	<b>10%</b>	<b>5%</b>	<b>5%</b>	<b>50%</b>	
<b>Course Description</b>	A private cloud refers to a cloud deployment model operated exclusively for a single organization, whether it is physically located at the company's on-site data center, or is managed and hosted by a third-party provider. The private cloud is defined as computing services offered either over the Internet or a private internal network and only to select users instead of the general public.					

<b>Course Objective</b>	<ol style="list-style-type: none"> <li>To define Cloud Computing and memorize the different Cloud service and deployment models</li> <li>To describe importance of virtualization along with their technologies.</li> <li>To examine different cloud computing services</li> <li>To analyze the components of open stack &amp; Google Cloud platform</li> <li>To understand Mobile Cloud Computing</li> </ol>														
<b>Course Outcome</b>	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>Describe various Cloud Deployment models and differentiate the various models.</li> <li>Illustrate private cloud deployment key features</li> <li>Analyze the organization's requirement and suggest a suitable transformation policy into Private cloud</li> <li>Explain the Features of Amazon Virtual Private Cloud and IBM Smart Cloud</li> <li>Summarize the key characteristics of VMware vCloud and deploy Private cloud using OpenStack</li> </ol>														
<b>Prerequisites: Network and Cloud Computing</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PS O1</b>	<b>PS O2</b>	<b>PS O3</b>
<b>CO-1</b>	3	-	3	2	3	2	-	2	3	3	-	3	2	3	2
<b>CO-2</b>	1	-	-	1	3	2	-	-	1	1	-	-	1	3	1
<b>CO-3</b>	1	1	1	-	-	1	-	-	1	1	1	1	-	-	2
<b>CO-4</b>	1	1	1	-	1	-	1	1	1	1	1	1	-	1	3
<b>CO-5</b>	3	2	3	2	1	1	1	1	1	2	1	2	2	2	1
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1 - CLOUD DEPLOYMENT MODELS</b>															<b>(9L)</b>
<p>Cloud Deployment Models – Private Cloud, Public Cloud, Hybrid Cloud and Community Cloud – Cloud Services and Deployment Models – Comparison of Various Cloud Deployment models.</p> <p><b>Practical component:</b> Create and run virtual machines using VMWare Workstation/Virtual Box.</p> <p><b>Suggested Readings:</b> Cloud Deployment Models</p>														<b>CO-1</b> <b>BTL-2</b>	
<b>MODULE 2 - PRIVATE CLOUD</b>															<b>(9L)</b>
<p>Introduction of Private Cloud – Characteristics of Private Cloud - Virtualization vs Private Cloud - Types of Private cloud , On Premise and Outsourced Private Cloud, Benefits and Issues. Limitations of Private Cloud.</p> <p><b>Practical component:</b> Implement Infrastructure as a Service by using OpenStack.</p> <p><b>Suggested Readings:</b> Virtualization vs Private Cloud</p>														<b>CO-2</b> <b>BTL-2</b>	
<b>MODULE 3 - TRANSITION INTO PRIVATE CLOUD</b>															<b>(9L)</b>
<p>Traditional IT environment, Planning and Strategy, Consolidation, Virtualization, Standardization, Automation, Shared Resources, Private Cloud. Features of Private Cloud: Automated Service Management, Self-service portal, Dashboard, Metering, usage and Accounting, Automated Provisioning</p>														<b>CO-3</b> <b>BTL-3</b>	

<b>Practical component:</b> Implement Software as a Service by using Own Cloud		
<b>Suggested Readings:</b> Features of Private Cloud		
<b>MODULE 4 - PRIVATE CLOUD CASE STUDIES - I</b>		<b>(9L)</b>
Amazon Virtual Private Cloud-Introduction to VPC And AWS Networking, AWS Networking Architecture, Building Your Own Custom VPC. IBM SmartCloud Entry – IaaS,SaaS and PaaS. Key Capabilities, Solution architecture.		<b>CO-4 BTL-2</b>
<b>Practical component:</b> Getting Started: MathWorks Managed Clusters, Get ready-to-use clusters with MATLAB Parallel Cloud.		
<b>Suggested Readings:</b> SmartCloud Entry		
<b>MODULE 5 - PRIVATE CLOUD CASE STUDIES - II</b>		<b>(9L)</b>
VMware vCloud Director- Components, Architecture Suite, VMware Cloud benefits. OpenStack – Core Software Projects, Features of OpenStack, Architectural Over view, Components.		<b>CO-5 BTL-2</b>
<b>Practical component:</b> Visualizing the Density of a Data Cloud with MATLAB.		
<b>Suggested Readings:</b> VMware Cloud benefits		
<b>TEXT BOOKS</b>		
1.	K. Chandra Sekaran(2015), <i>Essentials of Cloud Computing</i> , 1st Edition, CRC Press, Taylor & Francis Group.	
<b>REFERENCE BOOKS</b>		
1.	Ray Rafaels(2018), <i>Cloud Computing</i> , 1st Edition. CreateSpace Independent Publishing Platform	
<b>E BOOKS</b>		
1.	<a href="https://www.manning.com/books/exploring-cloud-computing">https://www.manning.com/books/exploring-cloud-computing</a> (Paid Version)	
<b>MOOC</b>		
1.	<a href="https://nptel.ac.in/courses/106105167">https://nptel.ac.in/courses/106105167</a>	
2.	<a href="https://www.coursera.org/specializations/cloud-computing">https://www.coursera.org/specializations/cloud-computing</a>	

COURSE TITLE		BACK UP AND DISASTER RECOVERY			CREDITS	3
COURSE CODE		CAC3728	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
Version	1.0	Approval Details	26 <sup>th</sup> ACM 23-03-2019	LEARNING LEVEL		BTL-3
<b>ASSESSMENT SCHEME</b>						
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance		ESE
15%	15%	10%	5%	5%		50%
Course Description	Failback is the disaster recovery process of switching back to the original systems. Once the disaster has passed and your primary data center is back up and running, you should be able to fail back seamlessly as well.					
Course Objective	<ol style="list-style-type: none"> <li>To identify, formulate, and solve complex engineering problems by applying principles</li> <li>To apply engineering design to produce solutions that meet specified needs</li> <li>To function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment,</li> </ol>					

	<p>4. To develop and conduct appropriate experimentation, analyze and interpret data.</p> <p>5. To acquire and apply new knowledge as needed, using appropriate learning strategies.</p>														
<b>Course Outcome</b>	<p>Upon completion of this course, the students should be able to</p> <ol style="list-style-type: none"> <li>Describe the basics of Storage</li> <li>Identify, analyze and address risks in Business continuity</li> <li>Enable the Backup &amp; Archive and fix restore mode.</li> <li>Apply the technologies of Local and Remote Replication</li> <li>Illustrate Securing storage Infrastructure</li> </ol>														
<b>Prerequisites: Security Concepts</b>															
<b>CO, PO AND PSO MAPPING</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>CO-1</b>	3	-	3	2	3	2	-	3	-	3	2	3	2	3	2
<b>CO-2</b>	1	-	-	1	3	2	-	1	-	-	1	3	1	3	1
<b>CO-3</b>	1	1	1	-	-	1	-	1	1	1	-	-	-	-	2
<b>CO-4</b>	1	1	1	-	1	-	1	1	1	1	-	1	-	1	1
<b>CO-5</b>	2	1	2	2	2	1	1	2	-	2	1	2	2	2	-
<b>1: Weakly related, 2: Moderately related and 3: Strongly related</b>															
<b>MODULE 1: BASICS OF STORAGE (9L)</b>															
Data Center Infrastructure-Redundant Array of Inexpensive Disk: Implementation Methods- Techniques-Levels- Components of an Intelligent storage Systems- Components of Intelligent Storage Systems-Storage Provisioning <b>Suggested Readings:</b> Intelligent Storage Systems-Storage Provisioning														<b>CO-1 BTL-3</b>	
<b>MODULE 2: INTRODUCTION TO BUSINESS CONTINUITY (9L)</b>															
Information Availability- BC Terminology- BC Planning Life Cycle- Failure Analysis- Business Impact Analysis-BC Technology Solutions- Concept in Practice <b>Suggested Readings:</b> Business Impact Analysis-BC Technology Solutions														<b>CO-2 BTL-3</b>	
<b>MODULE 3: BACKUP AND ARCHIVE (9L)</b>															
Backup purpose- Considerations- Granularity-Recovery considerations- Methods- Backup Architecture- Restore Operations-Backup in NAS environments- Backup Targets-Data Deduplication-Backup in virtualized environment-Data Archive <b>Suggested Readings:</b> Deduplication-Backup in virtualized environment-Data Archive														<b>CO-3 BTL-3</b>	
<b>MODULE 4: LOCAL AND REMOTE REPLICATION (9L)</b>															
Replication Terminology-Replica Consistency-Local replication Technologies- Tracking changes to source ad Replica-Restore and Restart Considerations- Creating multiple replicas-Local replication in virtualized environment- Remote replication modes and technologies-Three site replication <b>Suggested Readings:</b> Remote replication modes and technologies-Three site replication														<b>CO-4 BTL-3</b>	
<b>MODULE 5: LOCAL AND REMOTE REPLICATION (9L)</b>															
Risk Triad-Security implementations in FC SAN- NAS-Securing storage infrastructure in virtualized and cloud environments <b>Suggested Readings:</b> FC SAN- NAS-Securing storage,														<b>CO-5 BTL-3</b>	

<b>TEXT BOOKS</b>	
1.	Somasundaram Gnana Sundaram, Alok Shrivastava(2012), <i>“Information Storage and management, Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments”</i> , 2nd Edition, John Wiley & Sons
2.	Andrew Hiles(2010), <i>The Definitive Handbook of Business Continuity Management, 3rd Edition</i> , Wiley
<b>REFERENCE BOOKS</b>	
1.	Nitin Vengurlekar, Prasad Bagal(2013), <i>“Database Cloud Storage: The essential guide to Oracle Automatic Storage Management”</i> , McGraw-Hill Education
<b>E BOOKS</b>	
1.	<a href="https://pages.awscloud.com/rs/112-TZM-766/images/AWS004%20B%26R%20eBook%20R4i.pdf">https://pages.awscloud.com/rs/112-TZM-766/images/AWS004%20B%26R%20eBook%20R4i.pdf</a>
<b>MOOC</b>	
1.	<a href="https://www.udemy.com/course/computercavalry-it-administrator-backups/">https://www.udemy.com/course/computercavalry-it-administrator-backups/</a>