BHARATHIAR UNIVERSITY, COIMBATORE–641 046

MASTER OF COMPUTER APPLICATIONS (M.C.A.) 2020-2021
(CBCS) - University Department
.
(Effective from the academic Year 2020-2021)

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 1st or 2nd 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 2020 - 2021)

Program Code:

DEPARTMENT OF COMPUTER APPLICATIONS
Bharathiar University
(A State University, Accredited with "A" Grade by NAAC and
13th 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.

Program Educational Objectives (PEOs)	
The PEOs of **M.C.A.** 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, Computer applications and 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.

Program Outcomes (POs)	
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. Curriculum (University Department)
(For the students admitted during the academic year 2020 – 21 onwards)
Scheme of Examination

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
FIRST SEMESTER							
20CSEAC01	Data Structures using JAVA	4	32	60	25	75	100
20CSEAC02	Computer Networks	4	32	60	25	75	100
20CSEAC03	Soft Skills	4	32	60	25	75	100
20CSEAE20	Elective I - Software Project Management	4	62	-	25	75	100
20CSEAE01	Elective II - IT Infrastructure and Cloud Security	4	62	-	25	75	100
Supportive		2					50
Total		22					550
SECOND SEMESTER							
20CSEAC04	Open Source Programming	4	32	60	25	75	100
20CSEAC05	Mobile Programming	4	32	60	25	75	100
20CSEAC06	Digital Image Processing	4	32	60	25	75	100
Elective 3	Elective – III	4			25	75	100
Elective 4	Elective – IV	4			25	75	100
Supportive		2					50
Total		22					550
THIRD SEMESTER							
20CSEAC07	Progressive Web Application Development	4	32	60	25	75	100
20CSEAC08	Big Data Analytics	4	32	60	25	75	100
20CSEAC09	Internet of Things	4	32	60	25	75	100
Elective 5	Elective – V	4			25	75	100
Elective 6	Elective – VI	4			25	75	100
20CSEAC10	Mini Project & Viva-voce	8			50	150	200
Supportive		2					50
Total		30					750
FOURTH SEMESTER							
20CSEAC11	Major Project & Viva-voce	16			100	300	400
TOTAL		90					2250

JOB ORIENTED CERTIFICATE COURSES

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

VALUE ADDED COURSES

1. Introduction to Robotics

Electives

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
Group I: Networking and Distributed Systems							
20CSEAE01	IT Infrastructure and Cloud Security	4	62	-	25	75	100
20CSEAE02	Mobile Networking	4	32	60	25	75	100
20CSEAE03	Virtualization and Cloud	4	47	30	25	75	100
Group II: Database Technologies							
20CSEAE04	Data Analysis and Business Intelligence	4	62	-	25	75	100
20CSEAE05	Big Data Frameworks and Tools	4	32	60	25	75	100
20CSEAE06	NoSQL I - MongoDB	4	32	60	25	75	100
20CSEAE07	NoSQL II – Neo 4j	4	32	60	25	75	100
Group III: Intelligent Systems							
20CSEAE08	Soft Computing	4	62	-	25	75	100
20CSEAE09	Intelligent Agents	4	62	-	25	75	100
20CSEAE10	Machine Learning	4	32	60	25	75	100
Group IV: Web Technologies							
20CSEAE11	Semantic Web	4	62	-	25	75	100
20CSEAE12	Service Oriented Architecture and Web Services	4	62	-	25	75	100
20CSEAE13	Social Data Mining	4	62	-	25	75	100
20CSEAE14	Responsive Web Application	4	32	60	25	75	100
20CSEAE15	Internet Programming and Web Design	4	32	60	25	75	100
Group V: Advanced Programming							
20CSEAE16	Python Programming	4	32	60	25	75	100
20CSEAE17	.NET Programming	4	32	60	25	75	100
20CSEAE18	Graphical Programming and Virtual Instrumentation	4	32	60	25	75	100
20CSEAE19	Software testing with Selenium	4	47	15	25	75	100
Group VI: Other							
20CSEAE21	Software Project Management	4	62	-	25	75	100
20CESAE22	Computer Graphics and Multimedia	4	62	-	25	75	100
20CSEAE23	Augmented Reality	4	32	60	25	75	100

Course code	20CSEAC01	DATA STRUCTURES USING JAVA	L	T	P	C
Core/Elective/Supportive	Core		2	0	2	4
Pre-requisite		Basic knowledge of Data Structures and Core Java Programming	Syllabus Version		2020-2021	

Course Objectives:

The main objectives of this course are:

1. To understand and implement data structures in Java
2. To understand the Java Collections and GUI Framework
3. To Practice GUI programming and Database Connectivity
4. To develop Web based applications using JSP and Java Servlets

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Data Structures	10 hours

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.

Unit:2	Graphs and Sorting	16 hours

Graphs: Graph ADT – Data Structures for Graphs – Graph Traversals – Directed Acyclic Graphs – Shortest Paths – Minimum Spanning Tree - Sorting: Merge Sort – Quick Sort – Selection Sort.

Unit:3	Introduction to Collection and Swing Framework	15 hours

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.

Unit:4	Database Connectivity with JDBC	24 hours

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.

Unit:5	Web application Development using Java Servlets	25 hours

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

Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	**92 hours**

Text Books

1	Michael T. Goodrich, Roberto Tamassia and Michael H. Goldwasser, "Data Structures and Algorithms in Java", Wiley, 2014.
2	Herbert Schildt, "The Complete Reference Java", Tata McGrawHill Publishing Company Ltd, 2012

Reference Books

1	Marty Hall, Larry Brown, Yaakov Chaikin, "Core Servlets and Java Server pages": Volume 2 – Advanced Technologies, II edition, Pearson education, 2008.
2	Jamie Jaworskie,"Java 2 Platform Unleashed", Techmedia SAMS, IV edition, 2008.
3	Craig Walls, "Spring in Action", IV edition, Manning Publications, 2015.

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

1	Programming in Java https://nptel.ac.in/courses/106/105/106105191/
2	https://docs.oracle.com

Course Designed By: Mr**. S. Palanisamy**

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

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

Course code	20CSEAC02	COMPUTER NETWORKS	L	T	P	C
Core/Elective/Supportive	Core		**2**	**0**	**2**	**4**
Pre-requisite	Basics of networks		**Syllabus Version**		**2020-2021**	

Course Objectives:

The main objectives of this course are:

1. To understand the functionality of networks protocols and layers
2. To understand network simulation using NS2

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1		**Introduction to Networks**	**18 hours**

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 –Satellite communication.

Unit:2		**Data Transfer and Access**	**16 hours**

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.

Unit:3		**Network Layer**	**18 hours**

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.

Unit:4		**Transport Layer**	**18 hours**

TRANSPORT PROTOCOLS: Transport service – Transport protocols – Transport protocols in Internet: TCP and UDP

Unit:5		**Application Layer**	**20 hours**

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

Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	**92 hours**

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

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

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

Course code	20CSEAC03	SOFT SKILLS	L	T	P	C
Core/Elective/Supportive	Core		**2**		**2**	**4**
Pre-requisite	Fundamentals in English speaking and writing		Syllabus Version		2020-2021	

Course Objectives:

The main objectives of this course are to:

1. To understand the basics of communication skills
2. To Understand the logical skills
3. To develop interpersonal skills
4. To improve the writing skills
5. To acquired knowledge in technical programming
6. To acquired knowledge in technical programming and quantitative aptitude

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Introduction to Communication	12 hours

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

Unit:2	Personality Development	12 hours

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.

Unit:3	Technical programming skill	14 hours

Variables and keywords - Operators in C – Decision Making– Looping - Branching Statements – Array – Functions.

Unit:4	Quantitative Aptitude1	12 hours

Number series -Ratio, Proportion and Partnership – Problems on Ages - Average - Profit and Loss.

Unit:5	Quantitative Aptitude 2	10 hours
Simple Interest – Compound Interest – Time and Work – Time and Distance.		

Unit:6	Contemporary Issues	2 hours
Write an assignment on any one of the following:		
1. Traits needed for a software Engineer.		
2. Traits needed for a software project Manager.		
3. Traits needed for a Teacher (Software Tester).		

		Total Lecture hours	62 hours

Text Book(s)

1	Raman Sharma, "Technical Communication", 2ndEdition, Oxford University Press 2011.
2	Barun K. Mitra"Personality Development and Soft Skills", Oxford University Press 2011.

Reference Books

1	Dr. Balagurusamy, "Programming in C", Tata McGraw – Hill Edition, 2008. 4. S. Chand and AshishAggarwal, "Quick Arithmetic" Sixth Revised Edition.

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

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]

Web Links

1	https://owl.purdue.edu/ [Online Writing Lab]
2	www.grammarbook.com

Course Designed By:Dr. M. Punithavalli

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

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

Course code	20CSEAC04	OPEN SOURCE PROGRAMMING	L	T	P	C
Core/Elective/Supportive	Core		**2**	**0**	**2**	**4**
Pre-requisite	RDBMS, HTML		**Syllabus Version**		**2020-2021**	

Course Objectives:

The main objectives of this course are to:

1. To understand the basics of open source software
2. To create dynamic web applications using PHP, MySQL
3. To create web applications based on PHP and AJAX

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Open Source & Free Software Licensing	20 hours

Open Source Licensing: 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 – **Free and Open Source Software Development**: Models of Open Source and Free Software Development – Choosing an Open Source or Free Software License

Unit:2	Basics of PHP Programming	14 hours

Basics of PHP Programming: Introduction – syntax and variables – controls and functions – passing information between pages – strings – numbers – arrays, array functions and advanced array functions

Unit:3	Advanced Features and Techniques	16 hours

Advanced PHP Programming: Object-Oriented Programming with PHP – String and Regular Expression Functions – Filesystem and System Functions – Sessions, Cookies and HTTP – Exceptions and Error Handling

Unit:4	PHP and MySQL	20 hours

PHP and MySQL: Why PHP and MySQL? – Server-Side Web Scripting – SQL Tutorial – MySQL Database Administration – PHP/MySQL Functions – Displaying Queries in Tables – Building Forms from Queries

Unit:5	PHP & AJAX and Github Hosting Service	20 hours

PHP and AJAX: JavaScript and AJAX Client – JavaScript and DOM – XMLHttp Request Object

– AJAX form validation – Uploading a file using AJAX – Displaying a table in AJAX – Building Pagination using PHP and AJAX

Hosting Open Source Projects using Github: Introduction – Viewing Github Graphs- Editing Files – Collaborating on Pull Requests – Creating a Repository – Configuring a Repository

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars – webinars

	Total Lecture hours	92 hours

Text Book(s)

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	Bogdan Brinzarea-Lamandi, Cristian Darie 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

Reference Books

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.

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

1	www.spoken-tutorial.org
2	PHP and MySQL (https://swayam.gov.in/nd2_aic20_sp32/)

Course Designed By: **Dr. R. Rajeswari**

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

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

Course code	20CSEA C05	MOBILE PROGRAMMING	L	T	P	C
Core/Elective/Supportive		Core	**2**	**0**	**2**	**4**
Pre-requisite		Java Programming	**Syllabus Version**		**2020- 2021**	

Course Objectives:

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

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	**Introduction to OSS, OHA and Mobile Technologies**	**10 hours**

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.

Unit:2	**Android Architecture and Activity Lifecycle**	**16 hours**

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.

Unit:3	**Android Application Component and APIs**	**15 hours**

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.

Unit:4	**Android UI layouts and controls**	**24 hours**

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.

Unit:5	**DB Connectivity and Publishing Application**	**25 hours**

Working with databases: SQLite – coding for SQLite using Android - Publishing and

	Internationalizing mobile applications - mobile application deployment: Game, Clock, Calendar, Convertor, Phone book.	
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**92 hours**

Text Book	
1	Barry Burd, "Android Application Development – All-in-one for Dummies", 2nd Edition, Wiley India, 2016
2	Lauren Darcey, Shane Conder, "Sams Teach Yourself Android Application Development in 24 hours", 2nd edition, Pearson Education, 2013

Reference Books	
1	Jerome (J. F) DiMarzio, "Android – A Programmer"s Guide", McGraw HillEducation, 8th reprint, 2015
2	David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6Development: Exploring the iOS SDK",Apress, 2013.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	Mobile Programming using Android: https://onlinecourses.swayam2.ac.in/aic20_sp02/preview
2	http://www.developer.android.com
Course Designed By: Mr**. S. Palanisamy**	

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

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

Course code	20CSEA C06	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 Version**		**2020-2021**	

Course Objectives:

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

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction to Image Processing	16 hours

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

Unit:2	MATLAB for Image Processing	16 hours

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

Unit:3	Image Filtering and Restoration	20 hours

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

Unit:4	Morphological Image Processing and Image Segmentation	18 hours

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

Unit:5	Representation and Object Recognition	20 hours

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

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars - webinars

	Total Lecture hours	92 hours

Text Book(s)

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.

Reference Books

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.

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

1	Digital Image Processing, https://nptel.ac.in/courses/117/105/117105079/
2	Fundamentals of Digital Image and Video Processing, https://www.coursera.org/learn/digital

Course Designed By: Dr. R. Rajeswari

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

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

Course code	20CSEA C07	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 Version**		**2020-2021**	

Course Objectives:

The main objectives of this course are to:

1. To understand the basics of progressive web applications
2. To understand the fundamentals of Angular and develop Angular applications
3. To create, build and deploy progressive web applications using Angular

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Building Blocks of Angular	18 hours

TypeScript: Built-in Types – Classes – Utilities – Working with Angular CLI – **Building Blocks of Angular**: Modules – Components – Templates – Metadata – Data Binding – Directives – Services – Dependency Injection

Unit:2	Data Architecture and Testing in Angular	20 hours

Forms in Angular – HTTP - Routing – **Data Architecture in Angular**: Overview – Observables and RxJS – Redux in Angular – **Testing**: Testing Tools – End-to-End and Unit Testing – Testing Services and HTTP – Resting Routing to Components – Testing Forms – Testing HTTP requests

Unit:3	Service Workers in Progressive Web Apps (PWAs)	18 hours

Introduction to Progressive Web Apps (PWA) – Current and Future PWA Support – Why Angular – Installing Node and NPM – **Service Workers**: Understanding Service Worker – Service Worker Life Cycle – Service Worker Functional Events – Cache API – Cache Strategies – Runtime Cache in Angular Service Worker

Unit:4	App Manifest, Notifications and App Shell	18 hours

Background Sync API – **Data Storage**: IndexedDB and localForage **– App Manifest:** The Web App Manifest – Adding Web App Manifest to Home Screen **– Notifications:** Web Notifications – Push Notifications – **App Shell:** App Shell Model – Angular App Shell – Further Optimizations – Exploring HTTP/2 and Server Push

Unit:5	Debugging PWAs and Modern Web APIs	16 hours

Debugging: NGSW Debug – Web App Manifest – Service Workers – Storage – Cache – **Measurement**: Audit – Analytics –**Safety Service Worker**: Fail-safe – Safety Worker – **Modern Web APIs**: Credential Management – Payment Request – Video and Audio Capturing - Geolocation

Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars - webinars		

		Total Lecture hours	92 hours

Text Book(s)

1	Nathan Murray, Felipe Coury, Ari Lerner and Carlos Taborda, 'ng-book: The Complete Guide to Angular', Fullstack.io, 2018
2	Majid Hajian, 'Progressive Web Apps with Angular', Apress, 2019.
3	Dennis Sheppard, 'Beginning Progressive Web App Development', Apress, 2017.

Reference Books

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.

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

1	Developing Dynamic Web Applications Using Angular (https://www.edx.org/course/developing-dynamic-web-applications-using-angular)
	Course Designed By: **Dr. R. Rajeswari**

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

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

Course code	20CSEAC 08	BIG DATA ANALYTICS	L	T	P	C
Core/Elective/Supportive		Core	3	0	1	4
Pre-requisite		Knowledge on Data and data types	**Syllabus Version**		2020- 2021	

Course Objectives:

The main objectives of this course are to:

1. To understand Data source evolution, data Characteristics and Big data processing models.
2. To understand and apply Data Analytics Techniques on Datasets
3. To analyze and Build Data Analytics use cases for specific domain and applications.

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Big Data Landscape	18-- hours

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

Unit:2	Big Data Components	18-- hours

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 –SPARK architecture: RDD – Transformation - SPARK Vs Hadoop - NoSQL Database: Types

Unit:3	Data Analytics using R	18-- hours

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 - R Basics Data Structures – Vectors – Lists – Tuples – Data Frames – Packages - Visualization plots: Data Analytics: Histogram – Boxplot – Scatter Plot – Bar Chart- Pier Chart – Mosaic Plot – MASS – R Reporting – Markdown – Flex Dashboard

Unit:4	Data Analytics Techniques	18-- hours

Overview of Data mining: Data Mining Vs. Data Analytics - Data Preprocessing – Unsupervised approaches - –Clustering techniques: Clustering paradigms – Partition algorithm-K- Medeoid algorithms – CLARA- CLARANS –Hierarchical DBSCAN- BIRCH -Categorical clustering algorithms - Introduction to neural network - learning in NN- Genetic algorithm - Classification Technique: Introduction – Decision Trees: Tree Construction Principle - Decision Tree construction Algorithm – CART – ID3 – Random Forest – Rule Based Approaches – Association Rule Mining – Recommender Algorithms

Unit:5	Data Science Usecases	18-- hours

Data Science - Big Data– Big Data and AI - 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

Unit:6	Contemporary Issues	2 hours

Addressing Controversy Views of social media – Big Data Source – Data Science Technology - Expert lectures, online seminars – webinars

	Total Lecture hours	92-- hours

Text Book(s)	
1	V. Bhuvaneswari, T. Devi, "**Big Data Analytics: A Practitioner's Approach**", Sci-Tech Publications, 2016.
2	Seema Acharya, Subhashni Chellappan, "**Big Data Analytics**", Wiley, 2015
3	Joel Grus, **"Data Science from Scratch"**, First Edition, O'Reilly Publisher, ISBN: 9781491901427, 2015
4	Jaiwei Han and MichelineKamber," **Data Mining Concepts and Techniques**", MorganKaufmann Publishers, 2011, 3rd Edition.
5	Arun K. Pujari, "**Data mining Techniques**", Third Edition, Universities Press (India)Limited, Hyderabad, 2013.
6	V. Bhuvaneswari, "**Data Analytics with R – Step by Step**", First Edition, SciTech Publications, 2016.

Reference Books : EBooks	
1	Sinan Ozdemir, Sunil Kakade, "**Principles of Data Science**", Second Edition, [Packt]
2	David Natingga, **"Data Science for Algorithms in a Week",** Second Edition, [Packt]
3	Prabhanjan Tattar, Tony Ojeda, Et al, **"Practical Data Science Cookbook"**, Second Edition, [Packt], ISBN: 9781787129627
4	Lillian Pierson, Jake Porway, "Data Science for Dummies", Second Edition, John Wiley & Sons, Publishers, ISBN: 9781119327639, 2017

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

	Course Title	Duration	Provider
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	Simplilearn
5.	Data Science with Python	15 hours	Simplilearn

Web link

1. hthttps://builtin.com/data-science
2. https://www.udacity.com/course/intro-to-data-science--ud359
3. https://www.tutorialspoint.com/python_data_science/index.htm

Course Designed by: Dr.V.Bhuvaneswari

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

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

Course code	20CSEAC09	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 Version**		2020-2021	

Course Objectives:

The main objectives of this course are:
1. 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

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Introduction to IOT	10 hours

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.

Unit:2	Basic Electronics for IoT & Arduino IDE	20 hours

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.

Unit:3	Arduino Microcontroller and sensors	20 hours

 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.

Unit:4	Medical Sensors and Actuators	20 hours

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.

Unit:5	Data Communication from IOT devices	20 hours

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 .

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars – webinars

	Total Lecture hours	92 hours

Text Book(s)

1	Arshdeep Bahga, Vijay Madisetti, 'Internet of Things: A Hands-On Approach', Universities Press, 2015.
2	Boris Adryan, Dominik Obermaier, 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.

Reference Books

1	Charles Platt, "Make Electronics – Learning by discovery", O'Reilly Media, 2015.
2	Michael Miller, " The Internet of Things", Pearson India, 2015.

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

1	Introduction to IOT, https://nptel.ac.in/courses/106/105/106105166/

Course Designed By: **Dr. T. Amudha**

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

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

Course code	20CSEAE01	IT Infrastructure and Cloud Security	L	T	P	C
Core/Elective/Supportive		Elective	4			4
Pre-requisite		**Cloud, Networking Basics**	**Syllabus Version**		**2020-2021**	

Course Objectives:

The main objectives of this course are to:

1. To understand the concepts of Internet of Things
2. To learn how to use Cloud Services.
3. To implement Virtualization
4. To understand complex technologies leading to the development of current and future cloud computing security

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Introduction to Networking & Communication Protocols	10 hours

Networking: Introduction to Corporate Infrastructure – LAN, MAN and WAN. **Internet of Things:** Introduction – Definition Evolution – IoT Architecture – Resource Management – IoT Data Management and Analytics – Communication Protocols – Identity Management and Authentication – Privacy. Device Collaboration Framework.

Fog Computing		
Unit:2		14 hours

Fog Computing: Introduction – Characteristics – Reference Architecture – Applications – Research Directions and Enables – Commercial Products. **Stream Processing in IoT:** Foundation of Stream Processing in IoT – Continuous Logic Processing System – Challenges and Future Direction.

Cloud Computing Influences		
Unit:3		12 hours

Cloud Computing: Introduction – Characteristics – Architectural Influences – Technological Influences – Operational Influences. **Cloud Computing Architecture**: Delivery Model – Deployment Model – Benefits. Cloud Security Services.

Unit:4	Virtualization & Data Center	12 hours

	Cloud, Virtualization, and Data Storage & Data Center Networking Fundamentals: 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. **Infrastructure Resource Management:** Introduction - Managing Data Infrastructure for Cloud Virtual Environments – Understanding IT Resources – Managing IT Resources	

Unit:5	Security Threats and Risks	12 hours

| | **Data and Storage Networking Security:** Security Threat Risks and Challenges – Securing Networks – Securing Storage – Securing Clouds. **Data Protection:** Data Protection Challenges and Opportunities – Protect, Preserve, and Serve Information Services – Virtual – Physical, and Cloud Data Protection – Modernizing and Protection and Backup. | |

Unit:6	Contemporary Issues	2 hours

Internet of Robotic Things - Cloud-enabled Robotics.

		Total Lecture hours	62 hours

Text Book(s)

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.

Reference Books

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.

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

1	https://onlinecourses.nptel.ac.in [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

2	https://www.classcentral.com/course/cloud-computing-security-11754 [Cloud Computing Security]

Web Link

Course Designed By: CSCC Labs, Hyderabad and Dr. S. Gavaskar

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	S	L	M
CO2	L	L	L	L	L	L	L	S	L	M
CO3	S	S	S	M	S	M	M	S	S	S

CO4	S	S	M	S	M	S	S	S	M	M
CO5	M	M	M	S	M	S	S	S	M	M

Course code	20CSEAE02	MOBILE NETWORKING	L	T	P	C
Core/Elective/Supportive	Elective		4		0	4
Pre-requisite	Knowledge on networking		Syllabus Version		2020-2021	

Course Objectives:

The main objectives of this course are to:

1. To understand the basic concepts of Cellular System.
2. To understand the concepts of Radio Technology.
3. To understand GSM and GPRS concepts.
4. To understand 3G and UTMS concepts.

Expected Course Outcomes:

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, 3GWCDMA, 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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Introduction, Cellular System, Radio Propagation	12 hours

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.

Unit:2	Mobile Radio Channel, Radio Network Planning	12 hours

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.

Unit:3	Global System Mobile, GSM, 2G	12 hours

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 .

Unit:4	EGPRS: GPRS/EDGE	12 hours

GPRS Support Nodes - GPRS Interfaces - GPRS Procedures in Packet Call Setups - GPRS Mobility Management - Layered Overview of the Radio Interface - Channel Sharing .		

Unit:5	Third Generation Network (3G), UMTS	12 hours
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 .		

Unit:6	Contemporary Issues	2 hours
High-Speed Packet Data Access - 4G-Long Term Evolution (LTE) System - Further Development for the Fifth Generation . Expert lectures, online seminars – webinars		

	Total Lecture hours	62 hours

Text Book(s)

1	Alexander Kukushkin , "A Introduction to Mobile Network Engineering ", John Wiley & Sons Ltd , 2018.

Reference Books

1	Harish OM Sharma, "Mobile Network Technology", 1st Edition, Evincepub Publishing, 2019.
2	Yi-Bing Lin, "Wireless and Mobile Network Architecture" 3rd Edition, Wiley India Pvt.Ltd, 2008.

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

1	Introduction to Wireless and Cellular Communications : https://swayam.gov.in/nd1_noc19_ee48/preview

Course Designed By: **Dr. S. Gavaskar**

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

Course code	20CSEAE03	VIRTUALIZATION AND CLOUD	L	T	P	C
Core/Elective/Supportive	Elective		**3**	**0**	**1**	**4**
Pre-requisite	Basic knowledge of data storage, Client – Server systems		**Syllabus Version**	**2020-2021**		

Course Objectives:

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

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Distributed Systems**	15 hours

Introduction to distributed systems - Distributed algorithm - Distributed Data Stores - Distributed Computing - File Systems - Distributed Messaging - Distributed Applications – Distributed Transaction - Parallel and distributed computing - Applications.

Unit:2	**Cloud Computing**	15 hours

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.

Unit:3	**Virtualization**	15 hours

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.

Unit:4	**Virtual Machines**	15 hours

Virtual Machines: vSphere HA - vSphere Fault Tolerance - Protecting Data vSphere DRS - Network Scalability - vSphere Update Manager and Host Maintenance - Storage Scalability - Securing Virtual Machines.

Unit:5	**Datacenter**	15 hours

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.

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars - webinars

	Total Lecture hours	77 hours

Text Book(s)

1	George Coulouris, Jean Dollimore, Tim Kindberg, Gordan Blair, "Distributed Systems Concepts and Design", 5thEdition, Pearson Education, 2012.
2	Venkata Josyula , 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.

Reference Books

1	Andrew S. Tanenbaum, Maarten Van Steen, "Distributed Systems: Principles and Paradigms", 2nd edition, Createspace Independent Publishers, 2016.
2	Matthew Portnoy, "Virtualization Essentials", 2nd edition, Wiley Publication, 2016.

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

1	Cloud Computing and Distributed Systems, https://nptel.ac.in/courses/106/104/106104182/

Course Designed By: **Dr. T. Amudha**

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

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

Course code	20CSEAE 04	DATA ANALYSIS AND BUSINESS INTELLIGENCE	L	T	P	C
Core/Elective/Supportive		Elective	4			4
Pre-requisite		Knowledge on data and data bases	**Syllabus Version**		**2020-2021**	

Course Objectives:

The main objectives of this course are to:

1. To understand OLAP operations and basic Statistical concepts.
2. To understand the important concepts of Business Intelligence.
3. To create data warehouse for any domain.
4. To understand the Analytic concepts, tools and analysis of data using the tools.

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	DATA WAREHOUSING	12 hours

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.

Unit:2	STATISTICS FOR DATA ANALYSIS	14 hours

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.

Unit:3	ANALYTICS: A COMPREHENSIVE STUDY	12 hours

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.

Unit:4	BUSINESS INTELLIGENCE	12 hours
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		
Unit:5	BUSINESS INTELLIGENCE TOOLS	10 hours
BI Tools Overview – BI Tools (Any One Tool in Depth): Microsoft Power BI – IBM Cognos - Tableau – MicroStrategy – QlikView.		
Unit:6	CONTEMPORARY ISSUES	2 hours
Data Warehouse Design for Hospital - Design Business Intelligence Model and Conduct Analysis. **Expert lectures, online seminars – webinars**		
	Total Lecture hours	**62 hours**

Text Book(s)	
1	Arun K Pujari **"Data Mining Techniques"**, 3rd Edition, University Press, 2013.
2	R.S.N.Pillai, Bagavathi, **"Statistics Theory and Practice"**, 8th Edition, S.Chand Publishing, 2016.
3	Drew Bentley, **"Business Intelligence and Analytics"**, Library Press, 2017.
Reference Books : EBooks	
1	Jiaweu Gab, Micgekube Janver, Jian Pei, **"Data Mining Concepts"**, Third Edition, Morgan Kaufmann Publications, 2012.
2	Christian Heumann, Michael Schomaker, Shalabh **"Introduction to Statistics and Data Analysis With Exercises, Solutions and Applications in R"**, Springer, 2016.
3	Olivia Parr Rud **"Business Intelligence Success Factors: Tools for Aligning Your Business in the Global Economy"**, John Wiley & Sons, Inc., 2009.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	

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

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

Course code	20CSEAE 05	BIG DATA FRAMEWORKS AND TOOLS	L	T	P	C
Core/Elective/Supportive		Elective	4	2	2	4
Pre-requisite		**Basics of Big Data**	Syllabus Version		2020- 2021	

Course Objectives:

1. To understand MapReduce programming architecture, processing models.
2. To understand and design MapReduce Programming using PIG and Hive
3. To understand and compare the architectural and processing of MapReduce Programing languages Pig, Hive and SPARK

Expected Course Outcomes:

1	Understand MapReduce Processing architectures	K2
2	Configure and setup MapReduce Processing architectures Ecosystem – Hadoop, Spark , Pig and Hive	K1, K2
3	Understand, analyze dataset and write MapReduce program using Pig and Hive, spark	K3
4	Critically analyze case studies for and suggest MapReduce Programming models based on domains and applications	K4 , K5
5	Design and setup a Big Data Analytics Ecosystem for specific Business scenarios	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Big Data Framework**	**18-- hours**

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 Vs Hadoop 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

Unit:2	**PIG : MapReduce**	**18-- hours**

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

Unit:3	**Hive: Map Reduce - CURD**	**18-- hours**

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 –

Unit:4	**Hive: Aggregation and Indexing**	**18-- hours**

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 Hiivng Parameters. – Usecase :MapReduce using Hive QL – HiveQLVs SQL

Unit:5	SPARK Query	18-- hours

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

Unit:6	Contemporary Issues	2 hours

Data Processing Architectures Issues – Scalability - Case Study on Industrial Reports

	Total Lecture hours	92-- hours

Text Book(s):

1	Boris Lublinsky Kevin T. Smith Alexey Yakubovich, Professional Hadoop® Solutions, Wiley, ISBN: 9788126551071, 2015.
2	Chris Eaton, Dirk deroos et al., "**Understanding Big data**", McGraw Hill, 2012.
3	Tom White, "**Hadoop: The Definitive Guide**", O'Reilly Media 3rd Edition, May 6, 2012
4	Donald Miner, Adam Shook, "**MapReduce Design Patterns**", O'Reilly Media November 22, 2012
5	Edward Capriolo, Dean Wampler, Jason Rutherglen, "**Programming Hive**", O'Reilly Media; 1 edition , October, 2012
6	lan Gates, "**Programming Pig**", O'Reilly Media; 1st Edition, October, 2011

Reference Books:

1	Sridhar Alla**, "Big Data Analytics with Hadoop 3",** First Edition, ISBN: 978-1-78862-884-6, 2018, [Packt]
2	Naresh Kumar, **"Modern Big Data Processing with Hadoop",** ISBN: 9781787122765, 2018, [Packt]
3	Thilina Gunarathne, **"Hadoop MapReduce v2 Cookbook"**, Second Edition, ISBN: 978-1-78328-547-1, 2015, [Packt]
4	Vignesh Prajapati, **"Big Data Analytics with R and Hadoop",** First Edition, ISBN: 978-1-78216-328-2, 2013, [Packt]
5	Shumin Guo, **"Hadoop Operations and Cluster Management Cookbook",** ISBN: 978-1-78216-516-3, 2013, [Packt]
6	Deepak Vohra**, "Practical Hadoop Ecosystem: A Definitive Guide to Hadoop-Related Frameworks and Tools" First** Edition, Apress Publisher, ISBN: 9781484221983, 2016

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]			
S. No	Course Title	Duration	Provider - Free
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

Web Link – Video

1. http://hadooptutorial.info/mapreduce-programming-model/
2. https://hadoop.apache.org/docs/r1.2.1/mapred_tutorial.html
3. https://hadoop.apache.org/docs/current/hadoop-mapreduce-client/hadoop-mapreduce-client-core/MapReduceTutorial.html
4. https://www.edureka.co/blog/mapreduce-tutorial/

Course Designed By: Dr.V.Bhuvaneswari

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

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

Course code	20CSEAE06	NoSQL I– MongoDB	L	T	P	C
Core/Elective/Supportive		Elective	2		2	4
Pre-requisite		Fundamentals on data and databases	**Syllabus Version**		2020-2021	

Course Objectives:

The main objectives of this course are to:

1. To understand the concepts of DBMS, Data Model and Normal forms. .
2. To understand the concepts of concurrency control and Recovery.
3. To understand basics of SQL and NoSQL databases.
4. To understand and apply MongoDB (NoSQL) for Data Analysis using CURD and User Management.

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1		Database Overview		20 hours

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.

Unit:2		NoSQL		20 hours

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–NoSQL Tradeoffs–CAP Theorem–Eventual Consistency - NoSQL–database types – Document Oriented – Columnar – Graph – KeyValue Pair - NoSQL database, design for performance / quality parameters, documents and information retrieval .

Unit:3		MongoDB Introduction		18 hours

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			
Unit:4	**MongoDB Operators**		**16 hours**
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			
Unit:5	**Advanced MongoDB**		**16 hours**
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			
Unit:6	**Contemporary Issues**		**2 hours**
Data Security – Performance – Data Safety – Resource Utility – High Availability Expert lectures, online seminars - webinars			
		Total Lecture hours	**92 hours**

Text Book(s)

1	Abraham Silberchatz, Henry K.Forth, Sudharshan, "Database system Concepts", 6th edition, McGraw Hill, 2010.
2	Prabu C.S.R, "Object - Oriented Database Systems: Approaches and Architectures" 3rd Edition, PHI, 2011.
3	Kristina Chodorow , "MongoDB: The Definitive Guide", 2nd Edition , O'Reilly Media, 2013.
4	Guy Harrison, "Next Generation Databases: NoSQL, NewSQL, and Big Data" Apress, 2016.

Reference Books

1	Shamkant B.Navathe, Ramez Elamsri " Fundamentals of Database Systems ", 7th Edition, Pearson Education Limited, 2017.
2	David Hows , Peter Membrey , Eelco Plugge , Timm Hawkins , "The Definitive Guide to MongoDB", 3rd Edition, Apress, 2015.
3	Gaurav Vaish , "Getting Started with NoSQL " Packt Publishing, 2013.

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

1	Database Management System: https://swayam.gov.in/nd2_cec19_cs05/preview
2	Database Management System: https://nptel.ac.in/courses/106/105/106105175

Course Designed By: **Dr. S. Gavaskar**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	M	L

CO2	M	M	S	M	L	L	S	L	S	L
CO3	M	S	S	M	L	L	S	L	S	M
CO4	S	S	S	M	L	L	S	L	S	L
CO5	M	S	S	S	L	L	S	L	S	S

Course code	20CSEAE07	NoSQLII– Neo 4j	L	T	P	C
Core/Elective/Supportive			**2**		**2**	**4**
Pre-requisite		Students should know about the graph databases and cypher query language	**Syllabus Version**		**2020-2021**	

Course Objectives:

The main objectives of this course are to:

1. To understand the concepts of graph databases from a relational developer's
2. To enlighten the conceptual differences between relational and graph database structures and data models.

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction to Graph Databases	14 hours

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.

Unit:2	Neo4j Clauses	18 hours

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.

Unit:3	Cypher Queries	18 hours

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.

Unit:4	Data Import and Export	20 hours

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.

Unit:5	Building Neo4j Applications	20 hours

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

Unit:6	Contemporary Issues	2 hours

Expert lectures, YouTubes Videos, Animations, NPTEL, MOOC videos, online seminars – webinars for strengthening the subject matters.

	Total Lecture hours	92 hours

Text Book(s)

1	Chris Kemper, "Beginning Neo4j", Apress, 2016
2	Ankur Goel, "Neo4j Cookbook" , Packt Publishing, 2015

Reference Books

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

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

1	Lecture Notes: https://www.slideshare.net/neo4j0
2	PPT Slides: https://www.slideshare.net/maxdemarzi/neo4j-presentation
3	Tutorials/Animations: https://www.tutorialspoint.com/neo4j/index.htm
4	YouTube Videos: https://www.youtube.com/watch?v=Go3P73-KV30

Course Designed By: Dr. V. Bhuvaneswari

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

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

Course code	20CSEA E08	SOFT COMPUTING	L	T	P	C
Core/Elective/Supportive		Elective	4	0	0	4
Pre-requisite		Knowledge of algorithms, Problem solving strategies	**Syllabus Version**		**2020- 2021**	

Course Objectives:

The main objectives of the course are
1.To understand and apply evolutionary concepts.
2. To design neural network models.
3. To use fuzzy logic.
4. To apply soft computing frameworks to problem solving.

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction to Soft computing	12 hours

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.

Unit:2	Evolutionary computing	12 hours

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

Unit:3	Neural Networks	12 hours

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.

Unit:4	Fuzzy Logic	12 hours

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.

Unit:5	Bio-inspired Algorithms	12 hours

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.

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars - webinars

	Total Lecture hours	62 hours

Text Book(s)

1	David E Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning ", Pearson Education India, 2013.
2	S. Rajasekaran, G. A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Evolutionary Algorithms: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd., II edition, 2017.
3	S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", 3rd edition, Wiley India Pvt Ltd, 2018.
4	Andries P. Engelbrecht, "Fundamentals of Computational Swarm Intelligence", Wiley publications, 2005.

Reference Books

1	Xin She Yang, "Nature-Inspired Computation and Swarm Intelligence - Algorithms, Theory and Applications", 1st Edition, Academic Press, 2020.
2	Marco Dorigo, Thomas Stutzle, "Ant Colony Optimization", MIT Press, 2010.

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

1	Introduction to Soft Computing, https://nptel.ac.in/courses/106/105/106105173/

Course Designed By: **Dr. T. Amudha**

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

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

Course code	20CSEA E09	INTELLIGENT AGENTS	L	T	P	C
Core/Elective/Supportive	Elective		4	0	0	4
Pre-requisite	Basic knowledge of Artificial Intelligence	**Syllabus Version**		2020-2021		

Course Objectives:

The main objectives of this course are:

1. To gain insight about automation using Intelligent Agents
. 2. To understand the learning behavior and functioning of Agents
3. To develop knowledge in the application domains of Agents

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1		12 hours

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

Unit:2		12 hours

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

Unit:3		12 hours

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

Unit:4		12 hours

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

Unit:5		12 hours

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

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars - webinars

	Total Lecture hours	62 hours

Text Book(s)

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

Reference Books

1	M. Wooldridge: Reasoning about Rational Agents. MIT Press, 2000
2	Yoav Shoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, 2008.

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

1	https://nptel.ac.in/courses/106/105/106105077/

Course Designed By: **Dr. T. Amudha**

Mapping with Programme Outcomes

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

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

Course code	20CSEAE 10	MACHINE LEARNING	L	T	P	C
Core/Elective/Supportive		Elective	2		2	4
Pre-requisite		**Basics on Statistics and Linear Algebra**	Syllabus Version		2020- 2021	

Course Objectives:

1. To understand the concepts of Machine learning algorithms
2. To apply the machine learning algorithms for various applications.

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	**Unsupervised Models**	**18-- hours**

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

Unit:2	**Linear Models**	**18- hours**

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

Unit:3	**Graphical Models**	**18- hours**

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

Unit:4	Advanced Models	18-- hours

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,

Unit:5	Deep Learning Models	18-- hours

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

Unit:6	Contemporary Issues	2 hours

Ethical Considerations in Machine Learning Applications – Ethics and Challenges of AI and ML as disruptive technology Use cases – Webinars

		Total Lecture hours	92-- hours

Text Books:

1	Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2006
2	Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012
3	Ethem Alpaydin, "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.

Reference Books

1	Jannes Klaas, "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	**John Paul Mueller**, **Luca Massaron**, "Machine Learning (in Python and R) For Dummies", First Edition, Wiley Publisher, ISBN: 9788126563050, 2016
7	**U Dinesh Kumar Manaranjan Pradhan**,, "Machine Learning using Python".) Publisher: Wiley, ISBN: 9788126579907, 2019

Online Course:

S. No	Course Title	Duration	Provider -Free
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	L	L	L	L
CO2	L	L	S	L	L	S	L	L	L	L
CO3	S	S	S	S	M	S	L	M	L	L
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	20CSEAE11	SEMANTIC WEB	L	T	P	C
Core/Elective/Supportive		Elective	4	4	0	4
Pre-requisite		Knowledge on data, data structure and web	Syllabus Version		2020-2021	

Course Objectives:

The main objectives of this course are to:

1. To understand web 2.0 and web 3.0, the basics of semantic web, features, web standards.
2. To understand and apply knowledge representation methods, standard namespaces, Graph based validation.
3. To analyze and Build Data Integration semantic layer use cases for specific domain and applications.

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Introduction to Semantic Web	12-- hours

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

Unit:2	Knowledge Representation Methods	12-- hours

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)

Unit:3	Tools	12-- hours

Triple store: Jena – Allegro Graph – Mulgara – Sesame – Flickurl - Top Braid – Suite – Virtuoso Environment – Content Management System: Falcon – Drupal 7 – Redland – Pellet, **Development Environment:** Protégé – Ontotext – Open Anzo – RDF Gateway – RDFLib – DartGrid – Zitgist, **Inference Engines:** SWI-Prolog, Semantic Works –Ontobroker

Unit:4	Data Integration Semantic Layer	12-- hours

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

Unit:5	Use cases	12-- hours

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

Unit:6	Contemporary Issues	2-- hours

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

	Total Lecture hours	62-- hours

Text Book(s)

1	Dean Allemang, James Hendler: "Semantic Web for the Working Ontologist Effective Modeling in RDFs and OWL", 2nd 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 Web", 1st Edition, July 2009.
4	Pollock, J.T.: Semantic web for dummies. Wiley Publishing, Inc., Indianapolis, 2009.

Reference Books : EBooks

1	Grigoris Antoniou and Frank van Harmelen, A Semantic Web Primer, The MIT Press (2004), ISBN: 0262012103
2	*P. Hitzler, R. Sebastian, M. Krötzsch: Foundation of. Semantic Web Technologies, 2009.*
3	Kalfoglou, Yannis, Cases on Semantic Interoperability for Information Systems Integration - Practices and Applications. IGI Global 2009, ISBN 978-1-60566-894-9
4	Martin Große-Rhode, Semantic Integration of Heterogeneous Software Specifications, Springer-Verlag Berlin and Heidelberg GmbH & Co. KG, 2010, ISBN 978-3-64207-306-9

	Course Title	Duration	Provider
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]			
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
Web link			

1. http://www.linkeddatatools.com/semantic-web-basics
2. http://www.cambridgesemantics.com/blog/semantic-university/intro-semantic-web
3. https://www.mkbergman.com
4. http://euclid-project.eu

Course Designed by: Dr.V.Bhuvaneswari

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	M	M	M	M	M
CO3	S	S	S	M	S	M	M	M	M	L
CO3	S	S	S	M	S	M	M	M	M	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

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

Course code	20CSEAE12	SERVICE ORIENTED ARCHITECTURE AND WEB SERVICES	L	T	P	C
Core/Elective/Supportive		Elective	4		0	4
Pre-requisite		Fundamentals on web, architectures	Syllabus Version		2020-2021	

Course Objectives:

The main objectives of this course are to:

1. To familiar with the web services technology elements for realizing SOA

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	INTRODUCTION TO XML 9	12 hours

XML document structure – Well-formed and valid documents – Namespaces – DTD – XML Schema – X-Files

Unit:2	BUILDING XML- BASED APPLICATIONS 9	12 hours

Parsing XML – using DOM, SAX – XML Transformation and XSL – XSL Formatting – Modeling Databases in XML.

Unit:3	SERVICE ORIENTED ARCHITECTURE 9	13 hours

Characteristics of SOA, Comparing SOA with Client-Server and Distributed architectures – Benefits of SOA — Principles of Service orientation – Service layers.

Unit:4	WEB SERVICES 9	10 hours

Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Message Exchange Patterns – Orchestration – Choreography –WS Transactions.

Unit:5	BUILDING SOA-BASED APPLICATIONS 9	13 hours

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.

Unit:6	Contemporary Issues	2 hours

		Implement and use a web services based SOA technologies as well as tools- Usage of Web services protocols		
		Expert lectures, online seminars - webinars		
		Total Lecture hours		**62 hours**

Text Book(s)

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.

Reference Books

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.

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

1	https://www.fibre2fashion.com/industry-article/3062/web-services-implementation-methodology-for-soa-application
2	https://www.c-sharpcorner.com/uploadfile/raj1979/database-connectivity-using-webservice/
3	https://www.talend.com/resources/service-oriented-architecture/
4	https://www.sciencedirect.com/topics/computer-science/service-oriented-architecture

Course Designed By: **Dr. S. Gavaskar**

Mapping with Programme Outcomes

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

Course code	20CSEAE13	SOCIAL MEDIA MINING	L	T	P	C
Core/Elective/Supportive	**Elective**		**4**	**-**	**-**	**4**
Pre-requisite	Knowledge on Complex data structures, algorithm and web	**Syllabus Version**		**2020-2021**		

Course Objectives:

The main objectives of this course are to:
1. To understand how accurately analyze voluminous complex data set in social media and other sources
2. To understand the models and algorithms to process large data sets
3. To understand social behavior and recommendation challenges and methodologies

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Social Media Mining	12-- hours

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

Unit:2	Network Models	12-- hours

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

Unit:3	Social Media Communities	12-- hours

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.

Unit:4	Social Network	12-- hours

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

Unit:5	Recommender System	12-- hours

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

Unit:6	Contemporary Issues	2 hours

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

	Total Lecture hours	**62-- hours**

Text Book(s)	
1	Reza Zafarani , Mohhammad AliAbbasi – Social Media Mining: An Introduction – Published by Cambridge press, 2014 – (Free Ebook available http://dmml.asu.edu/smm/chapter)
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
Reference Books : EBooks	
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.]			
	Course Title	**Duration**	**Provider**
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

Web link

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

Course Designed by: Dr. V. Bhuvaneswari

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

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

Course code	20CSEA E14	RESPONSIVE WEB APPLICATIONS	L	T	P	C
Core/Elective/Supportive		Elective	**2**	**0**	**2**	**4**
Pre-requisite		HTML, CSS and Object Oriented Programming using JavaScript	**Syllabus Version**		**2020-2021**	

Course Objectives:

The main objectives of this course are to:

1. To understand fundamentals of responsive web applications and Angular
2. To develop Angular Applications using Bootstrap
3. To develop Angular Applications using Material Design

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction to Angular	16 hours

TypeScript: Built-in Types – Classes – Utilities – Working with Angular CLI – **Building Blocks of Angular**: Modules – Components – Templates – Metadata – Data Binding – Directives – Services – Dependency Injection

Unit:2	Introduction to Bootstrap	20 hours

Bootstrap Components: Introduction to Sass – Layouts with Grids and Containers – using Images – using Cards – using Buttons – Navs – Navbars - Carousal

Unit:3	Applications using Angular and Bootstrap	20 hours

Angular and Bootstrap: Creating the Template – Welcome Page Analysis – Application Structure – Navigation Component Template Expressions – Template Statements – Data Binding – Bootstrap Forms

Unit:4	Introduction to Material Design	18 hours

Material Design Components: Data Binding: Input Elements – Form Fields – Drop Downs – Date Picker Control – Slider – Navigation: Toolbar – Sidenav – Layout: Card – Tabs – Material

Design List – Alerts and Dialogs		
Unit:5	**Applications using Angular and Material Design**	**16 hours**

Angular and Material Design: Interpolation – Property Binding – Class Binding – Style Binding – Event Binding – Reactive Forms: Capture Changes – Validation – Route Outlet – Route Parameters – HTTP Client

Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars - webinars		
	Total Lecture hours	**92 hours**

Text Book(s)

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	Venkata Keerti Kotaru, 'Angular for Material Design', Apress, 2020.

Reference Books

1	Rajesh Gunasundaram, 'Learning Angular for .NET Developers', Packt Publishing, 2017.
2	Sridhar Rao Chivukula and Aki Iskandar, 'Web Development with Angular and Bootstrap', Packt Publishing, 2019.
3	Kyle Mew, 'Learning Material Design', Packt Publishing, 2015.

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

1	Angular Fundamentals (https://www.edx.org/course/angular-fundamentals)

Course Designed By: **Dr. R. Rajeswari**

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

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

Course code	20CSEA E15	INTERNET PROGRAMMING AND WEB DESIGNING	L	T	P	C
Core/Elective/Supportive		Elective	2	0	2	4
Pre-requisite		RDBMS	**Syllabus Version**		**2020-2021**	

Course Objectives:

The main objectives of this course are to:

1. To understand the basics of web designing and internet programming
2. To develop interactive and dynamic web applications using HTML, JavaScript, CSS, XML and ASP.NET
3. To explore different standards of web services

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Internet Basics, HTML 5, CSS3**	16 hours

Internet Basics: Introduction–Getting Connection –Services - Mail –FTP –HTTP –WWW – **HTML 5**: Fundamentals – working with text, links, tables, images, forms and multimedia – **CSS3**: Overview – backgrounds and color gradients – fonts and text styles – displaying, positioning and floating an element – table layouts

Unit:2	**Client Side Scripting**	20 hours

JavaScript: 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 – **jQuery**

Unit:3	**XML**	14 hours

XML: Need for XML –Documentation –Elements and Attributes –Valid Documents - Document Type Definitions –XML Schema–Rendering XML with XSLT – XPath, XLink and XPointer

Unit:4	**Server Side Scripting**	20 hours

ASP.NET: Introduction to .NET Framework –.NET Languages –Web Form Fundamentals – Web Controls – Validation Controls – State Management: **ADO.NET** –Overview – ADO.NET Data Access – Data Binding – DataList, DataGrid and Repeater Controls – Using XML ASP.NET

Model - View Controller (MVC) Application		
Unit:5	**AJAX and Web Services**	**20 hours**
AJAX: Understanding AJAX – Using Partial Page Refreshes – ASP.NET AJAX Controls – **Web Services**: Web Services Architecture – WSDL – SOAP – Creating Web Services – Using Web Services		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars - webinars		
	Total Lecture hours	**92 hours**

Text Book(s)

1	Harvey Deitel, Abbey Deitel, "Internet & World Wide Web –How to Program", Fifth Edition, Pearson Education, 2012.
2	DT Editorial Services, "HTML 5 Black Book", Dream Tech Publishers, 2016.
3	Matthew MacDonald, "ASP.NET: The Complete Reference", Tata McGraw Hill, 2002.

Reference Books

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.

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

1	www.spoken-tutorial.org
2	Internet Technology (https://nptel.ac.in/courses/106/105/106105084/)

Course Designed By: **Dr. R. Rajeswari**

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

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

Course code	20CSEAE16	PYTHON PROGRAMMING	L	T	P	C
Core/Elective/Supportive	**Elective**		**4**	**2**	**2**	**4**
Pre-requisite	Knowledge on principles of programming		**Syllabus Version**		**2020-2021**	

Course Objectives:

1. To understand the basics of Python Data structures and Programming constructs
2. To understand and Apply Python Libraries for Data Science and Machine Learning
3. To understand and apply Exploratory Data Analytics using Data Visualization

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Introduction**	**18-- hours**

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.

Unit:2	**Advanced Data Types**	**18-- hours**

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

Unit:3	**Control Structures**	**18-- hours**

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.

Unit:4	Python Libraries for Data Science	18-- hours

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

Unit:5	Python Libraries for NLP and Visualization	18-- hours

 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

Unit:6	Contemporary Issues	2-- hours

 Analyze Data to understand Global Issues on health care, pandemic situations etc..

	Total Lecture hours	92-- hours

Text Book(s)	
1	Jake VanderPlas, "Python Data Science Handbook" O'Reilly, 1st 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.

Reference Books	
1	Wesley J. Chun , "Core Python Programming", 2nd Edition,Pearson Education,2016.
2	Mark Summerfield ,"Programming in Python 3", Pearson Education,2018.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	PYTHON - A to Z Full Course for Beginners, https://www.udemy.com/
2	Python for Data Science, https://swayam.gov.in/
3	Python for Data Science and Machine Learning Bootcamp, https://www.udemy.com/
4	Introduction to Python Programming, https://www.udacity.com/
Course Designed By: Dr.J.Ramsingh , Dr.V.Bhuvaneswari	

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

Course code	20CSEA E17	.NET PROGRAMMING	L	T	P	C
Core/Elective/Supportive		Elective	2	0	2	4
Pre-requisite		RDBMS	Syllabus Version		2020-2021	

Course Objectives:

The main objectives of this course are to:

1. To understand various .NET framework components and object oriented programming concepts in .NET
2. To create .NET applications using files and ADO.NET
3. To apply LINQ in VB.NET and C# Programming

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction to C# and VB.NET	16 hours

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

Unit:2	Arrays, Collections and Exceptions	18 hours

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

Unit:3	Object Oriented Programming and Threading	18 hours

Object Oriented Programming: Class Fundamentals – Fields, Methods, Properties, Contractors, Events, Shared Members – Inheritance: Basics, Overriding, Sealed and Virtual Classes – Interfaces – Delegates – Attributes – **Threading**: Fundamentals, Thread Synchronization – Components and Assemblies – Reflection

Unit:4	File Handling and ADO.NET	18 hours

Files and Directories: 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 – **Data Access with ADO.NET** – Binding controls to database- Handling Database in Code-XML and ADO.NET

Unit:5	LINQ, Collections and Application Deployment	20 hours

Introduction to LINQ: 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

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars - webinars

		Total Lecture hours	92 hours

Text Book(s)

1	Donis Marshall, "Programming Visual C# 2008: The Language ", Microsoft Press Publication, 2008.
2	The Complete Reference – Visual Basic .NET, JefreyR.Shapiro, Tata McGraw-Hill, 2002

Reference Books

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

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

1	www.spoken-tutorial.org
2	.net core Guide - https:/docs.microsoft.com
3	https://www.tutorialsteacher.com/core/aspnet-core-middleware
4	

Course Designed By: **Dr. R. Rajeswari**

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

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

Course code	20CSEAE 18	Graphical Programming and Virtual Instrumentation	L	T	P	C
Core/Elective/Supportive			2		2	4
Pre-requisite		Students should know about the concept of graphical programming and virtual instrumentation	**Syllabus Version**		**2020-2021**	

Course Objectives:

The main objectives of this course are to:

1. To realize the concept of Graphical Programming and Virtual Instrumentation
2. Understanding Virtual Instrument concepts and Creating Virtual Instruments for practical works
3. to develop basic VI programs using loops, case structures etc. including its applications in Data Acquisition, Machine Vision, Image Processing and Analysis

Expected Course Outcomes:

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 programing 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

K1 - Remember; **K2** - Undestand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction to Graphical System Design	16 hours

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.

Unit:2	Introduction to LabVIEW	18 hours

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 Resourses, Keyboard Shortcuts.

Unit:3	Modular Programming	18 hours

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.

Unit:4	Programming in Lab View	18 hours

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.

Unit:5	Analysis using Lab View	20 hours

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.

Unit:6	Contemporary Issues	2 hours

Expert lectures, YouTubes Videos, Animations, NPTEL, MOOC videos, online seminars – webinars for strengthening the subject matters.

	Total Lecture hours	92 hours

Text Book(s)

1	Jovitha Jerome, "Virtual Instrumentation Using LabVIEW", PHI Learning Private Ltd., 2010
2	Gary W. Johnson and Richard Jennings, "LabVIEW Graphical Programming", McGraw-Hill Inc., 2006

Reference Books

1	Bruce Mihura, "LabVIEW for Data Acquisition", Prentice Hall, 2001
2	Gupta, Virtual Instrumentation Using Lab view 2nd Edition, Tata McGraw-Hill Education, 2010

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

1	Lecture Notes: https://www.bharathuniv.ac.in/colleges1/downloads/courseware_ece/notes/BEI 704%20%20%20-%20virtual%20instrumentation.pdf
2	PPT Slides: https://www.slideshare.net/PrincyRandhawa/virtual-instrumentation-labview
3	Tutorials/Animations:https://www.ni.com/en-in/innovations/white-papers/06/virtual-instrumentation.html
4	YouTube Videos: https://www.youtube.com/watch?v=u-AzZV-Ooyk

	Course Designed By : Dr. R. Rajeswari

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

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

Course code	20CSEA E19	SOFTWARE TESTING WITH SELENIUM	L	T	P	C
Core/Elective/Supportive		Elective	3	0	1	4
Pre-requisite		Knowledge of software engineering	**Syllabus Version**		**2020-2021**	

Course Objectives:

The main objectives of this course are:

1. To understand the basic concepts of software testing
2. To Gain knowledge over various selenium methods and automation frameworks

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Introduction to Automation**	**15 hours**

Introduction to Automation - Planning before Automation - Introduction to Selenium - Installing Selenium Components.

Unit:2	**Selenium IDE**	**15 hours**

Using Selenium IDE - Managing User Interface Controls - Creating First Selenium Web Driver Script.

Unit:3	**Selenium Methods**	**15 hours**

Selenium Methods - Common Selenium Web Driver Methods - Verification Point in Selenium - Exploring the Features of Web Driver.

Unit:4	**Working with UI**	**15 hours**

Handling Pop-up Dialogs and Multiple Windows - Working with Dynamic UI Objects- Data driven testing using TestNG - Selenium Functions, Common Questions and Tips.

Unit:5	**Automation Frameworks**	**15 hours**

Reporting in Selenium - Batch Execution- Automation Frameworks - Understanding Selenium Grid.

Unit:6	**Contemporary Issues**	**2 hours**

Expert lectures, online seminars - webinars

		Total Lecture hours	77 hours

Text Book(s)

1	AdithyaGarg, Ashish Mishra, "A Practitioner's Guide to Test Automation Using Selenium", Tata McGraw Hill Education, 2015.
2	NavneeshGarg, "Test Automation Using Selenium WebDriver with Java", AdactIn Group Pvt Ltd. 2014.
3	SatyaAvasarala, "Selenium Web Driver Practical Guide", 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, https://onlinecourses.nptel.ac.in/noc20_cs19/preview

Course Designed By: **Dr. T. Amudha**

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

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

Course code	20CSE AE20	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
Core/Elective/Supportive		Elective	4	0	0	4
Pre-requisite		Knowledge on software and functional domains in business	Syllabus Version		2020-2021	

Course Objectives:

The main objectives of this course are to:

1. To learn software planning, project management, activity planning
2. To analyze and apply effort and cost estimation techniques
3. To learn Monitoring, scheduling and Risk Management
4. To Evaluate Modern techniques for project management
5. To apply Software project Management concept in a case study using tools

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction to Software Project Management	12 hours

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.

Unit:2	Selection of Appropriate Project Approach	10 hours

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

Unit:3	Risk Management	14 hours

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.

Unit:4	Introduction to Devops	12 hours

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.

Unit:5	Software Tools	12 hours

[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)

Unit:6	Contemporary Issues	2 hours

Submit an assignment on Learning and Unlearning concept in software industry

	Total Lecture hours	62 hours

Text Book(s)

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

Reference Books

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 Assurance", Tata McGraw Hill,1995.

3   Ramesh Gopalasamy, "Managing Global Software Projects", Tata McGraw-Hill-2005

4   Joseph Joyner, "DevOps for Beginners",MihailsKonoplovs, 2015

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

1   www.coursera.com

2   www.edx.org

3   www.simplilearn.com

4   www.udemy.com

Web Link
  1. https://www.atlassian.com/
  2. https://www.scoro.com/blog/best-project-management-software-list/

Course Designed By: Dr. M Punithavalli

Mapping with Programme Outcomes

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

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

Course code	20CSEA E21	COMPUTER GRAPHICS AND MULTIMEDIA	L	T	P	C
Core/Elective/Supportive		Core	2	0	2	4
Pre-requisite		Knowledge on Data and data types	**Syllabus Version**		2020-2021	

Course Objectives:

The main objectives of this course are:

  1. To understand the Computer Graphics and the various graphic algorithms.
 2. To understand the 2D and 3D transformations, models and generation techniques
 3. To understand the Multimedia animation and Desktop Computing.

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Introduction to Computer Graphics	12 hours

 A Survey of Computer Graphics – Overview of Graphics Systems: Video Display Devices – Input Devices – Graphics Software.

Unit:2	Two dimensional graphics	20 hours

 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.

Unit:3	Three dimensional graphics	20 hours

 Three-Dimensional Display Methods – Three Dimensional Geometric and Modeling Transformations: Translation – Rotation – Scaling – Composite Transformations - Color Models and Color Applications.

Unit:4	Introduction to Multimedia	18 hours

 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.

Unit:5	Images, Audio and Video	20 hours

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.

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars – webinars

	Total Lecture hours	92 hours

Text Books

1.	Donald Hearn & M.Pauline Baker, "Computer Graphics", Second Edition, PHI/ Pearson Education.
2.	H.M.Neumann and R.F.Sproul, "Principles of Interactive computer Graphics", Second Edition, McGraw Hill.
3.	Multimedia Making It work – 9th Edition, Tay Vaughan, Mc Graw Hill, 2016

Reference Books

1. Steven Harrington, "Computer Graphics – A Programming Approach", 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 Practice", Addison-Wesley Professional; 3rd edition, 2013.

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

1	Computer Graphics, https://nptel.ac.in/courses/106/106/106106090/
2	Multimedia Systems, https://nptel.ac.in/courses/117/105/117105083/

Course Designed By: **Dr. J. Satheesh Kumar**

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

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

Course code	20CSEA E22	AUGMENTED REALITY	L	T	P	C
Core/Elective/Supportive		Core	**2**	**0**	**2**	**4**
Pre-requisite		Fundamentals on Graphics, Computer Vision	**Syllabus Version**		**2020-2021**	

Course Objectives:

The main objectives of this course are:

1. To understand the concepts behind AR
2. To design and develop AR applications

Expected Course Outcomes:

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

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	**Introduction to Augmented Reality**	**16 hours**

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

Unit:2	**Design Theory of AR**	**18 hours**

Design application: Theory - Story and process - Scripting principles - Hardware: AR, VR, XR - Hardware: Development environment - Tools, Software Development Kit (SDK), Scripting

Unit:3	**AR Development**	**18 hours**

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

Unit:4	**AR Environment**	**18 hours**

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

Unit:5	Creating AR Applications	20 hours

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

Unit:6	Contemporary Issues	2 hours

Expert lectures, online seminars – webinars

	Total Lecture hours	92 hours

Text Books	
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
Reference Books	
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
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	Virtual Reality, https://nptel.ac.in/courses/106/106/106106138/

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

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