VVCE

Vidyavardhaka Sangha ®, Mysuru

VIDYAVARDHAKA COLLEGE OF ENGINEERING

Autonomous Institute, Affiliated to Visvesvaraya Technological University, Belagavi

(Approved byAICTE, New Delhi & Government of Karnataka)
Accredited by NBA, NAAC with 'A' Grade
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Bachelor of Engineering

VII to VIII Semester Scheme and Syllabi

(2020 Scheme)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Scheme of Teaching and Examination for BE (Autonomous Scheme : 2020)

VII SEMESTER – Computer Science and Engineering

Sl. No.	Course Area	Course Code	Course Name	Teaching Department	Contact Hours / week			Examination				Credits
					L	T	P	Duration (Hrs.)	CIE Marks	SEE Marks	Total	
1	PC	20CS71#	Machine Learning-II	CS	3	0	0	3	50	50	100	3
2	PC	20CS72	Management and Entrepreneurship	CS	3	0	0	3	50	50	100	3
3	**PE**	**20CS73X**	**Professional Elective - III**	CS	3	0	0	3	50	50	100	3
4	**PE**	**20CS74X**	**Professional Elective - IV**	CS	3	0	0	3	50	50	100	3
5	**OE**	**20CS75X**	**Open Elective - III**	CS	3	0	0	3	50	50	100	3
6	PC	20CS76#	Machine Learning-II Laboratory	CS	1	0	2	3	50	50	100	2
7	PC	20CS77*	DevOps Laboratory	CS	1	0	2	3	50	50	100	2
8	PRI	20CS78	Major Project (Phase – I)	CS	0	0	2	-	50	-	50	1
TOTAL					**17**	**0**	**6**	**-**	**400**	**350**	**750**	**20**

Professional Elective – III		Professional Elective – IV		Open Elective – III	
20CS731#	Big Data Analytics	20CS741*	Storage Area Networks	20CS751	Introduction to Cyber Security
20CS732	Cyber Security and Forensics	20CS742$	Natural Language Processing	20IS752	Fundamentals of Storage Area Networks
20CS733$	Augmented Reality and Virtual Reality	20CS743#	Robotic Process Automation	20CS753	Introduction to Robotic Process Automation
20CS734*	UI/UX Design	20CS744	Network Management System	20CI754	Introduction to Block Chain Technology

*common to (AI&ML/CSE/ISE), #common to (CSE/ISE), $common to (AI&ML/CSE), @common to (AI&ML/ISE)

Scheme of Teaching and Examination for BE (Autonomous Scheme : 2020)

VIII SEMESTER – Computer Science and Engineering

Sl. No.	Course Area	Course Code	Course Name	Teaching Department	Contact Hours / week			Examination				Credits
					L	T	P	Duration (Hrs.)	CIE Marks	SEE Marks	Total	
1	PRI	20CS81	Major Project (Phase - II)	CS	-	-	-	3	100	100	200	12
2	PRI	20CS82	Internship (4 weeks) (Between 6th & 7th Sem vacation **OR** (Between 7th & 8th Sem vacation)	Industry	-	-	-	3	100	100	200	3
3	PE	20CS83	MOOCS/Swayam online course (8 – 12 weeks course)	Online Platform	-	-	-	-	-	100	100	2
Total					**-**	**-**	**-**		**200**	**300**	**500**	**17**

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SEMESTER – VII

Course Name	: Machine Learning - II	**Course Code:**	20CS71
Number of Lecture Hours / Week	: 03	**CIE Marks:**	50
Number of Tutorial / Practical Hours / Week	: 00	**SEE Marks:**	50
Total Number of Lecture + Tutorial/Practical Hours	: 40	**SEE Duration:**	03 Hrs.
L:T:P	: 3:0:0	**Credits:**	03

Course Prerequisites
Basic understanding of linear equation, neural network, probability and statistics, types of machine learning.

Course Overview
This course is concerned with computer programs that automatically improve their performance through experience which illustrates methodologies, technologies, mathematics and algorithms of machine learning techniques.

Course Learning Objectives (CLOs)
- Understand the fundamentals of deep learning.
- Know the theory behind Convolutional Neural Networks, RNN.
- Illustrate the strength and weaknesses of many popular deep learning approaches.
- Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems.

Modules	Teaching Hours
Module 1 **Introduction to Deep Learning** Introduction, Shallow Learning, Deep Learning, Why to use Deep Learning, How Deep Learning Works, How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization **SLT:** Deep Learning Challenges **Textbook 1:** Ch 1.1 – 1.6	**08**
Module 2 **Basics of Supervised Deep Learning** Introduction, Convolution Neural Network, Evolution of Convolution Neural Network, Architecture of CNN **SLT:** Convolution Operation **Textbook 1:** Ch 2.1 – 2.5	**08**
Module 3 **Training Supervised Deep Learning Networks** Training Convolution Neural Networks, Gradient Descent-Based Optimization Techniques, Challenges in Training Deep Networks. **Supervised Deep Learning Architectures:** LetNet-5 **SLT:** AlexNet **Text Book - 1 :** Ch 3.2,3.4,3.5, Ch 4.2,4.3	**08**
Module 4 **Recurrent and Recursive Neural Networks**	**08**

Unfolding Computational Graphs, Recurrent Neural Network, Bidirectional RNNs, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory. **SLT:** Gated RNNs **Text Book – 2:** 10.1-10.3, 10.5, 10.6, 10.10	
Module 5 **Applications of Deep Learning** Large-Scale Deep Learning, Computer Vision, Speech Recognition **SLT:** NLP **Textbook - 2:** Ch 12.1-12.4	**08**

Textbooks

1. M. Arif Wani Farooq Ahmad Bhat Saduf Afzal Asif Iqbal Khan, Advances in Deep Learning, Springer, 2020
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

Reference Books

1. Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning, 2009
2. N.D. Lewis, "Deep Learning Made Easy with R: A Gentle Introduction for Data Science", January 2016
3. Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", O'Reilly publications.

Course Outcomes (COs)

At the end of the course students will be able to

CO1	Understand the fundamentals of deep learning techniques
CO2	Apply deep learning techniques to solve real world problems
CO3	Examine the working of various deep learning techniques
CO4	Assess the research-oriented problems and propose apposite solutions using deep learning techniques

CO – PO – PSO Matrix

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2														
CO2	3												2		
CO3		2											2		
CO4				2						2		2	2		
AVG	**2.5**	**2**		**2**						**2**		**2**	**2**		

SEMESTER – VII

Course Name	: Management and Entrepreneurship	**Course Code:**	20CS72
Number of Lecture Hours / Week	: 03	**CIE Marks:**	50
Number of Tutorial / Practical Hours / Week	: 00	**SEE Marks:**	50
Total Number of Lecture + Tutorial/Practical Hours	: 40	**SEE Duration:**	03 Hrs.
L:T:P	: 3:0:0	**Credits:**	03

Course Prerequisites
Basic understanding of fundamentals of software engineering and functionalities of IT Industry.

Course Overview
This course aims to provide basic understanding of management and entrepreneurship skills required to manage the organization effectively. At the end of the course students will have thorough knowledge on ERP, IPR and institutional support.

Course Learning Objectives (CLOs)

- Explain the principles of management, organization and entrepreneur.
- Discuss on planning, staffing, ERP and their importance
- Infer the importance of intellectual property rights and relate the institutional support

Modules	Teaching Hours
Module 1 **Introduction** - Meaning, nature and characteristics of management, scope and Functional areas of management, goals of management, levels of management, , Management Principles: Early Classical Approaches, Neo-Classical Approaches, Modern Approaches, Managerial Economics: What is Managerial Economics?, Salient features and significance of managerial economics, Roles of Managerial Economics Planning - Nature, importance, types of plans, steps in planning, Organizing- nature and purpose, types of Organization, Staffing- meaning, process of recruitment and selection. **SLT:** Corporate/Social responsibilities of business **Textbook 1:** Ch 2, Ch 4, **Textbook 5:** Ch.1, **Textbook 4:** Ch1, Ch 3	**08**
Module 2 **Directing and controlling-** meaning and nature of directing, leadership styles, motivation Theories, Communication- Meaning and importance, Coordination- meaning and importance, Controlling- meaning, steps in controlling, methods of establishing control. **SLT:** Problems of control systems. **Textbook 4**: Ch 4	**08**
Module 3 **Entrepreneur** – Meaning of entrepreneur, characteristics of entrepreneurs, classification and types of entrepreneurs, various stages in entrepreneurial process, role of entrepreneurs in economic development, entrepreneurship in India and barriers to entrepreneurship. Identification of business opportunities, market feasibility study, technical feasibility study, financial feasibility study and social feasibility study **SLT**: Women entrepreneurs. **Textbook 2:** Ch 3, **Textbook 3:** Ch 5, **Textbook 4:** Ch 5	**08**
Module 4 **Preparation of project and ERP -** meaning of project, project identification, project selection, project report, need and significance of project report, contents, formulation, guidelines by planning commission for project report **Enterprise Resource Planning:** Meaning and Importance-	**08**

ERP and Functional areas of Management – Marketing / Sales- Supply Chain Management – Finance and Accounting – Human Resources. **SLT**: Types of reports and methods of report generation **Textbook 4**: Ch 8	
Module 5 **Micro and Small Enterprises:** Definition of micro and small enterprises, characteristics and advantages of micro and small enterprises, steps in establishing micro and small enterprises, Government of India industrial policy 2022 on micro and small enterprises, case study (Microsoft), Case study(Captain G R Gopinath),case study (N R Narayana Murthy & Infosys), Project Financing, **Institutional support:** MSME-DI, NSIC, SIDBI, KIADB, KSSIDC, TECSOK, KSFC, DIC and District level single window agency, **Introduction to IPR.** **SLT:** IPR process **Textbook 3:** Ch 1, Ch 2, Ch 4, **Textbook 2:** Ch 34	**08**

Textbooks

1. Principles of Management -P. C. Tripathi, P. N. Reddy; Tata McGraw Hill, 4th / 6th Edition, 2010.
2. Dynamics of Entrepreneurial Development & Management -Vasant Desai Himalaya Publishing House.
3. Entrepreneurship Development -Small Business Enterprises -Poornima M Charantimath Pearson Education – 2006.
4. Management and Entrepreneurship - Kanishka Bedi- Oxford University Press-2017
5. Managerial Economics, Theory and Applications – D M Mithani, Himalaya Publishing House, 7th Edition, 2013.

Reference Books

1. Management Fundamentals -Concepts, Application, Skill Development Robert Lusier – Thomson.
2. Entrepreneurship Development -S S Khanka -S Chand & Co.
3. Management -Stephen Robbins -Pearson Education /PHI -17th Edition, 2003

Course Outcomes (COs)

At the end of the course students will be able to

CO1	Understand the roles and responsibilities of management and outline their importance in entrepreneurship
CO2	Illustrate the various stages and roles in entrepreneurial process.
CO3	Analyse the ERP, IPRs and institutional support in entrepreneurship
CO4	Prepare the project proposal as per the norms of engineering practice for a given societal problem using appropriate tools and techniques.

CO – PO – PSO Matrix

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2														
CO2	3														
CO3		2													1
CO4					2	2		2							2
AVG	**2.5**	**2**			**2**	**2**		**2**							**1.5**

SEMESTER – VII

Course Name	: Big Data Analytics	**Course Code:**	20CS731
Number of Lecture Hours / Week	: 03	**CIE Marks:**	50
Number of Tutorial / Practical Hours / Week	: 00	**SEE Marks:**	50
Total Number of Lecture + Tutorial/Practical Hours	: 40	**SEE Duration:**	03 Hrs.
L:T:P	: 3:0:0	**Credits:**	03

Course Prerequisites
Basic understanding of Linux operating system and Database is required, also having the knowledge of Java is recommended.

Course Overview
The course provides an insight towards the importance of big data in analysis and decision-making resulting in higher operational efficiencies for the business. To efficiently manage and process high volumes of structured and unstructured data in real time using appropriate infrastructure.

Course Learning Objectives (CLOs)
- Understand the importance of big data technologies used for storage, analysis, and manipulation of data
- Analyze the use of Hadoop Distributed File System
- Provide insights into Hadoop framework and management functionalities
- Provide exposure to Hadoop ecosystem tools and techniques for big data processing

Modules	Teaching Hours
Module 1 **Introduction to Big Data Analytics** Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis. **SLT**: Applications of Big Data in the real world. **Textbook 1 :** Ch 1: 1.2 -1.7	**08**
Module 2 **Introduction to Hadoop** Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. **Hadoop Distributed File System Basics:** HDFS Design Features, Components **SLT:** HDFS User Commands. **Text book 1:** Ch 2 :2.1-2.6, Ch 3	**08**
Module 3 **NoSQL Big Data Management, MongoDB and Cassandra** Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases. **SLT:** Cassandra Databases **Textbook 1:** Ch 3: 3.1-3.7	**08**
Module 4 **MapReduce, Hive and Pig**	**08**

Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL. **SLT**: Pig **Textbook 1:** Ch4: 4.1-4.6	
Module 5 **Spark** Installing Spark, An Example: Spark Applications, Jobs, Stages, and Tasks, A Scala Standalone Application, A Java Example, A Python Example, Resilient Distributed Datasets: Creation, Transformations and Actions, Persistence, Serialization, Shared Variables: Broadcast Variables, Accumulators, Anatomy of a Spark Job: Run: Job Submission, DAG Construction. **SLT**: Task Scheduling, Task Execution. **Textbook 2:** Ch19	**08**

Textbooks

1. Raj Kamal, Preeti Saxena, "Big Data Analytics, Mc Graw Hill, 2019
2. Tom White, Hadoop: The Definitive Guide, 4th edition, O'Reilly.

Reference Books

1. Big Data: Black Book, DT Editorial Services, Wiley India Pvt Ltd, 2016 Edition
2. Arshdeep Bahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577

Course Outcomes (COs)

At the end of the course students will be able to

CO1	**Understand** the fundamentals of Big Data analytics
CO2	**Apply** the concept of HDFS, Map reduce for storing and processing of big data
CO3	**Analyze** Hive ecosystem for working with big data and formulate an efficient report
CO4	**Demonstrate** the use of any modern Hadoop tool in team or individually to perform the data analytics

CO – PO – PSO Matrix

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2												2		
CO2	3													3	
CO3		2												2	
CO4					2				2						2
AVG	**2.5**	**2**			**2**				**2**				**2**	**2.5**	**2**

SEMESTER – VII

Course Name	: Cyber Security and Forensics	**Course Code:**	20CS732
Number of Lecture Hours / Week	: 03	**CIE Marks:**	50
Number of Tutorial / Practical Hours / Week	: 00	**SEE Marks:**	100
Total Number of Lecture + Tutorial/Practical Hours	: 40	**SEE Duration:**	03 Hrs.
L:T:P	: 3:0:0	**Credits:**	03

Course Prerequisites
Basic knowledge of computer networks and network security

Course Overview
The course provides understanding of cybercrime and its tools. It also provides insights into computer forensics and its approaches for investigation.

Course Learning Objectives (CLOs)
- To understand Cyber offenses and various attacks
- To gain knowledge on tools and methods used in cybercrimes
- To understand computer forensics and forensics for handheld devices

Modules	Teaching Hours
Module 1 **Introduction to Cybercrime** Introduction, Cybercrime and information security, who are Cyber criminals? Classification of Cybercrimes, Cybercrime – The Legal Perspectives and Indian Perspective **SLT:** Case Study : Cybercrimes - Banking frauds, Email-phishing **Textbook 1:** Ch. 1.1- 1.7	**08**
Module 2 **Cyber Offenses: How Criminals Plan Them** Introduction, Categories of Cybercrime, how criminals plan the attack, classification of social engineering, Cyber stalking, Cybercafé and Cybercrimes **SLT:** Botnet – The fuel of cybercrimes **Textbook 1:** Ch. 2.1 - 2.6.	**08**
Module 3 **Tools and Methods used in Cybercrime** Introduction, Proxy servers and anonymizers, Phishing, Password cracking, Keyloggers and Spywares, Trojan horses and backdoors, SQL injection **SLT:** DoS and DDoS attacks **Textbook 1:** Ch. 4.1 - 4.7, 4.9	**08**
Module 4 **Cyber Forensics** Introduction, historical background of Cyber forensics, digital forensic science, the need for computer forensics, cyber forensics and digital evidence, digital forensics life cycle, chain of custody concept, approaching a computer forensics investigation **SLT**: Challenges in computer forensics **Textbook 1:** Ch. 7.1 - 7.5, 7.7- 7.8,7.10, 7.16	**08**

Module 5 **Cyber Forensics and Forensics of Handheld Devices** Computer forensics and steganography, Setting up a computer forensics laboratory, forensics auditing, anti-forensics. Introduction, handheld devices and digital forensics **SLT**: Toolkits for handheld device forensics **Textbook 1:** Ch. 7.11-7.12 ,7.18-7.19 Ch.8 – 8.1,8.3	**08**

Textbooks

1. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265-21791, 2011, First Edition (Reprinted 2018)

Reference Books

1. Computer Forensics: Computer Crime Scene Investigation by John R, Vacca, 2nd edition, Charles River Media, Inc, New Delhi, 2017.
2. Guide to Computer Forensics and Investigations by Bill Nelson, Amelia Phillips, Christopher Steuart, CENGAGE Learning, 2018.
3. Cybersecurity Essentials by Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short, ISBN: 978-1-119-36239-5, 2018.

Course Outcomes (COs)

At the end of the course students will be able to

CO1	**Explain** the fundamentals of cybercrime and cyber forensics
CO2	**Illustrate** the different types of cybercrimes
CO3	**Analyze** the various methods associated with cyber forensics
CO4	**Demonstrate** real world scenarios of cybercrimes using forensic tools in a team

CO – PO – PSO Matrix

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2												2		
CO2	2												2		
CO3		2											2		
CO4					2				2				2		
AVG	**2**	**2**			**2**				**2**				**2**		

SEMESTER – VII

Course Name	: Augmented Reality and Virtual Reality	**Course Code:**	20CS733
Number of Lecture Hours / Week	: 03	**CIE Marks:**	50
Number of Tutorial / Practical Hours / Week	: 00	**SEE Marks:**	50
Total Number of Lecture + Tutorial/Practical Hours	: 40	**SEE Duration:**	03 Hrs.
L:T:P	: 3:0:0	**Credits:**	03

Course Prerequisites
Basic understanding of real time 3D concepts, coordinate systems and transforms

Course Overview
The course provides fundamental understanding of virtual and augmented reality which helps to combine the virtual world and real world by overlaying the digital interactive contents on the existing world

Course Learning Objectives (CLOs)

- Understanding the basics of VR & AR
- Explain the democratization of VR and AR (Hardware and Software)
- Understand the scientific and technical aspects, challenges and complexity involved in AR & VR
- Study the real time applications

Modules	Teaching Hours
Module 1 **Introduction** Basic concepts of Virtual and Augmented Reality, The Emergence of Virtual Reality, Technology Revolution, Revolution in Use and Users, New Industrial Applications: Virtual and Augmented Reality in Industry, VR-AR for Industrial renewal, What about augmented reality? **SLT**: Case Study: Computer Assisted Surgery **Textbook 1:** Ch.1.1,1.2	**08**
Module 2 **The Democratization of VR and AR** New Equipment: Introduction, Positioning and Orientation devices, Restitution Devices, Technological Challenges and Perspective. New Software: Developing 3D applications, Dedicated VR-AR Software Solutions. **SLT**: Managing Peripheral Devices **Text Book 1:** Ch. 2.1, 2.2	**08**
Module 3 **Complexity and Scientific Challenges** Introduction: Physical Model and Detection Collisions, Populating 3D environments: single virtual human to a surging crowd, The difficulty of making 3D interaction natural, The difficulty of synthesizing haptic feedback, Complexity and scientific challenges of 3D interaction: Complexity and challenges surrounding the 3D interaction loop, Challenge 1: sensory-motor actions for interaction, Challenge 2: multisensory feedback, Challenge 3: users and perception **SLT**: The real–virtual relationship in augmented reality. **Textbook 1:** Ch 3.1. to 3.3	**08**
Module 4 **Scientific and Technical Aspects**	**08**

Brain Computer Interfaces**:** Brain-computer interfaces: introduction and definitions, What BCIs cannot do, Working principle of BCIs, Current applications of BCIs, The future of BCIs **The Challenges and Risks of Democratization of VR-AR:** Introduction, Health and Comfort problems: The different problems, Sensorimotor incoherences, Solutions to avoid discomfort and unease. **SLT**: Alternative Perceptions in Virtual Reality (Pseudo-sensory feedback) **Textbook 1:** Ch 5.2, 6.2, 6.3	
Module 5 **Case Studies** Creating Virtual Reality in a Business and Technology Educational Context, Tool, not a Toy: Using Virtual Reality to Evaluate the Communication Between Autonomous Vehicles and Pedestrians, Pulmonary Rehabilitation in Virtual Reality for COPD Patients. **SLT**: Case study on applications of AR and VR in advertisement industry **Textbook 2:** Ch 11, Ch 15, Ch 20	**08**

Textbooks

1. Bruno Arnaldi, Pascal Guitton, Guillaume Moreau, Virtual Reality and Augmented Reality: Myths and Realities, iSTE and WILEY, First Publication 2018.
2. M. Claudia tom Dieck Timothy Jung, Augmented Reality and Virtual Reality: The power of AR and VR for Businesses, Springer publications, 2018

Reference Books

1. Timothy Jung, M. Claudia tom Dieck, Augmented Reality and Virtual Reality: Empowering Human, Place and Business, Springer, 2018.

Course Outcomes (COs)

At the end of the course students will be able to

CO1	**Explain** the basics concepts of AR & VR.
CO2	**Apply** the scientific and technical aspects in implementation of AR & VR
CO3	**Analyze** the real-world applications of AR & VR
CO4	**Demonstrate** real world applications using modern tools

CO – PO – PSO Matrix

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2														2
CO2	3														3
CO3		2													2
CO4					2										2
AVG	**2.5**	**2**			**2**										**2.25**

SEMESTER – VII

Course Name	**:** UI/UX Design	**Course Code:**	20CS734
No. of Lecture Hours / Week	**:** 03	**CIE Marks:**	50
No. of Tutorial / Practical Hours / Week	**:** 00	**SEE Marks:**	50
Total No. of Lecture + Tutorial / Practical Hours	**:** 40	**SEE Duration:**	03 Hrs.
L: T: P	**:** 3:0:0	**CREDITS:**	03

Course Prerequisites
Basic understanding of computer usage and familiarity with web browsing and software applications would be beneficial.

Course Overview
The UI/UX course is designed to provide students with a comprehensive understanding of designing effective and user-friendly interfaces for various digital platforms. In today's technology-driven world, creating a positive user experience is crucial for the success of any product or service, be it a website, mobile app, or software application.

Course Learning Objectives (CLO)
This course will enable students to:

- Understand the concept of menus, windows, interfaces, and importance of user experience.
- Study about business functions and information architecture.
- Study the characteristics and components of windows and the various controls for the windows.
- Understand various problems in windows design with color, text and graphics to study the testing methods.
- Study User Experience components, define wireframes and understand the metrics for user experience measurement.

MODULES	Teaching Hours
Module 1 The User Interface: Introduction, Overview, the importance of user interface – Defining the user interface, The importance of good design, Characteristics of graphical and web user interfaces, Principles of user interface design. **SLT:** The importance of good design. **Textbook 1:** Ch. 1	**08**
Module 2 The User Interface Design process: Obstacles, Usability, Human characteristics in Design, Business Functions-Business definition and requirement analysis, Basic business functions, Design standards. What is User Experience, User Experience Components. Considerations before beginning UX. Examining why you should use UX. **SLT:** Design standards. **Textbook 1:** Part 2 – Ch 2 **Textbook 2:** Part-1 – Ch 1, 2	**08**
Module 3 Building the Information Architecture for User Experience: Benefits of good Information Architecture, Creating Sitemap as the Framework of your experience, creating blueprint with wireframes, Changing trends in UX, Designing for Mobile phones, Measuring UX performance as UX strategy, Defining specific metrics to measure.	**08**

SLT: Designing for Mobile phones. **Textbook 2:** Part 2 – Ch 9,10,13	
Module 4 System menus and navigation schemes- Structures of menus, Functions of menus, Contents of menus, Formatting of menus, Phrasing the menu, selecting menu choices, Navigating menus, Kinds of graphical menus. Windows - Characteristics, Components of window, Window presentation styles, Types of windows, Window management. **SLT:** Kinds of graphical menus. **Textbook 1:** Part 2 – Ch 4, 5	**08**
Module 5 Screen based controls- Operable control, Text control, Selection control, Custom control, Presentation control, Windows Tests-prototypes, kinds of tests. **Textbook 1:** Part 2 – Ch 7	**08**

Textbooks

1. Wilbert O. Galatz, "The Essential Guide to User Interface Design", John Wiley & Sons, Second Edition 2002.
2. Donald Chestnut, Kevin P Nichols, "UX for Dummies", For Dummies; 1st edition, Wiley, 2014.

Reference Books

1. Ben Sheiderman, "Design the User Interface", Pearson Education, 1998.
2. Alan Cooper," The Essential of User Interface Design", Wiley- Dream Tech Ltd., 2002.

Course Outcomes (COs)

At the end of the course, students will be able to

CO1	Describe the importance of user interface design and its impact on user experience.
CO2	Apply User Interface design principles to develop GUI with a better look and feel.
CO3	Analyze the requirements of User Interface design and propose an effective solution.
CO4	Make effective presentation and report for designed user interface.

CO – PO – PSO Matrix

CO	PO												PSO		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2														
CO2	3														
CO3		2													
CO4										2					2
AVG	**2.5**	**2**								**2**					**2**

SEMESTER –VII			
Course Name	: Storage Area Networks	**Course Code:**	20CS741
No. of Lecture Hours / Week	: 03	**CIE Marks:**	50
No. of Tutorial / Practical Hours / Week	: 00	**SEE Marks:**	50
Total No. of Lecture + Tutorial / Practical Hours	: 40 + 00 = 40	**SEE Duration:**	03 hr.
L: T: P	: 3:0:0	**Credits:**	03

Prerequisites: Understanding of fundamentals of networking concepts like IP addressing, subnet, routers, switches and protocols like TCP/IP, a basic understanding of storage concepts, Operating Systems.

COURSE OVERVIEW

The storage area network course's main objective is to expose the students to different Backup, Archive and Replication, Business Continuity, Local Replication, Cloud Computing, and Securing Storage Infrastructure. Students will gain knowledge to design, implement, manage, optimize, and leverage virtualized infrastructures to achieve the business benefits of the cloud.

COURSE LEARNING OBJECTIVES (CLO)

- Understand logical and physical components of a storage infrastructure.
- Identify components of managing and monitoring the data centre.
- Define backup, recovery, disaster recovery, and replication.
- Examine emerging technologies including IP-SAN.
- Define information security and identify different storage virtualization technologies.

MODULES	TEACHING HOURS
MODULE 1 **Storage System**: Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data Centre Infrastructure, Virtualization and Cloud Computing. **Data Centre Environment**: Application Database Management System (DBMS), Host (Compute), Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage.	**08**

SLT: Storage Design Based on Application. **Textbook**: Ch.1.1-1.4, Ch.2.1- 2.10	
MODULE 2 **Data Protection - RAID:** RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance. **Intelligent Storage Systems:** Components of an Intelligent Storage System, Types of Intelligent Storage Systems. **SLT**: RAID Comparison **Textbook**: Ch.3.1-3.6, Ch. 4.1, 4.3	**08**
MODULE 3 **Fibre Channel Storage Area Networks (FC-SAN):** Fibre Channel overview, Components of FC-SAN, FC Connectivity. **Network-Attached Storage:** General-Purpose Servers versus NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementations. **SLT**: Factors NAS File Sharing protocol **Textbook**: Ch 5.1,5.3,5.4, Ch. 7.1 to 7.7	**08**
MODULE 4 **Introduction to Business Continuity:** Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions. **Backup and Archive:** Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies **SLT**: Backup in NAS Environments **Textbook**: Ch.9.1-9.6, Ch. 10.1-10.9	**08**
MODULE 5 **Local Replication**: Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Restore and Restart Considerations, Creating Multiple Replicas. **Remote Replication**: Modes of Remote Replication, Remote Replication Technologies. **SLT**: Tracking Changes to Source and Replica **Textbook**: Ch.11.1- 11.7, Ch. 12.1, 12.2	**08**

Textbooks

1. EMC Education Services, "Information Storage and Management", Wiley India Publications, 2009. ISBN: 9781118094839

Reference Books

1. Paul Massiglia, Richard Barker, "Storage Area Network Essentials: A Complete Guide to Understanding and Implementing SANs Paperback", 1st Edition, Wiley India Publications, 2008

COURSE OUTCOME (CO)

At the end of the course, the student will be able to

CO1	**Understand** different storage networking technologies and virtualization.
CO2	**Apply** different RAID techniques for data replication and restoration in SAN.
CO3	**Analyze** different network technologies like NAS, SAN, DAS, and FC-SAN
CO4	**Present** various storage area network technologies using networking tools individually or in a team

CO – PO – PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2												2		
CO2	3												3		
CO3		2											2		
CO4						2				2			2		
AVG	**2.5**	**2**				**2**				**2**			**2.25**		

SEMESTER – VII

Course Name	: Natural Language Processing	**Course Code:**	20CS742
No. of Lecture Hours / Week	: 03	**CIE Marks:**	50
No. of Tutorial / Practical Hours / Week	: 00	**SEE Marks:**	50
Total No. of Lecture + Tutorial / Practical Hours	: 40	**SEE Duration:**	03 Hrs
L:T:P	: 3:0:0	**Credits:**	03

Course Prerequisites

Basic knowledge of problem-solving skills, logical thinking, discrete mathematics, python, Java, basics of machine learning and artificial intelligence.

Course Overview

This course will emphasize on learning the fundamentals of natural language, various techniques of natural language processing, grammar processing techniques of Indian language, parsing, syntactic analysis & tagging. The students will also learn about various techniques of raw text processing, text mining, extracting the relationship in text and the methods used in information retrieval.

Course Learning Objectives (CLO)

This course will enable students to,

- Learn about the concepts of language & various language models
- Apply various NLP techniques for language modelling.
- Examine the language modelling concepts such as parsing, tagging, tokenizing, extraction, regular expression, and information retrieval.

Modules	Teaching Hours
Module 1 **Overview and language modelling** **Overview:** Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modelling: Various Grammar- based Language Models. **SLT:** Statistical Language Model **Textbook 1:** Ch 1,2	**08**
Module 2 **Word level and syntactic analysis** Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar Constituency- Parsing. **SLT: Probabilistic Parsing** **Textbook 1:** Ch 3,4	**08**
Module 3 Processing Raw Text: Accessing Text from the Web and from Disk, Strings: Text Processing at the Lowest Level, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions, Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation. **SLT:** Formatting from Lists to string	**08**

Textbook 3: Ch 3	
Module 4 **Extracting Relations from Text** From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labelling **SLT:** Learning to Annotate Cases with Knowledge Roles and Evaluations **Textbook 2:** Ch 3,4	**08**
Module 5 **Information retrieval and lexical resources** Information Retrieval: Design features of Information Retrieval Systems-Classical, non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net Stemmers-POS Tagger **SLT:** Research Corpora **Textbook 1:** Ch 9,12	**08**

Textbooks

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), "Natural Language Processing and Text Mining", Springer-Verlag London Limited 2007.
3. Steven Bird, Ewan Klein, and Edward Loper, "Natural Language Processing with Python" First Edition, O'Reilly Media, Inc., 2019

Reference Books

1. Daniel Juraf sky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummings publishing company, 1995.
3. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.

Course Outcomes (COs)

At the end of the course students will be able to

CO1	**Understand** the concepts of text mining
CO2	**Apply** various NLP techniques for language processing
CO3	**Analyze** the concepts of NLP used in language modelling and processing
CO4	**Present** the solution for a given problem using appropriate Natural Language Processing techniques.

CO – PO – PSO Matrix															
CO	**PO**												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2														2
CO2	3														3
CO3		2													2
CO4										2					2
AVG	**2.5**	**2**								**2**					**2.25**

SEMESTER – VII

Course Name	: Robotic Process Automation	**Course Code:**	20CS743
Number of Lecture Hours / Week	: 03	**CIE Marks:**	50
Number of Tutorial / Practical Hours / Week	: 00	**SEE Marks:**	50
Total Number of Lecture + Tutorial/Practical Hours	: 40	**SEE Duration:**	03 Hrs.
L:T:P	: 3:0:0	**Credits:**	03

Course Prerequisites
Basic understanding of Programming Fundamentals and Automation Concepts.

Course Overview
The course provides fundamental understanding of Robotic Process Automation, Various platforms of RPA and usage of UiPath Studio to build different workflows. It provides basic knowledge of different types of activities used in UiPath and sequences.

Course Learning Objectives (CLOs)
- Understand basic concepts of RPA
- Describe RPA, where it can be applied and how it is implemented
- Describe the different types of variables, Control Flow and data manipulation techniques
- Understand Image, Text and Data Tables Automation
- Describe various types of Exceptions and strategies to handle

Modules	Teaching Hours
Module 1 RPA Foundations, What is RPA – Flavors of RPA, History of RPA, The Benefits of RPA, The downsides of RPA, RPA Compared to BPO, BPM and BPA– Consumer Willingness for Automation, The Workforce of the Future, RPA Skills, On-Premise Vs. the Cloud, Web Technology, Programming Languages and Low Code, OCR, Databases, APIs, AI, Cognitive Automation, Agile, Scrum, Kanban and Waterfall DevOps, Flowcharts. **SLT:** Major Issues of AI **Textbook 1:** Ch 1, Ch 2	**08**
Module 2 RPA Platforms, Components of RPA, RPA Platforms, About Ui Path, About, UiPath, The future of automation, Record and Play, Learning Ui Path Studio, Task recorder, Step-by-step examples using the recorder. **SLT:** Downloading and installing UiPath Studio **Textbook 2:** Ch 1, Ch 2	**08**
Module 3 Sequence, Flowchart and Control Flow, Sequencing the workflow Activities, Control flow, various types of loops, and decision making, Step-by- step example using Sequence and Flowchart, Data Manipulation, Variables and Scope, Collections, Arguments – Purpose and use, Data table usage with examples, Clipboard management, File operation with step-by-step example, CSV/Excel to data table and vice versa (with a step-by-step example).	**08**

SLT: Step-by-step example using Sequence and Control flow **Textbook 2:** Ch 3, Ch 4	
Module 4 Taking Control of the Controls, Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls – mouse and keyboard activities, Working with UiExplorer, Handling events, Revisit recorder, Screen Scraping, When to use OCR, Types of OCR available, How to use OCR **SLT:** Avoiding typical failure points **Text book 2:** Ch 5	**08**
Module 5 Handling User Events and Assistant Bots, What are assistant bots? , Monitoring system event triggers , Hotkey trigger ,Mouse trigger , System trigger Exception Handling, Debugging, and Logging, Exception handling, Common Exceptions and ways to handle them, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting, Future of RPA **SLT:** Monitoring image and element triggers **Text book 2:** Ch 7, Ch 8	**08**

Textbooks

1. Tom Taulli, The Robotic Process Automation Handbook : A Guide to Implementing RPA Systems, Publisher : A press, 2020,
2. 2. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9781788470940

Reference Books

1. James F Kurose and Keith W Ross, Computer Networking, A Top,Down Approach, Sixth Edition,Pearson,2017
2. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2019
3. Nader F. Mir: Computer and Communication Networks, 2nd Edition, Pearson Education, 2015
4. William Stallings, Data and Computer Communication 10th Edition, Pearson Education, Inc., 2014

Course Outcomes (COs)

At the end of the course students will be able to

CO1	**Understand** the basic concepts, components and platforms of RPA
CO2	**Illustrate** the various activities ,control and debugging techniques of RPA
CO3	**Analyze** different types of variables, control flow and data manipulation techniques
CO4	**Build** bots in a team for diverse use cases using various RPA Platform

CO – PO – PSO Matrix															
CO	**PO**												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2												2		
CO2	3												3		
CO3		2											2		
CO4					2				2				2		
AVG	**2.5**	**2**			**2**				**2**				**2.25**		

SEMESTER – VII

Course Name	: Network Management System	**Course Code:**	20CS744
Number of Lecture Hours / Week	: 03	**CIE Marks:**	50
Number of Tutorial / Practical Hours / Week	: 00	**SEE Marks:**	50
Total Number of Lecture + Tutorial/Practical Hours	: 40	**SEE Duration:**	03 Hrs.
L:T:P	: 3:0:0	**Credits:**	03

Course Prerequisites
Understand basic concepts of computer network and cryptography technique.

Course Overview
This course introduces standard networking management principles, practices and technologies. It also gives an insight on Data Communication and Network Management Overview, the Basic Standards, Models, and Language of Network Management System.

Course Learning Objectives (CLOs)

- To understand the principles of network management, different standards and protocols used in managing complex networks.
- To understand the Automation of network management operations and making use of readily available network management systems.

Modules	Teaching Hours
Module 1 **Data Communications and Network Management Overview** Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform **SLT:** Current Status and Future of Network Management **Textbook :** Ch.1	**08**
Module 2 **Basic Foundations: Standards, Models, and Language** Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names. **SLT:** Functional Model **Textbook 1:** Ch.3	**08**
Module 3 **Managed Network** The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information	**08**

Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMONI1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base **SLT:** RMON2 Conformance Specifications **Textbook1:** Ch. 4, Ch. 8	
Module 4 **Broadband Network Management** Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channelling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management **SLT:** ADSL Performance Management **Textbook :** Ch.13	**08**
Module 5 **Network Management Applications** Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation 24 Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management. **SLT:** Report Management, Policy- Based Management, Service Level Management **Textbook :** Ch.11	**08**

Textbooks

1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.

Reference Books

1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.

Course Outcomes (COs)

At the end of the course students will be able to

CO1	**Understand** network management standards.
CO2	**Apply** network management standards to manage practical networks.
CO3	**Analyse** the issues and challenges pertaining to management of emerging network technologies.
CO4	**Explore** various commercial network management systems using appropriate tool to keep abreast with technological change.

CO – PO – PSO Matrix															
CO	**PO**												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3												2		
CO2	2												2		
CO3		2											2		
CO4					2							2	2		
AVG	**2.5**	**2**			**2**							**2**	**2**		

SEMESTER – VII

Course Name	: Introduction to Cyber Security	**Course Code:**	20CS751
Number of Lecture Hours / Week	: 03	**CIE Marks:**	50
Number of Tutorial / Practical Hours / Week	: 00	**SEE Marks:**	50
Total Number of Lecture + Tutorial/Practical Hours	: 40	**SEE Duration:**	03 Hrs.
L:T:P	: 3:0:0	**Credits:**	03

Course Prerequisites
Good understanding of basic concepts of computer science theory and computer networks

Course Overview
The course provides a baseline understanding of common cyber security threats, vulnerabilities, and risks.

Course Learning Objectives (CLOs)

- To familiarize cybercrime terminologies and perspectives
- To understand Cyber Offenses and various attacks
- To gain knowledge on tools and methods used in cybercrimes
- To understand phishing attack and need of digital evidence

Modules	Teaching Hours
Module 1 **Introduction to Cybercrime:** Introduction to cybercrime, Cybercrime: Definition and origins of the word, Cybercrime and information security, who are Cybercriminals, Classification of Cybercrimes (E-mail Spoofing, Spamming, Internet Time Theft, Salami Attack, Web Jacking, Data diddling, E-mail Bombing, Password Sniffing, Online Fraud, Forgery, Credit Card Frauds, Identity Theft), Cybercrime: The Legal Perspectives. **SLT:** Cybercrimes: An Indian Perspective. **Textbook 1:** Chapter 1.1-1.4, 1.5.1-1.5.8, 1.5.12, 1.5.16, 1.5.19-1.5.21, 1.6, 1.7	**08**
Module 2 **Cyber offenses: How Criminals Plan Them:** Introduction, How criminal plan the attacks, Social engineering, Cyber stalking, Cybercafe and cybercrimes, Botnets: The fuel for cybercrime **SLT:** Attack Vector **Textbook 1:** Chapter 2.1-2.7	**08**
Module 3 **Tools and Methods used in Cybercrime:** Introduction, Proxy servers and anonymizers, Phishing, Password cracking, Key loggers and spywares, Trojan horses and backdoors, Steganography. **SLT:** Virus and Worms **Textbook 1:** Chapter 4.1-4.8	**08**
Module 4	**08**

Phishing and Identity theft: Introduction, Phishing, Methods of Phishing, Phishing Techniques, Identity theft, Types of Identity theft, Techniques of ID theft, Identity theft: Countermeasures. **SLT:** Personally Identifiable Information **Textbook 1:** Chapter 5.1, 5.2.1, 5.2.2, 5.3.1-5.3.4	
Module 5 **Cybercrime Detection Techniques:** Security Auditing and Log Firewall Logs, Reports, Alarms, and Alerts, Commercial Intrusion Detection Systems. **Collecting and preserving digital Evidence:** Introduction, understanding the role of evidence in a criminal case, collecting digital evidence, preserving digital evidence, recovering digital evidence. **SLT:** Documenting evidence. **Textbook 2**: Chapter 14.1-14.4 and Chapter 15.1-15.6	**08**

Textbooks

1. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265-21791, 2011, First Edition (Reprinted 2018)
2. Debra Little John Shinder and Michael Cross, "Scene of the cybercrime", 2nd edition, Syngress publishing Inc, Elsevier Inc, 2008

Reference Books

1. Computer Forensics and Cyber Crime An Introduction by Marjie T. Britz, Pearson publication, 3rd edition, 2013.

Course Outcomes (COs)

At the end of the course students will be able to

CO1	Summarize the cybercrime terminologies and its classifications.
CO2	Illustrate the different types of cyber-attacks and vulnerabilities.
CO3	Analyze the tools and methods used on Cybercrime.
CO4	Demonstrate the impact of phishing attacks and need for digital evidence in a team.

CO – PO – PSO Matrix

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2														
CO2	2														
CO3		2													
CO4										2					
AVG	**2**	**2**								**2**					

SEMESTER –VII			
Course Name	: Fundamentals of Storage Area Networks	**Course Code:**	20IS752
No. of Lecture Hours / Week	: 03	**CIE Marks:**	50
No. of Tutorial / Practical Hours / Week	: 00	**SEE Marks:**	50
Total No. of Lecture + Tutorial / Practical Hours	: 40 + 00 = 40	**SEE Duration:**	03 hrs.
L: T: P	: 3:0:0	**Credits:**	03

Prerequisites: Understanding of fundamentals of networking concepts like IP addressing, subnet, routers, switches and protocols like TCP/IP, a basic understanding of storage concepts, Operating Systems.

COURSE OVERVIEW

The storage area network course's main objective is to expose the students to different Backup, Archive and Replication, Cloud Computing, and Securing Storage Infrastructure. Students will gain knowledge to design, implement, manage, optimize, and leverage virtualized infrastructures to achieve the business benefits of the cloud.

COURSE LEARNING OBJECTIVES (CLO)

- Understand logical and physical components of a storage infrastructure.
- Identify components of managing and monitoring the data centre.
- Define backup, recovery, disaster recovery, and replication.
- Examine emerging technologies including IP-SAN.
- Define information security and identify different storage virtualization technologies.

MODULES	TEACHING HOURS
MODULE 1 **Introduction:** Data Communication, Networks, Network Types. **Network Models:** Protocol layering, TCP/IP protocol suite, The OSI model. SLT: Accessing the Internet. Textbook1: Ch.1.1 to 1.3, Ch.2.1 to 2.3	**08**
MODULE 2 **Storage System**: Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data Centre Infrastructure. **Data Centre Environment**: Application Database Management System (DBMS), Host (Compute), Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage design based on application requirements and disk performance. SLT: Virtualization and Cloud Computing. Textboo2k: Ch.1.1 to 1.4, Ch.2.1 to 2.10	**08**
MODULE 3 **Data Protection - RAID:** RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk	**08**

Performance. **Intelligent Storage Systems:** Components of an Intelligent Storage System, Types of Intelligent Storage Systems. SLT: RAID Comparison Textbook2: Ch.3.1 to 3.6, Ch. 4.1, 4.3	
MODULE 4 **Fibre Channel Storage Area Networks (FC-SAN):** Fibre Channel overview, Components of FC-SAN, FC Connectivity. **Network-Attached Storage:** General-Purpose Servers versus NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, NAS Implementations. SLT: NAS I/O Operation Textbook2: Ch 5.1,5.3,5.4, Ch. 7.1 to 7.6	**08**
MODULE 5 **Backup and Archive:** Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies. SLT: Backup in NAS Environments Textbook2: Ch. 10.1 to 10.9	**08**

Textbooks

2. Data Communications and Networking by Behrouz A. Forouzan, McGraw Hill Education, 5th Edition.
3. EMC Education Services, "Information Storage and Management", Wiley India Publications, 2009. ISBN: 9781118094839

Reference Books

2. Paul Massiglia, Richard Barker, "Storage Area Network Essentials: A Complete Guide to Understanding and Implementing SANs Paperback", 1st Edition, Wiley India Publications, 2008

COURSE OUTCOME (CO)

At the end of the course, the student will be able to

CO1	**Understand** different storage networking technologies and virtualization.
CO2	**Apply** different RAID techniques for data replication and restoration in SAN.
CO3	**Analyse** different network technologies like NAS, SAN, DAS, and FC-SAN
CO4	**Present** various storage area network technologies.

CO – PO – PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2															
CO2	2															
CO3		2														
CO4										2						
AVG	**2**	**2**								**2**						

SEMESTER – VII

Course Name	: Introduction to Robotic Process Automation	**Course Code:**	20CS753
Number of Lecture Hours / Week	: 03	**CIE Marks:**	50
Number of Tutorial / Practical Hours / Week	: 00	**SEE Marks:**	50
Total Number of Lecture + Tutorial/Practical Hours	: 40	**SEE Duration:**	03 Hrs.
L:T:P	: 3:0:0	**Credits:**	03

Course Prerequisites
Basic understanding of Programming Fundamentals.

Course Overview
The course provides fundamental understanding of Robotic Process Automation, Various platforms of RPA and usage of UiPath Studio to build different workflows. It provides basic knowledge of different types of activities used in UiPath and sequences.

Course Learning Objectives (CLOs)

- Understand basic concepts of RPA
- Describe RPA, where it can be applied and how it is implemented
- Describe the different types of variables, Control Flow and data manipulation techniques
- Understand Image, Text and Data Tables Automation
- Describe various types of Exceptions and strategies to handle

Modules	Teaching Hours
Module 1 **RPA Foundations**: What is RPA, Flavors of RPA, History of RPA, The Benefits of RPA, The downsides of RPA, RPA Compared to BPO, BPM and BPA, Consumer Willingness for Automation, The Workforce of the Future, RPA Skills, On-Premise Vs. the Cloud, Web Technology, Programming Languages and Low Code, OCR-Databases, APIs, AI, Cognitive Automation, Agile, Scrum, Kanban and Waterfall DevOps, Flowcharts. **SLT:** Major Issues of AI **Textbook 1:** Ch 1, Ch 2	**08**
Module 2 **RPA Platforms**: Components of RPA, RPA Platforms, About Ui Path-,About ,The future of automation , Record and Play, Learning Ui Path Studio, Task recorder ,Step-by- step examples using the recorder. SLT: Downloading and installing UiPath Studio **Textbook 2:** Ch 1, Ch 2	**08**
Module 3 **Sequence, Flowchart and Control Flow**: Sequencing the workflow Activities, Control flow, various types of loops, and decision making Step-by- step example using Sequence and Flowchart, Data Manipulation, Variables and Scope, Collections, Arguments, Purpose and use-Data table usage with examples, Clipboard management, File operation with step-by-step example-CSV/Excel to data table and vice versa (with a step-by-step example).	**08**

SLT: Step-by-step example using Sequence and Control flow **Textbook 2:** Ch 3, Ch 4	
Module 4 Taking Control of the Controls, Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls – mouse and keyboard activities, Working with UiExplorer, Handling events, Revisit recorder, Screen Scraping- When to use OCR, Types of OCR available, How to use OCR. **SLT:** Avoiding typical failure points **Textbook 2:** Ch 5	**08**
Module 5 Exception Handling, Debugging, and Logging, Exception handling, Common, Exceptions and ways to handle them, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting. **SLT:** Future of RPA **Textbook 2:** Ch 8	**08**

Textbooks

1. Tom Taulli, The Robotic Process Automation Handbook : A Guide to Implementing RPA Systems, Publisher : A press, 2020,
2. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9781788470940

Reference Books

1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth Edition,Pearson,2017
2. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2019
3. Nader F. Mir: Computer and Communication Networks, 2nd Edition, Pearson Education, 2015
4. William Stallings, Data and Computer Communication 10th Edition, Pearson Education, Inc., 2014

Course Outcomes (COs)

At the end of the course students will be able to

CO1	**Understand** the basic concepts, components and platforms of RPA
CO2	**Illustrate** the various activity ,control and debugging techniques of RPA
CO3	**Analyze** different types of variables, control flow and data manipulation techniques
CO4	**Explore** the Uipath framework to build the bots and make effective presentation

CO – PO – PSO Matrix

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2														
CO2	2														
CO3		2													
CO4										2					
AVG	**2**	**2**								**2**					

SEMESTER – VII

Course Name	: Introduction to Blockchain Technology	**Course Code:**	20CI754
Number of Lecture Hours / Week	: 03	**CIE Marks:**	50
Number of Tutorial / Practical Hours / Week	: 00	**SEE Marks:**	50
Total Number of Lecture + Tutorial/Practical Hours	: 40	**SEE Duration:**	03 Hrs.
L:T:P	: 3:0:0	**Credits:**	03

Course Prerequisites
Basic knowledge of computer networks and programming skills

Course Overview
The course provides a platform for students to learn about the history, important blockchain concepts, philosophy of decentralization behind blockchain and discussions happening within the blockchain environment. In addition, Course covers applications of blockchain and the impact it could have on the business world.

Course Learning Objectives (CLOs)
- To understand basic concepts of blockchain
- To provide knowledge about security mechanisms used in blockchain
- To appreciate the applications of blockchain in different sectors

Modules	Teaching Hours
Module 1 **Blockchain:** Distributed systems, CAP theorem, Byzantine Generals problems, Consensus, Introduction to blockchain, Generic elements of a blockchain, Features of a blockchain, Applications of blockchain technology, Tiers of blockchain technology, Types of Blockchain Consensus in blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain. **SLT:** The history of blockchain **Textbook:** Ch1	**08**
Module 2 **Decentralization:** Decentralization using blockchain, Blockchain and full ecosystem decentralization -Smart contract, organizations, autonomous organizations, autonomous corporations, autonomous societies, Platforms. **Cryptography and Technical Foundations:** Mathematics, Cryptography, Cryptographic primitives:Symmetric cryptography, DES, AES. **SLT:** Methods and Applications of decentralization **Textbook:** Ch2 & Ch3	**08**
Module 3 **Cryptographic primitives:** Asymmetric cryptography, Secure Hash Algorithms (SHAs), Merkle trees, Distributed hash tables (DHTs), Digital signatures. **SLT:** Public and private keys- RSA **Textbook:** Ch3	**08**
Module 4 **Bitcoin:** Bitcoin definition, Transactions -life cycle, structure, Blockchain: The structure of a block, The structure of a block header.	**08**

Smart Contracts: History, Definition **SLT:** Types of transaction **Textbook:** Ch4	
Module 5 **Applications of Blockchain:** Blockchain outside of Currencies: Internet of Things, Government, Health. **SLT:** Blockchain outside of Currencies: Finance and Media. **Textbook:** Ch17	**08**

Textbooks

1. Imran Bashir, "Mastering Blockchain", Packt, 2017

Reference Books

1. Mastering Bitcoin: Programing the Open Blockchain Paperback-2017 by Andreas M. O'rielly
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

Course Outcomes (COs)

At the end of the course students will be able to

CO1	**Understand** the blockchain terminologies with its applications.
CO2	Examine and **apply** the decentralization, cryptographic primitives and Bitcoin concepts.
CO3	**Analyze** the principles of Blockchain technology, Bitcoin and Smart Contracts.
CO4	Explore the applications of blockchain technology and **present** the implications in a **team.**

CO – PO – PSO Matrix

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2														
CO2	2														
CO3		2													
CO4									2	2					
AVG	**2**	**2**							**2**	**2**					

SEMESTER – VII

Course Name	: Machine Learning-II Laboratory	**Course Code:**	20CS76
Number of Lecture Hours / Week	: 01	**CIE Marks:**	50
Number of Tutorial / Practical Hours / Week	: 02	**SEE Marks:**	50
Total Number of Lecture + Tutorial/Practical Hours	: 12+24=36	**SEE Duration:**	03 Hrs.
L:T:P	: 1:0:2	**Credits:**	03

Course Prerequisites

- Basic knowledge of machine learning and neural networks
- Programming experience using Python

Course Overview

The course provides insights into various deep learning models and their design and implementation using packages/libraries for real world applications through hands-on experience.

Course Learning Objectives (CLOs)

- Design and implement deep learning models using Keras and Tensorflow libraries.
- Implement the machine learning concepts and algorithms in any suitable language of choice

PART A

The following programs can be implemented using Python libraries such as Keras, TensorFlow, NumPy, etc. Suitable datasets can be downloaded from Keras, Kaggle, etc. for model training and validation.

1. Design and implement a neural based network for generating word embedding for words in a document corpus.
2. Write a program to demonstrate the working of a deep neural network for classification task.
3. Desing and implement a Convolutional Neural Network(CNN) for classification of image dataset.
4. Build and demonstrate an autoencoder network using neural layers for data compression on image dataset.
5. Desing and implement a deep learning network for classification of textual documents.
6. Design and implement a deep learning network for forecasting time series data.
7. Write a program to enable pre-train models to classify a given image dataset.

PART – B

Open Ended Enquiry Problems

Students must apply suitable technique based on the dataset for applications such as

1. Image Recognition and Computer Vision
2. Natural Language Processing (NLP)
3. Generative Models

TYPE OF LAB EXERCISE PROBLEMS	LAB EXERCISE PROBLEM NUMBERS
DEMONSTRATION	1, 2
EXERCISE	3, 4
STRUCTURED ENQUIRY	5, 6, 7
OPEN ENDED	**PART-B**

Course Outcomes (COs) At the end of the course students will be able to	
CO1	Demonstrate the implementation of deep learning techniques
CO2	Examine various deep learning techniques for solving the real world problems
CO3	Design and implement research-oriented scenario using deep learning techniques in a team

CO – PO – PSO Matrix

CO	**PO**												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2														
CO2		2											2		
CO3			2	2					2				2		
AVG	**2**	**2**	**2**	**2**					**2**				**2**		

Semester – VII

Course Name	: DevOps Laboratory	**Course Code :**	20CS77
No. of Lecture Hours / Week	: 01	**CIE Marks :**	50
No. of Tutorial / Practical Hours / Week	: 02	**SEE Marks :**	50
Total No. of Lecture + Tutorial / Practical Hours	: 12 + 24 = 36	**SEE Duration :**	03 Hrs.
L:T:P	: 1:0:2	**Credits :**	02

Prerequisites of Course

- Basics of Computer Networks and Software Development Life cycle.
- Agile methodologies.
- Linux basic commands.

Course Overview

Course provides the insights of Continuous Integration/Continuous Deployment tools in software development life cycle

Course Learning Objectives (CLO)

- To acquaint students with various DevOps tools used in the industry
- To gain a hands-on experience for building a Continuous Integration /Continuous Deployment pipeline

A-Demonstration

A1. Demonstrate and Create project in local and remote repository using GitBash and GitHub and apply init, status, log, add, commit, push, config, clone and reset commands on repository.

A2. Demonstrate to create a project in remote repository and apply fork, merge, diff, merge conflict, branch and pull request concepts on repository using GitHub.

A3. Demonstrate the process of integration github repository with Jenkins to automate the project execution in CI/CD pipeline.

B-Exercise

B1. Create a docker image for an application stored in local repository and run the application using docker image.

B2. Create a process to dockerize the image for mysql database, demonstrate the working of client and server model using docker.

B3. Create and configure Jenkins files for workflow and build of an application and push the image on docker hub.

C-Structured Inquiry

C1. Apply maven life cycle commands on project and create a CI/CD pipeline using Jenkins.

C2. Apply Xpath to locate elements in an application for automation testing in CI/CD pipeline.

C3. Create and apply backlogs, sprints, tasks for project and retrieve data using J-query.

D-Open Ended Problem

D1. Create a Maven project and integrate all dependencies, integrate the project with github repository , integrate with docker and docker hub and create Continuous Integration / Continuous Deployment pipeline using Jenkins and enable email notification for status of build.

COURSE OUTCOMES (COs)

At the end of the course, students will be able to

CO1	**Illustrate** the fundamental of DevOps relevant to Software development and deployment	L2
CO2	**Use** DevOps tools such as GitHub, Jenkins, Maven, Docker, Selenium to perform version control, build management, defect tracking in an application	L3
CO3	**Design and Develop** end to end integration for an application using DevOps tools	L4

CO – PO – PSO Matrix

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2														2
CO2	2				3										2
CO3			3		1						2				2
AVG	2		3		2						2				2