

# Master of Computer Application

## Syllabus

### UNIVERSITY DEPARTMENT

Program Code: CSEA

2021 – 2022 onwards



## BHARATHIAR UNIVERSITY

(A State University, Accredited with “A” Grade by NAAC,  
Ranked 13<sup>th</sup> among Indian Universities by MHRD-NIRF,  
World Ranking: Times -801-1000, Shanghai -901-1000, URAP - 982)

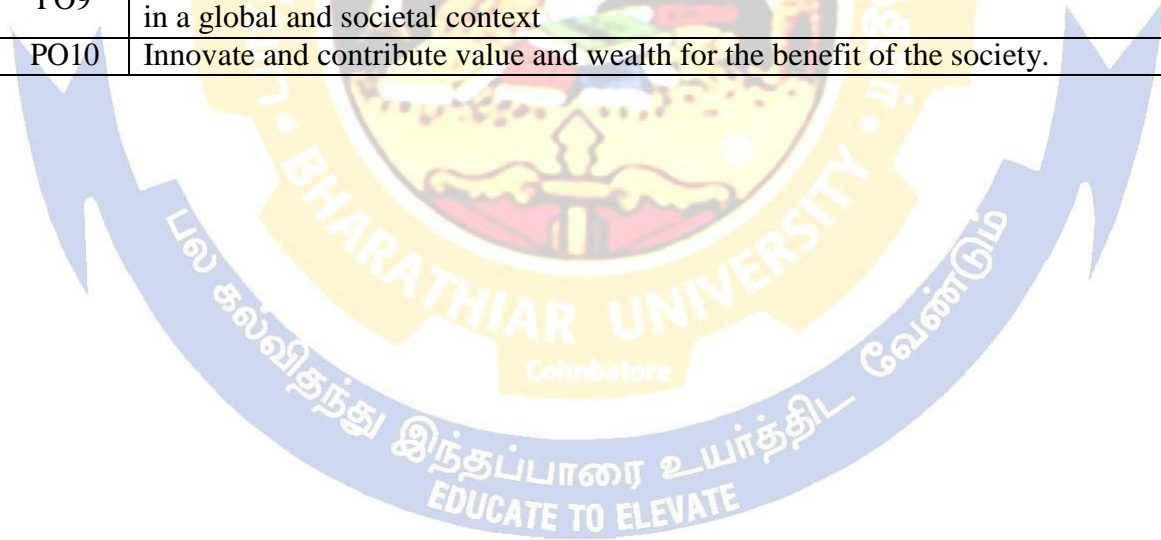
Coimbatore - 641 046, Tamil Nadu, India

<b>Program Educational Objectives (PEOs)</b>	
The PEOs of <b>M.C.A.</b> programme describe accomplishments that graduates are expected to attain within five to seven years after graduation	
PEO1	To progress their career productively in software industry, academia, research, entrepreneurial pursuit, government, consulting firms and other Information Technology enabled services.
PEO2	To achieve peer-recognition; as an individual or in a team; by adopting ethics and professionalism and communicate effectively to excel well in cross culture and inter-disciplinary teams.
PEO3	To continue a lifelong professional development in computing that contributes in self and societal growth.
PEO4	To appropriately apply the knowledge of computer application areas in modeling software applications for the industries.
PEO5	To assimilate and use state of the art computing technologies, tools and techniques to create systems for solving real world problems.
PEO6	To equip with skill to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social and ethical contexts.
PEO7	To appeal self-learning for continual development as a computer professional for the betterment of individuals, organizations, research community and society.
PEO8	To prepare report and effectively communicate with the stakeholders, about complex computational activities.
PEO9	To understand the need for and prepare themselves to engage in independent and life-long learning in the context of technological advancements.
PEO10	To select suitable ethical principles and commit to professional responsibilities and human values and also contribute value and wealth for the benefit of the society.

Program Specific Outcomes (PSOs)	
After the successful completion of M.C.A.programme, the students are expected to demonstrate	
PSO1	Ability to design and develop computing systems using concepts of Mathematics, Computerapplicationsand other related disciplines to meet customers' business objectives.
PSO2	Ability to analyze and formulate solutions with the use of state-of-the-art technologies, skills and models to existing and emerging issues
PSO3	Ability to communicate ideas effectively
PSO4	Ability to demonstrate team work, leadership skills, professional ethics and strong human values.
PSO5	Abilities to face the changing trends and career opportunities in computer application.
PSO6	Ability to update knowledge and skills through lifelong learning.
PSO7	Abilities to understand and align with the prevailing cross cultural, societal, professional, legal and ethical matters in industry.



<b>Program Outcomes (POs)</b>	
On successful completion of the M.C.A.programme, students will be able to	
PO1	Apply knowledge of mathematics, science and computing appropriately to model the software applications.
PO2	Assimilate and use state of the art computing technologies, tools and techniques necessary for computing practices.
PO3	Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social and ethical contexts
PO4	Have an ability to design, implement and evaluate sustainable computational solutions for various complex problems as per needs and specifications.
PO5	Communicate effectively with the computing community, and with society, about complex computing activities by being able to comprehend and write effective reports, design documentation, and make effective presentations.
PO6	Manage projects and function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO7	Recognize the need for and prepare themselves to engage in independent and life-long learning, engage in self-learning for continual development as a computing professional for the betterment of individuals, organizations, research community and society.
PO8	Apply ethical principles and commit to professional responsibilities and human values.
PO9	Utilize the education necessary to understand the impact of computing solutions in a global and societal context
PO10	Innovate and contribute value and wealth for the benefit of the society.



**BHARATHIAR UNIVERSITY, COIMBATORE 641 046**

**M.C.A. (CBCS PATTERN)**  
**(University Department)**

*(For the students admitted during the academic year 2021 – 22 onwards)*

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
<b>FIRST SEMESTER</b>							
21CSEAC01	Data Structures using JAVA	4	32	60	50	50	100
21CSEAC02	Computer Networks	4	32	60	50	50	100
21CSEAC03	Soft Skills	4	32	60	50	50	100
Elective 1	Elective I - Software Project Management	4	62	-	50	50	100
Elective 2	Elective II - - IT Infrastructure and cloud security	4	62	-	50	50	100
Supportive		2			25	25	50
<b>Total</b>		22			275	275	550
<b>SECOND SEMESTER</b>							
21CSEAC04	Open Source Programming	4	32	60	50	50	100
21CSEAC05	Mobile Programming	4	32	60	50	50	100
21CSEAC06	Digital Image Processing	4	32	60	50	50	100
Elective 3	Elective – III	4			50	50	100
Elective 4	Elective – IV	4			50	50	100
Supportive		2			25	25	50
<b>Total</b>		22			275	275	550
<b>THIRD SEMESTER</b>							
21CSEAC07	Progressive Web Application Development	4	32	60	50	50	100
21CSEAC08	Big Data Analytics	4	32	60	50	50	100
21CSEAC09	Internet of Things	4	32	60	50	50	100
Elective 5	Elective – V	4			50	50	100
Elective 6	Elective – VI	4			50	50	100
21CSEAC10	Mini Project & Viva-voce	8			100	100	200
Supportive		2			25	25	50
<b>Total</b>		26			325	325	650
<b>FOURTH SEMESTER</b>							
21CSEAC11	Major Project & Viva-voce	16			200	200	400
<b>Total</b>		16			200	200	400
<b>Grand Total</b>		<b>90</b>					<b>2250</b>

<b>ONLINE COURSES</b>						
SWAYAM – MOOC – Online Course*	2					50
	Non-scholastic with Credits					
<b>VALUE ADDED COURSES</b>						
Course 1	2					50
Course 2	2					50
<b>JOB ORIENTED COURSES</b>						
Course 1	2					50
Course 2	2					50

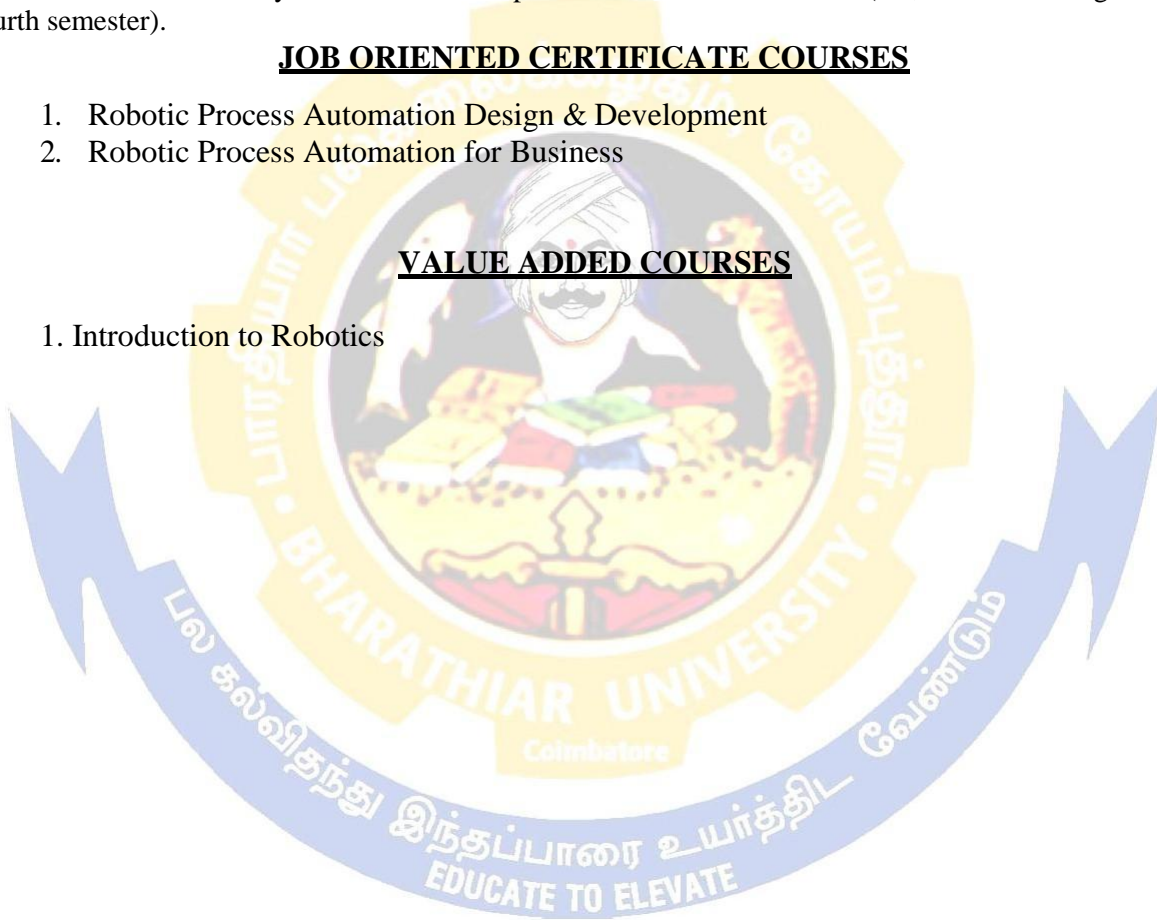
\*SWAYAM – MOOC – online course shall be of duration at least 4 weeks with at least 2 credits. The course shall be mandatory and shall be completed within third semester (i.e., before the beginning of fourth semester).

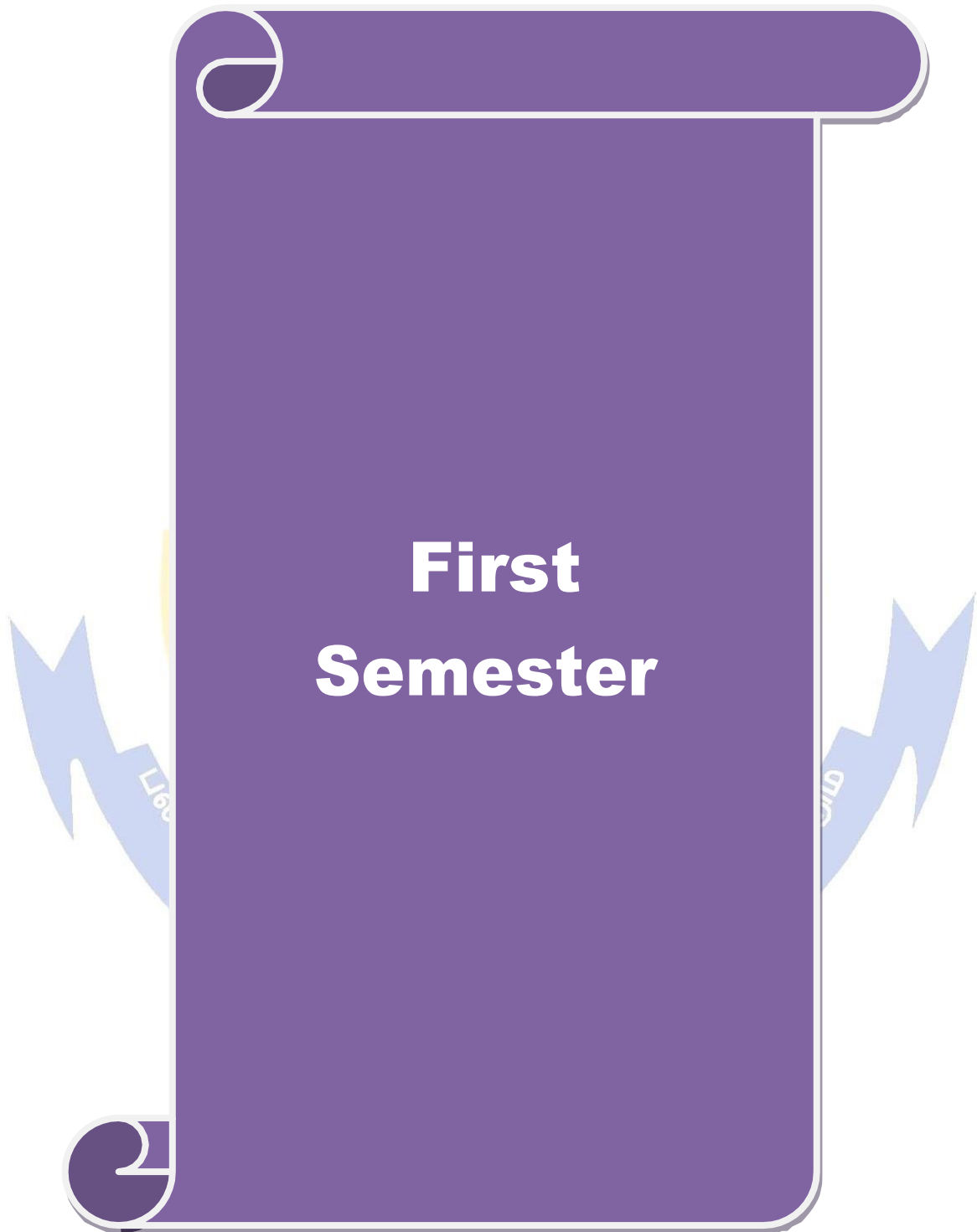
**JOB ORIENTED CERTIFICATE COURSES**

1. Robotic Process Automation Design & Development
2. Robotic Process Automation for Business

**VALUE ADDED COURSES**

1. Introduction to Robotics





Course code	21CSEAC01	DATA STRUCTURES USING JAVA	L	T	P	C
<b>Core/Elective/Supportive</b>	Core		2	0	2	4
<b>Pre-requisite</b>	Basic knowledge of Data Structures and Core Java Programming		<b>Syllabus</b>		<b>2021-22</b>	
<b>Course Objectives:</b>						
The main objectives of this course are:						
<ol style="list-style-type: none"> <li>1. To understand and implement data structures in Java</li> <li>2. To understand the Java Collections and GUI Framework</li> <li>3. To Practice GUI programming and Database Connectivity</li> <li>4. To develop Web based applications using JSP and Java Servlets</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	To understand and implement data structures in Java			K2, K3		
2	To understand Collections and GUI in Java Framework			K1,K2		
3	To Practice GUI using Java to demonstrate the operations on collections			K2,K3,K6		
4	To create database connectivity using JDBC			K3,K5,K6		
5	To Develop a web application using JSP			K2,K3		
<b>K1</b> - Remember; <b>K2</b> - Understand; <b>K3</b> - Apply; <b>K4</b> - Analyze; <b>K5</b> - Evaluate; <b>K6</b> – Create						
<b>Unit:1</b>	<b>Data Structures</b>				<b>10 hours</b>	
Functions – Comparing Growth Rates - Asymptotic Analysis – Arrays – Singly Linked List – Circularly Linked List – Stack – Queues – List Abstract Data Type (ADT) – Iterators – Tree ADT – Binary Trees – Tree Traversal Algorithms – Binary Search Trees – AVL Trees.						
<b>Unit:2</b>	<b>Graphs and Sorting</b>				<b>16 hours</b>	
Graphs: Graph ADT – Data Structures for Graphs – Graph Traversals – Directed Acyclic Graphs – Shortest Paths – Minimum Spanning Tree - Sorting: Merge Sort – Quick Sort – Selection Sort.						
<b>Unit:3</b>	<b>Introduction to Collection and Swing Framework</b>				<b>15 hours</b>	
Collections Framework: Collection classes and Interfaces – Legacy classes – Date – Calendar – Time Zone. Event Handling: Exploring Swing – JFrame – JComponent – Text Fields – Buttons – Combo boxes – Application design using Swing components.						
<b>Unit:4</b>	<b>Database Connectivity with JDBC</b>				<b>24 hours</b>	
Database Programming in Java: Overview of the JDBC Process - JDBC Concepts - JDBC Drivers – Database Connection - Statement Objects – The Connection Interface – Result Set – Interacting with the database - Transaction Processing.						
<b>Unit:5</b>	<b>Web application Development using Java Servlets</b>				<b>25 hours</b>	
Java Servlets: Initialization–Deployment–Reading Client Data–Reading HTTP Request Headers – Cookies - Session Tracking – Database Connections. Java Server Pages (JSP) - JSP tags - Components of a JSP page - Expressions–Scriptlets – Directives – Declarations - Working with JSP- JSP and JDBC- JQuery – AJAX - Application Development Environment: Overview of MVC architecture						



<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>92 hours</b>
<b>Reference Books</b>		
1	Michael T. Goodrich, Roberto Tamassia and Michael H. Goldwasser, -Data Structures and Algorithms in Javal, Wiley, 2014.	
2	Herbert Schildt, -The Complete Reference Javal, Tata McGrawHill Publishing Company Ltd, 2012	
3	Marty Hall, Larry Brown, Yaakov Chaikin, -Core Servlets and Java Server pages!: Volume 2 – Advanced Technologies, II edition, Pearson education, 2008.	
4	Jamie Jaworskie,  Java 2 Platform Unleashed  , Techmedia SAMS, IV edition, 2008.	
5	Craig Walls, -Spring in Action!, IV edition, Manning Publications, 2015.	
6	<a href="https://docs.oracle.com">https://docs.oracle.com</a>	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	Programming in Java <a href="https://nptel.ac.in/courses/106/105/106105191/">https://nptel.ac.in/courses/106/105/106105191/</a>	
Course Designed By: Mr. S. Palanisamy		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>	S	S	L	M						
<b>CO2</b>				M			M		S	S
<b>CO3</b>	S	S	L	L	S	M			S	
<b>CO4</b>		S		S	S	S			M	
<b>CO5</b>		S	L	S	M	M	S		L	

\*S-Strong; M-Medium; L-Low

Course code	21CSEAC02	COMPUTER NETWORKS	L	T	P	C
<b>Core/Elective/Supportive</b>	Core		2	0	2	4
<b>Pre-requisite</b>	Basics of networks		Syllabus rsion		2021- 22	
<b>Course Objectives:</b>						
The main objectives of this course are:						
<ol style="list-style-type: none"> <li>1. To understand the functionality of networks protocols and layers</li> <li>2. To understand network simulation using NS2</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	To describe the network concepts and explain the reference models of networks		K1, K2			
2	To discuss on the Data transfer and access protocol.		K3			
3	To examine the network layer protocols and its algorithm		K4, K6			
4	To examine the Transport layer protocols and its algorithm		K4, K5			
5	To analyze the issues in application layer		K5			
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create</b>						
<b>Unit:1</b>	<b>Introduction to Networks</b>					<b>18 hours</b>
Introduction to Networks & Communication Media: Uses –Network hardware–Network software–Reference Models–Example Networks: Internet–X.25-ATM-Transmission media–Wireless Transmission–Telephone system–ISDN, ATM communication – Satellitecommunication.						
<b>Unit:2</b>	<b>Data Transfer and Access</b>					<b>16 hours</b>
Data Transfer & Access Protocols: Error detection and correction methods–Elementary protocols –Sliding window protocols -IEEE 802.2 Logical Link Control – Bluetooth: architecture–protocolstack–radiolayer–basebandlayer–L2CAPlayer–frame structure.						
<b>Unit:3</b>	<b>Network Layer</b>					<b>18 hours</b>
Network Layer Protocols: Routing algorithms Congestion control: Principles –policies– Congestion control in VC subnets –congestion control in datagram subnets-Network layer in Internet: Architecture– IP protocol -IP Address – IPv6.						
<b>Unit:4</b>	<b>Transport Layer</b>					<b>18 hours</b>
TRANSPORT PROTOCOLS: Transport service – Transport protocols – Transport protocols in Internet: TCP and UDP						
<b>Unit:5</b>	<b>Application Layer</b>					<b>20 hours</b>
APPLICATION LAYER ISSUES: Domain Name System –Electronic Mail-Network security. Network Simulator: Basics of Computer Network Simulation –Introduction to Network Simulator2 (NS2) –Basic Architecture–Installation–Directories and Convention–Running NS2 Simulation–Simulation Examples						
<b>Unit:6</b>	<b>Contemporary Issues</b>					<b>2 hours</b>
Expert lectures, online seminars – webinars						
					<b>Total Lecture hours</b>	<b>92 hours</b>

<b>Text Books</b>	
1	Andrew S. Tanenbaum, -Computer Networks, PHI, 5th Edition, 2013
2	Behrouz A. Forouzan, -Data communication and Networking, TataMcGrawHill,4thEdition,2006
3	TeerawatUssaruyakul, EkramHossain, Introduction to Network Simulator NS2, Springer, 2009
<b>Reference Books</b>	
1. William Stallings, -Data and ComputerCommunication,7 <sup>th</sup> Edition, Pearson Education, 2007.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>	
1	Computer networks, <a href="https://nptel.ac.in/courses/106/106/106106091/">https://nptel.ac.in/courses/106/106/106106091/</a>
Course Designed By: <b>Dr. J. Satheesh Kumar</b>	

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>				M			M		S	S
<b>CO2</b>	S	S	L	L	S	M			S	
<b>CO3</b>		S		S	S	S			M	
<b>CO4</b>		S	L	S	M	M	S		L	
<b>CO5</b>		S	L	M	M	S	M	L		

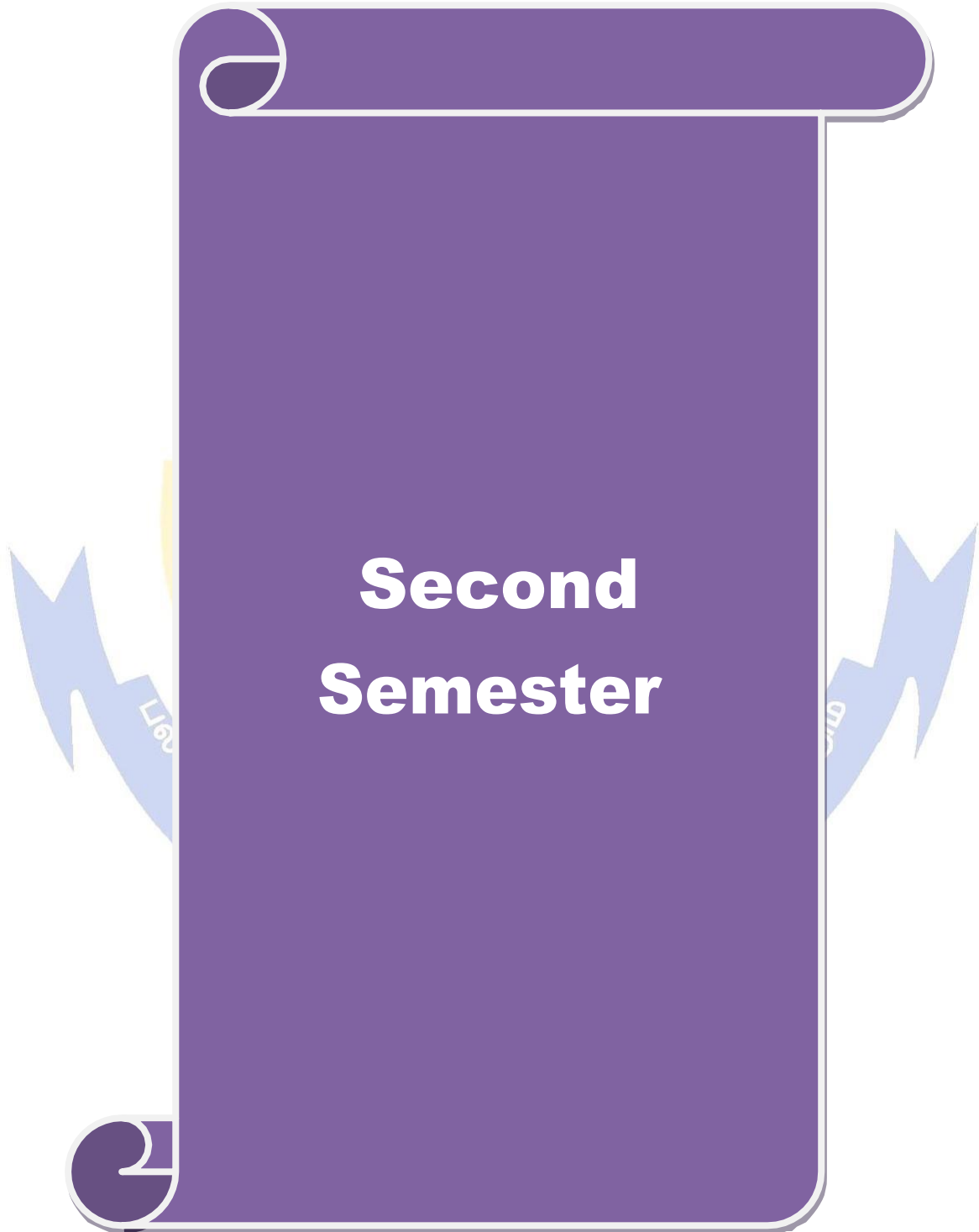
\*S-Strong; M-Medium; L-Low

Course code	21CSEAC03	SOFT SKILLS		L	T	P	C
Core/Elective/Supportive	Core			2		2	4
Pre-requisite	Nil			Syllabus rsion		2021- 22	
<b>Course Objectives:</b>							
The main objectives of this course are to:							
<ol style="list-style-type: none"> <li>To understand the basics of communication skills</li> <li>To Understand the logical skills</li> <li>To develop interpersonal skills</li> <li>To improve the writing skills</li> <li>To acquired knowledge in technical programming</li> <li>To acquired knowledge in technical programming and quantitative aptitude</li> </ol>							
<b>Expected Course Outcomes:</b>							
On the successful completion of the course, student will be able to:							
1	Develop the basics of communication skills and Develop confidence, clarity, fluency through active involvement					K2	
2	Increase logical skills, analytical skills and apply in software applications					K2	
3	Develop interpersonal skills, listening through (seminar, self intro, stage speaking)					K3	
4	Improve writing skills through various modes (letter writing, resume writing)					K3	
5	Practice technical programming, cracking code, simple logic and concepts					K1/K4	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6- Create</b>							
<b>Unit:1</b>	<b>Introduction to Communication</b>					<b>12 hours</b>	
Importance – Basics of Communication – Purpose and Audience - Language as a Tool of Communication – Communicative Skills - Modes of Communication – Active Listening- Introduction - Traits of a Good Listener – Listening Modes – Effective Speaking: Achieving Confidence, Clarity and Fluency – Paralinguistic Features – Types of Speaking							
<b>Unit:2</b>	<b>Personality Development</b>					<b>12 hours</b>	
A Must for Leadership and Career Growth – Swami Vivekananda’s Concept of Personality Development – Interpersonal Skills -Soft Skills: Introduction to Soft Skills – Classification of Soft Skills-Case study: Resume Writing-Email-letter Writing-Self Introduction.							
<b>Unit:3</b>	<b>Technical programming skill</b>					<b>14 hours</b>	
Variables and keywords - Operators in C – Decision Making– Looping - Branching Statements – Array – Functions.							
<b>Unit:4</b>	<b>Quantitative Aptitude1</b>					<b>12 hours</b>	
Number series -Ratio, Proportion and Partnership – Problems on Ages - Average - Profit and Loss.							
<b>Unit:5</b>	<b>Quantitative Aptitude 2</b>					<b>10 hours</b>	
Simple Interest – Compound Interest – Time and Work – Time and Distance.							
<b>Unit:6</b>	<b>Contemporary Issues</b>					<b>2 hours</b>	
Write an assignment on any one of the following:							
<ol style="list-style-type: none"> <li>Traits needed for a software Engineer.</li> </ol>							

2. Traits needed for a software project Manager.	
3. Traits needed for a Teacher (Software Tester).	
<b>Total Lecture hours</b>	
<b>62 hours</b>	
<b>Text Book(s)</b>	
1	Raman Sharma, -Technical Communication", 2ndEdition, Oxford University Press 2011.
2	Barun K. Mitra"Personality Development and Soft Skills", Oxford University Press 2011.
<b>Reference Books</b>	
1	Dr. Balagurusamy, -Programming in C , Tata McGraw – Hill Edition, 2008. 4. S. Chand and AshishAggarwal, -Quick Arithmetic  Sixth Revised Edition.
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>	
1	www.coursera.com [E-mail letter writing- Write Professional Emails in English]
2	www.coursera.com[Improve your English Communication Skills specialization course]
3	www.udemy.com [Personality and Soft Skills Development]
4	www.coursera.com[ The Science of Well Being]
<b>Web Links</b>	
1	<a href="https://owl.purdue.edu/">https://owl.purdue.edu/</a> [Online Writing Lab]
2	<a href="http://www.grammarbook.com">www.grammarbook.com</a>
Course Designed By:Dr. M. Punithavalli	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	-	M	L	S	S	S	S	M	M	L
CO2	-	M	L	S	S	S	S	M	M	M
CO3	M	M	M	M	L	M	M	L	S	-
CO4	S	L	M	-	-	M	M	-	L	-
CO5	S	L	M	-	-	M	M	-	L	-
CO6	-	M	-	L	L	-	-	-	L	M

\*S-Strong; M-Medium; L-Low



Course code	21CSEAC04	OPEN SOURCE PROGRAMMING	L	T	P	C
Core/Elective/Supportive	Core		2	0	2	4
Pre-requisite	RDBMS, HTML		Syllabus rsion		2021- 22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>To understand the basics of open source software</li> <li>To create dynamic web applications using PHP, MySQL</li> <li>To create web applications based on PHP and AJAX</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	To explain the significance of open source principles and practices					K1
2	To learn the fundamentals of PHP					K2
3	To develop object oriented based applications using PHP					K3
4	To develop web applications using PHP, MySQL and AJAX					K6
5	To host open source projects using Github					K6
<b>K1</b> - Remember; <b>K2</b> - Understand; <b>K3</b> - Apply; <b>K4</b> - Analyze; <b>K5</b> - Evaluate; <b>K6</b> – Create						
<b>Unit:1</b>						
<b>Open Source &amp; Free Software Licensing</b>					<b>20 hours</b>	
<b>Open Source Licensing:</b> Basic Principles of Copyright Law – Contract and Copyright – Open Source Software Licensing – Issues with Copyrights and Patents – Open Source Definition – MIT License – BSD License – Apache License – GNU General Public License – <b>Free and Open Source Software Development:</b> Models of Open Source and Free Software Development – Choosing an Open Source or Free Software License						
<b>Unit:2</b>						
<b>Basics of PHP Programming</b>					<b>14 hours</b>	
<b>Basics of PHP Programming:</b> Introduction – syntax and variables – controls and functions – passing information between pages – strings – numbers – arrays, array functions and advanced array functions						
<b>Unit:3</b>						
<b>Advanced Features and Techniques</b>					<b>16 hours</b>	
<b>Advanced PHP Programming:</b> Object-Oriented Programming with PHP– String and Regular Expression Functions – Filesystem and System Functions – Sessions, Cookies and HTTP – Exceptions and Error Handling						
<b>Unit:4</b>						
<b>PHP and MySQL</b>					<b>20 hours</b>	
<b>PHP and MySQL:</b> Why PHP and MySQL? – Server-Side Web Scripting – SQL Tutorial – MySQL Database Administration – PHP/MySQL Functions – Displaying Queries in Tables – Building Forms from Queries						
<b>Unit:5</b>						
<b>PHP &amp; AJAX and Github Hosting Service</b>					<b>20 hours</b>	
<b>PHP and AJAX:</b> JavaScript and AJAX Client – JavaScript and DOM – XMLHttpRequest Object – AJAX form validation – Uploading a file using AJAX – Displaying a table in AJAX – Building Pagination using PHP and AJAX						
<b>Hosting Open Source Projects using Github:</b> Introduction – Viewing Github Graphs- Editing Files – Collaborating on Pull Requests – Creating a Repository – Configuring a Repository						

<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
		<b>Total Lecture hours</b>
		<b>92 hours</b>
<b>Text Book(s)</b>		
1	Andrew M. St. Laurent, ‘_Understanding Open Source & Free Software Licensing’, O’Reilly Media, 2004.	
2	Tim Converse and Joyce Park, ‘_PHP 5 and MySQL Bible’, Wiley Publishing, 2004.	
3	BogdanBrinzarea-Lamandi, CristianDarie and Audra Hendrix, ‘_AJAX and PHP’, Packt Publishing, 2009.	
4	Peter Bell and Brent Beer, ‘_Introducing Github: a Non-Technical Guide’, O’Reilly Media, 2014	
<b>Reference Books</b>		
1	Gordon Haff, ‘_How Open Source Ate Software’, Apress, 2018.	
2	Rao M. N., ‘_Fundamentals of Open Source Software’, PHI Learning Pvt Ltd, 2014.	
3	Robin Nixon, ‘_Learning PHP, MySQL & JavaScript with jQuery, CSS & HTML5’, O’Reilly Media, 2015.	
4	Steven Holzner, ‘_PHP: The Complete Reference’, McGraw Hill Education, 2017.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="http://www.spoken-tutorial.org">www.spoken-tutorial.org</a>	
2	PHP and MySQL ( <a href="https://swayam.gov.in/nd2_aic20_sp32/">https://swayam.gov.in/nd2_aic20_sp32/</a> )	
Course Designed By: <b>Dr. R. Rajeswari</b>		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>		S					M			
<b>CO2</b>		S					M			
<b>CO3</b>			S	S			M		L	
<b>CO4</b>			S	S			M		L	
<b>CO5</b>			S	S			M		L	

\*S-Strong; M-Medium; L-Low



<b>Course code</b>	<b>21CSEAC05</b>	<b>MOBILE PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Core/Elective/Supportive</b>	Core		<b>2</b>	<b>0</b>	<b>2</b>	<b>4</b>
<b>Pre-requisite</b>	Java Programming		<b>Syllabus</b>		<b>2021-22</b>	
<b>Course Objectives:</b>						
The main objectives of this course are:						
4. To understand basics the Mobile Technology: OHA, OSS, Android and iOS						
2. To understand Android Stack, APIS, UI, and SQLite						
3. To develop Android Application and Publishing						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	To understand Mobile Technologies: OSS, OHA, Android and iOS			K2		
2	To understand Android Architecture, Stack and App Life Cycle Model			K2		
3	To discuss android APIs and development components			K2		
4	To develop android application using UI components			K3,K5,K6		
5	To understand SQLite operations and publishing the application			K2,K3,K6		
<b>K1</b> - Remember; <b>K2</b> - Understand; <b>K3</b> - Apply; <b>K4</b> - Analyze; <b>K5</b> - Evaluate; <b>K6</b> – Create						
<b>Unit:1</b>	<b>Introduction to OSS, OHA and Mobile Technologies</b>				<b>10 hours</b>	
Introduction to Mobile Applications: Native and web applications - Mobile OS and Databases. Introduction to Android: History - Features – OSS – OHA - Versions - Android devices - Setting up software – IDE - XML. Introduction to Objective C and iOS – iOS features –user interface - Using Wifi – iPhone marketplace.						
<b>Unit:2</b>	<b>Android Architecture and Activity Lifecycle</b>				<b>16 hours</b>	
Android Architecture: Android Stack - Linux Kernel - Android Runtime - Application Framework - Android emulator - Android applications development -Virtualization – APIs – Android File system – A Basic Android Application - Deployment. Android Activities: The Activity Lifecycle – Lifecycle methods – Creating Activity.						
<b>Unit:3</b>	<b>Android Application Component and APIs</b>				<b>15 hours</b>	
Intents – Intent Filters – Activity stack. Android Services: Simple services – Binding and Querying the service – Executing services. Broadcast Receivers: Creating and managing receivers – Receiver intents. Content Providers: Creating and using content providers – Content resolver.						
<b>Unit:4</b>	<b>Android UI layouts and controls</b>				<b>24 hours</b>	
Android UI - Android Layouts – Attributes – Layout styles - Linear – Relative – Table – Grid – Frame – Menus - Lists and Notifications - Input Controls: Buttons - Text Fields – Checkboxes - alert dialogs – Spinners - rating bar - progress bar.						
<b>Unit:5</b>	<b>DB Connectivity and Publishing Application</b>				<b>25 hours</b>	
Working with databases: SQLite – coding for SQLite using Android - Publishing and Internationalizing mobile applications - mobile application deployment: Game, Clock, Calendar, Converter, Phone book.						

<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>92 hours</b>
<b>Reference Books</b>		
1	Barry Burd, –Android Application Development – All-in-one for Dummies, 2 <sup>nd</sup> Edition, Wiley India, 2016	
2	Lauren Darcey, Shane Conder, –Sams Teach Yourself Android Application Development in 24 hours, 2nd edition, Pearson Education, 2013	
3	Jerome (J. F) DiMarzio, –Android – A Programmer’s Guide, McGraw Hill Education, 8th reprint, 2015	
4	David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, –Beginning iOS 6 Development: Exploring the iOS SDK, Apress, 2013.	
5	<a href="http://www.developer.android.com">http://www.developer.android.com</a>	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	Mobile Programming using Android: <a href="https://onlinecourses.swayam2.ac.in/aic20_sp02/preview">https://onlinecourses.swayam2.ac.in/aic20_sp02/preview</a>	
Course Designed By: <b>Mr. S. Palanisamy</b>		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>		S	M	M	S	S	S		S	L
<b>CO2</b>		S	S							
<b>CO3</b>		S		L						
<b>CO4</b>		S	L	S	S	S	S	L	S	L
<b>CO5</b>		S	L	M	S	M			S	M

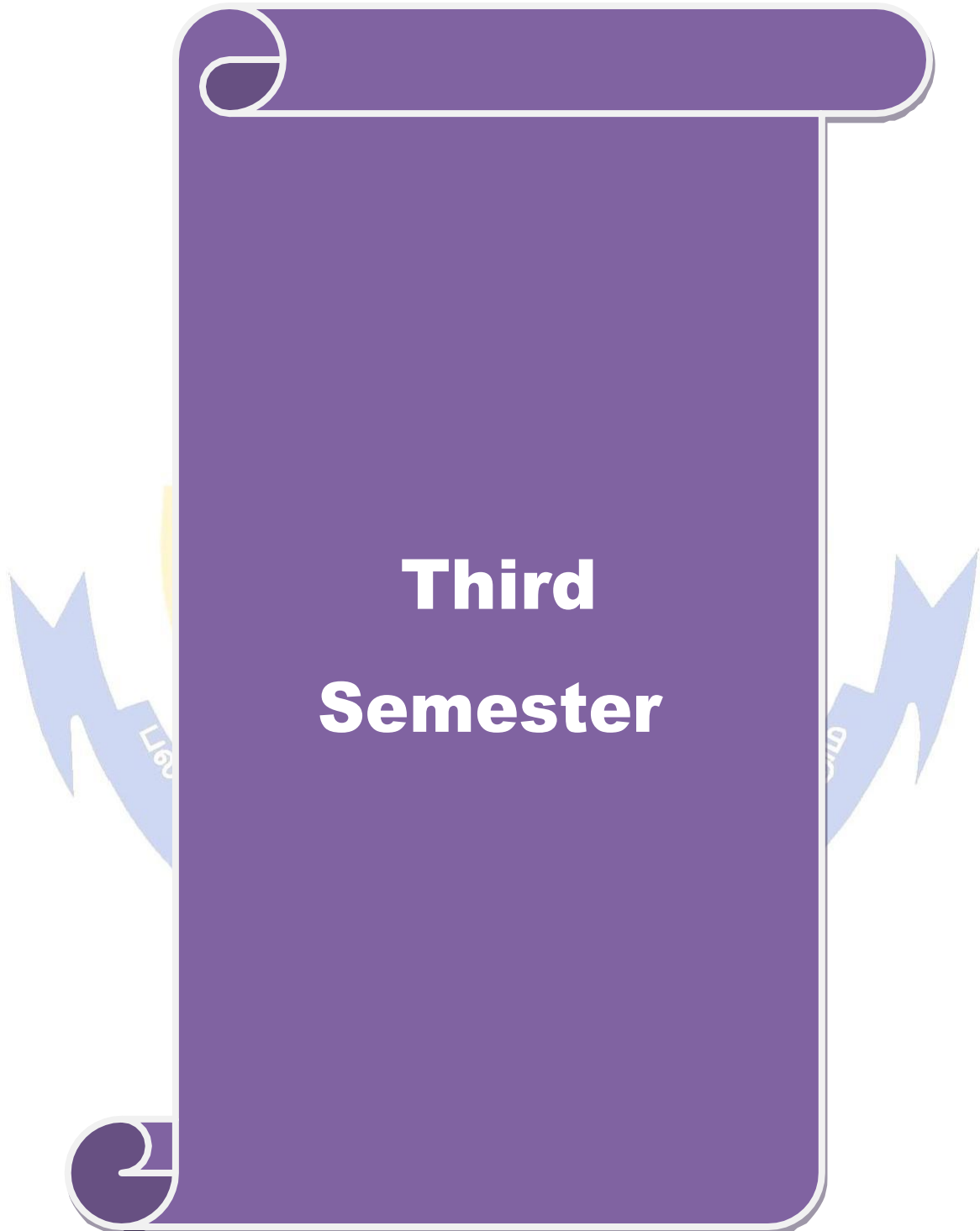
\*S-Strong; M-Medium; L-Low

Course code	21CSEAC06	DIGITAL IMAGE PROCESSING	L	T	P	C
Core/Elective/Supportive	Elective		2	0	2	4
Pre-requisite	Fundamentals of linear algebra, probability theory and applied discrete mathematics	Syllabus	rsion		2021-22	
<b>Course Objectives:</b>						
The main objectives of the course are to						
1. study the fundamentals of digital image processing						
2. learn the image processing operations such as image enhancement, restoration and segmentation						
3. understand the methods used for object recognition						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
CO1	Understand the Fundamentals of Digital Image Processing					K1, K2
CO2	Understand the Image Processing Toolbox in MATLAB					K1, K2
CO3	Understand and Implement Intensity Transforms and Image Restoration using Spatial and Frequency Domain Filters					K2, K3
CO4	Understand and Apply Morphological Image Processing and Image Segmentation					K2, K3
CO5	Design and Implement Object Recognition Methods					K5,K6
<b>K1</b> - Remember; <b>K2</b> - Understand; <b>K3</b> - Apply; <b>K4</b> - Analyze; <b>K5</b> - Evaluate; <b>K6</b> - Create						
<b>Unit:1</b>	<b>Introduction to Image Processing</b>					<b>16 hours</b>
Introduction: Fundamental Steps in Image processing – Components of an Image Processing System – Digital Image Fundamentals: Image Sensing and Acquisition – Image Sampling and Quantization – Image enhancement – Image restoration – Color Image Processing – Wavelets and Multi-resolution Processing – Image data compression – Morphological Processing – Segmentation – Image Representation and Description – Object Recognition						
<b>Unit:2</b>	<b>MATLAB for Image Processing</b>					<b>16 hours</b>
MATLAB Working Environment – Reading, Displaying and Writing Images – Data Classes – Image Types – Converting between Data Classes and Image Types – Array Indexing – Standard Arrays – M-Function Programming: M-Files – Operators – Flow Control – Code Optimization – Interactive I/O – Cell Arrays and Structures						
<b>Unit:3</b>	<b>Image Filtering and Restoration</b>					<b>20 hours</b>
Intensity Transformations and Spatial Filtering: Intensity Transformation Functions – Histogram Processing – Spatial Filtering – Standard Spatial Filters – Frequency Domain Processing: 2D Discrete Fourier Transform – Filtering in Frequency Domain – Obtaining Frequency Domain Filters from Spatial Filters - Generating Filters Directly in Frequency Domain – Sharpening Frequency Domain Filters – Image Restoration: Noise Models – Restoration by Spatial Filtering – Periodic Noise Reduction by Frequency domain Filtering – Modeling the Degradation Function – Direct Inverse Filtering – Wiener Filtering – Constrained Least Squares Filtering						
<b>Unit:4</b>	<b>Morphological Image Processing and Image Segmentation</b>					<b>18 hours</b>
Morphological Image Processing: Preliminaries – Dilation and Erosion – Combining Dilation and Erosion – Labeling Connected Components – Morphological Reconstruction – Gray-Scale Morphology – Image Segmentation: Point, Line and Edge Detection – Line Detection using the Hough Transform – Thresholding – Region-Based Segmentation						

<b>Unit:5</b>	<b>Representation and Object Recognition</b>	<b>20 hours</b>
Representation and Description: Representation – Boundary Descriptors – Regional Descriptions – Using Principal Components for Description – Object Recognition: Computing Distance Measures in MATLAB – Recognition based on Decision-Theoretic Methods: Pattern Matching using Minimum-Distance Classifiers – Matching by Correlation – Optimum Statistical Classifiers – Adaptive Learning Systems – Neural Networks and Deep Convolutional Networks for Pattern Classification – Structural Recognition		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars - webinars		
<b>Total Lecture hours</b>		<b>92 hours</b>
<b>Text Book(s)</b>		
1	Rafael C. Gonzalez and Richard E. Woods, ‘_Digital Image Processing’, Pearson Education, 2018.	
2	Rafael C. Gonzalez, Richard E. Woods and Steven L. Eddins, ‘_Digital Image Processing using MATLAB’, Pearson Education, 2005.	
<b>Reference Books</b>		
1	Scott E Umbaugh, ‘_Digital Image Processing and Analysis: Applications with MATLAB and CVIP Tools’, CRC Press, Third Edition, 2017.	
2	Anil K. Jain, ‘_Fundamentals of Digital Image Processing’, Prentice Hall Learning Private Limited, 1994.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	Digital Image Processing, <a href="https://nptel.ac.in/courses/117/105/117105079/">https://nptel.ac.in/courses/117/105/117105079/</a>	
2	Fundamentals of Digital Image and Video Processing, <a href="https://www.coursera.org/learn/digital">https://www.coursera.org/learn/digital</a>	
Course Designed By: Dr. R. Rajeswari		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>		S					M			
<b>CO2</b>		S					M			
<b>CO3</b>			S	S			M		L	
<b>CO4</b>			S	S			M		L	
<b>CO5</b>			S	S			M		L	

\*S-Strong; M-Medium; L-Low



Course code	21CSEAC07	PROGRESSIVE WEB APPLICATION DEVELOPMENT	L	T	P	C
Core/Elective/Supportive	Core		2	0	2	4
Pre-requisite	HTML, CSS and Object-Oriented Programming using JavaScript		Syllabus rsion		2021- 22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>To understand the basics of progressive web applications</li> <li>To understand the fundamentals of Angular and develop Angular applications</li> <li>To create, build and deploy progressive web applications using Angular</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	To learn the basics of Angular and Progressive Web Applications					K2
2	To understand and use Angular forms, dependency injection and routing					K3
3	To create build and deploy an Angular application using Angular CLI					K6
4	To explore Service Workers, Data Storage, App Manifest and Notifications in Progressive Web Applications					K3
5	To build and deploy responsive, fast and reliable Progressive Web Applications using Angular					K6
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>Building Blocks of Angular</b>					<b>18 hours</b>
<b>TypeScript:</b> Built-in Types – Classes – Utilities – Working with Angular CLI – <b>Building Blocks of Angular:</b> Modules – Components – Templates – Metadata – Data Binding – Directives – Services – Dependency Injection						
<b>Unit:2</b>	<b>Data Architecture and Testing in Angular</b>					<b>20 hours</b>
Forms in Angular – HTTP - Routing – <b>Data Architecture in Angular:</b> Overview – Observables and RxJS – Redux in Angular – <b>Testing:</b> Testing Tools – End-to-End and Unit Testing – Testing Services and HTTP – Resting Routing to Components – Testing Forms – Testing HTTP requests						
<b>Unit:3</b>	<b>Service Workers in Progressive Web Apps (PWAs)</b>					<b>18 hours</b>
<b>Introduction to Progressive Web Apps (PWA)</b> – Current and Future PWA Support – Why Angular – Installing Node and NPM – <b>Service Workers:</b> Understanding Service Worker – Service Worker Life Cycle – Service Worker Functional Events – Cache API – Cache Strategies – Runtime Cache in Angular Service Worker						
<b>Unit:4</b>	<b>App Manifest, Notifications and App Shell</b>					<b>18 hours</b>
Background Sync API – <b>Data Storage:</b> IndexedDB and localForage – <b>App Manifest:</b> The Web App Manifest – Adding Web App Manifest to Home Screen – <b>Notifications:</b> Web Notifications – Push Notifications – <b>App Shell:</b> App Shell Model – Angular App Shell – Further Optimizations – Exploring HTTP/2 and Server Push						
<b>Unit:5</b>	<b>Debugging PWAs and Modern Web APIs</b>					<b>16 hours</b>
<b>Debugging:</b> NGSW Debug – Web App Manifest – Service Workers – Storage – Cache – <b>Measurement:</b> Audit – Analytics – <b>Safety Service Worker:</b> Fail-safe – Safety Worker – <b>Modern Web APIs:</b> Credential Management – Payment Request – Video and Audio Capturing - Geolocation						

<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars - webinars		
<b>Total Lecture hours</b>		<b>92 hours</b>
<b>Text Book(s)</b>		
1	Nathan Murray, Felipe Coury, Ari Lerner and Carlos Taborda, 'Angular-book: The Complete Guide to Angular', Fullstack.io, 2018	
2	MajidHajian, 'Progressive Web Apps with Angular', Apress, 2019.	
3	Dennis Sheppard, 'Beginning Progressive Web App Development', Apress, 2017.	
<b>Reference Books</b>		
1	Tal Ater, 'Building Progressive Web Apps', O'Reilly Media, 2017.	
2	Chris Love, 'Progressive Web Application Development By Example', Packt Publishing Ltd, 2018.	
3	John M. Wargo, 'Learning Progressive Web Apps', Addison Wesley, 2020.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	Developing Dynamic Web Applications Using Angular ( <a href="https://www.edx.org/course/developing-dynamic-web-applications-using-angular">https://www.edx.org/course/developing-dynamic-web-applications-using-angular</a> )	
Course Designed By: <b>Dr. R. Rajeswari</b>		

<b>Mapping with Programme Outcomes</b>										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
<b>CO1</b>	S	S								
<b>CO2</b>		L	S	S						
<b>CO3</b>		M	L	L					M	M
<b>CO4</b>		L	S	S					M	M
<b>CO5</b>		L	M	M					L	L

\*S-Strong; M-Medium; L-Low

Course code	21CSEAC08	BIG DATA ANALYTICS		L	T	P	C
Core/Elective/Supportive	Core		4	-	2	4	
Pre-requisite	Nil		Syllabus Version		2021-22		
<b>Course Objectives:</b>							
The main objectives of this course are to:							
<ol style="list-style-type: none"> <li>1. To understand Data source evolution, data Characteristics and Big data processing models.</li> <li>2. To understand and apply Data Analytics Techniques on Datasets</li> <li>3. To analyze and Build Data Analytics use cases for specific domain and applications.</li> </ol>							
<b>Expected Course Outcomes:</b>							
On the successful completion of the course, student will be able to:							
1	Understand Data sources, generations, data formats, Data Evolution, Data from various domains					K1, K2	
2	Understand Big Data Characteristics , Frameworks , components and Limitation of traditional approaches and map Big Vs to Data Domains					K3	
3	Understand the Concepts of Data Analytics Phases and Techniques					K2	
4	Apply Data Analytics Techniques practically using R environment					K2-K5	
5	Analyze various domains of Data Characteristics, Platform, Programming Model and Design Data Analytic ecosystem, and data processing framework					K4-K5	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>							
<b>Unit:1</b>	<b>Big Data Landscape</b>					<b>18-- hours</b>	
Data Evolution: Data Development Time Line – ICT Advancement-a Perspective – Data Growth-a Perspective – IT Components-Business Process – Landscape-Data to Data Science – Understanding data: Data Classification – Hot Data – Cold Data – Warm Data – Thick Data – Thin Data - Classification of digital Data: Structured, Semi-Structured and Un-Structured. Data Sources - Data Science-Components – Data Science vs Statistics – Mathematics - Programming Language - Database, - Machine Learning. Data Analytics Relation: Data Science, Analytics, Big Data Analytics							
<b>Unit:2</b>	<b>Big Data Components</b>					<b>18-- hours</b>	
Big Data: Introduction To Big Data: - Evolution What is Big Data – Sources of Big Data. Characteristics of Big Data 6Vs – Big data-Challenges of Conventional Systems- — Data Processing Models – Limitation of Conventional Data Processing Approaches – Big Data Myths - Data Discovery-Traditional Approach, Big Data Technology: Big Data Exploration - Data Augmentation – Operational Analysis – 360 View of Customers – Security and Intelligence – Hadoop: Basic Concepts-An Overview of Hadoop-The Hadoop Distributed File System-Anatomy of a Hadoop Cluster-Hadoop Ecosystem Components – NoSQL Database: Types							
<b>Unit:3</b>	<b>Data Analytics using R</b>					<b>18-- hours</b>	
R Basics Data Structures – Vectors – Lists – Tuples – Data Frames - Visualization using R – : Histogram – Boxplot – Scatter Plot – Bar Chart- Pier Chart – Mosaic Plot-Lattice Package – ggplot , Plotly – Packages - rpart – party – MASS – R Reporting – Markdown – Flex Dashboard - Data Analytics Classification – Descriptive – Diagnostic – Predictive – Diagnostic – Data Analytics – Case Studies – Data mining in Big Data –Big Data Roles Data Scientist , Data Architect, Data Analyst – Skills –							



<b>Unit:4</b>	<b>Data Analytics Techniques</b>	<b>18-- hours</b>	
Data mining: Introduction – Data as a Subject – Data Formats - Definitions- KDD vs. Data mining- DM techniques- Association Rules: Concepts- Methods to discover Association rules- A priori algorithm – Partition algorithm- Pincer search algorithm –Clustering techniques: Clustering paradigms – Partition algorithm-K- Medeoid algorithms – CLARA- CLARANS –Hierarchical DBSCAN- BIRCH -Categorical clustering algorithms STIRR-ROCK-- Introduction to neural network - learning in NN- Genetic algorithm			
<b>Unit:5</b>	<b>Data Science Usecases</b>	<b>18-- hours</b>	
Classification Technique: Introduction – Decision Trees: Tree Construction Principle - Decision Tree construction Algorithm – CART – ID3 – Random Forest - Pruning Text Analytics – Pre-Processing -Data Science & Big Data Use cases – Discussion – Data Sources Identification – Data Types –Data Classification – Data Characteristics of Big V’s – Data Science P’s – Big Data Frameworks – Data Analytics Classification - Domains : Customer Insights – Behavioural Analysis -- Marketing – Retails – Insurance – Risk and Security –Health care – Supply Chain Logistics			
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>	
Addressing Controversy Views of social media – Big Data Source – Data Science Technology - Expert lectures, online seminars – webinars			
	<b>Total Lecture hours</b>	<b>92-- hours</b>	
<b>Text Book(s)</b>			
1	V. Bhuvanewari, T. Devi, <b>-Big Data Analytics: A Practitioner’s Approach</b> l, Sci-Tech Publications, 2016.		
2	SeemaAcharya, SubhashniChellappan, <b>-Big Data Analytics</b> l, Wiley, 2015		
3	<a href="#">Joel Grus</a> , <b>“Data Science from Scratch”</b> , First Edition, O’Reilly Publisher, ISBN: 9781491901427, 2015		
4	Jaiwei Han and MichelineKamber, <b>l Data Mining Concepts and Techniques</b> l, MorganKaufmann Publishers, 2011, 3rd Edition.		
5	Arun K. Pujari, <b>-Data mining Techniques</b> l, Third Edition, Universities Press (India)Limited, Hyderabad, 2013.		
6	V. Bhuvanewari, <b>-Data Analytics with R – Step by Step</b> l, First Edition, SciTech Publications, 2016.		
<b>Reference Books : EBooks</b>			
1	SinanOzdemir, Sunil Kakade, <b>-Principles of Data Science</b> l, Second Edition, [Packt]		
2	David Natingga, <b>“Data Science for Algorithms in a Week”</b> , Second Edition, [Packt]		
3	PrabhanjanTattar, Tony Ojeda, Et al, <b>“Practical Data Science Cookbook”</b> , Second Edition, [Packt], ISBN: 9781787129627		
4	<a href="#">Lillian Pierson</a> , <a href="#">Jake Porway</a> , <b>-Data Science for Dummies</b> l, Second Edition, John Wiley & Sons, Publishers, ISBN: 9781119327639, 2017		
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>			
	<b>Course Title</b>	<b>Duration</b>	<b>Provider</b>
1.	Python for Data Science	4 Weeks	Swayam
2.	Introduction to Data Science in Python (Free)	4 Weeks	Coursera
3.	Intro to Data Science (Free)	8 Weeks	Udacity
4.	Data Science Certification Training – R Programming	14 hours	Simlilearn
5.	Data Science with Python	15 hours	Simlilearn

<b>Web link</b>		
1. <a href="https://builtin.com/data-science">https://builtin.com/data-science</a>		
2. <a href="https://www.udacity.com/course/intro-to-data-science--ud359">https://www.udacity.com/course/intro-to-data-science--ud359</a>		
3. <a href="https://www.tutorialspoint.com/python_data_science/index.htm">https://www.tutorialspoint.com/python_data_science/index.htm</a>		
Course Designed by: Dr.V.Bhuvanewari		

<b>Mapping with Programme Outcomes</b>										
<b>Cos</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>	L	M	S	S	S	M	M	M	S	M
<b>CO3</b>	M	M	M	M	S	S	S	S	S	S
<b>CO3</b>	M	M	M	M	S	S	S	S	S	S
<b>CO4</b>	S	S	S	S	S	S	S	S	S	S
<b>CO5</b>	S	S	S	M	S	S	S	S	S	S

\*S-Strong; M-Medium; L-Low



Course code	21CSEAC09	INTERNET OF THINGS	L	T	P	C
Core/Elective/Supportive	Core		2	0	2	4
Pre-requisite	Basic knowledge of hardware, Programming in C		Syllabus	rsion	2021-22	
<b>Course Objectives:</b>						
The main objectives of this course are:						
6. To gain insight about the architecture and enabling technologies of Internet of Things						
2. To understand Arduino micro controller and IDE						
3. To develop simple IoT Applications for different domains						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
CO1	To learn the importance of smart objects and smart environment					K1
CO2	To understand and use the microcontroller and various sensors					K2
CO3	To create programs using Arduino IDE and extract data					K3
CO4	To perform WiFi data communications, remote data storage in cloud, and handle the data using web applications					K3, K4
CO5	To identify potential problems and develop solutions using IOT					K5, K6
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create</b>						
<b>Unit:1</b>	<b>Introduction to IOT</b>					<b>10 hours</b>
Introduction to IOT - Enabling technologies of IOT - AI and Machine Learning - Physical and logical design of IoT - IOT Reference Architecture - IOT Functional Architecture - IoT levels and deployment templates – Application domains of IoT: Home automation – Cities – Environment – Energy – Industry – Agriculture – Transportation - Health care & Lifestyle.						
<b>Unit:2</b>	<b>Basic Electronics for IoT&amp;Arduino IDE</b>					<b>20 hours</b>
Understanding basic electronic components and power elements Electric Charge, Resistance, Current and Voltage – Resistors, Capacitors, Diodes, LED, Potentiometer, circuit boards - Analog and digital circuits – Microcontrollers – Electronic Signals – A/D and D/A Conversion – Pulse Width Modulation Arduino IDE: Installation and Set-up - Programming Fundamentals with C using Arduino IDE Program Structure in C - Basic Syntax - Data Types / Variables / Constants - Operators, Conditional Statements and Loops - Using Arduino C Library functions for Serial, delay and other invoking functions.						
<b>Unit:3</b>	<b>Arduino Microcontroller and sensors</b>					<b>20 hours</b>
Working with Arduino: LED and Switch - Data acquisition with IOT Devices - Understanding Sensors and Devices - Understanding the Inputs from Sensors - Working with Temperature Sensors -Working with Ultrasound Sensor -Working with humidity sensor - Working with Motion Sensor - Working with IR Sensor - Working with Proximity Sensor - Working with Accelerometer and vibration sensor.						
<b>Unit:4</b>	<b>Medical Sensors and Actuators</b>					<b>20 hours</b>
Understanding Medical Sensors: Flow Sensor - Optical Sensor - Body Temperature Sensor - Blood Pressure Sensor -Airflow sensor (breathing) - Patient position sensor (accelerometer) - Pulse and oxygen in blood sensor (SPO2) - Galvanic skin response (GSR - sweating) sensor. Understanding the Outputs through Actuators - Activating LED Lights - Activating Relays - Activating Buzzer - Running DC Motors - Running Stepper Motors and Servo Motors.						

<b>Unit:5</b>	<b>Data Communication from IOT devices</b>	<b>20 hours</b>
Building and Using Communication Devices to transfer data from IOT Devices - Understanding the Communication Principles to Transfer the data from IOT Devices; Using WIFI to Transfer the data from IOT Sensor; Programming Fundamentals with Web Applications for handling Data Communication from IOT Device; Remote Communication to cloud/external application .		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>92 hours</b>
<b>Text Book(s)</b>		
1	ArshdeepBahga, Vijay Madiseti, ‘Internet of Things: A Hands-On Approach’, Universities Press, 2015.	
2	Boris Adryan, DominikObermaier, Paul Fremantle, ‘The Technical Foundations of IoT’, Artech Houser Publishers, 2017.	
3	Michael Margolis, ‘-Arduino Cookbook  2nd Edition, O’Reilly Media, 2012.	
4	Marco Schwartz, ‘Internet of Things with ESP8266’, Packt Publishing, 2016.	
<b>Reference Books</b>		
1	Charles Platt, ‘-Make Electronics – Learning by discovery , O’Reilly Media, 2015.	
2	Michael Miller, ‘— The Internet of Things , Pearson India, 2015.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	Introduction to IOT, <a href="https://nptel.ac.in/courses/106/105/106105166/">https://nptel.ac.in/courses/106/105/106105166/</a>	
Course Designed By: <b>Dr. T. Amudha</b>		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>	S	S								
<b>CO2</b>		L	S	S						
<b>CO3</b>		M	L	L					M	M
<b>CO4</b>		L	S	S					M	M
<b>CO5</b>		L	M	M					L	L

\*S-Strong; M-Medium; L-Low



# Elective Courses

Course code	21CSEAE01	COMPUTER SECURITY AND CRYPTOGRAPHY	L	T	P	C
Core/Elective/Supportive	Elective		4	0	0	4
Pre-requisite	None		Syllabus rsion		2021- 22	
<b>Course Objectives:</b>						
The main objectives of this course are:						
<ol style="list-style-type: none"> <li>1. To understand the concepts in encryption, cryptography</li> <li>2. To understand the concepts of system security and database security</li> <li>3. To understand the ethical issues in computer security</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	To explain the structure and model of the Network Security		K1, K2			
2	To design firewalls and apply RPA		K3			
3	To explain the security requirements in the multilevel database		K4, K6			
4	To explain the security standards in the secure socket layer		K4, K5			
5	To explore the legal issues in computer security		K5			
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create</b>						
<b>Unit:1</b>	<b>Introduction to Security</b>				<b>12 hours</b>	
Introduction: Introduction to security attacks - services and mechanism - introduction to cryptography - Classical Encryption Techniques – Network Security Model – Data Encryption Standard-Triple DES-block cipher modes of operations –Different types of ciphers- Electronic Mail Security-IP Security- Web Security						
<b>Unit:2</b>	<b>Cryptography Concepts</b>				<b>12 hours</b>	
Public Key Cryptography: Number Theory concepts – Primality – Modular Arithmetic – Fermat & Euler Theorem – Euclid Algorithm – RSA Algorithm – Elliptic Curve Cryptography – Diffie Hellman Key Exchange - Cryptographic hash functions - Cipher Block Chaining - Secure Hash Algorithm - Digital Signature: Schnorr Digital Signature Scheme -Digital Signature Standard – Kerberos						
<b>Unit:3</b>	<b>System Security</b>				<b>12 hours</b>	
System Security: Intruders-Intruder Detection-Password management- Viruses- virus countermeasures-worms-DOS attack- Types of Firewalls – Firewall Designs – SET for E-Commerce Transactions -Secure Socket Layer-Security standards						
<b>Unit:4</b>	<b>Database Security</b>				<b>12 hours</b>	
Operating System and Database Security: Internet Key Exchange (Phases of IKE), PGP - Access Control – File Protection mechanism- User Authentication-Wireless application protocol (WAP) – Protocol overview – Detecting conficker with Nmap- Security Requirements- Multilevel database.						
<b>Unit:5</b>	<b>Legal and Ethical Issues</b>				<b>12 hours</b>	
Ethical and Legal Issues in Computer Security: Cybercrime- Computer Crime-Copyrights- patents-Information and law-Ethical issues-case studies.						

<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>62 hours</b>
<b>Text Books</b>		
1	William Stallings, –Cryptography & Network Security , Pearson Education, 5th edition.New Delhi 2013.	
2	Charles P. Pfleeger, Shari L. Pfleeger, –Security in Computing , Prentice Hall, 4th edition. 2003.	
<b>Reference Books</b>		
1. Forouzan, –Cryptography And Network Security , 3rd Edition, McGraw Hill India, 2015		
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	Cryptography & Network Security, <a href="https://nptel.ac.in/courses/106/105/106105031/">https://nptel.ac.in/courses/106/105/106105031/</a>	
Course Designed By: <b>Dr. J. Satheesh Kumar</b>		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>		S	M	M	S	S	S		S	L
<b>CO2</b>		S	S							
<b>CO3</b>		S		L						
<b>CO4</b>		S	L	S	S	S	S	L	S	L
<b>CO5</b>		S	L	M	S	M			S	M

\*S-Strong; M-Medium; L-Low

Course code	21CSEAE02	MOBILE NETWORKING	L	T	P	C
Core/Elective/Supportive	Elective		4		0	4
Pre-requisite	Nil		Syllabus Version	2021-22		
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>To understand the basic concepts of Cellular System.</li> <li>To understand the concepts of Radio Technology.</li> <li>To understand GSM and GPRS concepts.</li> <li>To understand 3G and UTMS concepts.</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
CO1	Understand basic concepts of mobile network engineering used in the design and rollout of mobile networks.					K2
CO2	Understand the principles, design constraints and provide a more advanced insight into the radio interface protocol stack, operation and dimensioning for three major mobile network technologies; the GSM, 3G WCDMA, 4G-LTE.					K2
CO3	Understand development towards the next generation of mobile networks (5G)					K3
CO4	Analyze the Mobile radio propagation, fading, diversity concepts and the channel modeling.					K4
CO5	Analyze Multiuser Systems, CDMA, WCDMA network planning and OFDM Concepts.					K4
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create</b>						
<b>Unit:1</b>	<b>Introduction, Cellular System, Radio Propagation</b>				<b>12 hours</b>	
Introduction – Type of Mobile Network by Multiple-Access Scheme. Cellular System : Cellular Concept - Carrier-to-Interference Ratio - Formation of Clusters - Sectorization - Frequency Allocation - Trunking Effect - Erlang Formulas - Erlang B Formula. Radio Propagation: Propagation Mechanisms.						
<b>Unit:2</b>	<b>Mobile Radio Channel, Radio Network Planning</b>				<b>12 hours</b>	
Mobile Radio Channel: Channel Characterization - Fading - Diversity to Mitigate Multipath Fading. Generic Link Budget: Receiver Sensitivity Level - Design Level - Rayleigh Fading Margin - Lognormal Fading Margin - Body Loss - Car Penetration Loss - Design Level - Building Penetration Loss - Outdoor-to-Indoor Design Level - Power Link Budget - Power Balance.						
<b>Unit:3</b>	<b>Global System Mobile, GSM, 2G</b>				<b>12 hours</b>	
General Concept for GSM System Development - GSM System Architecture - Radio Specifications - Background for the Choice of Radio Parameters - Communication Channels in GSM - Mapping the Logical Channels onto Physical Channels - Signaling During a Call - Signal Processing Chain - Estimating Required Signaling Capacity in the Cell .						
<b>Unit:4</b>	<b>EGPRS: GPRS/EDGE</b>				<b>12 hours</b>	
GPRS Support Nodes - GPRS Interfaces - GPRS Procedures in Packet Call Setups - GPRS Mobility Management - Layered Overview of the Radio Interface - Channel Sharing .						



<b>Unit:5</b>	<b>Third Generation Network (3G), UMTS</b>	<b>12 hours</b>
The WCDMA Concept - Major Parameters of 3G WCDMA Air Interface - Spectrum Allocation for 3G WCDMA - 3G Services - UMTS Reference Network Architecture and Interfaces - Air-Interface Architecture and Processing - Channels on the Air Interface - Physical-Layer Procedures - RRC States - RRM Functions - Initial Access to the Network .		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
High-Speed Packet Data Access - 4G-Long Term Evolution (LTE) System - Further Development for the Fifth Generation . Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>62 hours</b>
<b>Text Book(s)</b>		
1	Alexander Kukushkin , -A Introduction to Mobile Network Engineering  , John Wiley & Sons Ltd , 2018.	
<b>Reference Books</b>		
1	Harish OM Sharma, -Mobile Network Technology , 1 <sup>st</sup> Edition, Evincepub Publishing, 2019.	
2	Yi-Bing Lin, -Wireless and Mobile Network Architecture  3 <sup>rd</sup> Edition, Wiley India Pvt.Ltd, 2008.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	Introduction to Wireless and Cellular Communications : <a href="https://swayam.gov.in/nd1_noc19_ee48/preview">https://swayam.gov.in/nd1_noc19_ee48/preview</a>	
Course Designed By: <b>Dr. S. Gavaskar</b>		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>		L		M	M		L		L	L
<b>CO2</b>		L	L	M	M		L		L	L
<b>CO3</b>		L	L	M	S		M		M	M
<b>CO4</b>		M	M	S	S		S		M	S
<b>CO5</b>		M	M	S	S		S		M	S

<b>Course code</b>	<b>21CSEAE03</b>	<b>VIRTUALIZATION AND CLOUD</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Core/Elective/Supportive</b>	Elective		<b>3</b>	<b>0</b>	<b>1</b>	<b>4</b>
<b>Pre-requisite</b>	Basic knowledge of data storage, Client – Server systems		<b>Syllabus</b>		<b>2021-22</b>	
<b>Course Objectives:</b>						
The main objectives of this course are:						
1. To impart knowledge on the concepts of distributed systems, cloud computing and AWS						
2. To gain knowledge over various virtualization and virtual machines						
3. To gain understanding about the data centers						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
CO1	To learn the fundamentals of distributed systems				K2	
CO2	To understand and use the cloud services and AWS				K3	
CO3	To understand and perform virtualization				K3, K6	
CO4	To create, configure and manage virtual machines				K4	
CO5	To learn about data center				K5	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>Distributed Systems</b>				<b>15 hours</b>	
Introduction to distributed systems - Distributed algorithm - Distributed Data Stores - Distributed Computing - File Systems - Distributed Messaging - Distributed Applications – Distributed Transaction - Parallel and distributed computing - Applications.						
<b>Unit:2</b>	<b>Cloud Computing</b>				<b>15 hours</b>	
Cloud Concepts: Introduction Cloud Computing - Advantages of Cloud - Public Cloud - five essential characteristics - three service models - Four deployment models - Benefits of Cloud Computing - Cloud Vendors - Traditional Infrastructure setup and Challenges – AWS.						
<b>Unit:3</b>	<b>Virtualization</b>				<b>15 hours</b>	
Virtualization: Introduction to vSphere and the Software - Defined Data Center - Creating Virtual Machines - VCenter Server - Configuring and Managing - Virtual Networks - Configuring and Managing Virtual Storage - Virtual Machine Management - Resource Management and Monitoring.						
<b>Unit:4</b>	<b>Virtual Machines</b>				<b>15 hours</b>	
Virtual Machines: vSphere HA - vSphere Fault Tolerance - Protecting Data vSphere DRS - Network Scalability - vSphere Update Manager and Host Maintenance - Storage Scalability - Securing Virtual Machines.						
<b>Unit:5</b>	<b>Datacenter</b>				<b>15 hours</b>	
Datacenter: Data center overview -Components - Provisions - Need of Data Center - Data Center Architecture - Different Racks - Data center architecture for cloud computing - role of data center in cloud computing.						
<b>Unit:6</b>	<b>Contemporary Issues</b>				<b>2 hours</b>	
Expert lectures, online seminars - webinars						
<b>Total Lecture hours</b>					<b>77 hours</b>	

<b>Text Book(s)</b>	
1	George Coulouris, Jean Dollimore, Tim Kindberg, Gordan Blair, –Distributed Systems Concepts and Design, 5 <sup>th</sup> Edition, Pearson Education, 2012.
2	VenkataJosyula , Malcolm Orr , Greg Page, –Cloud Computing: Automating the Virtualized Data Center, 1st Edition, Cisco Press, 2011.
3	Brian J.S. Chee, Curtis Franklin Jr., –Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center, 1st Edition, CRC Press, 2010.
<b>Reference Books</b>	
1	Andrew S. Tanenbaum, Maarten Van Steen, –Distributed Systems: Principles and Paradigms, 2 <sup>nd</sup> edition, Createspace Independent Publishers, 2016.
2	Matthew Portnoy, –Virtualization Essentials, 2 <sup>nd</sup> edition, Wiley Publication, 2016.
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>	
1	Cloud Computing and Distributed Systems, <a href="https://nptel.ac.in/courses/106/104/106104182/">https://nptel.ac.in/courses/106/104/106104182/</a>
Course Designed By: <b>Dr. T. Amudha</b>	

<b>Mapping with Programme Outcomes</b>										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S					M			
CO2		S	M	S						
CO3		M	S	L			L		M	M
CO4		L	S	M					M	M
CO5		L	S	S			M		M	L

\*S-Strong; M-Medium; L-Low

Course code	21CSESE04	IT Infrastructure and Cloud Security	L	T	P	C
<b>Core/Elective/Supportive</b>		<b>Elective</b>	<b>4</b>			<b>4</b>
<b>Pre-requisite</b>		<b>Cloud, Networking Basics</b>	<b>Syllabus Version</b>		<b>2021-2022</b>	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1. To understand the concepts of Internet of Things</li> <li>2. To learn how to use CloudServices.</li> <li>3. To implementVirtualization</li> <li>4. To understand complex technologies leading to the development of current and future cloud computingsecurity</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Understand the nature of malware, its capabilities, and how it is combated through detection and classification.					K2
2	Understand the social, economic, and historical context in which malware occurs.					K2
3	Analyze malicious in windows programs.					K4
4	Apply the tools and methodologies used to perform static and dynamic analysis on unknown executable.					K3
5	Apply techniques and concepts to unpack, extract, decrypt, or bypass new anti-analysis techniques in future malware samples.					K3
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create</b>						
<b>Unit:1</b>	<b>Introduction to Networking &amp; Communication Protocols</b>				<b>10hours</b>	
<b>Networking:</b> Introduction to Corporate Infrastructure – LAN, MAN and WAN. <b>Internet of Things:</b> Introduction – Definition Evolution – IoT Architecture – Resource Management – IoT Data Management and Analytics – Communication Protocols – Identity Management and Authentication – Privacy. Device Collaboration Framework.						
<b>Fog Computing</b>						
<b>Unit:2</b>					<b>14hours</b>	
<b>Fog Computing:</b> Introduction – Characteristics – Reference Architecture – Applications – Research Directions and Enables – Commercial Products. <b>Stream Processing in IoT:</b> Foundation of Stream Processing in IoT – Continuous Logic Processing System – Challenges and Future Direction.						
<b>Cloud Computing Influences</b>						
<b>Unit:3</b>					<b>12hours</b>	
<b>Cloud Computing:</b> Introduction – Characteristics – Architectural Influences – Technological Influences – Operational Influences. <b>Cloud Computing Architecture:</b> Delivery Model – Deployment Model – Benefits. Cloud SecurityServices.						
<b>Unit:4</b>	<b>Virtualization &amp; Data Center</b>				<b>12hours</b>	
<b>Cloud, Virtualization, andDataStorage &amp; Data Center NetworkingFundamentals:</b> Server and Storage I/O Fundamentals – I/O Connectivity and Networking Fundamentals – IT Clouds – Virtualization: Servers, Storage and Networking – Virtualization and Storage Services						

– Data and Storage Access. <b>Infrastructure Resource Management:</b> Introduction - Managing Data Infrastructure for Cloud Virtual Environments – Understanding IT Resources – Managing IT Resources		
<b>Unit:5</b>	<b>Security Threats and Risks</b>	<b>12hours</b>
<b>Data and Storage Networking Security:</b> Security Threat Risks and Challenges – Securing Networks – Securing Storage – Securing Clouds. <b>Data Protection:</b> Data Protection Challenges and Opportunities – Protect, Preserve, and Serve Information Services – Virtual – Physical, and Cloud Data Protection – Modernizing and Protection and Backup.		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Internet of Robotic Things - Cloud-enabled Robotics.		
<b>Total Lecture hours</b>		<b>62hours</b>
<b>Text Book(s)</b>		
1	Rajkumar Buyya, Amir Vahid Dastjerdi, “Internet of Things: Principles and Paradigms”, Morgan Kaufmann Publications, 2016.	
2	Ronald L.Krutz, Russell Dean Vines, “Cloud Security: A Comprehensive Guide to Secure Cloud Computing”, Wiley Publishing, Inc, 2010.	
<b>Reference Books</b>		
1	Fei Hu, “Security and Privacy in Internet of Things: Models, Algorithm and Implementations”, CRC Press, 2016.	
2	John R.Vacca, “Cyber Security and IT Infrastructure Protection”, Syngress, 2013.	
3	Chris Dotson, “Practical Cloud Security: A Guide for Secure Design and Deployment”, O’Reilly Media Publications, 2019.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
<a href="https://onlinecourses.nptel.ac.in">https://onlinecourses.nptel.ac.in</a> [Two Courses]		
1	Components And Applications Of Internet Of Things	15 Weeks
2	Introduction to Industry 4.0 and Industrial Internet of Things.	12 Weeks
<a href="https://www.classcentral.com/course/cloud-computing-security-11754">https://www.classcentral.com/course/cloud-computing-security-11754</a> [Cloud Computing Security]		
<b>Web Link</b>		
Course Designed By: Dr. S. Gavaskar & CSSC Labs		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>P O1</b>	<b>P O2</b>	<b>P O3</b>	<b>P O4</b>	<b>P O5</b>	<b>P O6</b>	<b>P O7</b>	<b>P O8</b>	<b>P O9</b>	<b>PO 10</b>
<b>CO1</b>	M	L	L	L	L	L	L	S	L	M
<b>CO2</b>	L	L	L	L	L	L	L	S	L	M
<b>CO3</b>	S	S	S	M	S	M	M	S	S	S
<b>CO4</b>	S	S	M	S	M	S	S	S	M	M
<b>CO5</b>	M	M	M	S	M	S	S	S	M	M

\*S-Strong; M-Medium; L-Low

Course code	21CSEAE05	DATA ANALYSIS AND BUSINESS INTELLIGENCE	L	T	P	C
Core/Elective/Supportive	Elective		4			4
Pre-requisite	Nil		Syllabus	rsion	2021-22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1. To understand OLAP operations and basic Statistical concepts.</li> <li>2. To understand the important concepts of Business Intelligence.</li> <li>3. To create data warehouse for any domain.</li> <li>4. To understand the Analytic concepts, tools and analysis of data using the tools.</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Understand the concepts of Data Warehousing and Statistics					K2
2	Analyze the correlation between various parameters of a data set using suitable techniques through statistical study					K4
3	Design a Data Warehouse and Analyze using OLAP.					K4, K6
4	Apply Predictive and Prescriptive Analytics in Business					K3
5	Identify suitable technique for various stages of data analytics					K4
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create</b>						
<b>Unit:1</b>	<b>DATA WAREHOUSING</b>				<b>12 hours</b>	
Introduction – Data warehouse architecture – Dimensional Modeling – Aggregate Function – Summarisability – Fact-Dimension Relationship – OLAP Operations – Lattice of Cuboids – OLAP Server – ROLAP – MOLAP – Data Mart – ETL – Data Cleaning – ELT vs ETL – Cloud Data Warehousing.						
<b>Unit:2</b>	<b>STATISTICS FOR DATA ANALYSIS</b>				<b>14 hours</b>	
Measures of Central Tendency and Dispersion: Arithmetic Mean - Median and Quantiles – Mode – Geometric Mean –Harmonic Mean. Measures of Dispersion: Range and Interquartile Range – Absolute Deviation, Variance, Standard Deviation – Coefficient of Variation. Correlation: Correlation and Causation – Types of Correlation – Karl Pearson’s Coefficient Correlation – Rank Coefficient of Correlation. Regression: Correlation and Regression – Graphic Method, Algebraic Method – Regression Line – Regression Equation – Mathematical Equation. Chi Square Test: Test of Goodness of Fit – Test of Independence – Test of Homogeneity.						
<b>Unit:3</b>	<b>ANALYTICS: A COMPREHENSIVE STUDY</b>				<b>12 hours</b>	
Business Analytics – Analytics – Software Analytics – Embedded Analytics – Learning Analytics – Predictive Analytics – Prescriptive Analytics – Social Media Analytics – Behavioral Analytics. Analyse and predict results based on historical patterns.						
<b>Unit:4</b>	<b>BUSINESS INTELLIGENCE</b>				<b>12 hours</b>	
Business Intelligence – Mobile Business Intelligence – Real-Time Business Intelligence – Context Analysis – Business Performance Management – Business Process Discovery - Information System – organizational Intelligence – Data Visualization – Data Profiling – Data Cleansing – Process Mining – Competitive Intelligence						

<b>Unit:5</b>	<b>BUSINESS INTELLIGENCE TOOLS</b>	<b>10 hours</b>
BI Tools Overview – BI Tools (Any One Tool in Depth): Microsoft Power BI – IBM Cognos - Tableau – MicroStrategy – QlikView.		
<b>Unit:6</b>	<b>CONTEMPORARY ISSUES</b>	<b>2 hours</b>
Data Warehouse Design for Hospital - Design Business Intelligence Model and Conduct Analysis. <b>Expert lectures, online seminars – webinars</b>		
<b>Total Lecture hours</b>		<b>62 hours</b>
<b>Text Book(s)</b>		
1	Arun K Pujari“ <b>Data Mining Techniques</b> ”, 3 <sup>rd</sup> Edition, University Press, 2013.	
2	R.S.N.Pillai, Bagavathi, “ <b>Statistics Theory and Practice</b> ”, 8 <sup>th</sup> Edition, S.Chand Publishing, 2016.	
3	Drew Bentley, “ <b>Business Intelligence and Analytics</b> ”, Library Press, 2017.	
<b>Reference Books : EBooks</b>		
1	Jiaweu Gab, MicgekubeJanver, Jian Pei, “ <b>Data Mining Concepts</b> ”,Third Edition, Morgan Kaufmann Publications, 2012.	
2	Christian Heumann, Michael Schomaker, Shalabh “ <b>Introduction to Statistics and Data Analysis With Exercises, Solutions and Applications in R</b> ”, Springer, 2016.	
3	Olivia Parr Rud“ <b>Business Intelligence Success Factors: Tools for Aligning Your Business in the Global Economy</b> ”, John Wiley & Sons, Inc., 2009.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		

	<b>Course Title</b>	<b>Duration</b>	<b>Provider</b>
1.	Data Mining	12 Weeks	Swayam
2.	Business Statistics	10 Weeks	Swayam
3.	Business Analytics For Management Decision	12 Weeks	Swayam
<b>Web link</b>			
4.	<a href="https://www.tutorialspoint.com/power_bi/index.htm">https://www.tutorialspoint.com/power_bi/index.htm</a>		
5.	<a href="https://tekslate.com/cognos">https://tekslate.com/cognos</a>		
6.	<a href="https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial-home.htm">https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial-home.htm</a>		
7.	<a href="https://www.guru99.com/microstrategy-tutorial.html">https://www.guru99.com/microstrategy-tutorial.html</a>		
8.	<a href="https://www.edureka.co/blog/qlikview-tutorial/">https://www.edureka.co/blog/qlikview-tutorial/</a>		
Course Designed by: <b>Mr. S.Palanisamy</b>			

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>	S	M	S	S	M	L	S		S	
<b>CO2</b>	M			M	M				M	
<b>CO3</b>	M	S							S	M
<b>CO4</b>	S		L	S	S	M			M	
<b>CO5</b>	S	S	M	L			S		M	

<b>Course code</b>	<b>21CSEAE06</b>	<b>BIG DATA FRAMEWORKS AND TOOLS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Core/Elective/Supportive</b>	Elective		<b>4</b>	<b>2</b>	<b>2</b>	<b>4</b>
<b>Pre-requisite</b>	<b>Basics of Big Data</b>		<b>Syllabus Version</b>		<b>2021-22</b>	
<b>Course Objectives:</b>						
<ol style="list-style-type: none"> <li>1. To understand MapReduce programming architecture, processing models.</li> <li>2. To understand and design MapReduce Programming using PIG and Hive</li> <li>3. To understand and compare the architectural and processing of MapReduce Programming languages Pig, Hive and SPARK</li> </ol>						
<b>Expected Course Outcomes:</b>						
1	Understand MapReduce Processing architectures			K2		
2	Configure and setup MapReduce Processing architectures Ecosystem – Hadoop, Spark , Pig and Hive			K1, K2		
3	Understand and write MapReduce program using Pig and Hive, spark			K3		
4	Analyze dataset using Pig , Hive and SPARK			K3		
5	Critically analyze case studies for and suggest MapReduce Programming models based on domains and applications			K4 , K5		
6	Design and setup a Big Data Analytics Ecosystem for specific Business scenarios			K6		
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>Big Data Framework</b>				<b>18-- hours</b>	
Introduction to Big Data – Distributed file system –,Hadoop Storage [HDFS], Common Hadoop Shell commands - Anatomy of File Write and Read, NameNode, Secondary Name Node, and Data Node - Map Reduce Architecture - Hadoop Configuration: Environment : Steps – Hadoop 1.0 Version VsHadoop 2.0 YARN – Setting up Hadoop Eco System – Oozie – FLUME- STORM – FLUME - Pig Configuration – Hive Configuration - SPARK Configuration – Integration – Hadoop with R – Hadoop with Python						
<b>Unit:2</b>	<b>PIG : MapReduce</b>				<b>18-- hours</b>	
Pig Introduction : Overview of Pig - Pig Architecture - Pig Execution modes, Pig Grunt shell and Shell -commands. Pig Latin Basis: Data model, Data Types, Operator - Pig Latin Commands - Load & Store, Diagnostic Operators, Grouping, Cogroup, Joining, Filtering, Sorting, Splitting - Built-In Functions, User define functions.- Pig Execution Modes – Batch Mode – Embedded Mode – Pig Execution in Batch Mode – Embedding Pig in Python – Use cases - Map Reduce programs with Pig – Pig Vs SQL						
<b>Unit:3</b>	<b>Hive: Map Reduce - CURD</b>				<b>18-- hours</b>	
Introduction of Hive - Hive Features - Hive architecture -Hive Meta store - Hive data types – Hive Tables - Table types - Creating database , Altering database, Create table, alter table, Drop table, - Built-In Functions - Built-In Operators, User defined functions –						
<b>Unit:4</b>	<b>Hive: Aggregation and Indexing</b>				<b>18-- hours</b>	
HiveQL–Introduction to HiveQL, HiveQL Select, HiveQL – MapReduce using HiveQLOrderBy,Group By Joins, LIMIT, Distribute By , Cluster By - Sorting And Aggregation – Partitioning – Static –Dynamic – Index Creation - Bucketing – Analysis of MapReduce execution						



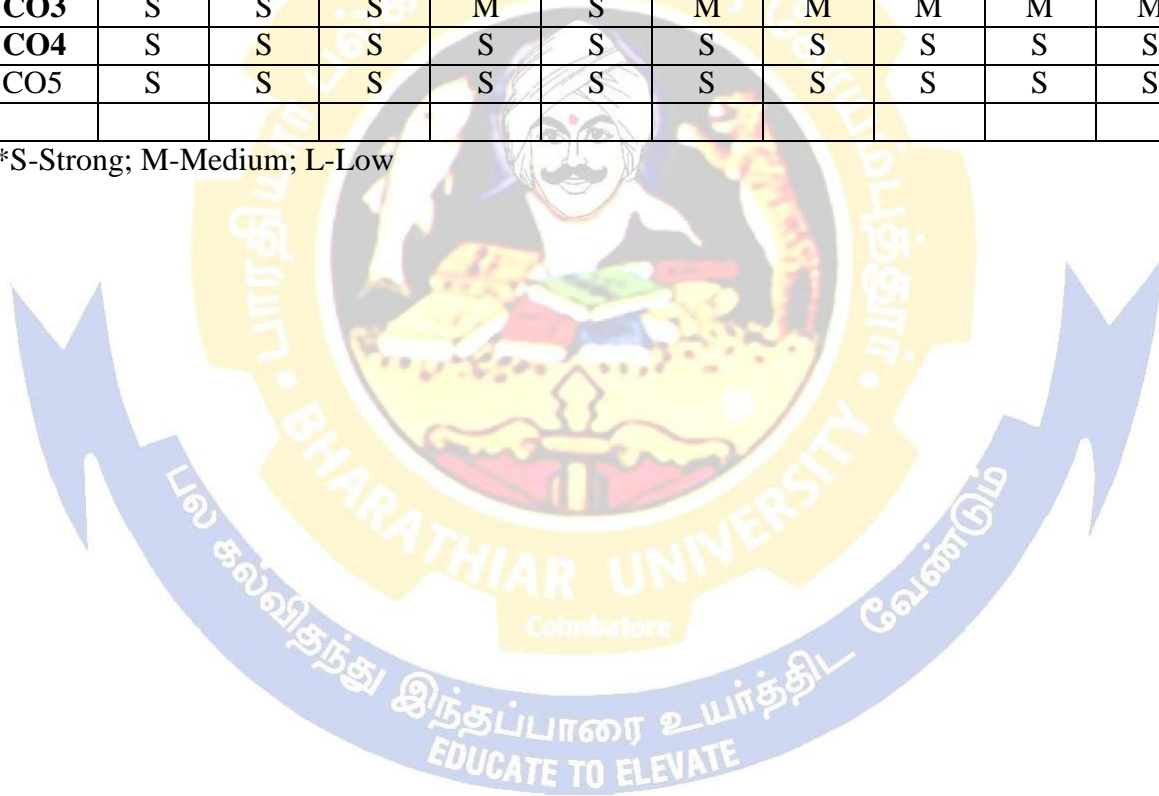
– Hive Optimization – Setting Hiiing Parameters. – Usecase :MapReduce using Hive QL – HiveQLVs SQL		
<b>Unit:5</b>	<b>SPARK Query</b>	<b>18-- hours</b>
SPARK – MapReduce - RDD Transformations – SPARK Operations – Usecase with SPARK and Comparison - MapReduce – Python – R – Pig – Spark – Hadoop - Limitations – Advantage – SPARK vsHadoop – SPARK Vs Pig and Hive – MapReduce- Spark Transformations		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Data Processing Architectures Issues – Scalability - Case Study on Industrial Reports		
<b>Total Lecture hours</b>		<b>92-- hours</b>
<b>Text Book(s):</b>		
1	Boris Lublinsky Kevin T. Smith Alexey Yakubovich, Professional Hadoop® Solutions, Wiley, ISBN: 9788126551071,2015.	
2	Chris Eaton, Dirk deroos et al., <b>-Understanding Big data</b> , McGraw Hill, 2012.	
3	Tom White, <b>-Hadoop: The Definitive Guidel</b> , O'Reilly Media 3rd Edition, May 6, 2012	
4	Donald Miner, Adam Shook, <b>-MapReduce Design Patterns</b> l, O'Reilly Media November 22, 2012	
5	Edward Capriolo, Dean Wampler, Jason Rutherglen, <b>-Programming Hive</b> l, O'Reilly Media; 1 edition , October, 2012	
6	lan Gates, <b>-Programming Pig</b> l, O'Reilly Media; 1st Edition, October, 2011	
<b>Reference Books:</b>		
1	Sridhar Alla, <b>“Big Data Analytics with Hadoop 3”</b> , First Edition, ISBN: 978-1-78862-884-6, 2018, [Packt]	
2	Naresh Kumar, <b>“Modern Big Data Processing with Hadoop”</b> , ISBN: 9781787122765, 2018, [Packt]	
3	ThilinaGunarathne, <b>“HadoopMapReduce v2 Cookbook”</b> , Second Edition, ISBN: 978-1-78328-547-1, 2015, [Packt]	
4	VigneshPrajapati, <b>“Big Data Analytics with R and Hadoop”</b> , First Edition, ISBN: 978-1-78216-328-2, 2013, [Packt]	
5	ShuminGuo, <b>“Hadoop Operations and Cluster Management Cookbook”</b> , ISBN: 978-1-78216-516-3, 2013, [Packt]	
6	<u>Deepak Vohra</u> , <b>“Practical Hadoop Ecosystem: A Definitive Guide to Hadoop-Related Frameworks and Tools”</b> First Edition, Apress Publisher, ISBN: 9781484221983, 2016	

<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>			
<b>S. No</b>	<b>Course Title</b>	<b>Duration</b>	<b>Provider - Free</b>
1.	Big Data Hadoop and Spark Developer – R Programming	26 hours	Simplilearn
2.	Intro to Hadoop and MapReduce	4 Weeks	Udacity
3.	Hadoop Platform and Application Framework	5 Weeks	Coursera
4.	Big Data Essentials: HDFS, MapReduce and Spark RDD	6 Weeks	Coursera
5.	Mining Massive Datasets	7 Weeks	edX

<b>Web Link – Video</b>
<ol style="list-style-type: none"> <li>1. <a href="http://hadooptutorial.info/mapreduce-programming-model/">http://hadooptutorial.info/mapreduce-programming-model/</a></li> <li>2. <a href="https://hadoop.apache.org/docs/r1.2.1/mapred_tutorial.html">https://hadoop.apache.org/docs/r1.2.1/mapred_tutorial.html</a></li> <li>3. <a href="https://hadoop.apache.org/docs/current/hadoop-mapreduce-client/hadoop-mapreduce-client-core/MapReduceTutorial.html">https://hadoop.apache.org/docs/current/hadoop-mapreduce-client/hadoop-mapreduce-client-core/MapReduceTutorial.html</a></li> <li>4. <a href="https://www.edureka.co/blog/mapreduce-tutorial/">https://www.edureka.co/blog/mapreduce-tutorial/</a></li> </ol>
Course Designed By: Dr.V.Bhuvaneshwari

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>	S	S	M	M	S	M	M	M	M	M
<b>CO3</b>	S	S	S	M	S	M	M	M	M	L
<b>CO3</b>	S	S	S	M	S	M	M	M	M	M
<b>CO4</b>	S	S	S	S	S	S	S	S	S	S
<b>CO5</b>	S	S	S	S	S	S	S	S	S	S

\*S-Strong; M-Medium; L-Low



<b>Course code</b>	<b>21CSEAE07</b>	<b>NoSQLI- MongoDB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Core/Elective/Supportive</b>		<b>Elective</b>	<b>2</b>		<b>2</b>	<b>4</b>
<b>Pre-requisite</b>	<b>Nil</b>		<b>Syllabus Version</b>		<b>2021-22</b>	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1. To understand the concepts of DBMS, Data Model and Normal forms. .</li> <li>2. To understand the concepts of concurrency control and Recovery.</li> <li>3. To understand basics of SQL and NoSQL databases.</li> <li>4. To understand and apply MongoDB (NoSQL) for Data Analysis using CURD and User Management.</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
CO1	Understand the structure and model of the relational database system.					K2
CO2	Design multiple tables, and using group queries.					K3
CO3	Design a database based on a data model normalization to a specified level					K4
CO4	Mongo DB& Operators					K3
CO5	Design a secure database and analyze with security protocols					K4, k6
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>Database Overview</b>					<b>20 hours</b>
Introduction - Database concepts, Basic components of DBMS, sources of data - data models – hierarchical – network – XML and Stores - Relational Database Design: Anomalies in a Database–Functional Dependency – Lossless Join and Dependency – Preserving Decomposition – Third Normal Form– BoyceCodd Normal Form – Multivalued Dependency – Fourth Normal Form – Join Dependency – Project Join Normal Form –Domain Key Normal Form - SQL: Data Definition – Data Manipulation – Integrity Constraints–Views–PL/SQL.						
<b>Unit:2</b>	<b>NoSQL</b>					<b>20 hours</b>
Indexing and Hashing – Query Processing – Transaction Processing – Concurrency Control and Recovery - Advanced Database Concepts and Emerging Applications: Distributed Databases – Object Oriented Databases - Object Relational Databases- Data mining and Data Warehousing – Big Data - Big Databases- SQL–NoSQLTradeoffs–CAP Theorem–Eventual Consistency - NoSQL–database types – Document Oriented – Columnar – Graph – KeyValue Pair - NoSQL database, design for performance / quality parameters, documents and information retrieval .						
<b>Unit:3</b>	<b>MongoDB Introduction</b>					<b>18 hours</b>
MongoDB- Introduction - MongoDb – Need – MongoDBVs RDBMS – MongoDB- Driver Installation – Configuration – Import and Export – MongoDB Server Configuration - Data Extraction Fundamentals - Intro to Tabular Formats - Parsing CSV -Parsing XLS with XLRD- Parsing XML - Intro to JSON - Getting Data into MongoDB - MongoDB- CURD – Database Creation – Update – Read – Delete						
<b>Unit:4</b>	<b>MongoDB Operators</b>					<b>16 hours</b>
Using mongoimport -Operators like \$gt, \$lt, \$exists, \$regex -Querying Arrays and using \$in and \$all Operators -Changing entries: \$update, \$set, \$unset - Data Analysis - Field Queries - Projection Queries- Limiting – Sorting - Aggregation - Examples of Aggregation Framework -						

The Aggregation Pipeline - Aggregation Operators: \$match, \$project, \$unwind, \$group		
<b>Unit:5</b>	<b>Advanced MongoDB</b>	<b>16 hours</b>
User Management – MongoDB Data Replication in Servers – Data Sharding – MongoDB Indexes – Create – Find – Drop – Backup – MongoDB – Relationships – Analyzing Queries – MongoDBObjectid – Advanced MongoDB:MapReduce – MongoDB - Text Processing - Regular Expression – Case Studies – Text processing of large datasets, Map Reduce using MongoDB		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Data Security – Performance – Data Safety – Resource Utility – High Availability Expert lectures, online seminars - webinars		
<b>Total Lecture hours</b>		<b>92 hours</b>
<b>Text Book(s)</b>		
1	Abraham Silberchatz, Henry K.Forth, Sudharshan, –Database system Concepts , 6 <sup>th</sup> edition, McGraw Hill, 2010.	
2	Prabu C.S.R, –Object - Oriented Database Systems: Approaches and Architectures  3 <sup>rd</sup> Edition, PHI, 2011.	
3	Kristina Chodorow , –MongoDB: The Definitive Guidel, 2nd Edition , O'Reilly Media, 2013.	
4	Guy Harrison, –Next Generation Databases: NoSQL, NewSQL, and Big Data  Apress, 2016.	
<b>Reference Books</b>		
1	ShamkantB.Navathe, RamezElamsri" Fundamentals of Database Systems ", 7 <sup>th</sup> Edition, Pearson Education Limited, 2017.	
2	David Hows , Peter Membrey , EelcoPlugge , Timm Hawkins , –The Definitive Guide to MongoDB , 3 <sup>rd</sup> Edition, Apress, 2015.	
3	GauravVaish , –Getting Started with NoSQL   Packt Publishing, 2013.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	Database Management System: <a href="https://swayam.gov.in/nd2_cec19_cs05/preview">https://swayam.gov.in/nd2_cec19_cs05/preview</a>	
2	Database Management System: <a href="https://nptel.ac.in/courses/106/105/106105175">https://nptel.ac.in/courses/106/105/106105175</a>	
Course Designed By: <b>Dr. S. Gavaskar</b>		

<b>Mapping with Programme Outcomes</b>										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L		L					M	
CO2	M	M	S	M			S		S	
CO3	M	S	S	M			S		S	M
CO4	S	S	S	M			S		S	
CO5	M	S	S	S			S		S	S

<b>Course code</b>	<b>21CSEAE08</b>	<b>NoSQLII– Neo 4j</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Core/Elective/Supportive</b>			<b>2</b>		<b>2</b>	<b>4</b>
<b>Pre-requisite</b>	Students should know about the graph databases and cypher query language		<b>Syllabus Version</b>	<b>2021-22</b>		
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1. To understand the concepts of graph databases from a relational developer's</li> <li>2. To enlighten the conceptual differences between relational and graph database structures and data models.</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Describe the concepts of graph databases with relational databases and its transactions			K1, K2		
2	Demonstrate environment setup of Neo4J by suitable Cypher Query Language and their various clause			K2, K3		
3	Study the syntax and properties of Meet cypher and develop case study on different Applications using Neo4J and CQL commands			K2,K3,K4		
4	Analyse to import data from CSV files to a Neo4j graph database and to learn Backing up the Database			K2,K3,K4		
5	Build the Application with Neo4j and Develop exciting real-world applications with Neo4j			K5,K6		
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>Introduction to Graph Databases</b>			<b>14 hours</b>		
Introduction to Graph Databases: - Introduction - Database Transactions – Graph - Graph Theory - Origins - Graph Databases - Relational Databases – Relationships – NoSQL - Key Value – Column - Document-orientated - Neo4j: Overview - Data Model - Environment Setup - Building Blocks – Download – Install.						
<b>Unit:2</b>	<b>Neo4j Clauses</b>			<b>18 hours</b>		
Neo4j – CQL: Introduction - Creating Nodes - Creating a Relationship - Write Clauses - Merge Command - Set Clause - Delete Clause - Remove Clause - Foreach Clause - Read Clause - Match Clause - Optional Match Clause - Where Clause - Count Function - Return Clause - Order By Clause - Limit Clause - Skip Clause - With Clause - Unwind Clause.						
<b>Unit:3</b>	<b>Cypher Queries</b>			<b>18 hours</b>		
Meet Cypher : Basic Syntax – Nodes – Properties – Relationships - Querying Cypher – Browser - REST API - How to Build a Cypher Query - A Quick note on Comments – Return – Match - Create/Create Unique - Delete/Remove – Where - Order By – Indexes – Constraints – Limit- Skip – With – Unwind – Union – Using – Merge – Set.						
<b>Unit:4</b>	<b>Data Import and Export</b>			<b>20 hours</b>		
Importing and Exporting Data: Importing Data - Import from a CSV Using Cypher - Using a Custom Import Script - Exporting Data - Backing up the Database - Getting Data from the Neo4j Browser - Write Your Own Data Exporter. Querying Data in Neo4j with Cypher- Getting the Data, the Website Used - Querying the Data - Location-Based Queries - Closest Metro Station.						

<b>Unit:5</b>	<b>Building Neo4j Applications</b>	<b>20 hours</b>
Building an Application with Neo4j - A Quick Note on Code Comments - Installing the Spatial Plugin - What the App is Being Built On - How the Data will be Structured - Place/BusStop – Timetable – Transport - Building the Application - Installing Composer - Setting Up Silex - Silex Service Providers - Using the Client – Routes – Commands - Create Indexes - Import Bus Stops - Import Timetables - Setting up the Website with Commands - Technology Used		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, YouTubes Videos, Animations, NPTEL, MOOC videos, online seminars – webinars for strengthening the subject matters.		
<b>Total Lecture hours</b>		<b>92 hours</b>
<b>Text Book(s)</b>		
1	Chris Kemper, -Beginning Neo4j], Apress, 2016	
2	AnkurGoel, -Neo4j Cookbook], Packt Publishing, 2015	
<b>Reference Books</b>		
1	Shehzad Ahmed, -Learning Neo4j 3.x], Packt Publishing, 2019	
2	Chris Fauerbach, -Learning Neo4j Graphs and Cypher], Packt Publishing, 2017	
3	Gregory Jordan, -Practical Neo4j], Apress, 2015	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	Lecture Notes: <a href="https://www.slideshare.net/neo4j0">https://www.slideshare.net/neo4j0</a>	
2	PPT Slides: <a href="https://www.slideshare.net/maxdemarzi/neo4j-presentation">https://www.slideshare.net/maxdemarzi/neo4j-presentation</a>	
3	Tutorials/Animations: <a href="https://www.tutorialspoint.com/neo4j/index.htm">https://www.tutorialspoint.com/neo4j/index.htm</a>	
4	YouTube Videos: <a href="https://www.youtube.com/watch?v=Go3P73-KV30">https://www.youtube.com/watch?v=Go3P73-KV30</a>	
Course Designed By: Dr. V. Bhuvanewari		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>	S	S	S	L	S	L	S	S	M	M
<b>CO3</b>	S	S	S	L	S	L	S	M	L	L
<b>CO3</b>	S	S	S	L	M	M	S	M	M	L
<b>CO4</b>	S	S	S	L	M	L	S	M	L	L
<b>CO5</b>	S	S	S	L	M	L	S	S	L	M

\*S-Strong; M-Medium; L-Low

Course code	21CSEAE09	Image Processing	L	T	P	C
<b>Core/Elective/Supportive</b>		Elective	2	0	2	4
<b>Pre-requisite</b>		Basics of graphics	Syllabus		2021-22	
<b>Course Objectives:</b>						
The main objectives of the course are						
4. To understand the Image processing concepts						
5. To understand the image enhancement, image filtering and restoration						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
CO1	Understand the fundamentals of digital image processing					K1, K2
CO2	Gain knowledge on image enhancement techniques					K2, K3
CO3	Analyze image filtering and restoration techniques					K4
CO4	Apply image compression methods					K3
CO5	Perform image segmentation					K5, K6
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>Introduction to Image Processing</b>					<b>16 hours</b>
Introduction: Fundamental Steps in Image processing – Elements – Digital Image Fundamentals – Image representation – Modeling – Image enhancement – Image restoration – Image analysis – Image reconstruction from projections – Image data compression – Two-Dimensional Systems and Mathematical Preliminaries: Notation and definitions – Discrete and Fast Fourier Transform						
<b>Unit:2</b>	<b>Image Enhancement Techniques</b>					<b>16 hours</b>
Image Enhancement: Point operations – Enhancement by point processing – Histogram modeling – Spatial operations – Enhancement in Frequency Domain – Transform operations – Multispectral Image Enhancement – Color Image Enhancement						
<b>Unit:3</b>	<b>Image Filtering and Restoration</b>					<b>18 hours</b>
Image Filtering and Restoration: Degradation model – Diagonalization of circulant and block circulant matrices - Algebraic approach to restoration – Inverse and Wiener filtering – Finite impulse response Wiener filters – Other Fourier Transform Filters – Smoothing splines and Interpolation – Least square filters – Recursive and semirecursive filtering – Maximum entropy restoration – Bayesian methods – Coordinate transformation and Geometric correction – Blind deconvolution – Extrapolation of band-limited signals						
<b>Unit:4</b>	<b>Fundamentals of Image Compression</b>					<b>20 hours</b>
Image Data compression: Fundamentals – Image compression models – Elements of information theory – Pixel coding – Predictive techniques – Transform coding theory – Transform coding of images – Hybrid coding and vector DPCM – Inter frame coding – Image coding in the presence of channel errors – Coding of two tone images – color and multi-spectral Image coding – Lossless and lossy compressions – standards.						
<b>Unit:5</b>	<b>Image Segmentation</b>					<b>20 hours</b>
Image Segmentation – Representation and Description – Recognition – Interpretation – Image analysis and Computer vision – Image reconstruction from Projections – Artificial Neural						

networks for color classification - Realization for real time processing – Three-dimensional Filters		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars - webinars		
<b>Total Lecture hours</b>		<b>92 hours</b>
<b>Text Book(s)</b>		
1	Anil K. Jain, -Fundamentals of Digital Image Processing, Second Edition, Prentice-Hall of India Private Limited, New Delhi, 1995.	
2	Rafael C. Gonzalez and Richard E. Woods, -Digital Image Processing, Addison-Wesley Publishing Company, Newyark, Third edition, 2008.	
<b>Reference Books</b>		
1	Maher A. Sid-Ahmed, -Image Processing – Theory, Algorithms and Architectures, McGraw Hill, Inc, Newyark, 1995.	
2	Moeslund Thomas B, -Introduction to Video and Image Processing, Springer, 2012.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	Digital Image Processing, <a href="https://nptel.ac.in/courses/117/105/117105079/">https://nptel.ac.in/courses/117/105/117105079/</a>	
Course Designed By: <b>Dr. J. Satheesh Kumar</b>		

<b>Mapping with Programme Outcomes</b>										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
<b>CO1</b>	S	S					L			
<b>CO2</b>		S	M	S						
<b>CO3</b>		M	S	L			M		M	M
<b>CO4</b>		L	S	M					M	M
<b>CO5</b>		L	S	S			M		M	L

\*S-Strong; M-Medium; L-Low



Course code	21CSEAE10	SOFT COMPUTING	L	T	P	C
<b>Core/Elective/Supportive</b>		Elective	4	0	0	4
<b>Pre-requisite</b>		Knowledge of algorithms, Problem solving strategies	Syllabus rsion		2021- 22	
<b>Course Objectives:</b>						
The main objectives of the course are						
6. To understand and apply evolutionary concepts.						
7. To design neural network models.						
8. To use fuzzy logic.						
9. To apply soft computing frameworks to problem solving.						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
CO1	Understand soft computing methodologies in the context of modern heuristic methods					K1, K2
CO2	Gain knowledge in matching soft computing techniques in solving various classes of problems					K3
CO3	Analyze machine learning principles					K4
CO4	Solve optimization problems using suitable algorithms					K5
CO5	Develop effective algorithms for real-world applications					K6
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>Introduction to Soft computing</b>					<b>12 hours</b>
Introduction to Soft computing - Evolution of Computing - Soft Computing Elements – From Conventional AI to Computational Intelligence - Machine Learning – Optimization and search techniques - Multi-Objective optimization problems - Principles of Multi-objective optimization – Pareto-optimality - Pareto Front and Non-dominated Solutions.						
<b>Unit:2</b>	<b>Evolutionary computing</b>					<b>12 hours</b>
Introduction to evolutionary computing - Genetic Algorithms - Evolutionary Strategies – Representations – Recombination - Binary Strings - Real-Valued Vectors - Various Selection Strategies. Search Operators - Crossover and Mutation – Fitness function - Generational cycles – Stopping criteria and constraints - Advances in Genetic Algorithms						
<b>Unit:3</b>	<b>Neural Networks</b>					<b>12 hours</b>
Evolution of neural networks- basic models – Fundamentals of Artificial neural networks - Architecture – Learning Paradigms – Taxonomy -Activation functions - Machine Learning Using neural network, Adaptive networks – Supervised Learning and unsupervised learning networks – Advances in neural networks.						
<b>Unit:4</b>	<b>Fuzzy Logic</b>					<b>12 hours</b>
Fuzzy logic - Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions - Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making - Adaptive Neuro-Fuzzy Inference Systems.						
<b>Unit:5</b>	<b>Bio-inspired Algorithms</b>					<b>12 hours</b>
Biologically inspired optimization techniques - Ant Colony Optimization - Pheromone mediated search -Search space - Exploration and Exploitation, Particle swarm optimization - PSO strategies						

and variants - Neighborhood topologies – Applications of Soft Computing - Real world Optimization problems.		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars - webinars		
<b>Total Lecture hours</b>		<b>62 hours</b>
<b>Text Book(s)</b>		
1	David E Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning ", Pearson Education India, 2013.	
2	S. Rajasekaran, G. A.VijayalakshmiPai, -Neural Networks, Fuzzy Logic and Evolutionary Algorithms: Synthesis & Applicationsl, Prentice-Hall of India Pvt. Ltd., II edition, 2017.	
3	S.N.Sivanandam and S.N.Deepa, -Principles of Soft Computingl, 3 <sup>rd</sup> edition, Wiley India Pvt Ltd, 2018.	
4	Andries P. Engelbrecht, -Fundamentals of Computational Swarm Intelligencel, Wiley publications, 2005.	
<b>Reference Books</b>		
1	Xin She Yang, -Nature-Inspired Computation and Swarm Intelligence - Algorithms, Theory and Applicationsl, 1st Edition, Academic Press, 2020.	
2	Marco Dorigo, Thomas Stutzle, -Ant Colony Optimizationl, MIT Press, 2010.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	Introduction to Soft Computing, <a href="https://nptel.ac.in/courses/106/105/106105173/">https://nptel.ac.in/courses/106/105/106105173/</a>	
Course Designed By: <b>Dr. T. Amudha</b>		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>	S	S					L			
<b>CO2</b>		S	M	S						
<b>CO3</b>		M	S	L			M		M	M
<b>CO4</b>		L	S	M					M	M
<b>CO5</b>		L	S	S			M		M	L

\*S-Strong; M-Medium; L-Low

Course code	21CSEAE11	INTELLIGENT AGENTS	L	T	P	C
Core/Elective/Supportive	Elective		4	0	0	4
Pre-requisite	Basic knowledge of Artificial Intelligence		Syllabus rsion		2021- 22	
<b>Course Objectives:</b>						
The main objectives of this course are:						
<ol style="list-style-type: none"> <li>1. To gain insight about automation using Intelligent Agents</li> <li>2. To understand the learning behavior and functioning of Agents</li> <li>3. To develop knowledge in the application domains of Agents</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
CO1	To understand the fundamental concepts in intelligent agents.				K1	
CO2	To understand agent communications and interactions				K2	
CO3	To analyze various agent negotiation strategies				K4	
CO4	To understand how learning happens in multiagent systems				K2	
CO5	To evaluate current trends and applications of intelligent agents				K5	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>					<b>12 hours</b>	
Introduction to Intelligent Autonomous Agents- Motivations for agent-based computing - Abstract Architectures for Intelligent Agents - Key concepts and models of reasoning agents – deductive reasoning - symbolic reasoning - reactive reasoning - practical reasoning - Rational decision making and handling uncertainty						
<b>Unit:2</b>					<b>12 hours</b>	
Agent Interactions – Communication and cooperation – Ontology fundamentals – Building blocks – Ontology Languages – Software tools for ontologies – Agent Communication Languages. Conceptual Foundations of Communication in Multiagent systems - Traditional Software Engineering Approaches - Traditional AI Approaches - Commitment-Based Multiagent Approaches - Engineering with Agent Communication						
<b>Unit:3</b>					<b>12 hours</b>	
Cooperative Distributed Problem Solving - Task Sharing and Result Sharing - Coordination - Multiagent Planning and Synchronization - Negotiation and Bargaining - Aspects of Negotiation - Game-Theoretic Approaches for Single-Issue Negotiation - Game-Theoretic Approaches for Multi-Issue Negotiation - Heuristic Approaches for Multi-Issue Negotiation -Argumentation-Based Negotiation						
<b>Unit:4</b>					<b>12 hours</b>	
Multiagent Learning - Introduction - Challenges in Multiagent Learning - Reinforcement Learning for Multiagent Systems - Evolutionary Game Theory as a Multiagent Learning paradigm - Swarm Intelligence as a Multiagent Learning Paradigm -Neuro-Evolution as a Multiagent Learning Paradigm - Case Study in Multiagent Learning						
<b>Unit:5</b>					<b>12 hours</b>	
Agent Applications - Agents for Workflow and Business Process Management - Agents for						

Distributed Sensing - Agents for Information Retrieval and Management - Agents for Electronic Commerce - Agents for Human-Computer Interfaces - Agents for Virtual Environments - Agents for Social Simulation - Deploying agents within a simulated environment - Practical reasoning strategies for computational markets		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars - webinars		
<b>Total Lecture hours</b>		<b>62 hours</b>
<b>Text Book(s)</b>		
1	Michael Wooldridge: An Introduction to MultiAgent Systems (2nd ed.). Wiley, 2009	
2	G. Weiss (ed.): Multi-Agent Systems - A Modern Approach to Distributed Artificial Intelligence (2nd ed.). MIT Press, 2013	
<b>Reference Books</b>		
1	M. Wooldridge: Reasoning about Rational Agents. MIT Press, 2000	
2	YoavShoham, KevinLeyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, 2008.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="https://nptel.ac.in/courses/106/105/106105077/">https://nptel.ac.in/courses/106/105/106105077/</a>	
Course Designed By: <b>Dr. T. Amudha</b>		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>C01</b>	S	S								
<b>C02</b>		L	S	S						
<b>C03</b>		M	L	L					M	M
<b>C04</b>		L	S	S					M	M
<b>C05</b>		L	M	M					L	L

\*S-Strong; M-Medium; L-Low

<b>Course code</b>	<b>21CSEAE12</b>	<b>MACHINE LEARNING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Core/Elective/Supportive</b>	Elective		<b>2</b>		<b>2</b>	<b>4</b>
<b>Pre-requisite</b>	<b>Basics on Statistics and Linear Algebra</b>		<b>Syllabus Version</b>	<b>2021-22</b>		
<b>Course Objectives:</b>						
<ol style="list-style-type: none"> <li>To understand the concepts of Machine learning algorithms</li> <li>To apply the machine learning algorithms for various applications.</li> </ol>						
<b>Expected Course Outcomes:</b>						
CO1	Understand the concepts of machine learning				K1	
CO2	Understand the theoretical concepts of probabilistic and linear methods				K2	
CO3	Distinguish Supervised, Unsupervised and semi supervised learning				K2	
CO4	Understand and Apply the algorithms for a given specific problem in a specific tool using Supervised, Unsupervised and semi supervised algorithms				K4, K5	
CO5	Design a Machine Learning models for Prediction for any specific domain applications				K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create</b>						
<b>Unit:1</b>	<b>Unsupervised Models</b>				<b>18-- hours</b>	
Introduction : Machine Learning - Machine Learning Foundations –Overview – applications - Types of machine learning - basic concepts in machine learning Examples of Machine Learning - Applications - - Unsupervised Learning Clustering- K-means - EM - Mixtures of Gaussians - The EM Algorithm in General -Model selection for latent variable models - high-dimensional spaces -- The Curse of Dimensionality -Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA- Independent components analysis						
<b>Unit:2</b>	<b>Linear Models</b>				<b>18- hours</b>	
Supervised Learning Linear Models for Regression - Linear Basis Function Models - The Bias-Variance Decomposition - Bayesian Linear Regression - Bayesian Model Comparison Linear Models for Classification - Discriminant Functions -Probabilistic Generative Models - Probabilistic Discriminative Models - Bayesian Logistic Regression. Decision Trees - Classification Trees-Regression Trees - Pruning. Support Vector Machines - Ensemble methods- Bagging- Boosting – Evaluation Methods						
<b>Unit:3</b>	<b>Graphical Models</b>				<b>18- hours</b>	
Probabilistic Graphical Models Directed Graphical Models - Bayesian Networks - Exploiting Independence Properties - From Distributions to Graphs -Examples -Markov Random Fields - Inference in Graphical Models - Learning –Naive Bayes classifiers-Markov Models – Hidden Markov Models – decoding states from observations, learning HMM parameters-Inference – Learning Generalization – Undirected graphical models- Markov random fields- Conditional independence properties - Parameterization of MRFs - Examples - Learning - Conditional random fields (CRFs) - Structural SVMs						
<b>Unit:4</b>	<b>Advanced Models</b>				<b>18-- hours</b>	
Advanced Learning Sampling – Basic sampling methods – Monte Carlo. Reinforcement Learning- K-Armed Bandit Elements - Model-Based Learning- Value Iteration- Policy Iteration. Temporal Difference Learning Exploration Strategies- Deterministic and Non-deterministic Rewards and Actions- Eligibility Traces - Generalization- Partially Observable States- The Setting- Example. Semi - Supervised Learning. Computational Learning Theory - Mistake bound analysis, sample						

complexity analysis,			
<b>Unit:5</b>	<b>Deep Learning Models</b>	<b>18-- hours</b>	
Neural Networks -Feed-forward Network Functions - Error Back propagation - Regularization - Mixture Density and Bayesian Neural Networks - Kernel Methods - Dual Representations - Radial Basis Function Networks – Sequence Models = Recurrent Net – Types – Word Disambiguation – Convolution Net – Basics – Applications			
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>	
Ethical Considerations in Machine Learning Applications – Ethics and Challenges of AI and ML as disruptive technology Use cases – Webinars			
<b>Total Lecture hours</b>			<b>92-- hours</b>
<b>Text Books:</b>			
1	Christopher Bishop, -Pattern Recognition and Machine Learning  Springer, 2006		
2	Kevin P. Murphy, -Machine Learning: A Probabilistic Perspective , MIT Press, 2012		
3	EthemAlpaydin, -Introduction to Machine Learning 3(Adaptive Computation and Machine Learning Series) , Third Edition, MIT Press, 2014		
4	Tom M Mitchell, -Machine Learning , First Edition, McGraw Hill Education, 2013.		
<b>Reference Books</b>			
1	JannesKlaas, -Machine Learning for Finance , ISBN: 978178936364, 2019 [Packt]		
2	Giuseppe Bonaccorso, -Machine Learning Algorithms , Second Edition, ISBN: 9781789347999, 2018 [Packt]		
3	Stephen Marsland, -Machine Learning –An Algorithmic Perspective , CRC Press, 2009		
4	Hastie, Tibshirani, Friedman, -The Elements of Statistical Learning , Second Edition, Springer, 2008		
5	Yuxi Liu, -Python Machine Learning By Example , 2017 [Packt]		
6	<u>John Paul Mueller, Luca Massaron</u> , -Machine Learning (in Python and R) For Dummies , First Edition, Wiley Publisher, ISBN: 9788126563050, 2016		
7	<u>U Dinesh Kumar ManaranianPradhan</u> ,, -Machine Learning using Python . ) Publisher: Wiley, ISBN: 9788126579907, 2019		
<b>Online Course:</b>			
<b>S.No</b>	<b>Course Title</b>	<b>Duration</b>	<b>Provider -Free</b>
1.	Machine Learning	12 hours	Simlilearn
2.	Machine Learning for Data Analysis	4 Weeks	Coursera
3.	Machine Learning Foundations: A Case Study Approach	6 Weeks	Coursera
4.	Machine Learning : Regression	6 Weeks	Coursera
5.	Introduction to Machine Learning	12 Weeks	Swayam - NPTEL
6	Deep Learning Specialization	4 Courses	Coursera

**Web Link - Video:**

1. <https://www.packtpub.com/data/hands-on-machine-learning-with-scikit-learn-and-tensorflow-2-0-video>
2. <https://www.packtpub.com/data/machine-learning-projects-with-tensorflow-2-0-video>
3. <https://www.packtpub.com/application-development/complete-machine-learning-course-python-video>

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	M	-	L	-	-	-
CO2	L	L	S	L	-	S	-	L	-	L
CO3	S	S	S	S	M	S	L	M	-	-
CO4	S	S	S	S	S	S	S	S	S	M
CO5	S	S	S	S	M	S	S	L	M	S

\*S-Strong; M-Medium; L-Low



Course code	21CSEAE13	SEMANTIC WEB	L	T	P	C
Core/Elective/Supportive		Elective	4	4	0	4
Pre-requisite		Nil	Syllabus Version		2021-22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1. To understand web 2.0 and web 3.0, the basics of semantic web, features, web standards.</li> <li>2. To understand and apply knowledge representation methods, standard namespaces, Graph based validation.</li> <li>3. To analyze and Build Data Integration semantic layer use cases for specific domain and applications.</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Understand Web standards, features, Distributed web data, limits of the web, Need of languages				K1, K2	
2	Understand the concept of Ontology, Knowledge representation, scheme classification				K6	
3	Understand the platform to model, semantic web tools: Triple stores, Development environments, Inference engines				K4	
4	Understand the Semantic web layer for integration, Issues addressed, Representation formats, Mining stack and knowledge graphs.				K2-K4	
5	Analyze various domains, Platform, Mapping of knowledge models, and semantic processing framework of domains of Transportation.				K4-K5 K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create</b>						
<b>Unit:1</b>	<b>Introduction to Semantic Web</b>				<b>12-- hours</b>	
Web 2.0 and 3.0 – Meaning of Semantic Data – Distributed web of data – Metadata - Features of semantic web – Data across the web – The basics of semantic web - The Limits of the web – The vision of the semantic web – Semantic web standards – RDF – RDF Scheme (RDFS) – OWL Web Ontology Language – SPARQL Protocol – RDF Query Language (SPARQL) - Need of RDFS – Machine Readability – core elements of RDFS – XML Schema – RDF schema						
<b>Unit:2</b>	<b>Knowledge Representation Methods</b>				<b>12-- hours</b>	
The concept of Ontology - SKOS – Representation of thesauri - Glossaries – Scheme classification – Taxonomies – Controlled Vocabularies - Hierarchical Structure – Formal Representations - Standard Namespaces – JSON based serialization for Linked Data - RDF Triple stores – Turtle – RDFa – Internal Identifiers - URI – RDFS – Classes – Resources – Inferred Property Characterization – Literals – Linked Open Data – DBpedia – Querying RDF Graphs – Vocabularies – Graph based validation - Shape constraint Language (SHACL)						
<b>Unit:3</b>	<b>Tools</b>				<b>12-- hours</b>	
<b>Triple store:</b> Jena – Allegro Graph – Mulgara – Sesame – Flickurl - Top Braid – Suite – Virtuoso Environment – Content Management System: Falcon – Drupal 7 – Redland – Pellet, <b>Development Environment:</b> Protégé – Ontotext – Open Anzo – RDF Gateway – RDFLib – DartGrid – Zitgist, <b>Inference Engines:</b> SWI-Prolog, Semantic Works –Ontobroker						



<b>Unit:4</b>	<b>Data Integration Semantic Layer</b>	<b>12-- hours</b>	
Data Integration issues- Data Interoperability – Data Migration – Data Representation Formats – Data Silos – Linked Data Management – Knowledge Mining Stack – NLP – Named Entity Recognition – Machine Learning – Knowledge Graphs			
<b>Unit:5</b>	<b>Use cases</b>	<b>12-- hours</b>	
Use cases Specifications and Discussion: - Transportation: Data Sources – Representation – Linked Data Mapping - Knowledge Modeling – Telecommunication – Knowledge Modeling – Customer Care Support Documents – Internal Reports – Named Entity Recognition – Linked Data Mapping			
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2-- hours</b>	
Customer provider mismatch – Interlinking domain specific information – Combining different services from different providers – contrast with contemporary web applications			
Markup languages – Object Access Protocols – Service description – Discovery – Integration			
<b>Total Lecture hours</b>			<b>62-- hours</b>
<b>Text Book(s)</b>			
1	Dean Allemang, James Hendler: –Semantic Web for the Working Ontologist Effective Modeling in RDFs and OWLl, 2 <sup>nd</sup> Edition, 2008.		
2	Liyang Yu, –Introduction to the Semantic Web and Semantic web services  Chapman & Hall/CRC, Taylor & Francis group, 2007.		
3	Toby Segaran, Colin Evans, Jamie Taylor, –Programming the Semantic Webl, 1 <sup>st</sup> Edition, July 2009.		
4	Pollock, J.T.: Semantic web for dummies. Wiley Publishing, Inc., Indianapolis, 2009.		
<b>Reference Books : EBooks</b>			
1	Grigoris Antoniou and Frank van Harmelen, A Semantic Web Primer, The MIT Press (2004), ISBN: 0262012103		
2	<i>P. Hitzler, R. Sebastian, M. Krötzsch: Foundation of. Semantic Web Technologies, 2009.</i>		
3	Kalfoglou, Yannis, Cases on Semantic Interoperability for Information Systems Integration - Practices and Applications. IGI Global 2009, ISBN 978-1-60566-894-9		
4	<u>Martin Große-Rhode</u> , Semantic Integration of Heterogeneous Software Specifications, Springer-Verlag Berlin and Heidelberg GmbH & Co. KG, 2010, ISBN 978-3-64207-306-9		
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>			
	<b>Course Title</b>	<b>Duration</b>	<b>Provider</b>
1.	Semantic Web Technologies (Free)	6 Weeks	OpenHPI
2.	Linked Data Engineering (Free)	6 Weeks	OpenHPI
3.	Introduction to a Web of Linked Data	4 Weeks	Fun Inria
4.	Web of Data	17 hours	Coursera
5.	Dynamics of Knowledge Organization (Free)	2 hours	Udemy
<b>Web link</b>			
1. <a href="http://www.linkeddatatools.com/semantic-web-basics">http://www.linkeddatatools.com/semantic-web-basics</a>			
2. <a href="http://www.cambridgesemantics.com/blog/semantic-university/intro-semantic-web">http://www.cambridgesemantics.com/blog/semantic-university/intro-semantic-web</a>			
3. <a href="https://www.mkbergman.com">https://www.mkbergman.com</a>			
4. <a href="http://euclid-project.eu">http://euclid-project.eu</a>			
Course Designed by: Dr.V.Bhuvaneswari			

Course code	21CSEAE14	SERVICE ORIENTED ARCHITECTURE AND WEB SERVICES	L	T	P	C
Core/Elective/Supportive		Elective	4		0	4
Pre-requisite		Nil	Syllabus Version		2021-22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
1. To familiar with the web services technology elements for realizing SOA						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
CO1	To build applications based on XML.					K2
CO2	To develop Web services using technology elements					K2
CO3	Build SOA based applications for intra enterprise and inter enterprise applications					K3
CO4	To identify and repair coding errors in a program					K3
CO5	To develop web services with SOA architecture					K6
<b>K1</b> - Remember; <b>K2</b> - Understand; <b>K3</b> - Apply; <b>K4</b> - Analyze; <b>K5</b> - Evaluate; <b>K6</b> - Create						
<b>Unit:1</b>	<b>INTRODUCTION TO XML 9</b>					<b>12 hours</b>
XML document structure – Well-formed and valid documents – Namespaces – DTD – XML Schema – X-Files						
<b>Unit:2</b>	<b>BUILDING XML- BASED APPLICATIONS 9</b>					<b>12 hours</b>
Parsing XML – using DOM, SAX – XML Transformation and XSL – XSL Formatting – Modeling Databases in XML.						
<b>Unit:3</b>	<b>SERVICE ORIENTED ARCHITECTURE 9</b>					<b>13 hours</b>
Characteristics of SOA, Comparing SOA with Client-Server and Distributed architectures – Benefits of SOA — Principles of Service orientation – Service layers.						
<b>Unit:4</b>	<b>WEB SERVICES 9</b>					<b>10 hours</b>
Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Message Exchange Patterns – Orchestration – Choreography –WS Transactions.						
<b>Unit:5</b>	<b>BUILDING SOA-BASED APPLICATIONS 9</b>					<b>13 hours</b>
Service Oriented Analysis and Design – Service Modeling – Design standards and guidelines — Composition – WS-BPEL – WS-Coordination – WS-Policy – WS-Security – SOA support in J2EEframeworks: Django.						
<b>Unit:6</b>	<b>Contemporary Issues</b>					<b>2 hours</b>
Implement and use a web services based SOA technologies as well as tools- Usage of Web services protocols						
Expert lectures, online seminars - webinars						
<b>Total Lecture hours</b>					<b>62 hours</b>	

<b>Text Book(s)</b>	
1	Ron Schmelzer et al. –XML and Web Services , Pearson Education, 2002..
2	Thomas Erl, –Service Oriented Architecture: Concepts, Technology, and Design , Pearson Education, 2005
3	Thomas Erl, –Service Oriented Architecture: Concepts, Technology, and Design , Pearson Education, 2015.
<b>Reference Books</b>	
1	Sandeep Chatterjee and James Webber, –Developing Enterprise Web Services: An Architect’s Guide , Prentice Hall, 2004
2	Frank P.Coyle, –XML, Web Services and the Data Revolution , Pearson Education, 2002.
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>	
1	<a href="https://www.fibre2fashion.com/industry-article/3062/web-services-implementation-methodology-for-soa-application">https://www.fibre2fashion.com/industry-article/3062/web-services-implementation-methodology-for-soa-application</a>
2	<a href="https://www.c-sharpcorner.com/uploadfile/raj1979/database-connectivity-using-webservice/">https://www.c-sharpcorner.com/uploadfile/raj1979/database-connectivity-using-webservice/</a>
3	<a href="https://www.talend.com/resources/service-oriented-architecture/">https://www.talend.com/resources/service-oriented-architecture/</a>
4	<a href="https://www.sciencedirect.com/topics/computer-science/service-oriented-architecture">https://www.sciencedirect.com/topics/computer-science/service-oriented-architecture</a>
Course Designed By: <b>Dr. S. Gavaskar</b>	

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>	S	S	S	S		M	S		M	S
<b>CO2</b>	M	M	M	M			M		L	M
<b>CO3</b>	S	S	S	S		M	S		M	S
<b>CO4</b>	M	M	L	M			S		M	M
<b>CO5</b>	M	M	M	M			M		L	M

Course code	21CSEAE15	SOCIAL MEDIA MINING	L	T	P	C
Core/Elective/Supportive		Elective	4	-	-	4
Pre-requisite		Nil	Syllabus Version		2021-22	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>To understand how accurately analyze voluminous complex data set in social media and other sources</li> <li>To understand the models and algorithms to process large data sets</li> <li>To understand social behavior and recommendation challenges and methodologies</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Understand the concepts of Graph Models, social communities					K1, K2
2	Understand the network models and measures to evaluate information					K3
3	Understand and apply algorithms to model data using graph and network structures and recommendations					K2,K5
4	Brief on algorithms on social data diffusion and apply for various domains					K2,K3, K4
5	Distinguish and Suggest the appropriate algorithms for domain specific applications for data modelling and information diffusion, Evaluate the algorithms for metrics					K4,K5, K6
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create</b>						
<b>Unit:1</b>	<b>Social Media Mining</b>				<b>12-- hours</b>	
Social Media Mining - Introduction – Atoms – Molecules – Interactions – Social Media mining Challenges - Graphs - Basics – Nodes – Edges – Degree of Distribution- Types –Directed – Undirected – Weighted - Graph Connectivity - Tress and Forests – Bipartite graphs – Complete Graphs – Sub graphs – Planar Graphs - Graph Representation - Graph Traversal Algorithms – Shortest path algorithms Dijkstra’s - Spanning tree algorithms – Prims - Bipartite matching - Ford-Fulkerson algorithm						
<b>Unit:2</b>	<b>Network Models</b>				<b>12-- hours</b>	
Network Models – Measures – Node : Eigen Centrality – Page Rank – Group Measures – Between ness centrality - group degree centrality, centrality, and group - Closeness centrality - Node Linking Behavior - Transitivity and reciprocity - Linking Analysis - Cluster coefficient – Jaccard - Case Study : -Modeling small networks with real world model						
<b>Unit:3</b>	<b>Social Media Communities</b>				<b>12-- hours</b>	
Social media Communities – Social Communities – Member based Detection – Node degree – Node Similarity – Node reachability - Group Based detection methods - balanced – robust - modular – dense - hierarchical - Spectral Clustering : Balanced Community algorithm Community Evolution - Evaluation.						
<b>Unit:4</b>	<b>Social Network</b>				<b>12-- hours</b>	
Social Network – Information Diffusion – Types - herd behavior - information cascades diffusion of innovation – epidemics – Diffusion Models Case Study – Herd Behavior – Information						

Cascades Methods – Social Similarity – assortativity – Social Forces - Influence homophily – Confounding - Assortativity measures – Influence measures – Predictive Models		
<b>Unit:5</b>	<b>Recommender System</b>	<b>12-- hours</b>
Recommendation Vs Search – Recommendation Challenges – Recommender algorithms - Content-Based Methods- Collaborative Filtering – Memory Based – Model Based – Social Media Recommendation – User friendship – Recommendation Evaluation – Precision – Recall – Behavioral– User Behavior – User – Community behavior – User Entity behavior – Behavioral Analytics - Methodology		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
1. Social Media Plagiarism – Legal and Ethical issues – Social Media Marketing 2. Lack of focus – Productivity – Relationship – Infidelity – Privacy – Fake Identities 3. Negative impact on Academics – Cyber-crime – Bullying		
<b>Total Lecture hours</b>		<b>62-- hours</b>
<b>Text Book(s)</b>		
1	Reza Zafarani , MohammadAliAbbasi – Social Media Mining: An Introduction – Published by Cambridge press, 2014 – (Free Ebook available <a href="http://dmml.asu.edu/smm/chapter">http://dmml.asu.edu/smm/chapter</a> )	
2	Memon, N., Xu, J.J., Hicks, D.L., Chen, H. (Eds.), Data Mining for Social Network Data- Springer – Annals of Information Systems ,ISBN 978-1-4419-6287-4	
3	Lam Thuy Vo, 2019, –Mining Social Media: Finding Stories in Internet Data	
<b>Reference Books : EBooks</b>		
1	Matthew A. Russel and Mikhail Klassen, 2018, –Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Instagram, GitHub	
2	GungorPolatkan, AntonoisChalkiopoulos, P. Oscar Boykin et.al., 2018, –Social Media Mining and Analytics.	

**Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]**

	<b>Course Title</b>	<b>Duration</b>	<b>Provider</b>
1.	Social Media Data Analytics (Free)	4 Weeks	Coursera
2.	Introduction to Social Media Analytics	4 Weeks	Coursera
3.	Social Media Analytics: Using Data to Understand Public Conversations	3 Weeks	Future Learn
4.	Starting with social network analysis	2 hours	Udemy
<b>Web link</b>			

- <https://learn.g2.com/social-media-data-mining>
- <https://www.javatpoint.com/social-media-data-mining>
- <https://www.igi-global.com/dictionary/applying-critical-theories-to-social-media-mining-and-analysis/50376>
- <https://www.cambridge.org/core/books/social-media-mining/introduction/75F143896832B7B9339F2CE663C4815B>

Course Designed by: Dr. V. Bhuvaneshwari

Course code	21CSEAE16	RESPONSIVE WEB APPLICATIONS	L	T	P	C
<b>Core/Elective/Supportive</b>	Elective		2	0	2	4
<b>Pre-requisite</b>	HTML, CSS and Object Oriented Programming using JavaScript		<b>Syllabus</b>		<b>2021-22</b>	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>To understand fundamentals of responsive web applications and Angular</li> <li>To develop Angular Applications using Bootstrap</li> <li>To develop Angular Applications using Material Design</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	To learn the basics of Angular, Bootstrap and Material Design					K2
2	To understand and use Bootstrap components					K3
3	To develop responsive web applications using Angular and Bootstrap					K6
4	To explore and use Material Design components					K3
5	To develop responsive web applications using Angular and Material Design					K6
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>Introduction to Angular</b>				<b>16 hours</b>	
<b>TypeScript:</b> Built-in Types – Classes – Utilities – Working with Angular CLI – <b>Building Blocks of Angular:</b> Modules – Components – Templates – Metadata – Data Binding – Directives – Services – Dependency Injection						
<b>Unit:2</b>	<b>Introduction to Bootstrap</b>				<b>20 hours</b>	
<b>Bootstrap Components:</b> Introduction to Sass – Layouts with Grids and Containers – using Images – using Cards – using Buttons – Navs – Navbars - Carousal						
<b>Unit:3</b>	<b>Applications using Angular and Bootstrap</b>				<b>20 hours</b>	
<b>Angular and Bootstrap:</b> Creating the Template – Welcome Page Analysis – Application Structure – Navigation Component Template Expressions – Template Statements – Data Binding – Bootstrap Forms						
<b>Unit:4</b>	<b>Introduction to Material Design</b>				<b>18 hours</b>	
<b>Material Design Components:</b> Data Binding: Input Elements – Form Fields – Drop Downs – Date Picker Control – Slider – Navigation: Toolbar – Sidenav – Layout: Card – Tabs – Material Design List – Alerts and Dialogs						
<b>Unit:5</b>	<b>Applications using Angular and Material Design</b>				<b>16 hours</b>	
<b>Angular and Material Design:</b> Interpolation – Property Binding – Class Binding – Style Binding – Event Binding – Reactive Forms: Capture Changes – Validation – Route Outlet – Route Parameters – HTTP Client						
<b>Unit:6</b>	<b>Contemporary Issues</b>				<b>2 hours</b>	
Expert lectures, online seminars - webinars						
<b>Total Lecture hours</b>					<b>92 hours</b>	

<b>Text Book(s)</b>	
1	Nathan Murray, Felipe Coury, Ari Lerner and Carlos Taborda, 'ng-book: The Complete Guide to Angular', Fullstack.io, 2018
2	Sergey Akopkokhyants, Stephen Radford, 'Web Development with Bootstrap 4 and Angular 2', Packt Publishing, 2016.
3	VenkataKeertiKotaru, 'Angular for Material Design', Apress, 2020.
<b>Reference Books</b>	
1	Rajesh Gunasundaram, 'Learning Angular for .NET Developers', Packt Publishing, 2017.
2	Sridhar RaoChivukula and Aki Iskandar, 'Web Development with Angular and Bootstrap', Packt Publishing, 2019.
3	Kyle Mew, 'Learning Material Design', Packt Publishing, 2015.
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>	
1	Angular Fundamentals ( <a href="https://www.edx.org/course/angular-fundamentals">https://www.edx.org/course/angular-fundamentals</a> )
Course Designed By: <b>Dr. R. Rajeswari</b>	

<b>Mapping with Programme Outcomes</b>										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S								
CO2		L	S	S						
CO3		M	L	L					M	M
CO4		L	S	S					M	M
CO5		L	M	M					L	L

\*S-Strong; M-Medium; L-Low

Course code	21CSEAE17	INTERNET PROGRAMMING AND WEB DESIGNING	L	T	P	C
<b>Core/Elective/Supportive</b>	Elective		2	0	2	4
<b>Pre-requisite</b>	RDBMS		<b>Syllabus</b>		<b>2021-22</b>	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>To understand the basics of web designing and internet programming</li> <li>To develop interactive and dynamic web applications using HTML, JavaScript, CSS, XML and ASP.NET</li> <li>To explore different standards of web services</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	To learn the basics of Internet					K2
2	To develop web pages using HTML and JavaScript					K3
3	To develop web applications using ASP.NET					K6
4	To develop web applications using XML and web services					K6
5	To explain the concept of service-oriented architecture					K2
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>Internet Basics, HTML 5, CSS3</b>				<b>16 hours</b>	
<b>Internet Basics:</b> Introduction–Getting Connection –Services - Mail –FTP –HTTP –WWW – <b>HTML 5:</b> Fundamentals – working with text, links, tables, images, forms and multimedia – <b>CSS3:</b> Overview – backgrounds and color gradients – fonts and text styles – displaying, positioning and floating an element – table layouts						
<b>Unit:2</b>	<b>Client Side Scripting</b>				<b>20 hours</b>	
<b>JavaScript:</b> Cascading Style Sheets: types of style sheets –positioning elements – backgrounds – margins and padding – manipulating text and images - Java Script programming: form handling and validation–Document Object Model – Browser Management - Event model - ActiveX controls – JSON – <b>jQuery</b>						
<b>Unit:3</b>	<b>XML</b>				<b>14 hours</b>	
<b>XML:</b> Need for XML –Documentation –Elements and Attributes –Valid Documents - Document Type Definitions –XML Schema–Rendering XML with XSLT – XPath, XLink and XPointer						
<b>Unit:4</b>	<b>Server Side Scripting</b>				<b>20 hours</b>	
<b>ASP.NET:</b> Introduction to .NET Framework –.NET Languages –Web Form Fundamentals – Web Controls – Validation Controls – State Management: <b>ADO.NET</b> –Overview – ADO.NET Data Access – Data Binding – DataList, DataGrid and Repeater Controls – Using XML ASP.NET Model - View Controller (MVC) Application						
<b>Unit:5</b>	<b>AJAX and Web Services</b>				<b>20 hours</b>	
<b>AJAX:</b> Understanding AJAX – Using Partial Page Refreshes – ASP.NET AJAX Controls – <b>Web Services:</b> Web Services Architecture – WSDL – SOAP – Creating Web Services – Using Web Services						



<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars - webinars		
		<b>Total Lecture hours</b>
		<b>92 hours</b>
<b>Text Book(s)</b>		
1	Harvey Deitel, Abbey Deitel, -Internet & World Wide Web –How to Programl, Fifth Edition, Pearson Education, 2012.	
2	DT Editorial Services, -HTML 5 Black Bookl, Dream Tech Publishers, 2016.	
3	Matthew MacDonald, -ASP.NET: The Complete Referencel, Tata McGraw Hill, 2002.	
<b>Reference Books</b>		
1	John Dean, Web Programming, Jones &Barlett Learning, 2019.	
2	Brian Benz and John R. Durant, XML Programming Bible, Wiley Publishing Inc., 2003.	
3	Alex Ferrara and Matthew MacDonald, Programming with .Net Web Services, O’Reilly Media, First Edition, 2002.	
4	Jess Chadwick, Todd Snyder and Hrusikesh Panda, Programming ASP.NET MVC 4, O’Reilly Media, First Edition, 2012.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	www.spoken-tutorial.org	
2	Internet Technology ( <a href="https://nptel.ac.in/courses/106/105/106105084/">https://nptel.ac.in/courses/106/105/106105084/</a> )	
Course Designed By: <b>Dr. R. Rajeswari</b>		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>		S					M			
<b>CO2</b>		M	S	S			M		L	
<b>CO3</b>		M	S	S			M		L	
<b>CO4</b>		M	S	S			M		L	
<b>CO5</b>		S					M			

\*S-Strong; M-Medium; L-Low

Course code	21CSEAE18	PYTHON PROGRAMMING	L	T	P	C
<b>Core/Elective/Supportive</b>		<b>Elective</b>	<b>4</b>	<b>2</b>	<b>2</b>	<b>4</b>
<b>Pre-requisite</b>		<b>Nil</b>	<b>Syllabus</b>		<b>2021-22</b>	
<b>Course Objectives:</b>						
<ol style="list-style-type: none"> <li>1. To understand the basics of Python Data structures and Programming constructs</li> <li>2. To understand and Apply Python Libraries for Data Science and Machine Learning</li> <li>3. To understand and apply Exploratory Data Analytics using Data Visualization</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Understand the basic programming structure-List, Dictionary, Tuple, String					K1,K2
2	Understand the Control structures and object oriented concepts					K1,K2
3	Design and Analyze dataset applying statistical models, visualization and models using various tools					K3,K4
4	Understand the visualization methods , packages, statistical packages and other packages for building data models					K3,K4, K6
5	Design data analytic model using the packages in python and provide inferences for multi-disciplinary domains					K3,K4
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>Introduction</b>					<b>18-- hours</b>
Introduction to Python: Python Introduction, History of Python, Python features , Python interpreter, Overview of programming in Python, Basic data types, Program input and Program output, Variables and assignment. Global and local variables. Python - Basic Operators: Arithmetic Operators, Comparison Operators, Logical (or Relational) Operators, Assignment Operators, Conditional (or ternary) Operators. Modules: Importing module, Math module Random module, Packages, Composition.						
<b>Unit:2</b>	<b>Advanced Data Types</b>					<b>18-- hours</b>
Python Strings and string manipulation [Assigning values in strings, String manipulations, String special operators, String formatting operators, Triple Quotes, Raw String, Unicode String, Build-in-String methods], Python List : Introduction, Accessing values in list, List manipulations, List Operations, Indexing, slicing & matrices. Python Dictionary - Introduction, Accessing values, Properties, Functions in Dictionary. Python Tuples: Introduction, Operation, Accessing, Function and methods in tuples and Data Type Conversion. Python sets						
<b>Unit:3</b>	<b>Control Structures</b>					<b>18-- hours</b>
Conditional Statement: Branching (if, else-if, nested), Looping: while statement, for statements, Control Statements: break, continue and pass Statements. Python Exception Handling: Try, Catch, Finally Functions : Defining a function , Calling a function ,Types of functions , Function Arguments Anonymous functions , Regular expressions : Match function, Search function ,Modifiers. Python OOPs: Class, Object, Inheritance and Constructor.						
<b>Unit:4</b>	<b>Python Libraries for Data Science</b>					<b>18-- hours</b>
Reading and Writing CSV Files in Python using CSV Module, NumPy [Arrays and matrices]: N-dimensional data structure, Creating array, Indexing array, Reshaping, Vectorized operations,						

Pandas [Data Manipulation]: Create Data Frame, Combining Data Frames, Summarizing, Columns selection, Rows selection (basic) , Rows selection (filtering) , Sorting, Descriptive statistics, Rename values, Dealing with outliers. SciPy Introduction, Basic functions, Special functions(scipy. special), Integration(scipy. integrate), Optimization (scipy. optimize).Tensor Flow: Computation with Tensor Flow, Regression with Tesorflow		
<b>Unit:5</b>	<b>Python Libraries for NLP and Visualization</b>	<b>18-- hours</b>
NLTK,: tokenizing, part-of-speech tagging, stemming, Sentence Segmentation, Methods for cleaning and normalizing text. Textblobn-grams, Parsing, Spelling correction. Visualization libraries : matplotlib, Seabon: Simple Line Plots, Simple Scatter Plots, Density and Contour Plots, Histograms, Customizing Colorbars, Subplots, Text and Annotation, Visualization with Seaborn		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2-- hours</b>
Analyze Data to understand Global Issues on health care, pandemic situations etc..		
<b>Total Lecture hours</b>		<b>92-- hours</b>
<b>Text Book(s)</b>		
1	Jake VanderPlas, -Python Data Science Handbook  O'Reilly, 1 <sup>st</sup> Edition, 2017.	
2	Andreas C. Muller & Sarah Guido -Introduction to Machine Learning with Python , O'Reilly, 1 Edition, 2016.	
3	Dr. Charles Russell Severance, Sue Blumenberg, Elliott Hauser, AimeeAndrion—Python for Everybody: Exploring Data in Python 3 ,CreateSpace, 2016.	
<b>Reference Books</b>		
1	Wesley J. Chun , -Core Python Programming , 2 <sup>nd</sup> Edition,Pearson Education,2016.	
2	Mark Summerfield , -Programming in Python 3 , Pearson Education,2018.	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	PYTHON - A to Z Full Course for Beginners, <a href="https://www.udemy.com/">https://www.udemy.com/</a>	
2	Python for Data Science, <a href="https://swayam.gov.in/">https://swayam.gov.in/</a>	
3	Python for Data Science and Machine Learning Bootcamp, <a href="https://www.udemy.com/">https://www.udemy.com/</a>	
4	Introduction to Python Programming, <a href="https://www.udacity.com/">https://www.udacity.com/</a>	
Course Designed By: Dr.J.Ramsingh , Dr.V.Bhuvaneshwari		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>	M	L		M			M		L	
<b>CO2</b>	M	L		M			S		S	
<b>CO3</b>	S	S	S	S	M	L	S		S	S
<b>CO4</b>	M	M	L	M	S	L	S		M	M
<b>CO5</b>	S	S	S	S	S	M	S		M	S

Course code	21CSEAE19	.NET PROGRAMMING	L	T	P	C
<b>Core/Elective/Supportive</b>	Elective		2	0	2	4
<b>Pre-requisite</b>	RDBMS		<b>Syllabus rsion</b>		<b>2021- 22</b>	
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>1. To understand various .NET framework components and object oriented programming concepts in .NET</li> <li>2. To create .NET applications using files and ADO.NET</li> <li>3. To apply LINQ in VB.NET and C# Programming</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	To design applications using Object Oriented concepts in VB.NET and C#					K3
2	To describe Thread creation, Multi-threading and synchronization, File handling operations					K4
3	To create Database ADO .NET components/ Files in designing applications for specific problems					K3
4	To evaluate the usage of LINQ features and .NET remoting in application designing					K5
5	To design and Develop Applications for real time societal problems using .NET Framework					K6
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>Introduction to C# and VB.NET</b>					<b>16 hours</b>
Software Development and VB.NET – The VB.NET Development Environment – Common Elements in Visual C# 2008 – Name spaces Modules and Namespaces – data Types – Assignments and Operators – Types: Structures–Enumerations –Bitwise Enumeration – Equivalence versus Identity Structures and Enumeration – Control Structures – Control Flow – Error Handling: Basics						
<b>Unit:2</b>	<b>Arrays, Collections and Exceptions</b>					<b>18 hours</b>
Arrays and Collections:– Array Elements –Multidimensional Arrays –Jagged Arrays – System.Array– System.Array Properties – params keyword – Array Conversion Collections: Array List Collection – Bit Array Collection – Hash table Collection- A standard exception model – Structured Exception Handling–System.Exception–Remote Exceptions–Unhandled Exceptions						
<b>Unit:3</b>	<b>Object Oriented Programming and Threading</b>					<b>18 hours</b>
<b>Object Oriented Programming:</b> Class Fundamentals – Fields, Methods, Properties, Contractors, Events, Shared Members – Inheritance: Basics, Overriding, Sealed and Virtual Classes – Interfaces – Delegates – Attributes – <b>Threading:</b> Fundamentals, Thread Synchronization – Components and Assemblies – Reflection						
<b>Unit:4</b>	<b>File Handling and ADO.NET</b>					<b>18 hours</b>
<b>Files and Directories:</b> Directory and File Classes, Path Class – Streams: Stream class, stream operations, stream readers and writers, reading and writing text files, reading and writing xml files – <b>Data Access with ADO.NET</b> – Binding controls to database- Handling Database in Code-XML and ADO.NET						

<b>Unit:5</b>	<b>LINQ, Collections and Application Deployment</b>	<b>20 hours</b>
<b>Introduction to LINQ:</b> C# Extension-LINQ Essentials-LINQ to Objects-Examples of LINQ to Object as-LINQ Operators. Queue Collection-Stack Collection- Specialized Collections – .NET Remoting - .Net Core – Introduction – Application Deployment Types – Docker – Basics – Containers – Creating Docker		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars - webinars		
<b>Total Lecture hours</b>		<b>92 hours</b>
<b>Text Book(s)</b>		
1	Donis Marshall, -Programming Visual C# 2008: The Language -, Microsoft Press Publication, 2008.	
2	The Complete Reference – Visual Basic .NET, JeffreyR.Shapiro, Tata McGraw-Hill, 2002	
<b>Reference Books</b>		
1	Christian Nagel, Bill Evjen, Morgan Skinner, Jay Glynn, Karli Watson, _Professional C# 2012 and .NET 4.5‘, Wiley India, 2012.	
2	StevemHolzner, _Visual Basic .Net Programming Black Book‘, Dreamtech Press, Reprint 2011	
3	Andrew Troelsen and Philip Japikse, _C# and the .NET 4.6 Framework‘, Apress 2017.	
4	Mark J. Price, _C# 8.0 and .NET Core 3.0‘, Packt Publishing, 2019	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	<a href="http://www.spoken-tutorial.org">www.spoken-tutorial.org</a>	
2	<a href="https://docs.microsoft.com">.net core Guide - https://docs.microsoft.com</a>	
3	<a href="https://www.tutorialsteacher.com/core/aspnet-core-middleware">https://www.tutorialsteacher.com/core/aspnet-core-middleware</a>	
Course Designed By: <b>Dr. R. Rajeswari</b>		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>		M	S	S			M		L	
<b>CO2</b>		M	S	S			M		L	
<b>CO3</b>		M	S	S			M		L	
<b>CO4</b>		M	S	S			M		L	
<b>CO5</b>			S	S					S	S

\*S-Strong; M-Medium; L-Low

<b>Course code</b>	<b>21CSEAE20</b>	<b>Graphical Programming and Virtual Instrumentation</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Core/Elective/Supportive</b>			<b>2</b>		<b>2</b>	<b>4</b>
<b>Pre-requisite</b>	Students should know about the concept of graphical programming and virtual instrumentation		<b>Syllabus Version</b>	<b>2021-22</b>		
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>To realize the concept of Graphical Programming and Virtual Instrumentation</li> <li>Understanding Virtual Instrument concepts and Creating Virtual Instruments for practical works</li> <li>to develop basic VI programs using loops, case structures etc. including its applications in Data Acquisition, Machine Vision, Image Processing and Analysis</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Describe the concepts of Graphical System Design Model using LabView and its applications			K1 & K2		
2	Demonstrate of LabVIEW software environment and creating saving a VI with keyboard shortcuts			K2 & K3		
3	Study the structure of modular programming and Build A VI Front Panel and Block Diagram using LabVIEW software			K2, K3 & K4		
4	Analyse the loops, arrays, clusters and error handling using LabVIEW concepts in real-time applications			K2, K3 & K4		
5	Construct the various analysis using Data Acquisition, Image Processing, Particle and Machine Vision with GSD Applications			K5 & K6		
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>Introduction to Graphical System Design</b>				<b>16 hours</b>	
Graphical System Design: Introduction, Graphical System Design Model, Design Flow With GSD, Virtual Instrumentation, Virtual Instrument and Traditional Instrument, Hardware and Software In Virtual Instrumentation, Virtual Instrumentation For Test, Control And Design, Virtual Instrumentation In The Engineering Process, Virtual Instruments Beyond Personal Computer, Graphical System Design Using LABVIEW, Graphical Programming and Textual Programming.						
<b>Unit:2</b>	<b>Introduction to LabVIEW</b>				<b>18 hours</b>	
Introduction, Advantages of LabVIEW, Software Environment, Creating and Saving A VI, Front Panel Toolbar, Block Diagram Toolbar, Palettes, Shortcut Menus, Property Dialog Boxes, Front Panel Controls and Indicators, Block Diagram, Data Types, Data Flow Program, Labview Documentation Resources, Keyboard Shortcuts.						
<b>Unit:3</b>	<b>Modular Programming</b>				<b>18 hours</b>	
Modular Programming – Introduction, Modular Programming In LabVIEW, Build A VI Front Panel and Block Diagram, Icon and Connector Pane, Creating an Icon, Building A Connector Pane, Displaying SubVIs and Express Vis as Icons or Expandable Nodes, Creating SubVIs From Sections of A VI, Opening and Editing SubVIs, Placing SubVIs On Block Diagrams, Saving SubVIs, Creating A Stand-Alone Application.						
<b>Unit:4</b>	<b>Programming in Lab View</b>				<b>18 hours</b>	
Repetition and Loops - for loops - While Loops, Structure Tunnels. Arrays: Introduction - Arrays						

in LabVIEW – 1D, 3D and Multidimensional Arrays. Clusters: Introduction - Creating Cluster Controls And Indicators - Creating Cluster Constant - Order of Cluster Elements - Cluster Operations - Assembling Clusters - Disassembling Clusters - Conversion Between Arrays and Clusters - Error Handling - Error Cluster.		
<b>Unit:5</b>	<b>Analysis using Lab View</b>	<b>20 hours</b>
Structures – Introduction - Case Structures - Sequence Structures - Customizing Structures - Timed Structures - Event Structure. Strings and File I/O: Introduction - Creating String Controls And Indicators - String Functions. Data Acquisition - Image Processing and Analysis, Particle Analysis, Machine Vision, LabVIEW Tool and GSD Applications.		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, YouTubes Videos, Animations, NPTEL, MOOC videos, online seminars – webinars for strengthening the subject matters.		
	<b>Total Lecture hours</b>	<b>92 hours</b>
<b>Text Book(s)</b>		
1	Jovitha Jerome, –Virtual InstrumentationUsingLabVIEWI, PHI Learning Private Ltd., 2010	
2	Gary W. Johnson and Richard Jennings, –LabVIEW Graphical ProgrammingI, McGraw-Hill Inc., 2006	
<b>Reference Books</b>		
1	Bruce Mihura, –LabVIEW for Data AcquisitionI, Prentice Hall, 2001	
2	Gupta, Virtual Instrumentation Using Lab view 2nd Edition, Tata McGraw-Hill Education, 2010	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	Lecture <a href="https://www.bharathuniv.ac.in/colleges1/downloads/courseware_ece/notes/BEI704%20%2020-%20virtual%20instrumentation.pdf">https://www.bharathuniv.ac.in/colleges1/downloads/courseware_ece/notes/BEI704%20%2020-%20virtual%20instrumentation.pdf</a>	Notes:
2	PPT Slides: <a href="https://www.slideshare.net/PrincyRandhawa/virtual-instrumentation-labview">https://www.slideshare.net/PrincyRandhawa/virtual-instrumentation-labview</a>	
3	Tutorials/Animations: <a href="https://www.ni.com/en-in/innovations/white-papers/06/virtual-instrumentation.html">https://www.ni.com/en-in/innovations/white-papers/06/virtual-instrumentation.html</a>	
4	YouTube Videos: <a href="https://www.youtube.com/watch?v=u-AzZV-Ooyk">https://www.youtube.com/watch?v=u-AzZV-Ooyk</a>	
Course Designed By : Dr. R. Rajeswari		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>	S	S	S	L	M	L	S	S	M	M
<b>CO3</b>	S	S	S	L	S	M	S	M	L	L
<b>CO3</b>	S	S	S	L	M	L	S	M	L	L
<b>CO4</b>	S	S	S	L	M	M	S	S	L	L
<b>CO5</b>	S	S	S	M	M	L	S	S	M	M

\*S-Strong; M-Medium; L-Low

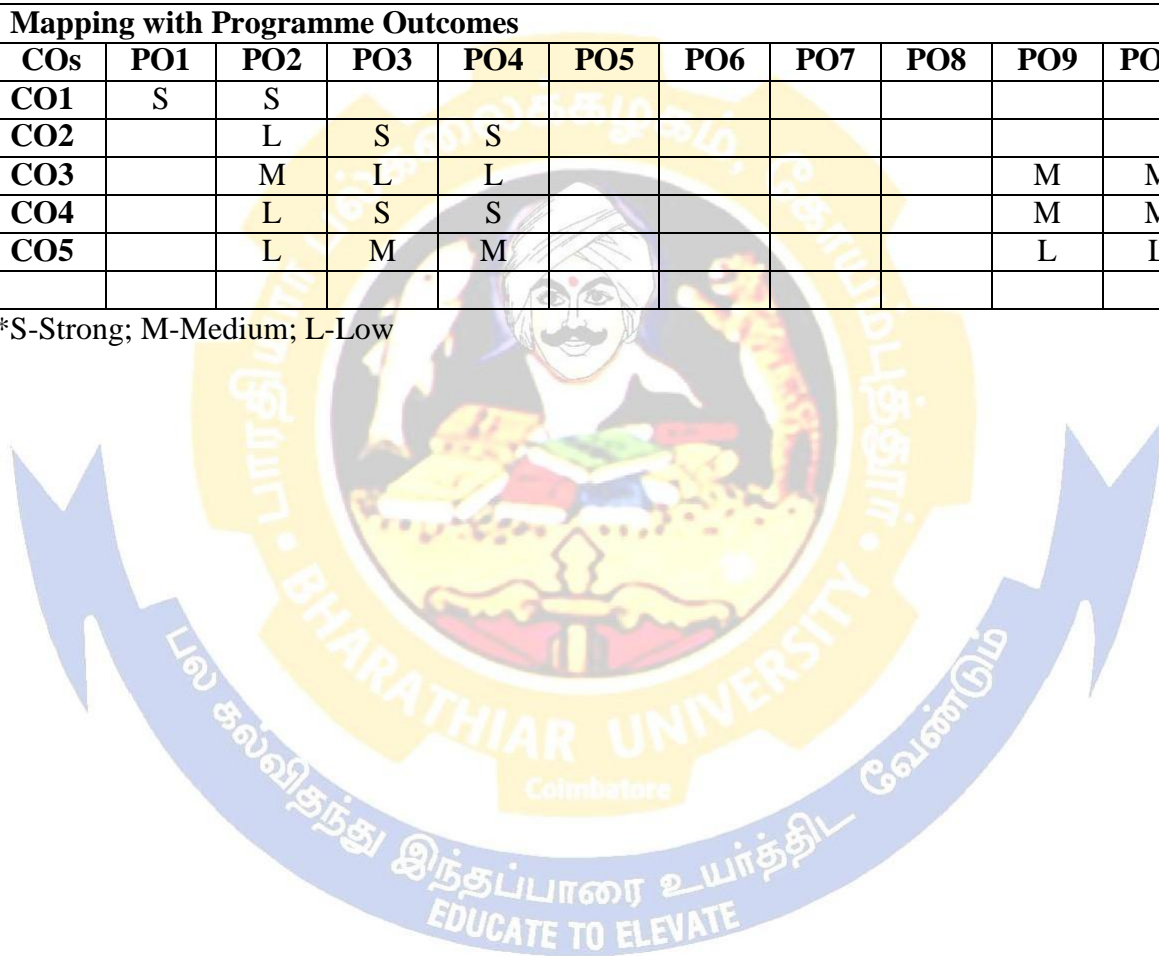
Course code	21CSEAE21	SOFTWARE TESTING WITH SELENIUM	L	T	P	C
Core/Elective/Supportive	Elective		3	0	1	4
Pre-requisite	Knowledge of software engineering		Syllabus rsion		2021- 22	
<b>Course Objectives:</b>						
The main objectives of this course are:						
<ol style="list-style-type: none"> <li>To understand the basic concepts of software testing</li> <li>To Gain knowledge over various selenium methods and automation frameworks</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
CO1	To learn the importance of software testing				K1	
CO2	To understand and use Selenium IDE				K2	
CO3	To create programs using Selenium				K3	
CO4	To create test beds for software testing				K4, K6	
CO5	To identify potential problems in software and develop solutions for testing				K5	
<b>K1</b> - Remember; <b>K2</b> - Understand; <b>K3</b> - Apply; <b>K4</b> - Analyze; <b>K5</b> - Evaluate; <b>K6</b> - Create						
<b>Unit:1</b>	<b>Introduction to Automation</b>				<b>15 hours</b>	
Introduction to Automation - Planning before Automation - Introduction to Selenium - Installing Selenium Components.						
<b>Unit:2</b>	<b>Selenium IDE</b>				<b>15 hours</b>	
Using Selenium IDE - Managing User Interface Controls - Creating First Selenium Web Driver Script.						
<b>Unit:3</b>	<b>Selenium Methods</b>				<b>15 hours</b>	
Selenium Methods - Common Selenium Web Driver Methods - Verification Point in Selenium - Exploring the Features of Web Driver.						
<b>Unit:4</b>	<b>Working with UI</b>				<b>15 hours</b>	
Handling Pop-up Dialogs and Multiple Windows - Working with Dynamic UI Objects- Data driven testing using TestNG - Selenium Functions, Common Questions and Tips.						
<b>Unit:5</b>	<b>Automation Frameworks</b>				<b>15 hours</b>	
Reporting in Selenium - Batch Execution- Automation Frameworks - Understanding Selenium Grid.						
<b>Unit:6</b>	<b>Contemporary Issues</b>				<b>2 hours</b>	
Expert lectures, online seminars - webinars						
					<b>Total Lecture hours</b>	<b>77 hours</b>
<b>Text Book(s)</b>						
1	AdithyaGarg, Ashish Mishra, –A Practitioner’s Guide to Test Automation Using Seleniuml, Tata McGraw Hill Education, 2015.					
2	NavneeshGarg, –Test Automation Using Selenium WebDriver with Javal, AdactIn Group Pvt Ltd. 2014.					
3	SatyaAvasarala, –Selenium Web Driver Practical Guidel, Packt Publishing, 2014.					



Reference Books	
1	Rex Allen Jones II, -Selenium Web Driver for Functional Automation Testing!, Test 4 Success, LLC. 2016.
2	David Burns, Selenium 1.0 Testing Tools, Packt Publishing, 2010.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	Software testing, <a href="https://onlinecourses.nptel.ac.in/noc20_cs19/preview">https://onlinecourses.nptel.ac.in/noc20_cs19/preview</a>
Course Designed By: <b>Dr. T. Amudha</b>	

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S								
CO2		L	S	S						
CO3		M	L	L					M	M
CO4		L	S	S					M	M
CO5		L	M	M					L	L

\*S-Strong; M-Medium; L-Low



Course code	21CSEAE22	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
Core/Elective/Supportive	Elective		4	0	0	4
Pre-requisite	Nil		Syllabus	2021-22		
<b>Course Objectives:</b>						
The main objectives of this course are to:						
<ol style="list-style-type: none"> <li>To learn software planning, project management, activity planning</li> <li>To analyze and apply effort and cost estimation techniques</li> <li>To learn Monitoring, scheduling and Risk Management</li> <li>To Evaluate Modern techniques for project management</li> <li>To apply Software project Management concept in a case study using tools</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	Remember Software Process Models					K2
2	Understand steps involved in Software Project Management					K2
3	Apply and Analyze Software effort Estimation Methods					K2
4	Apply and Evaluate Software Project Management Tools					K2
5	Understand the Activity Planning, Risk Management using case studies					K3
6	Learn the modern techniques in Software Project Management like Agile, Scrum, DevOps					K2
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create</b>						
<b>Unit:1</b>	<b>Introduction to Software Project Management</b>					<b>12 hours</b>
Definition of Software Engineering – Software Process Models – Agile Process Models. Introduction to Software Project Management- Software project versus other types of project-Activities – Management - Stakeholders- Requirement Specification – Information and control in organizations - step wise project -Project evaluation.						
<b>Unit:2</b>	<b>Selection of Appropriate Project Approach</b>					<b>10 hours</b>
Software Process Models: Agile (introduction, Why Agile, What is Agile), SCRUM, Enhancers - Choice of Process Model – Selecting the most appropriate Process model – Software Effort Estimation - Activity Planning – Network Planning Models – Forward Pass - Backward Pass – Critical path - Float – Precedence Networks						
<b>Unit:3</b>	<b>Risk Management</b>					<b>14 hours</b>
Nature of risk- Managing Risks- Risk Identification-Risk Analysis –Reducing Risks- Evaluating Risks- z values. - Monitoring and control- creating the frame work- collecting the data- visualizing the progress- cost monitoring- earned value- prioritizing, monitoring-Change control.Software quality –importance.						
<b>Unit:4</b>	<b>Introduction to Devops</b>					<b>12 hours</b>
Define Devops - What is Devops - SDLC models, Lean, ITIL, - Why Devops - History of Devops - Devops Stakeholders - Devops Goals - Important terminology - Devops perspective - Devopsand Agile - Devops Tools - Configuration management - Continuous Integration and Deployment.						
<b>Unit:5</b>	<b>Software Tools</b>					<b>12 hours</b>
[Software Tools for SDLC.] Software tools for Project Planning, Scheduling and reporting,						

Resource Management. Case Studies: Applications of SPM concepts in Hospitals, Library, Inventory, Marketing (For Unit Case studies, students are expected to apply SPM tools and submit a report)		
<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Submit an assignment on Learning and Unlearning concept in software industry		
<b>Total Lecture hours</b>		<b>62 hours</b>
<b>Text Book(s)</b>		
1	Mike Cotterell, Bob Hughes, –Software Project Management ,Inclination/Thomas Computer Press,1995.	
2	Robert K. Wysocki –Effective Software Project Management  – WileyPublication,2011.	
3	Walker Royce: –Software Project Management - Addison-Wesley,1998.	
4	Andrew Stellmen&Greene Jennifer, –Learning Agile , Mary Treaseler 2014	
<b>Reference Books</b>		
1	Gopalaswamy Ramesh, –Managing Global Software Projects  – McGraw Hill Education (India), Fourteenth Reprint2013.	
2	Darrel Ince, H.Sharp and M.Woodman, –Introduction to Software Project Managementand Quality Assurancel, Tata McGraw Hill,1995.	
3	Ramesh Gopalam, –Managing Global Software Projects , Tata McGraw-Hill- 2005	
4	Joseph Joyner, –DevOps for Beginners ,MihailsKonoplovs, 2015	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	www.coursera.com	
2	www.edx.org	
3	www.simplilearn.com	
4	www.udemy.com	
<b>Web Link</b>		
1. <a href="https://www.atlassian.com/">https://www.atlassian.com/</a>		
2. <a href="https://www.scoro.com/blog/best-project-management-software-list/">https://www.scoro.com/blog/best-project-management-software-list/</a>		
Course Designed By: Dr. M Punithavalli		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>	-	M	L	L	M	L	L	M	L	M
<b>CO2</b>	L	M	M	M	M	M	M	M	L	M
<b>CO3</b>	M	M	L	-	L	-	-	M	L	L
<b>CO4</b>	-	M	M	M	M	M	M	M	L	M
<b>CO5</b>	L	S	M	S	S	M	M	S	S	S
<b>CO6</b>	L	L	-	-	L	-	-	L	M	L

\*S-Strong; M-Medium; L-Low

Course code	21CSEAE23	COMPUTER GRAPHICS AND MULTIMEDIA	L	T	P	C
Core/Elective/Supportive	Core		2	0	2	4
Pre-requisite	None		Syllabus rsion		2021- 22	
<b>Course Objectives:</b>						
The main objectives of this course are:						
<ol style="list-style-type: none"> <li>To understand the Computer Graphics and the various graphic algorithms.</li> <li>To understand the 2D and 3D transformations, models and generation techniques</li> <li>To understand the Multimedia animation and Desktop Computing.</li> </ol>						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	To understand the activities involved in modelling, rendering, shading and animation of computer graphics.				K1, K2	
2	To use OpenGL to create interactive computer graphics.				K3	
3	To understand a typical graphics pipeline and make pictures with their computer.				K4, K6	
4	To understand the latest interactive multimedia devices, and image formats.				K4, K5	
5	To understand data compression, image compression and video compression techniques and develop an interactive multimedia presentation.				K5, K6	
<b>K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create</b>						
<b>Unit:1</b>	<b>Introduction to Computer Graphics</b>				<b>12 hours</b>	
A Survey of Computer Graphics – Overview of Graphics Systems: Video Display Devices – Input Devices – Graphics Software.						
<b>Unit:2</b>	<b>Two dimensional graphics</b>				<b>20 hours</b>	
Output Primitives: Points and Lines – Line Drawing Algorithms: DDA – Bresenham`s. Properties of Circles and Ellipses – Pixel Addressing. Two Dimensional Geometric Transformations: Basic Transformations – Matrix Representation – Composite Transformations.						
<b>Unit:3</b>	<b>Three dimensional graphics</b>				<b>20 hours</b>	
Three-Dimensional Display Methods – Three Dimensional Geometric and Modeling Transformations: Translation – Rotation – Scaling – Composite Transformations - Color Models and Color Applications.						
<b>Unit:4</b>	<b>Introduction to Multimedia</b>				<b>18 hours</b>	
Multimedia: Introduction, Definition, Uses of Multimedia, Delivering Multimedia, computer display Vs TV display - TEXT: Fonts and Faces - Using Text in Multimedia - Computers and Text - Font Editing and Design Tools - Hypermedia and Hypertext. – using MAYA / 3ds MAX / Dreamweaver						
<b>Unit:5</b>	<b>Images, Audio and Video</b>				<b>20 hours</b>	
Images: Making Still Images - Image File Formats - 2 D, 3 D - Sound: Digital Audio - MIDI Audio - MIDI vs. Digital Audio - Audio File Formats - Adding Sound to Your Multimedia Project - Animation – Video: Analog, Digital - Digital Video Containers - Obtaining Video Clips - Shooting and Editing Video – using MAYA / 3ds MAX / Dreamweaver – Design of UI / UX						

<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
<b>Total Lecture hours</b>		<b>92 hours</b>
<b>Text Books</b>		
1.	Donald Hearn &M.Pauline Baker, –Computer GraphicsI, Second Edition, PHI/ Pearson Education.	
2.	H.M.Neumann and R.F.Sproul, –Principles of Interactive computer GraphicsI, Second Edition, McGraw Hill.	
3.	Multimedia Making It work – 9th Edition, Tay Vaughan, McGraw Hill, 2016	
4.	Autodesk Maya Press, –Learning Autodesk Maya 2016: FoundationI, John Wiley & Sons, 2015	
5.	Kelly L. Murdock, –3ds Max 2021: Complete Reference Guide‘, SDC Publications, 2020.	
<b>Reference Books</b>		
1. Steven Harrington, –Computer Graphics – A Programming ApproachI, McGraw Hill, 1983.		
2. John F. Hughes, Andries van Dam, Morgan McGuire, David F. Sklar, James D. Foley, Steven K. Feiner, Kurt Akeley, –Computer Graphics: Principles and Practicel, Addison-Wesley Professional; 3 <sup>rd</sup> edition, 2013.		
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	Computer Graphics, <a href="https://nptel.ac.in/courses/106/106/106106090/">https://nptel.ac.in/courses/106/106/106106090/</a>	
2	Multimedia Systems, <a href="https://nptel.ac.in/courses/117/105/117105083/">https://nptel.ac.in/courses/117/105/117105083/</a>	
Course Designed By: <b>Dr. J. Satheesh Kumar</b>		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>		S	M	M	S	S	S		S	L
<b>CO2</b>		S	S							
<b>CO3</b>		S		L						
<b>CO4</b>		S	L	S	S	S	S	L	S	L
<b>CO5</b>		S	L	M	S	M			S	M

\*S-Strong; M-Medium; L-Low

Course code	21CSEAE24	AUGMENTED REALITY	L	T	P	C
Core/Elective/Supportive	Core		2	0	2	4
Pre-requisite	None		Syllabus rsion		2021- 22	
<b>Course Objectives:</b>						
The main objectives of this course are:						
4. To understand the concepts behind AR 5. To design and develop AR applications						
<b>Expected Course Outcomes:</b>						
On the successful completion of the course, student will be able to:						
1	To understand Virtual and Augmented reality				K1, K2	
2	To understand the AR and VR development environment				K2, K3	
3	To do basic VR and AR development				K3, K6	
4	To create AR Environments				K6	
5	To design and develop AR applications				K5, K6	
<b>K1</b> - Remember; <b>K2</b> - Understand; <b>K3</b> - Apply; <b>K4</b> - Analyze; <b>K5</b> - Evaluate; <b>K6</b> – Create						
<b>Unit:1</b>	<b>Introduction to Augmented Reality</b>				<b>16 hours</b>	
Introduction to Augmented Reality (AR), Virtual Reality (VR), eXtended Reality (XR) - Introduction to Unity3D and Content Generation Tools - History, evolution and market impact - Sample applications of AR, VR, XR: Presentation						
<b>Unit:2</b>	<b>Design Theory of AR</b>				<b>18 hours</b>	
Design application: Theory - Story and process - Scripting principles - Hardware: AR, VR, XR - Hardware: Development environment - Tools, Software Development Kit (SDK), Scripting						
<b>Unit:3</b>	<b>AR Development</b>				<b>18 hours</b>	
Basic development: Identifying basic design principles, reciting common choices, styles, and/or aesthetics Visual, audial, interactive, and narrative - System Dynamics and Scripting Fundamentals - Interfaces, Environments, Asset Management, and Animation - Project 1: Creating a project and environment - Project 2: Creating and using an asset - Project 3: Creating and using a Component – using MAYA						
<b>Unit:4</b>	<b>AR Environment</b>				<b>18 hours</b>	
Creating Environment: Principles of Cameras and Lighting in Application Environments-Principles of Audio, Animation - Physics, Particle system - Interaction: Eye tap, Gaze, Handheld controllers – Tracking – Spatial immersion and interaction – Principles of Quality and Functionality Assurance in Development - using MAYA						
<b>Unit:5</b>	<b>Creating AR Applications</b>				<b>20 hours</b>	
Project 4: Creating first application - Project 5: Creating a simple application: Principles of Versioning and Release – Packaging - Installing application on the device – Practical Applications: Virtual Circuit - Virtual Chemistry lab - Virtual Dental experiment – Game - Virtual Assembly and Repair - Augmented Book - Augmented Tourism - Augmented Healthcare: X-rays						

<b>Unit:6</b>	<b>Contemporary Issues</b>	<b>2 hours</b>
Expert lectures, online seminars – webinars		
		<b>Total Lecture hours</b>
		<b>92 hours</b>
<b>Text Books</b>		
1	Erin Pangilinan, Steve Lukas, et al. _Creating Augmented and Virtual Realities: Theory and Practice for Next-Generation Spatial Computing‘, Apr 14, 2019	
2	Steve Aukstakalnis, _Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability)‘, 2016	
3	Jonathan Linowes, _Augmented Reality for Developers: Build practical augmented reality applications with Unity, ARCore, ARKit, and Vuforia‘, October 9, 2017	
<b>Reference Books</b>		
1.	Michael Wohl, _The 360° Video Handbook: A step-by-step guide to creating video for virtual reality (VR)‘, July 1, 2017	
2.	John Bucher, _Storytelling for Virtual Reality: Methods and Principles for Crafting Immersive Narratives‘, Jul 6, 2017	
3.	Jonathan Linowes, _Unity Virtual Reality Projects: Learn Virtual Reality by developing more than 10 engaging projects with Unity 2018‘, 2nd Edition 2nd Edition, Kindle Edition	
<b>Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]</b>		
1	Virtual Reality, <a href="https://nptel.ac.in/courses/106/106/106106138/">https://nptel.ac.in/courses/106/106/106106138/</a>	
Course Designed By: <b>Dr. J. Satheesh Kumar</b>		

<b>Mapping with Programme Outcomes</b>										
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>		S	M	M	S	S	S		S	L
<b>CO2</b>		S	S							
<b>CO3</b>		S		L						
<b>CO4</b>		S	L	S	S	S	S	L	S	L
<b>CO5</b>		S	L	M	S	M			S	M

\*S-Strong; M-Medium; L-Low



**Job Oriented  
Certificate  
Course**



## **JOB ORIENTED CERTIFICATE COURSES**

### **Robotic Process Automation Design & Development**

#### **Unit I**

Robotic Process Automation (RPA) - Programming Basics - Data & Data Structures - Algorithms - Software Development Guidelines - Compilers - Frameworks and Languages - Information Sharing - File Types - Access Control.

Basic RPA Concepts - Applying RPA - RPA vs Automation - Programming Constructs in RPA - RPA deployments. Advanced RPA Concepts - Standardization of processes - RPA Development - Robotic control flow architecture - RPA business case - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.

#### **Unit II**

UiPath Introduction - Installing UiPath Studio Academic Alliance edition - The User Interface - Keyboard Shortcuts - Automation Projects - Automation Debugging - Managing Activities Packages - Reusing Automation Library - Variables within Studio - Namespaces - Control Flow - Loops – Flowcharts. Data Manipulation techniques - Scalar variables, collections and Tables - Text Manipulation - Data manipulation - Gathering and Assembling Data.

#### **Unit III**

Recording and Advanced UI Interaction - Basic and Desktop Recording - Web Recording - Screen Scraping - Data Scraping. Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenges. UiPath Advanced concepts and application - Image, Text and Data Tables Automation in Studio – Automating Citrix, PDF, and Email - Best Practices

#### **Unit IV**

Excel Data Tables & PDF - Data Tables in RPA - Data Manipulation in excel - Extracting Data from PDF - Anchors - Using anchors in PDF. Debugging and Exception handling - Debugging Tools - Strategies for solving issues - Catching errors. Project Organization - Best practices – Avoiding pitfalls - Invoke Activity.

#### **Unit V**

UiPath Orchestrator - Tenants - Authentication - Users & Roles - Robots - Environments - Queues & Transactions – Schedules.

Artificial Intelligence and Machine learning implementation in RPA - Digital Assistant - Future of RPA - Basic RPA Projects: Sales order entry Robot - Robot for transactions & Email categorization. Advanced Projects: Email Autoresponder Robot - Disk monitoring and clean-up Robot.

#### **References**

1. <https://www.uipath.com/landing/academic-studio-download>
2. <https://www.uipath.com/rpa/robotic-process-automation>
3. <https://www.uipath.com/rpa/academy>

## Robotic Process Automation for Business

### Unit I

Introduction to RPA - Overview of RPA - Benefits of RPA in a business environment - Industries & domains fit for RPA - Identification of process for automation - Types of Robots - Ethics of RPA & Best Practices - Automation and RPA Concepts - Different business models for implementing RPA - Centre of Excellence – Types and their applications - Building an RPA team - Approach for implementing RPA initiatives.

### Unit II

Role of a Business Manager in Automation initiatives - Skills required by a Business Manager for successful automation - The importance of a Business Manager in automation - Analyzing different business processes - Process Mapping frameworks - Role of a Business Manager in successful implementation – Part 1 - Understanding the Automation cycle – First 3 automation stages and activities performed by different people.

### Unit III

Evaluating the Automation Implementation Detailed description of last 3 stages and activities performed by different people - Role of a Business Manager in successful completion – Part 2 - Activities to be performed post-implementation - Guidelines for tracking the implementation success - Metrics/Parameters to be considered for gauging success - Choosing the right licensing option - Sending emails - Publishing and Running Workflows.

### Unit IV

Ability to process information through scopes/systems - Understand the skill of information processing and its use in business - Leveraging automation - Creating a Robot - New Processes.

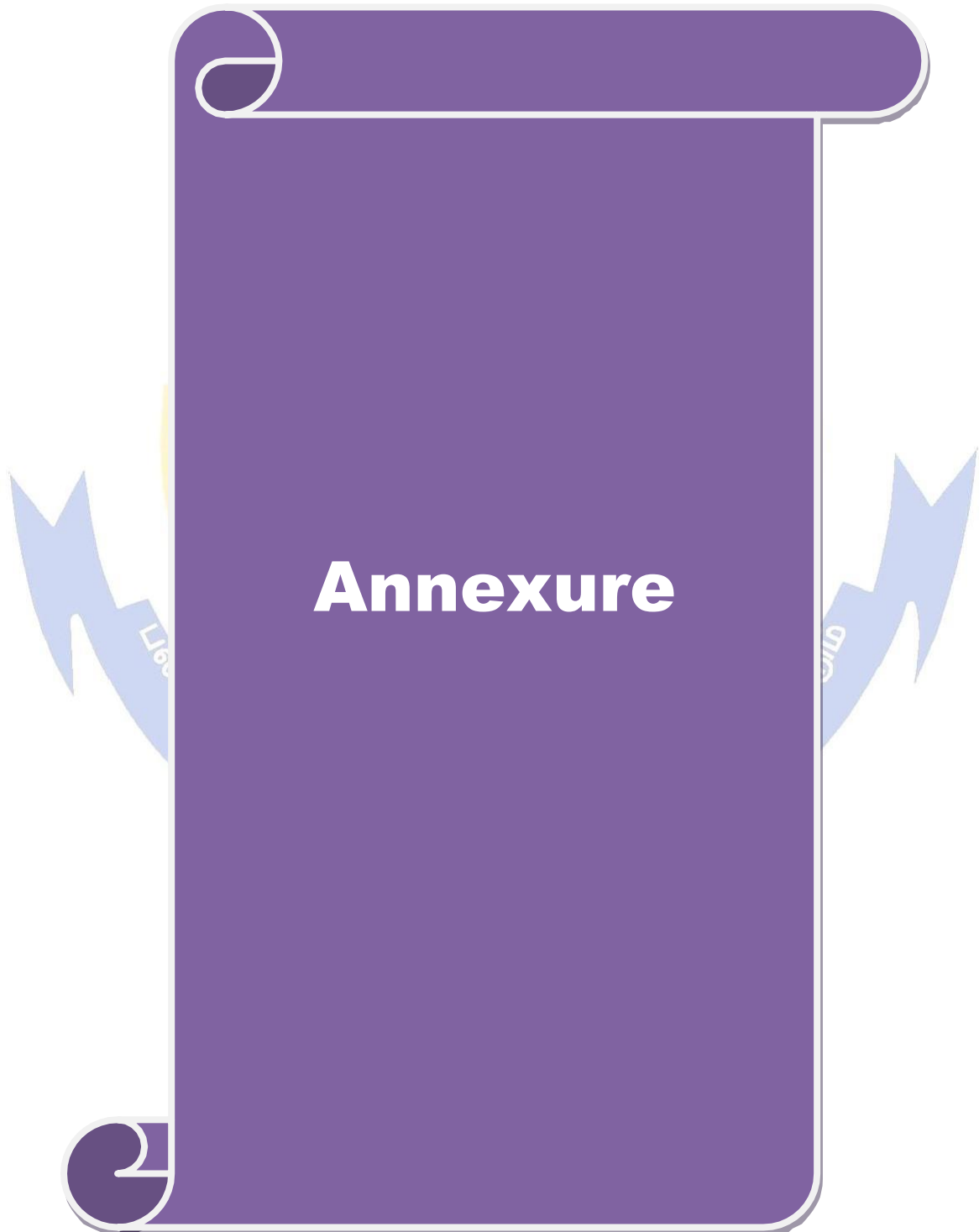
Establish causality by variable behaviour - Understand the skill of drawing inference or establishing causality by tracking the behaviour of a variable as it varies across time/referenced variable - Leveraging automation for this skill - Robot & new process creation.

### Unit V

Inference from snapshots of curated terms – Omni-source data curation - Multi-source trend tracking - Understand the skill of drawing inference from the behaviour of curated terms by taking snapshots across systems in reference to time/variable(s) - Leveraging automation for this skill – Robot creation and new process creation for this skill.

## References

1. <https://www.uipath.com/landing/academic-studio-download>
2. <https://www.uipath.com/rpa/robotic-process-automation>
3. <https://www.uipath.com/rpa/academy>



**BHARATHIAR UNIVERSITY, COIMBATORE-641 046**

**MASTER OF COMPUTER APPLICATIONS (M.C.A.) 2021-2022  
(CBCS) - University Department**

**(Effective from the academic Year 2021-2022)**

**1. Eligibility for Admission to the Courses**

A pass in Bachelors degree of minimum 3 years duration in BCA, B.Sc. (Computer Science/ Computer Technology/ Information Technology/ Computer System and Design) or equivalent with Mathematics as a course at Higher Secondary level or at Graduate level. The candidate should have appeared for TANCET/ Bharathiar University M.C.A. Entrance Test.

(or)

A pass in any Bachelors degree of minimum 3 years duration with Mathematics or Statistics as any one of the subjects at Graduate level. The candidate should have appeared for TANCET/ Bharathiar University M.C.A. Entrance Test and Bridge Course.

**2. Duration of the Courses**

The M.C.A. programme shall be offered on a full-time basis for two years. The programme will consist of three semesters of course work and laboratory work and the final semester consists of major project.

**3. Regulations**

The general Regulations of the Bharathiar University Choice Based Credit System Programme are applicable to these programmes.

**4. The Medium of Instruction and Examinations**

The medium of instruction and Examinations shall be in English.

**5. Submission of Record Notebooks for Practical Examinations & Project Viva-Voce.**

Candidates taking the Practical Examinations should submit bonafide Record Note Books prescribed for the Examinations. Otherwise the candidates will not be permitted to take the Practical Examinations. Candidates taking the Project Viva Examination should submit Project Report prescribed for the Examinations. Otherwise the candidates will not be permitted to take the Project Viva-voce Examination.

Students carry out Mini-project and major project and the schedule for project review meetings are as given below:

Table: Schedule for Project Review Meetings

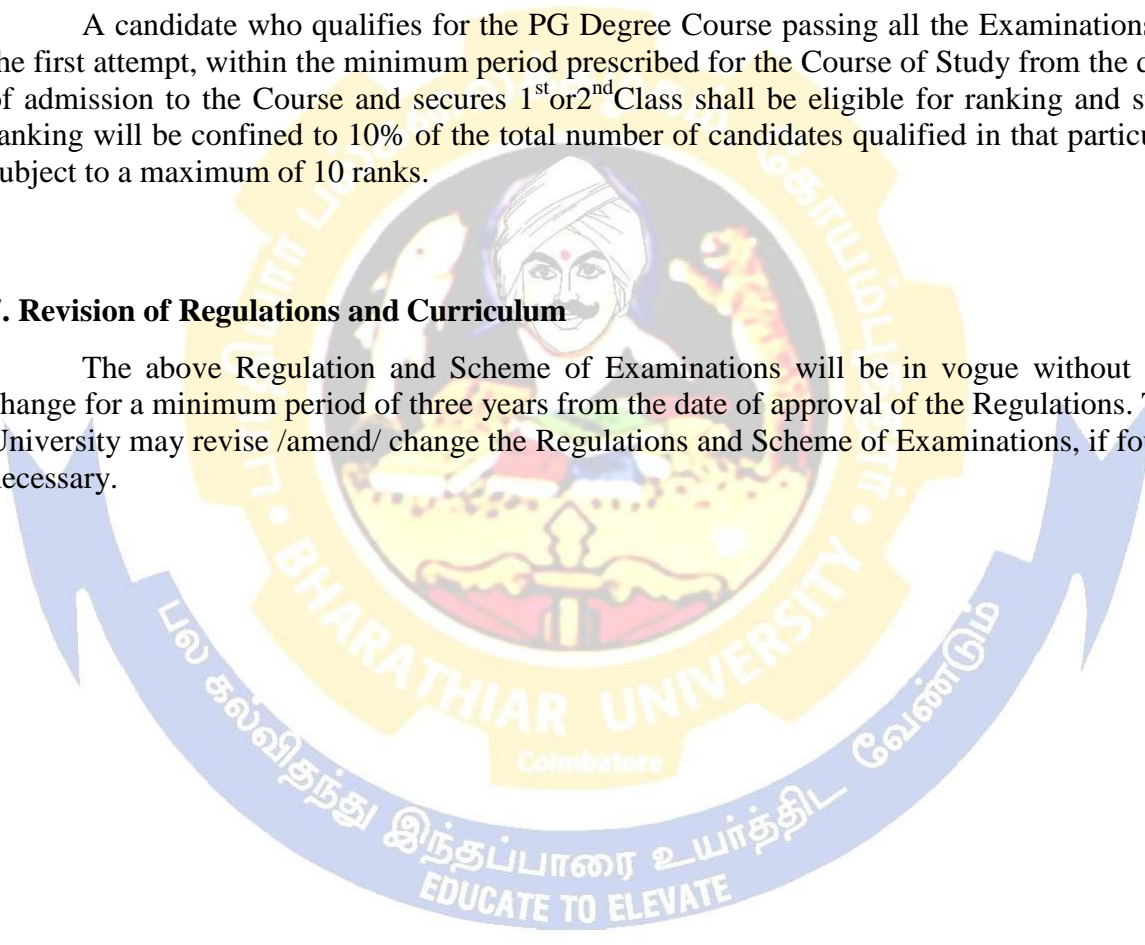
	First Review	Second Review
Mini Project	Thursday of first week in June	Thursday of first week in August
Major Project	Friday of first week of February	Friday of first week of April

## 6.Ranking

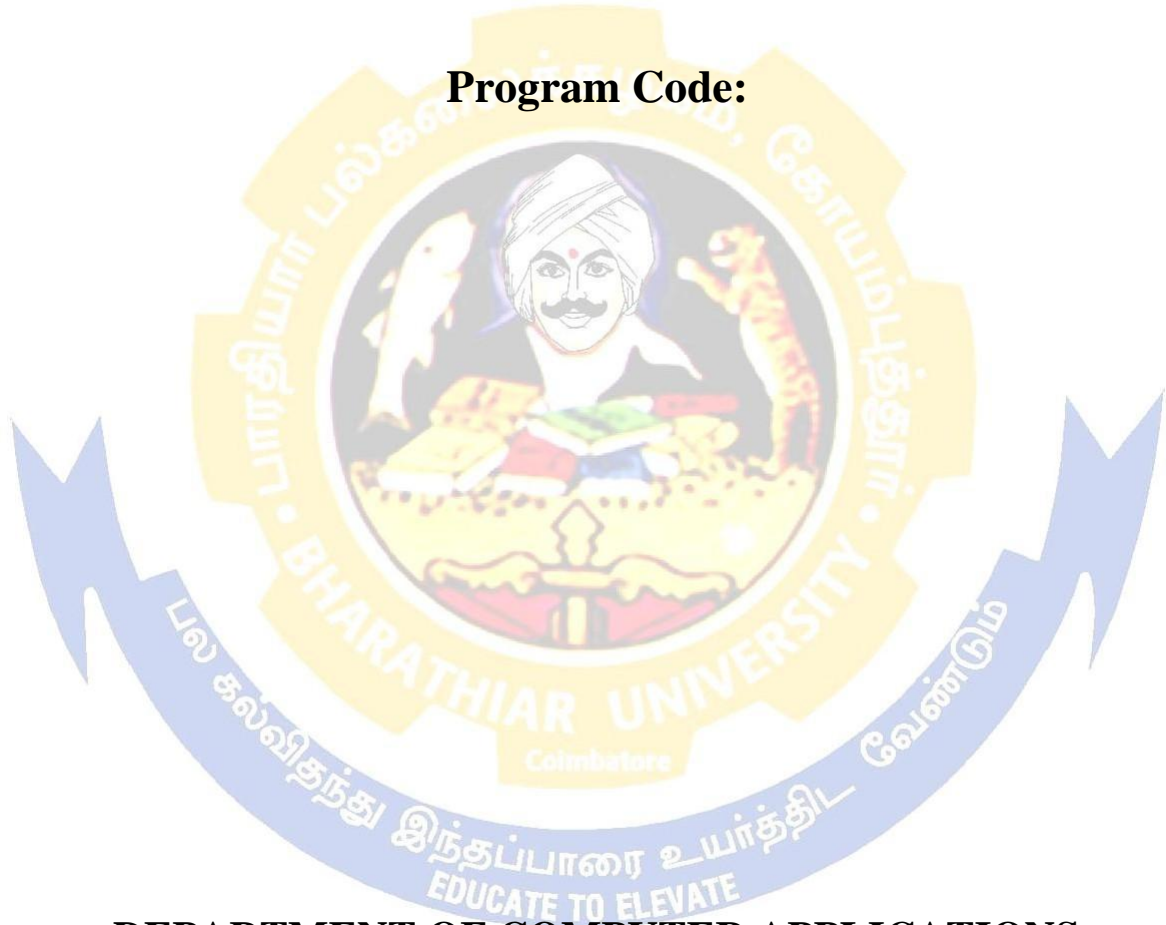
A candidate who qualifies for the PG Degree Course passing all the Examinations in the first attempt, within the minimum period prescribed for the Course of Study from the date of admission to the Course and secures 1<sup>st</sup> or 2<sup>nd</sup> Class shall be eligible for ranking and such ranking will be confined to 10% of the total number of candidates qualified in that particular subject to a maximum of 10 ranks.

## 7. Revision of Regulations and Curriculum

The above Regulation and Scheme of Examinations will be in vogue without any change for a minimum period of three years from the date of approval of the Regulations. The University may revise /amend/ change the Regulations and Scheme of Examinations, if found necessary.



**M.C.A.Programme**  
**Syllabus**  
**(With effect from 2021 - 2022)**



**DEPARTMENT OF COMPUTER APPLICATIONS**

**Bharathiar University**

(A State University, Accredited with "A" Grade by NAAC and  
13<sup>th</sup> Rank among Indian Universities by MHRD-NIRF)

**Coimbatore 641 046, INDIA**

## **BHARATHIAR UNIVERSITY: COIMBATORE 641046**

### **DEPARTMENT OF COMPUTER APPLICATIONS**

#### **MISSION**

- To impart practical knowledge and professional skills in the area of computer applications to students to make them industry ready.
- To contribute to the advancement of knowledge in the field of Computer Applications through research.
- To involve the students in societal contributions to make them aware of the society and its needs.

