IV Year - I Semester

S.No	Category	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	PE	UGCS7T0320 UGAI7T0120 UGAI7T0220 UGAI7T0320	**Professional Elective –III:** a) Image Processing b) Adhoc & Sensor Networks c) Network Security d) Software Testing Methodologies	3	-	-	3	30	70	100
2	PE	UGCS7T0720 UGAI7T0420 UGAI7T0520 UGAI7T0620	**Professional Elective –IV:** a) Human Computer Interaction b) Cyber Security and Cyber Laws c) Web Intelligence d) Applied Data Mining	3	-	-	3	30	70	100
3	PE	UGIT7T0620 UGIT7T0120 UGIT7T0420 UGAI7T0720	**Professional Elective –V:** a) E-Commerce & Digital Marketing b) Bio-Metrics c) Block Chain Technologies d) Drone Technologies	3	-	-	3	30	70	100
4	OE/JOE	UGAI7T0820 UGAI7T0920 UGAI7T1020	**Job Oriented Elective III:** a) Ethical Hacking b) NoSQL databases c) Cloud Technologies	2	-	2	3	30	70	100
5	OE/JOE	UGAI7T1120 UGAI7T1220 UGAI7T1320	**Job Oriented Elective IV:** a) Natural Language Processing b) Scala Programming c) Big Data Analytics	2	-	2	3	30	70	100
6	HSSE	UGMB7T0120	Management Science	3	-	-	3	30	70	100
7	SAC/SSC	UGAI7K1420	IoT Lab	1	-	2	2	50	-	50
8	Internship	UGAI7I1520	Industrial/Research Internship (after third year)	-	-	-	3	50	-	50
			Total	17	0	6	23	280	420	700
			Honors/Minor Course (4 Credits)							

IV Year - II Semester

S.No	Category	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	Major Project	UGAI8J0120	Major Project & Internship (6 Months)	-	-	20	10	100	100	200
2	Seminar	UGAI8S0220	Seminar	-	2	-	2	50	-	50
			Total	0	2	20	12	150	100	250

L – Lectures, T – Tutorials, P – Practicals, C – Credits, IM – Internal Marks, EM – External Marks, TM – Total Marks

BS - Basic Science, HSS - Humanities & Social Science, ES - Engineering Science, MC - Mandatory Course, PC - Professional Core, SOC - Skill Oriented Course, SAC – Skill Advanced Course, SSC – Soft Skill Course, OE/JOE - Open Elective/Job Oriented Elective, PE - Professional Elective, HSSE - Humanities & Social Science Elective

Syllabus
IV B.Tech I SEM

IMAGE PROCESSING
(Professional Elective-III)

Subject Code: UGCS7T0320		L	T	P	C
IV Year / I Semester		3	0	0	3

PRE-REQUISITES:
➢ Basic knowledge in Mathematics and Computer Graphics.
COURSE OBJECTIVE:
➢ The course objective is to provide introduction to basic concepts and methodologies to digital image processing, and to develop a foundation that can be used as the basis for further study and research in this field..
SYLLABUS:

UNIT I:	(08 hrs)

INTRODUCTION:
Introduction to Digital Image Processing, Fundamental steps in image processing systems, Image acquisition, Sampling and quantization, Basic relationship between pixels, Mathematical tools used in image processing, Camera model of Image, Need for image transform and spatial frequencies in image processing, 2-D DFT, DCT, DST transforms.

UNIT II:	(08 hrs)

IMAGE ENHANCEMENT:
Some basic intensity transformation functions, Histogram processing, Fundamentals of spatial filtering –smoothing spatial filters and sharpening spatial filters, combining spatial enhancement methods, Transformation and spatial filtering, Image smoothing using frequency domain filters Selective filtering and implementation.

UNIT III:	(09 hrs)

IMAGE RESTORATION & RE-CONSTRUCTION:
Image degradation/restoration model, Noise models, Restoration in the presence of noise, linear Position invariant degradation, Estimation of degradation function and inverse filtering, Wiener filtering, Constrain least square filtering.

UNIT IV:	(09 hrs)

COLOR IMAGE PROCESSING:
Color fundamentals, Color models, Pseudo color Image Processing, Basics of full color image processing, Color transformations, Smoothing and sharpening. Introduction to Video Processing.

UNIT V:	**(08 hrs)**

IMAGE COMPRESSION AND WATER MARKING:

Lossless Compression: Variable length coding, Dictionary-based coding, LZW compression, Lossy Compression, Image Compression standards, JPEG, JPEG 2000, Digital Water Marking, Frequency Domain Water Marking, Security Attacks.

UNIT VI:	**(07 hrs)**

SEGMENTATION & MORPHOLOGICAL PROCESSING:

Erosion and Dilation, Opening and closing, Hit or miss transformation, some basic Morphological algorithms, Gray-Scale Morphology, Point, line and edge detection, Thresholding, Region oriented segmentation, Segmentation using morphological watersheds, Use of motion in segmentation.

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Understand the fundamentals steps in image processing.
CO2:	Analyze different filters and transformations for the enhancement of an image.
CO3:	Apply image processing techniques for restoration, reconstruction and compression of images.
CO4:	Compare various color models to perform color image processing.
CO5:	Uunderstands the concepts of segmentation and distinguish basic morphological algorithms.

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	2	-	-	-	-	-	-	-	-	-
CO3	3	-	2	2	2	-	-	-	2	2	-	2	2	3
CO4	2	2	-	-	3	-	-	-	2	2	-	2	2	3
CO5	2	2	2	-	2	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1.	Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, 2011, Pearson Education
2.	Anil K jain, Fundementals of Digital Image Processing, 2012, Prentice Hall of India.

REFERENCE BOOKS:

1.	S.Jayaraman,S,Esakkirajan,T.Veerakumar, Digital Image Processing, 2009, McGraw Hill Publisher
2.	B.Canda and D DuttaMjumder, Digital Image Processing and analysis, 2011/12, Prentice Hall of india

ADHOC & SENSOR NETWORKS
(PROFESSIONAL ELECTIVE–III)

Subject Code: UGAI7T0120		L	T	P	C
IV Year / I Semester		3	0	0	3

PRE-REQUISITES:	
➤ Students should have a basic knowledge in computer networks	

COURSE OBJECTIVE:

➤ Understand the design issues in ad hoc and sensor networks.
➤ Learn the different types of MAC protocols.
➤ Be familiar with different types of adhoc routing protocols.
➤ Be expose to the TCP issues in adhoc networks.
➤ Learn the architecture and protocols of wireless sensor networks.
➤ Have an exposure to mote programming platforms and tools

SYLLABUS:

UNIT I: INTRODUCTION	(8 hrs)
Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor networks.	

UNIT II: MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS	(8 hrs)
Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols-Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms	

UNIT III: ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORKS	(8 hrs)
Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.	

UNIT IV: WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS	(9 hrs)
Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.	

UNIT V: WSN ROUTING, LOCALIZATION & QOS	(8 hrs)
Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design	

UNIT VI: SENSOR NETWORK PLATFORMS AND TOOLS	(7 hrs)
Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software	

platforms – TinyOS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Explain the concepts, network architectures and applications of ad hoc and wireless sensor networks
CO2:	Analyze the protocol design issues of ad hoc and sensor networks
CO3:	Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues
CO4:	Evaluate the QoS related performance measurements of ad hoc and sensor networks
CO5:	Be familiar with the OS used in Wireless Sensor Networks and build basic modules

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	3	-	-
CO3	3	2	2	1	-	-	-	-	-	-	-	3	-	-
CO4	3	2	2	1	-	-	-	-	-	-	-	3	-	-
CO5	3	2	2	1	1	-	-	-	-	-	-	3	-	-

TEXT BOOKS:

1.	Ad Hoc Wireless Networks Architectures and Protocols, C. Siva Ram Murthy and B. S. Manoj, Prentice Hall, PTR, 2004.
2.	Protocols and Architectures for Wireless Sensor Networks, Holger Karl and Andreas Willig, Wiley, 2005

REFERENCE BOOKS:

1.	sensor networks: a survey, I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, —Wireless computer networks, Elsevier, 2002, 394 - 422.
2.	Wireless Sensor Networks, Feng Zhao and Leonides Guibas, Elsevier Publication – 2002.
3.	Ad Hoc Networking, Charles E. Perkins, Addison Wesley, 2000.
4.	Wireless Sensor Networks-Technology, Protocols, and Applications, Kazem Sohraby, Daniel Minoli, & Taieb Znati, John Wiley, 2007.
5.	Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

NETWORK SECURITY
(Professional Elective-III)

Subject Code: UGAI7T0220		L	T	P	C
IV Year / I Semester		3	0	0	3

PRE-REQUISITES:
➢ Introduction to Computer Networks ➢ Cryptography ➢ Computer Fundamentals
COURSE OBJECTIVE:
➢ Able to build a solid foundation in network security concepts and design ➢ To understand computer network architectures, protocols, and interfaces. ➢ To understand the key concepts and practices employed in modern computer networking security.
SYLLABUS:

UNIT I:	(08 hrs)
Computer Networks and the Internet: What Is the Internet?, The Network Edge , The Network Core , Delay, Loss, and Throughput in Packet-Switched Networks , Protocol Layers and Their Service Models, Networks Under Attack	

UNIT II:	(08 hrs)
Security considerations in Mobile & wireless Computing: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in mobile and Wireless Computing Era, Security Challenges posed by Mobile Devices, registry Settings by Mobile Devices, Authentication Service Security, Mobile Devices: Security Implications for Organizations.	

UNIT III:	(07 hrs)
IEEE 802.11 Wireless Lan Security: Background, Authentication, Pre- WEP Authentication, Authentication in WEP, Authentication and key agreement in 802.11i, Confidentiality and Integrity: Data protection in WEP, Data protection in TKIP and CCMP	

UNIT IV:	(08 hrs)
CellPhone Security: Preliminaries, GSM(2G) Security, Security in UMTS(3G)	

UNIT V:	(08 hrs)
Biometrics-Based Security: Issues and Challenges, Introduction, Criteria for Selection of Biometrics Application, classification of Biometrics Applications, Architectural and Design Issues in Biometrics Systems, Interoperability Issues in Biometrics Systems, Standards for Biometrics, Cost of Biometrics, Economic and Social Aspects of Biometrics, Legal Challenges of Biometrics	

UNIT VI:	(07 hrs)
Intrusion Prevention and Detection: Introduction, Prevention versus Detection, Types of Intrusion Detection systems, DdoS Attack Prevention/Detection, Malware Detection	

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Enumerate the principles of Computer Networks security.	
CO2:	Describe about the design, security exposure, selective perception, and network builds.	
CO3:	Analyze the general-purpose formalism for network security essentials.	
CO4:	Illustrate the methods on network protocols, network structures, and network security layers	
CO5:	Identify the intrusion prevention and detection techniques of network security.	

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	2	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	2	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1.	Bernard Menezes, Network Security and Cryptography, CENGAGE Learning, 2010
2.	Nina Godbole, Information systems Security, Wiley India, 2017
3.	Andrew Lockhart, Network Security Hacks, O'Reilly, SPD,2006
4.	WM.Arthur Conklin, Greg White, Principles of Computer Sceurity, TMH

REFERENCE BOOKS:

1.	Greg Tomsho, Ed Tittel, David Johnson, Guide to Networking Essentials, Fifth Edition, Thomson
2.	S.Keshav, An Engineering Approach to Computer Networking, Pearson Education.

SOFTWARE TESTING METHODOLOGIES
(PROFESSIONAL ELECTIVE–III)

Subject Code: UGAI7T0320		L	T	P	C
IV Year / I Semester		3	0	0	3

PRE-REQUISITES:
➢ Basic concepts of Programming, software engineering and analytical skills.
COURSE OBJECTIVE:
This course enables the learners to have a higher level knowledge related to software testing of a product in IT industry.
➢ It focuses on various principles, methods and techniques related to various types of software testing as well as efficient testing strategies, software quality management, and automation & testing tools.
➢ Learners will get exposure to various real time testing practices testing different types of software through this course.
SYLLABUS:

UNIT I:	(7 hrs)

SOFTWARE TESTING:
Introduction, Evolution, Myths & Facts, Goals, Psychology, Definition, Model for testing, Effective Vs Exhaustive Software Testing.
Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, Software Testing Methodology**. [T1]**

UNIT II:	(8 hrs)

VERIFICATION AND VALIDATION:
Verification & Validation Activities, Verification, Verification of Requirements, High level and low level designs, how to verify code, Validation**. [T2]**
Dynamic Testing, I: Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table based testing, Cause-Effect Graphing based testing, Error guessing. [**T1**]

UNIT III:	(7 hrs)

DYNAMIC TESTING II:
White-Box Testing: need, Logic coverage criteria, Basis path testing, Graph matrices, Loop testing, data flow testing
Static Testing: inspections, Structured Walkthroughs, Technical reviews. [**T1**]

UNIT IV:	(7 hrs)

VALIDATION ACTIVITIES:
Unit testing, Integration Testing, Function testing, system testing, acceptance testing.

Regression testing: Progressives Vs regressive testing, Objectives of regression testing, when regression testing done? Regression testing types, Regression testing techniques. [**T1**]	
UNIT V:	**(6 hrs)**
AUTOMATION AND TESTING TOOLS: Need for automation, categorization of testing tools, selection of testing tools, Cost incurred, Guidelines for automated testing, overview of some commercial testing tools.	
UNIT VI:	**(6 hrs)**
Testing Web based Systems: Challenges in testing for web based software, quality aspects, web engineering, testing of web based systems, Testing mobile systems. **[T1]**	

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Understand various testing issues & solutions in software (**L2**)
CO2:	Apply modern software testing processes in relation to software Development and project management. **(L3)**
CO3:	Analyze different types of verification & validation techniques to ensure the Functioning of a software system. **(L4)**
CO4:	Create and execute test cases for object oriented and web based Projects. **(L6)**
CO5:	Evaluate different testing tools and their Working mechanisms **(L5)**

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	--	-
CO3	-	3	-	-	-	-	-	-	-	3	-	-	-	-
CO4	-	-	3	-	-	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1.	Naresh Chauhan , Software Testing, Principles and Practices, , Oxford.
3.	Yogesh Singh, Software Testing- CAMBRIDGE

REFERENCE BOOKS:

1.	Baris Beizer, Software testing techniques - International Thomson computer press, second edition.
2.	M G Limaye, Software Testing, Principles, techniques and Tools, TMH

HUMAN COMPUTER INTERACTION
(PROFESSIONAL ELECTIVE-IV)

Subject Code: UGCS7T0720		L	T	P	C
IV Year / I Semester		3	0	0	3

PRE-REQUISITES:
➢ Basic concepts of system analysis and design and exposure to various user interface designs related to web and mobile.
COURSE OBJECTIVE:
Upon successful completion of this course, students should be able to: ➢ Design clear, easy-to-understand and use interfaces and screens for graphical and Web systems. ➢ Describe and apply core theories, models and methodologies from the field of HCI.
SYLLABUS:

UNIT I	(8 hrs)
The User Interface – An Introduction and Overview: Importance of User Interface, Defining the User Interface, importance of Good Design, Benefits of Good Design, A brief history of the Human-Computer Interface. **Characteristics of Graphical and Web User Interfaces:** The Graphical User Interface, popularity of Graphics, the concept of direct manipulation, Graphical systems: Advantages and Disadvantages, Characteristics of the Graphical User Interface, The Web User Interface, The Popularity of the Web, Characteristics of a Web Interface, Principles of user interface Design.	

UNIT II	(8 hrs)
The User Interface Design process: Obstacles and Pitfalls in the Development Path, Usability, The Design Team, Understanding How People Interact with Computers, Important Human Characteristics in Design, Human Considerations in Design, Human Interaction Speeds. **Understand the Business Function:** Business Definition and Requirements Analysis, Determining Basic Business Functions, Design Standards or Style Guides, System Training and Documentation Needs.	

UNIT III	(9 hrs)
Develop System Menus and Navigation Schemes: Structures of Menus, Functions of Menus, Content of Menus, Formatting of Menus, Phrasing the Menu, Selecting Menu Choices, Navigating Menus, Kinds of Graphical Menus.	

UNIT IV	(9 hrs)
Select the Proper Kinds of Windows: Window Characteristics, Components of a Window, Window Presentation Styles, Types of Windows, Window Management, Organizing Window Functions, Window Operations, Web Systems	

UNIT V	(8 hrs)
Select the Proper Device-Based Controls: Characteristics of Device-Based Controls, Selecting the Proper Device-Based Controls. **Choose the Proper Screen-Based Controls:** Operable Controls, Text Entry/Read-Only Controls, Selection Controls, Combination Entry/Selection Controls, Other Operable Controls, Custom Controls, Presentation Controls, Selecting the Proper Controls.	
UNIT IV:	(7 hrs)
Components: Words, Sentences, Messages and Text, Text for Web Pages. **Create Meaningful Graphics, Icons and Images:** Icons, Multimedia. **Choose the Proper Colors:** Color, Color Uses, Possible Problems with Color, Color and Human Vision, Choosing Colors, Choosing Colors for Textual Graphic Screens, Choosing Colors for Statistical Graphics Screens, Choosing Colors for Web Pages, Colors to Avoid.	

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Interpret the basic principles of user interface & GUI design concepts.
CO2:	Apply interactive design principles in real-time application development with client and system requirements.
CO3:	Classify various interface design components by using modern tools.

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	-	3	-	3	3	-	-	3	3	3	3	-	-
CO3	3	-	3	-	3	3	-	-	-	-	-	3	-	-

TEXT BOOKS:

1.	1. Wilbert O Galitz, "The Essential Guide To User Interface Design", Wiley DreamaTech.
2.	Ben Shneidermann, "Designing The User Interface", 3rd Edition, Pearson Education Asia.

REFERENCE BOOKS:

1.	Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, "Human Computer Interaction", Pearson.
2.	Prece, Rogers, Sharps, "Interaction Design", Wiley Dreamtech.
3.	Soren Lauesen, "User Interface Design", Pearson Education.

CYBER SECURITY and CYBER LAWS
(Professional Elective-IV)

Subject Code: UGAI7T0420		L	T	P	C
IV Year / I Semester		3	0	0	3

COURSE OBJECTIVE:
- To understand various types of cyber-attacks and cyber-crimes   - To learn threats and risks within context of the cyber security   - To have an overview of the cyber laws & concepts of cyber forensics   - To study the defensive techniques against these attacks.

SYLLABUS:	
UNIT I:	**(08 hrs)**
Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.	
UNIT II:	**(08 hrs)**
Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics	
UNIT III:	**(08 hrs)**
Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Organizational security Policies and Measures in Mobile Computing Era, Laptops.	
UNIT IV:	**(10 hrs)**
Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.	
UNIT V:	**(08 hrs)**
Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Datalinking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial domains	

UNIT VI:	(06 hrs)
Cybercrime: Examples and Mini-Cases Examples: Indian Banks Lose Millions of Rupees, Parliament Attack, e-mail spoofing instances. Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain	

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Analyse cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.
CO2:	Interpret and forensically investigate security incidents
CO3:	Apply policies and procedures to manage Privacy issues
CO4:	Design and develop secure software modules

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	-	3	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-		-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1.	Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and SunitBelpure,Wiley
2.	Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, B.B.Gupta, D.P.Agrawal, Haoxiang Wang, CRC Press, ISBN 9780815371335, 2018

REFERENCE BOOKS:

1.	Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRCPress.
2.	Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

WEB INTELLIGENCE
(PROFESSIONAL ELECTIVE–IV)

Subject Code : UGAI7T0520		L	T	P	C
IV Year / I Semester		3	0	0	3

PRE-REQUISITES:	
➢ The student must have a solid background in mathematics, algorithms, and data structures.	
COURSE OBJECTIVE:	
➢ Student will study how to search and gather the data in the web and process as well as mine that data to extract meaningful information to understand its application to search engines. Students will gain an understanding of the strategic and operational aspects of Web analytics.	
SYLLABUS:	

UNIT I: INTRODUCTION TO WEB	**(8 hrs)**
Introduction to Internet, web, blogs, tweets, wikis, grid, and cloud. Collaborative mapping, Components of typical web, Characteristics and benefits of the Web.	
UNIT II: WEB INTELLIGENCE	**(8 hrs)**
Semantic web, Social intelligence, Search engine techniques, Web information retrieval and filtering, Levels of WI, Goal of WI, Characteristics of web intelligence, Challenges and issues of WI, Future of WI.	
UNIT III: WEB INFORMATION RETRIEVAL	**(9 hrs)**
Managing web data. Web search engines, Google searching, Introduction to web crawler, Architecture of a web crawler, Distributed crawling, Focused spiders/crawlers, Collaborative crawling, Some tools and open source for web crawling, Models of information retrieval.	
UNIT IV: WEB MINING	**(9 hrs)**
Introduction to data mining: Classification & clustering, Pattern recognition, Introduction to web mining, Evolution, Process, Web content mining, Web usage mining, Web structure mining.	
UNIT V: INTELLIGENT WEB ALGORITHMS	**(8 hrs)**
The intelligent-algorithm lifecycle, Classes of intelligent algorithm, Recommendation engines based on users, items, and content.	
UNIT IV: WEB ANALYTICS	**(7 hrs)**
How Web Analytics Works – Basic Concepts, collection of Web Data and other types of data, basic dashboards, Predictive Analytics, Web Analytics Ecosystem and Tools, Data Visualization, Acquisition and Conversions.	

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Understand the concepts of web, web mining, web intelligence and analytics.
CO2:	Implement Web Mining using web intelligent algorithms.
CO3:	Apply how to retrieve information from web.
CO4:	Deploy web/social analytics platforms such as Google Analytics.

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	3	2	3	3	-	-	-	2	-	-	3	2	-
CO3	3	3	2	3	3	-	-	-	2	-	-	3	2	-
CO4	3	3	2	3	3	-	-	-	2	-	-	3	2	-

TEXT BOOKS:

1.	Priti Srinivas Sajja, Rajendra Akerkar, Intelligent Technologies for Web Applications - CRC Press - Taylor & Francis Group.
2.	Douglas G. McIlwraith, HaralambosMarmanis, and Dmitry Babenko , Algorithms of the Intelligent Web, Second Edition -Manning Publications.

REFERENCE BOOKS:

1.	Matthew A. Russell and Mikhail Klassen, Mining the Social Web, Third Edition, Published by O'Reilly Media. 4.
2.	Ian Witten, Eibe Frank, Mark Hall, Christopher Pal, Data Mining Practical Machine Learning Tools and Techniques, Fourth Edition, Elsevier.

APPLIED DATA MINING
(PROFESSIONAL ELECTIVE–IV)

Subject Code: UGAI7T0620		L	T	P	C
IV Year / I Semester		3	0	0	3

PRE-REQUISITES:
➢ Basic knowledge in Data Science and Statistics.
COURSE OBJECTIVE:
➢ This course enables students to extract knowledge from big datasets by applying supervised and unsupervised data mining methods using software tools
SYLLABUS:

UNIT I: ORGANISATION OF THE DATA	(8 hrs)
From the data warehouse to the data marts, The data warehouse, The data webhouse, Data marts, Classification of the data, The data matrix, Binarisation of the data matrix, Frequency distributions, Univariate distributions, Multivariate distributions, Transformation of the data, Other data structures	
UNIT II: EXPLORATORY DATA ANALYSIS	**(8 hrs)**
Univariate exploratory analysis, Bivariate exploratory analysis, Multivariate exploratory analysis of quantitative data, Multivariate exploratory analysis of qualitative data, Reduction of dimensionality	
UNIT III: COMPUTATIONAL DATA MINING	**(9 hrs)**
Measures of distance, Cluster analysis, Linear regression, Logistic regression, Tree models, Neural networks, Nearest-neighbour models .	
UNIT IV: STATISTICAL DATA MINING	**(9 hrs)**
Uncertainty measures and inference, Non-parametric modeling, The normal linear model , Generalised linear models, Log-linear models, Graphical models.	
UNIT V: EVALUATION OF DATA MINING METHODS	**(8 hrs)**
Criteria based on statistical tests:Distance between statistical models, Discrepancy of a statistical model, The Kullback–Leibler discrepancy. Criteria based on scoring functions, Bayesian criteria, Computational criteria, Criteria based on loss functions.	
UNIT IV: BUSINESS CASES	**(7 hrs)**
Market basket analysis: Objectives of the analysis, Description of the data, Exploratory data analysis, Model building, Log-linear models, Association rules. Web clickstream analysis: Objectives of the analysis, Description of the data, Exploratory data analysis, Model building, Sequence rules, Link analysis, Probabilistic expert systems, Markov chains.	

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Understand how data can be organized and analysed to apply data mining techniques.
CO2:	Understand various computational and statistical techniques for data mining and their applications.
CO3:	Evaluate different data mining models.
CO4:	Apply data mining methods in different business cases.

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	-	-	-	2	2	-	3	2	-
CO2	3	3	3	3	3	-	-	-	2	2	-	3	2	-
CO3	3	3	3	3	3	-	-	-	2	2	-	3	2	-
CO4	3	3	3	3	3	-	-	-	2	2	-	3	2	-

TEXT BOOKS:

1.	Applied Data Mining, Statistical Methods for Business and Industry, PAOLO GIUDICI, , Wiley–Blackwell; 2nd Edition.
2.	Data Mining: Concepts and Techniques, Han, Jiawei, Kamber, Michelle, and Pei, Jian, , 3rd ed. By. Elsevier, 2012. ISBN 978-0-12-381479-1.

REFERENCE BOOKS:

1.	Data Mining - Concepts and Techniques, Jiawei Han, Jian Pei & Michcline Kamber, Morgan Kauffman Publishers.
2.	Data Mining and Data Warehousing Principles and Practical Techniques, Parteek Bhatia, 1st edition, Cambridge University Press.

E-COMMERCE & DIGITAL MARKETING
(PROFESSIONAL ELECTIVE–V)

Subject Code: UGIT7T0620		L	T	P	C
IV Year / I Semester		3	0	0	3

PRE-REQUISITES:	
➢ Knowledge on traditional commerce and business processes ➢ Basics of internet and online related transactions	
COURSE OBJECTIVE:	
➢ Basic concepts of e-business and e-commerce, including presentation and discussion of the strategies and technologies involved ➢ Concepts and challenges of e-business, including a balanced coverage of both the technical and the management (operational, tactical and strategic) aspects of successful e-business ➢ Concepts of business strategies, and technologies involved in the design and deployment of business and Digital Marketing on the internet and World Wide Web.	
SYLLABUS:	

UNIT I: ELECTRONIC COMMERCE	(8 hrs)
Frame work, anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications, Consumer Oriented Electronic commerce, Mercantile Process models	

UNIT II: ELECTRONIC PAYMENT SYSTEMS	(8 hrs)
Smart Cards, Credit Cards, Risks in Electronic Payment systems.	

UNIT III: INTER ORGANIZATIONAL COMMERCE	(8 hrs)
EDI, EDI Implementation, Value added networks, Intra Organizational Commerce - work Flow, Automation Customization and internal Commerce, Supply chain Management.	

UNIT IV: CORPORATE DIGITAL LIBRARY	(9 hrs)
Document Library, digital Document types, corporate Data Warehouses, Advertising and Marketing - Information based marketing, Advertising on Internet, on-line marketing.	

UNIT V: INTRODUCTION TO DIGITAL MARKETING	(8 hrs)
Origin of Digital Marketing, traditional Vs Digital Marketing, internet users, Digital Marketing strategy, Digital marketing Advertisement in India.	

UNIT VI: DIGITAL MARKETING STRATEGIES	(7 hrs)
Social median marketing, Facebook Marketing-Introduction, Anatomy of an ad campaign, adverts.	

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Comprehend the increasing significance of E- Commerce and its applications in Business and Various Sectors
CO2:	To identify various Payment, Security, Privacy and Legal Issues.
CO3:	To develop skills of students in relation with application of IT in E-Commerce.
CO4:	To explore the students to the latest trends in marketing.
CO5:	Analyze the confluence of Digital marketing and operations in real- time delivery.

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	3	-	-	-	3	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO3	-	-	3	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1.	Frontiers of electronic commerce, Ravi Kalakata, Andrew B.Whinston, Pearson education.
2.	Digital Marketing, Seema Gupta, McGraw HILL Education.

REFERENCE BOOKS:

1.	-Commerce fundamentals and applications by Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, - John Wiley.
2.	E-Commerce by S.Jaiswal – Galgotia.
3.	E-Commerce by EfrainTurbon, Jae Lee, David King, H.Michael Chang.
4.	Electronic Commerce by Gary P.Schneider – Thomson

BIOMETRICS
(PROFESSIONAL ELECTIVE–V)

Subject Code: UGIT7T0120		L	T	P	C
IV Year / I Semester		3	0	0	3

PRE-REQUISITES:
➢ Knowledge on Biometric authentication process ➢ Awareness on different biometric devices
COURSE OBJECTIVE:
➢ Understand the Biometric technology including the definition, terminologies used, parameters and basic features. ➢ Learn the principle, process, hardware used and issues for the different biometric methods like finger, facial, iris, voice, hand, signature, keystroke, AFIS and retina. ➢ Know the different biometric applications. ➢ Know the difference between physiological and behavioural biometrics.
SYLLABUS:

UNIT I	(06 hrs)
Introduction – Why Biometrics? - Benefits of biometrics versus Traditional Authentication methods, Benefits of biometrics in identification Systems **Key Biometric Terms and Processes** - Definitions, Verification and identification, Logical versus Physical Access, how biometric matching works, **Accuracy in biometric systems**– False match rate, False non-match rate, Failure to enroll rate, Derived metrics. **[T1]**.	

UNIT II	(8 hrs)
Finger scan – Components, how finger scan technology works, competing finger Scan technologies, Finger scan Deployments, Finger scan Strengths, Finger scan weaknesses. **[T1]** **Facial Scan** – Components, how facial scan technology works, competing facial Scan technologies, Facial scan Deployments, Facial scan Strengths, Facial scan weaknesses. **[T1]**	

UNIT III	(9 hrs)
Iris Scan - Components, how it works, Deployments, Iris scan Strengths, Iris scan weaknesses. **[T1]** **Voice Scan** - Components, how it works, Deployments, Voice scan Strengths, Voice scan weaknesses. **[T1]**	

UNIT IV	(9 hrs)
Other physiological biometrics – Hand Scan, Retina Scan, Automatic Fingerprint Identification Systems (AFIS)	

Other Leading Behavioral Biometrics – Signature scan, keystroke scan. **[T1]**	
UNIT V	**(8 hrs)**
Categorizing Biometrics Applications – Defining the Seven Biometric Applications, Introduction to IBG's Biometric Solution Matrix **Assessing the Privacy Risks of Biometrics** – Bio Privacy Technology Risk Ratings **Biometric standards** – Why Standards? Application Programming Interfaces. **[T1]**	
UNIT IV	**(8 hrs)**
Recommended Biometric for Network Security – Finger Biometrics, Face Biometrics, Voice Biometrics, Iris Biometrics, the Choice of a Biometric for Network Access **An Introduction to Statistical Measures of Biometrics** – FAR, FRR, FTE, EER, and What Measure is Most Important? **The Biometric Transaction** – Securing and Trusting a Biometric Transaction, Trusted Biometric Devices, and non-trusted biometric devices, Matching Location. **[T2]**	

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Identify various biometric techniques and standards. **[L3]**
CO2:	Categorizes biometric applications and technologies to real time
CO3:	Problems. **[L4]**
CO4:	Describe various biometric mechanisms. **[L2]**

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	-	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1.	Biometrics–Identity Verification in a Networked World, Samir Nanavati, Michael Thieme, Raj Nanavati, A Wiley Tech Brief.
2.	Biometrics for Network Security, Paul Reid, Pearson Education.

REFERENCE BOOKS:

1.	Biometrics- The Ultimate Reference, John D. Woodward, Jr. Wiley Dreamtech

2.	Woodward, J.D. and Orlans, Nicholos M., Biometrics, McGraw Hill
3.	Implementing Biometric Security", John Chirillo, Scott Blaul, Wiley

ONLINE COURSES / REFERENCES:

1.	"Biometrics-An introductory course about understanding the different types and uses of biometrics" Created by Art of Service – Udemy course
2.	"Biometrics"- offered by IIT Kanpur – NPTEL Course
3.	"Usable Security" offered by University of MaryLand – Coursera course
4.	https://blog.mantratec.com/category/biometric-technology
5.	https://www.bayometric.com/biometric-blog/
6.	https://www.aware.com/blog/

BLOCKCHAIN TECHNOLOGIES
(Professional Elective-V)

Subject Code: UGIT7T0420		L	T	P	C
IV Year / I Semester		3	0	0	3

PRE-REQUISITES:
➢ The prerequisites to learn about blockchain technology are important to identify whether you are ready for blockchain concepts.
COURSE OBJECTIVE:
➢ To give students the understanding of emerging abstract models for Blockchain Technology and to familiarize them with the functional/operational aspects of cryptocurrency eco-system.

SYLLABUS:	
UNIT I:	**(08 hrs)**
Basics of Blockchain: Introduction, Concept of Blockchain, History, Definition of Blockchain, Fundamentals of Blockchain, Characteristics of Blockchain, Consensus in Trust-Building Exercise, Public, Private, and Hybrid Blockchains, Distributed Ledger Technologies, DLT Decentralized Applications and Databases, Architecture of Blockchain, Transactions, Chaining Blocks, Value Proposition of Blockchain Technology.	
UNIT II:	**(08 hrs)**
Architecture of Blockchain: Architecture of Blockchain, Transactions, Chaining Blocks, Value Proposition of Blockchain Technology. **Consensus:** Introduction, Consensus Approach, Consensus Algorithms, Byzantine Agreement Methods.	
UNIT III:	**(08 hrs)**
Blockchain Components: Introduction, Ethereum, History, Ethereum Virtual Machine, Working of Ethereum, Ethereum Clients, Ethereum Key Pairs, Ethereum Addresses, Ethereum Wallets, Ethereum Transactions, Ethereum Languages, Ethereum Development Tools.	
UNIT IV:	**(10 hrs)**
Smart Contracts: Introduction, Smart Contracts, Absolute and Immutable, Contractual Confidentiality, Law Implementation and Settlement, Characteristics, Internet of Things, **Bitcoin:** Introduction, Working of Bitcoin, Merkle Trees, Bitcoin Block Structure, Bitcoin Address, Bitcoin Transactions, Bitcoin Network, Bitcoin Wallets, Bitcoin Payments, Bitcoin Clients, Bitcoin Supply	
UNIT V:	**(08 hrs)**
Blockchain and Allied Technologies: Blockchain and Cloud Computing, Characteristics of Blockchain Cloud, Blockchain and Artificial Intelligence, Blockchain	

	and IoT, Blockchain and Machine Learning, Blockchain and Robotic Process Automation	
UNIT VI:		**(06 hrs)**
Introduction to Augmented Reality: What Is Augmented Reality - Defining augmented reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality Augmented Reality Concepts- How Does Augmented Reality Work? Concepts Related to Augmented Reality, Ingredients of an Augmented Reality Experience.		

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Apply and explore the working of Blockchain technology Architecture and components. (Apply)
CO2:	Analyze the working of Smart Contracts. (Analyze)
CO3:	Analyze and evaluate Crypto currency. (Evaluate)
CO4:	Apply the learning of solidity and de-centralized apps on Ethereum. (Apply)

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO2	-	-	3	-	-	3	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	3	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1.	Blockchain Technology: Concepts and Applications.Kumar Saurabh, Ashutosh Saxena,Wiley.
2.	Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016), ISBN-10: 9332578494.
3.	Allan Fowler-AR Game Development‖, 1st Edition, A press Publications, 2018, ISBN 978- 1484236178 2

REFERENCE BOOKS:

1.	Blockchain Technology, Chandramouli Subramanian, Asha A George, Abhilash K A and Meena Karthikeyan, Universities Press
2.	Blockchain Basics: A Non-Technical Introduction in 25 Steps by Daniel Drescher, Apress.
3.	Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016.

DRONE TECHNOLOGIES
(Professional Elective-V)

Subject Code: UGAI7T0720		L	T	P	C
IV Year / I Semester		3	0	0	3

PRE-REQUISITES:
➢ Basic knowledge on electrical and electronics
COURSE OBJECTIVE:
➢ To understand the basics of Unmanned Arial Vehicles (Drones) and its various applications.   ➢ To learn fundamental concepts of electrical and electrics required for the drone.   ➢ The students will be introduced to the safety and operational considerations during building and flying the drone.
SYLLABUS:

UNIT I:	(06 hrs)
Introduction to Drones: Definitions, History of UAVs, Classification of UAVs, Applications of Drones, safety & operational considerations**. [T2,T3]**	

UNIT II:	(08 hrs)
Basic Electrical and Electronics: **Electrical:** Voltage, Current, Power, Speed, Torque, series and parallel connection sources.**[T1]** **Electronics:** Basics of Diodes, Transistors and FET's (definitions, V-I Characteristics and Switching behavior), Concept of Relays, LEDs.**[T1]**	

UNIT III:	(09 hrs)
Concepts of Flight: Aerodynamics, Flight Performance, Stability and Control **[T3,T4]**	

UNIT IV:	(09 hrs)
Components and Specifications-1: **Flight Controller:** Basics of Microcontrollers (Definition, types and Applications), Modes of Communications,(IR and RF Transmitter, Receiver.) **[T2,T4]** **Battery:** Types, Selection, Charge-Discharge states, diode bridge rectifier (AC-DC)-5V, 12V, Battery charger. **[T2,T4]**	

UNIT V:	(08 hrs)
Components and Specifications-2: **Propeller System:** Propellers, types of propellers, selection of propellers.**[T4]** **BLDC Motors:** Principles of operation, Construction. **[T4]** **ESC (Motor Driver):** PWM, Speed Control.**[T4]**	

UNIT VI:	(07 hrs)
Payload and Case Studies: **Impact of Payloads:** Types of Payloads and their application sensors, Case Studies.**[T3,T4]**	

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Explore various considerations for building a drone like electrical, electronics, aerodynamics, safety and operations aspects. **[L2]**
CO2:	Differentiate between various components used for building application specific drones. **[L4]**
CO3:	Apply the concepts of electrical, electronic and aerodynamics for developing drone solutions. **[L3]**
CO4:	Create a working prototype in teams, involving design, assembling, calibrating and testing using appropriate hardware components and software tools. **[L5]**

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	-	2	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	3	-	3	-	-	-	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1.	Basic Electrical and Electronics Engineering by S.K. Bhattacharya 2011, Pearson Education
2.	DIY Drones for the Evil Genius: Design, Build, and Customize Your Own Drones by Fitz Tepper, Ian Cinnamon, and Romi Kadri, Tata McGraw-Hill, 2016
3.	Unmanned Aircarft System, UAVS Design, Development and Deployment, Reg Austin - Wiley
4.	Make: Getting Started with Drones by Terry Kilby & Belinda Kilby, SPD

REFERENCE BOOKS:

1.	Basic Electrical and Electronics Engineering by S.K. Bhattacharya 2011, Pearson Education
2.	DIY Drones for the Evil Genius: Design, Build, and Customize Your Own Drones by Fitz Tepper, Ian Cinnamon, and Romi Kadri, Tata McGraw-Hill, 2016
3.	Unmanned Aircarft System, UAVS Design, Development and Deployment, Reg Austin - Wiley
4.	Make: Getting Started with Drones by Terry Kilby & Belinda Kilby, SPD

ONLINE RESOURCES:
1. http://www.faa.gov/
2. http://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak/
3. http://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_107-2pdf
4. http://dronetraininghq.com/
5. http://www.precisionhawk.com/lancaster
6. https://3dr.com/
7. http://www.dji.com/
8. https://oscarliang.com/build-a-quadcopter-beginners-tutorial-1/
9. https://blog.owenson.me/build-your-own-quadcopter-flight-controller/
10. http://andrew.gibiansky.com/blog/physics/quadcopter-dynamics/
11. http://blog.owenson.me/build-your-own-quadcopter-flight-controller/

ONLINE COURSES:

- Make an Open Source Drone in Udemy
  https://www.udemy.com/course/make_a_drone/

ETHICAL HACKING
(Job Oriented Elective II)

Subject Code: UGAI7T0820		L	T	P	C
IV Year / I Semester		2	0	2	3

PRE-REQUISITES:
➢ Familiarity with Computer Networks and Information Security
COURSE OBJECTIVE:
➢ This course introduces the concepts of Ethical Hacking and gives the students the opportunity to learn about different tools and techniques in hacking and security. This makes students to understand how perimeter defenses work, escalate privileges and lead them to know about scanning and attacking of networks. Students will also learn about Intrusion Detection, Policy Creation, Social Engineering, DDoS Attacks, Buffer Overflows and Virus Creation
SYLLABUS:

UNIT I:	(09 hrs)

INTRODUCTION:

Hacking (Effects, Types, Purpose, advantages and disadvantages), Types of Hackers, Types of Cybercrimes, Ethical Hacking, Types of Data Stolen from the Organizations and its protection, Elements of Information Security (Confidentiality, Integrity, Availability, Authentication, Non – repudiation and Access control), Information Security Challenges, Penetration Testing (Objectives, Types, preliminary knowledge of Process), Role of Security Penetration Tester, Benefits of a Penetration Testing Methodology, Penetration Testing Methodology, Networking and Computer Attacks and its protection.

UNIT II:	(07 hrs)

Malicious Software:

Protection and detection of malicious software (Virus, Macro virus, Worms, Trojan programs, Spyware & Adware), Protection against from all Malware, Intruder Attacks on Networks and Computers (including Proxy and Packet Filtering, Denial of Service, Sniffer.), Addressing Physical Security, Key Loggers and its types, Back Doors.

UNIT III:	(09 hrs)

Pre – Attack Phase:

Foot Printing: Web Tools for Foot Printing (Purpose, Types, Techniques), Conducting Competitive Intelligence and Techniques, Google Hacking, Scanning (Types and Methodologies), Steps of Scanning, Types of port scanning, Scanning Tools: NMAP, Angry IP Scanner, Advanced IP Scanner, Types of Pings, Enumeration and its different tools.

Social Engineering: Shoulder Surfing, Dumpster Driving, Piggybacking.

UNIT IV:	(08 hrs)
Data Security: Physical Security - Attacks and Protection, Steganography – Methods, Attacks and Measures, Cryptography – Methods and Types of Attacks, Wireless Hacking, Windows Hacking, Linux Hacking.	
UNIT V:	(09 hrs)
Network Protection System: Routers, Firewalls & Honeypots, Web Filtering, Vulnerability, Penetration, Testing, Session Hijacking, Web Servers, SQL Injection, Cross Site Scripting, Exploit Writing, Buffer Overflow, Reverse Engineering, E-mail Hacking, Bluetooth Hacking, Mobile Phone Hacking.	
UNIT VI:	(08 hrs)
Ethical Hacking Laws and Tests: Legal, Professional and Ethical Issues, Ethical Responsibilities, Professional Integrity, Host Reconnaissance, Session Hijacking, Hacking Web servers, Databases, Password Cracking, Methodical Penetration Testing,IT acts & amendments in India,(aadhar bill, privacy bill etc)	

Experiments:

1) OWASP-10, Cookie/Session based vulnerabilities - Session Fixation, Session Hijacking, Insecure Cookie Attributes
2) Familiarity of KaliLinux
3) Injection attacks - Cross Site Scripting (XSS), SQL Injection, HTML Injection, CSS Injection, XML injection, OS Command Injection
4) Remote code execution
5) local file inclusion
6) remote file inclusion
7) Insecure file upload
8) Path Traversal / Directory Listing
9) Cache Misconfiguration
10) Brute force attacks
11) Denial of Service
12) Distributed Denial of Service

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Interpret several types of hacking, elements and challenges in information security, penetration testing methodology for data protection
CO2:	Learn techniques to detect and protect networks and computers from malicious software's by using Foot Printing and Scanning Tools.
CO3:	Summarize data protection techniques and network protection systems.
CO4:	Choose relevant legal and ethical hacking laws to apply on Hackers and Intruders.
CO5:	Analyse the vulnerabilities of the target system

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	-	-	3	3	-	3	2	2	-	3	-	-
CO2	3	3	-	-	3	-	-	3	2	2	-	3	-	-
CO3	3	3	-	-	-	-	-	3	2	2	-	3	-	-
CO4	3	3	-	-	3	3	-	3	2	2	-	3	-	-
CO5	-	-	3	-	3	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

| 1. | Michael T. Simpson, Kent Backman, James E Corley, Hand-On Ethical Hacking and Network Defense, Second Edition, CENGAGE Learning |

REFERENCE BOOKS:

| 1. | Manthandesai, Basics of Ethical hacking, Hacking for beginners, Hacking Tech. |
| 2. | Patrick Engebretson, The Basics of Hacking and Penetration Testing Ethical Hacking and Penetration Testing Made Easy, Syngress –Elsevier. |

NoSQL DATABASES
(Job Oriented Elective II)

Subject Code: UGAI7T0920		L	T	P	C
IV Year / I Semester		2	0	2	3

PRE-REQUISITES:	
➢ The students should have knowledge on Database Management Systems.	
COURSE OBJECTIVE:	
➢ The course is intended to familiarize with various NoSQL Databases to handle structured, semi-structured and unstructured data.	
SYLLABUS:	
UNIT I:	**(08 hrs)**
Introduction: Early Database Management Systems, Relational Database Revolution, Motivations for NoSQL Databases, Four Types of NoSQL Databases - Key-Value Databases, Document Databases, Column Family Databases, Graph Databases	
UNIT II:	**(09 hrs)**
Key-Value Databases: From Arrays to Key-Value Databases, Essential Features of Key-Value Databases, Keys: More Than Meaningless Identifiers, Values: Storing Just About Any Data You Want, Key-Value Database Data Modeling Terms, Key-Value Architecture Terms, Key-Value Implementation Terms, Key Design and Partitioning, Designing Structured Values, Limitations of Key-Value Databases.	
UNIT III:	**(08 hrs)**
Document Databases: What is a Document?, Avoid Explicit Schema Definitions, Basic Operations on Document Databases, Document and Collection Terms, Types of Partitions, Data Modeling and Query Processing, Designing for Document Databases.	
UNIT IV:	**(10 hrs)**
Column Family Databases: Column Family Database Features, Architectures Used in Column Family Databases, When to Use Column Family Databases, Basic Components of Column Family Databases, Implementing Column Family Databases, Internal Structures and Configuration Parameters, Clusters and Partitions, Processes and Protocols, Designing for Column Family Databases.	
UNIT V:	**(08 hrs)**
Graph Databases: What Is a Graph?, Graphs and Network Modeling, Advantages of Graph Databases, Elements of Graphs, Operations on Graphs, Properties of Graphs and Nodes, Types of Graphs, Designing for Graph Databases.	
UNIT VI:	**(06 hrs)**

Guidelines for Selecting a NoSQL Database: Selecting Key-Value Databases, Selecting Document Databases, Selecting Column Family Databases, Selecting Graph Databases, Using NoSQL and Relational Databases together, List of NoSQL Databases.

Experiments:

1. Installation and setup of MongoDB Client and Server
2. Demonstrate the mongo Shell environment and Create database with collections and documents in JSON format
3. Demonstrate the commands of MongoDB – Insert, Query, Update, Delete, Projection, Index
4. Demonstrate various MongoDB queries such as displaying all the records, displaying selected records with conditions, sort, and aggregates.
5. Demonstrate how the operations like comparison and logical query operators - $gt, $gte, $lt, $lte, $in, #nin, $ne, $and, $or, $not, $nor are performed in MongoDB
6. Demonstrate how to Perform the operations on MongoDB database using element, array based and evaluation query operators -$exists, $type, $mod, $regex, $where
7. Demonstrate how to handle datasets in MongoDB and Import various collections and apply some queries to get specified output.
8. Demonstrate the CRUD Operations on Google Firebase

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Understand the need of NoSQL Databases and compare different NoSQL Databases such as Key-Value, Document, Column Family and Graph Databases.
CO2:	Demonstrate competency in designing Key-Value and Document databases.
CO3:	Demonstrate competency in designing Column Family and Graph databases.
CO4:	Choose NoSQL databases for a specific application.

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO4	3	3	3	-	3	-	-	-	-	-	-	3	3	-

TEXT BOOKS:

1.	NoSQL for Mere Mortals, Dan Sullivan, Addison Wesley.
2.	NoSQL For Dummies, Adam Fowler, John Wiley & Sons Inc.

REFERENCE BOOKS:

1.	Next-Generation Databases, Guy Harrison, Apress.
2.	Professional NoSQL, Shashank Tiwari, Wrox Press
3.	NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pramod J Sadalage, Martin Fowler, Addison Wesley.

CLOUD TECHNOLOGIES
(Job Oriented Elective-II)

Subject Code: UGAI7T1020		L	T	P	C
IV Year / I Semester		2	0	2	3

PRE-REQUISITES:
➢ Familiarity with Operating Systems, Computer Networks and Database Management Systems.
COURSE OBJECTIVE:
➢ To provide students with the comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications.
SYLLABUS:

UNIT I:	(08 hrs)
Computing Paradigms: High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing. **Cloud Computing Fundamentals:** Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models, Three Service Offering Models	

UNIT II:	(08 hrs)
Cloud Computing Architecture and Management: Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications, on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure, Managing the Cloud application, Migrating Application to Cloud-Phases of Cloud Migration, Approaches for Cloud Migration.	

UNIT III:	(08 hrs)
Cloud Deployment Models: Introduction, Private Cloud, Characteristics, On-Premise Private Cloud, Outsourced Private Cloud, advantages and disadvantages, Public Cloud Characteristics, Suitability, Issues, Advantages, Disadvantages, Community Cloud, Characteristics, Suitability, On-Premise Community Cloud Issues, Outsourced Community Cloud, Issues, Advantages, disadvantages, Hybrid Cloud, Characteristics, Suitability, Issues, Advantages, Disadvantages	

UNIT IV:	(10 hrs)
Cloud Service Models: Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS	

UNIT V:	(08 hrs)
Virtualization: Introduction. Virtualization Opportunities-Processor Virtualization, Memory, Virtualization, Storage Virtualization, Network Virtualization, Data Virtualization, Application Virtualization, Approaches to Virtualization, Full Virtualization, Para virtualization, Hardware-Assisted Virtualization, Hypervisors, Types of Hypervisors, Security Issues and Recommendations Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS	
UNIT VI:	(06 hrs)
Security in Cloud Computing: Introduction, Cloud in Information Technology, Cloud General Challenges, Security Aspects, Data Security, Data Centre Security, Access Control, Encryption and Decryption, Virtualization Security, Network Security, Platform-Related Security, Security Issues in Cloud Service Models, Software-as-a-Service Security Issues, Platform-as-a-Service Security, Infrastructure-as-a-Service Security Issues	

Lab Experiments:
1. Demonstrate the creation of the Amazon VPC using the VPC Wizard
2. Demonstrate the following components of a VPC:
   a. Public and private subnets
   b. Route tables and routes
   c. NAT Gateways
   d. Network ACLs
   e. Elastic IPs
3. Demonstrate the following with respect to EC2
   a. Launch a web server with termination protection enabled
   b. Monitor the EC2 instance created
   c. Modify the security group that your web server is using to allow HTTP access
   d. Resize the Amazon EC2 instance to scale and EC2 limits
   e. Terminate the EC2 instance

Storage: Introduction to Elastic Block Store - EBS, EBS Snapshots, EBS Volume Types Introduction to Simple Storage Service (S3),Object Storage Vs. Block Storage, Static Website Hosting
1. Demonstrate the following with respect to Amazon S3
   a. Create a bucket in Amazon S3
   b. Add an object to a bucket
   c. Manage access permissions on an object and a bucket
   d. Use bucket versioning
   e. Static Website Hosting

f. Store images and show them in the browser

Elastic Load Balancers: Understanding High Availability Configuration, ELB Configuration
Auto Scaling

1. Demonstrate the following with respect to Elastic Load Balancers
   a. Create a Network Load Balancer and use the two web servers as Elastic Load Balancer targets
   b. Test the default functionality of the load balancer
   c. Enabled Cross-Zone load balancing and test how the load balancer behaves
   d. Test the behavior of your load balancer during a failure of one of the web servers
   e. Test the behavior of your load balancer after the web server has recovered from the failure

Identity & Access Management: Root Account Vs IAM user, Multi-Factor Authentication for Users, IAM Password Policies, Creating Customer Managed Policies - Groups, Roles
1. Exploring pre-created IAM Users and Groups

2. Inspecting IAM policies as applied to the pre-created groups
3. Following a real-world scenario, adding users to groups with specific capabilities enabled
4. Locating and using the IAM sign-in URL
5. Experimenting with the effects of policies on service access

Database Services: Amazon RDS, DynamoDB
1. Demonstrate the following with respect to Amazon RDS
   a. Create an Amazon Relational Database Service (RDS) instance
   b. Creating a MySQL DB instance
   c. Connecting to a database on a DB instance running the MySQL database engine
   d. Enter data into the MySQL database
   e. Query the MySQL database table
   f. Deleting a DB instance
2. Demonstrate the following with respect to DynamoDB
   a. Create an Amazon DynamoDB table
   b. Enter data into an Amazon DynamoDB table
   c. Query an Amazon DynamoDB table
   d. Delete an Amazon DynamoDB table

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Distinguish the different models and computing paradigms. (L4)
CO2:	Analyze the reasons for migrating into cloud (L4)
CO3:	Apply the services in the cloud for real world scenarios (L4)
CO4:	Make use of cloud services effectively in terms of infrastructure ,platform and software (L3).
CO5:	Explain the levels of virtualization and resources virtualization (L2)

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
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CO2	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1.	Essentials of cloud Computing: K. Chandra sekhran, CRC press

REFERENCE BOOKS:

1.	Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
2.	Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
3.	Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp2011.

NATURAL LANGUAGE PROCESSING
(JOB ORIENTED ELECTIVE-III)

Subject Code: UGAI7T1120		L	T	P	C
IV Year / I Semester		2	0	2	3

PRE-REQUISITES:
➢ Student must familiar with probability, linear algebra, and calculus ➢ Students must familiar with Python and Machine Learning
COURSE OBJECTIVE:
➢ Introduces fundamental concepts and techniques of NLP ➢ Provides in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information ➢ Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems ➢ Explore Machine Learning Techniques used in NLP ➢ Examine Deep Neural Architectures for Sequence Processing ➢ Understands Encoder-Decoder architectures and is able to build Machine Translation Models.
SYLLABUS:

UNIT I:	(08 hrs)
Introduction : Natural Language Processing Definition, Origins, applications, challenges, components of modern NLP – Regular Expressions, Words, Corpora, Tokenization, Text Normalization, Minimum Edit Distance. **Language Models:** N-grams, Evaluating Language Models - Perplexity, Generalization and zeros, Smoothing – Laplace, Add-k, Interpolation and Backoff	

UNIT II:	(08 hrs)
Naive Bayes: Naive Bayes Classifier - Training the NB Classifier - an example, Optimizing for Sentiment Analysis, NB for other text classification tasks, NB as a Language Model, Evaluation: Precision, Recall, F-measure, Test sets and Cross-validation.	

UNIT III:	(12 hrs)
Logistic Regression: Generative vs. Discriminative classifiers - components of machine learning classifier - Classification: the sigmoid, binary sentiment classification with sigmoid, Learning in Logistic Regression - The Cross-Entropy Loss function, Gradient Descent, SGD, Mini-batch, Regularization - Multinomial Logistic regression.	

UNIT IV:	(10 hrs)
Vector Semantics and Embeddings : Lexical Semantics, Vector Semantics, Words and Vectors, Cosine for measuring similarity, TF-IDF: Weighing terms in the vector, Pointwise Mutual Information (PMI), Applications of the tf-idf or PPMI vector models, Word2vec, Visualizing Embeddings, Semantic properties of embeddings, Bias and Embeddings.	

UNIT V:	(10 hrs)

Neural Networks and Neural Language Models : Units, the XOR problem, Feedforward Neural Networks, Feedforward networks for NLP : classification, Feedforward Neural Language Modelling, Training Neural Nets, Training the Neural Language the model.

Sequence Labelling for Parts of Speech and Named Entities : English word classes, Part-of-speech tagging, Named Entities and Named Entity Tagging.

UNIT VI:	(10 hrs)

Deep Learning Architectures for Sequence Processing : Language Models, Recurrent Neural Networks, Managing Context in RNNs: LSTMs and GRUs, Potential Harms from Language Models

Machine Translation and Encoder-Decoder Models : The Encoder-Decoder Model, Encoder-Decoder with RNNs

Lab Experiments:
1. Solve the following by writing Regular Expressions in Python
   a. Replace all occurrences of **5** with '**five**' for the given string
   b. For the given list, filter all elements that do *not* contain '**e'**.
   c. For the given input string, display all lines not containing '**start'** irrespective of case.
   d. For the given input list, filter all elements that contains **42** surrounded by word characters.
   e. Validate the CVV number(It should have 3 or 4 digits, It should have a digit between 0-9, It should not have any alphabets and special characters)
   f. For the given input string, change whole word **mall** to **1234** only if it is at the start of a line
   g. Check whether the given email address is valid or not.
   h. Check whether the Aadhar number is valid or not (It should have 12 digits, It should not start with 0 and 1, It should not contain any alphabet and special characters, It should have white space after every 4 digits)
2. Write code snippets to
   a. Tokenize words and sentences.
   b. Perform stemming on the tokens present in the given sentence.
   c. Perform Lemmatization on the tokens present in the given sentence.
3. Write a program to implement the Minimum Edit Distance algorithm.
4. Design a function with the name ngram_converter() that takes in a **sentence** and '**n**' as an argument and converts it into N-grams.
5. Write a program to compute unsmoothed unigrams and bigrams.
6. Build a basic N-gram language model using trigrams of Reuters corpus. Reuters corpus is a collection of 10,788 news documents totaling 1.3 million words.
7. Run N-gram program on two different small corpora of your choice (you might use email textor newsgroups). Now compare the statistics of the two corpora. What are the differences in the most common unigrams between the two? How about interesting differences in bigrams?
8. Add an option to the above program to compute the perplexity of a test set.
9. Implement and Evaluate Naïve Bayes Model for Email Spam filtering task.

10. Implement and Evaluate Naïve Bayes Model for Sentiment Analysis task.
11. Write Python functions to calculate sigmoid, softmax, cross-entropy loss.
12. Create a sample value of Z (weighted sum as in logistic regression) and create the cross-entropy loss function plot showing plots for cost function output vs hypothesis function output (probability value).
13. Train a Text Classifier for E-mail spam detection using Logistic Regression.
14. Train a Text Classifier for Sentiment Analysis using Logistic Regression
15. Design a Sequence labelling task "Part-of-Speech tagging" using Hidden Markov Model.
16. Build a custom Named-Entity-Recognition model using any library (NLTK or spacy)

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Understand the theoretical foundations of natural language processing in linguistics and formal language theory
CO2:	Analyse NLP tasks like text pre-processing, part-of-speech tagging, syntax parsing and semantic role labelling using existing algorithms and frameworks
CO3:	Apply existing mathematical models and machine learning algorithms to build NLP applications.
CO4:	Conduct experiments to implement building blocks of statistical NLP
CO5:	Evaluate language models designed to solve NLP problems

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	-	2	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	-	3	-	-	-	-	-	-	-	-	-	-	3
CO4	-	-	-	3	-	-	-	-	-	-	-	-	-	3
CO5	-	-	3	3	-	-	-	-	-	-	-	-	-	3

TEXT BOOKS:

1.	Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications

REFERENCE BOOKS:

1.	Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems, Oreilly Publishers - by Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana
2.	Natural Language Processing with Python: Analysing Text with the Natural Language Toolkit. Oreilly Publishers - Stevem Bord. Ewam Klein, Edward Loper

SCALA PROGRAMMING
(Job Oriented Elective III)

Subject Code: UGAI7T1220		L	T	P	C
IV Year / I Semester		2	0	2	3

PRE-REQUISITES:	
➢ Basic programming knowledge	
COURSE OBJECTIVE:	
➢ The objective of this course is to provide insights in Scala Programming. This course also focuses on various concepts such as lists, tuples, sets, maps, control structures, classes and packages in Scala.	
SYLLABUS:	
UNIT I	**(7 hrs)**
Introduction to Scala: A Scalable Language, First Steps in Scala, Next Steps in Scala- Steps in Scala- Parameterize arrays with Use list- Use tuples- Use sets and maps- Learn to recognize the Read lines from a file, Classes and objects-Classes, fields, and methods- Semicolon inference- Singleton objects-Scala application.	
UNIT II	**(7 hrs)**
Types and operations: Basic types, Literals, Operators are methods, Arithmetic operations, Relational and logical operations, Bitwise operations, Object equality, Operator precedence and associativity.	
UNIT III	**(7 hrs)**
Functional Objects: Constructing a Rational- Reimplementing the to String method- Checking preconditions-Adding fields-Self references- Auxiliary constructors- Private fields and methods- Defining operators- Identifiers in Scala-Method overloading Implicit conversions.	
UNIT IV	**(9 hrs)**
Control structures and function: If expressions, While loops, For expressions, Exception handling, Match expressions, break and continue, Variable scope, Functions and Closure Methods -Local functions- First- class functions- Closures-Repeated parameters-Tail recursion , Control Abstraction.	
UNIT V	**(8 hrs)**
Composition and Inheritance: Abstract classes - Defining parameterless methods- Extending classes- Overriding methods and fields -. Defining parametric fields- Invoking superclass constructors - Using override modifier-Polymorphism and dynamic binding-Using composition and inheritance.	
UNIT VI	**(8 hrs)**
Packages and list: Packages, Imports, Assertions, Unit Testing, Case Classes and Pattern Matching, List literals, The List type, Constructing lists, Operations on lists, List patterns,	

Collections, Stateful Objects, Type Parameterization, Abstract Members, Implicit Conversions and Parameters.

EXPERIMENTS:	
1.	Setting up Scala
2.	Develop Scala programs to understand comments, types, operations and conversions
3.	Develop Scala programs to understand variables, functions and loops
4.	Develop Scala programs to understand the built-in control structures in Scala
5.	Develop Scala programs to understand lists, tuples, sets and maps
6.	Handling packages and imports in scala
7.	Develop Scala program to perform pattern matching
8.	Handling packages and imports in scala
9.	Implementing Algorithms in Scala
10.	Scraping Websites using Scala

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Understand introductory concept of Scala language
CO2:	Implement different operation performed in Scala
CO3:	Understand several functions and properties of Scala
CO4:	Understand packages available in Scala programming

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	-	-	-	2	2	-	3	-	3
CO2	3	3	3	3	3	-	-	-	2	2	-	3	-	3
CO3	3	3	3	3	3	-	-	-	2	2	-	3	-	3
CO4	3	3	3	3	3	-	-	-	2	2	-	3	-	3

TEXT BOOKS:

1.	Odersky, Spoon & Venners, Artima , Programming in Scala— (4th edition).
2.	Chiusano & Bjarnason, Manning , Functional Programming in Scala.

REFERENCE BOOKS:

1.	Dean Wampler and Alex Payne , Programming Scala: Scalability = Functional Programming + Objects, "O'Reilly Media, Inc.", 2014.
2.	Cay S. Horstmann, Scala for the Impatient, Addison-Wesley Professional; first edition, 2012.

BIG DATA ANALYTICS
(JOB ORIENTED ELECTIVE-III)

Subject Code: UGAI7T1320		L	T	P	C
IV Year / I Semester		2	0	2	3

PRE-REQUISITES:

➢ The student should have knowledge of high level programming languages and SQL for analyzing the data.

COURSE OBJECTIVE:

➢ The core objective of this course is to get a comprehensive understanding of large volumes of data, including structured, unstructured, text, social media, video, audio, and image.

➢ Mastering technologies used to store, manipulate, analyse, and derive insights using statistics, Machine Learning algorithms, and Big Data tools..

SYLLABUS:

UNIT I:	(07 hrs)

Overview of Big Data and Spark: Big Data Problem, Spark Introduction, Basic Architecture, Language APIs, DataFrames, Transformations and Actions; Spark's toolset. **[T1]**

UNIT II:	(08 hrs)

Structured APIs: Overview – Structured Spark Types, Structured API Execution; Basic Structured Operations – DataFrame Transformations; Spark SQL – How to Run Spark SQL Queries, Tables; Datasets – Creating Datasets . **[T1]**

UNIT III:	(07 hrs)

Low-Level APIs: Resilient Distributed Datasets – Overivew, Creating RDDs, Transformations; Advanced RDDs – Key-Value Basics. **[T1]**

UNIT IV:	(07 hrs)

Production Applications: How Spark Runs on a Cluster – The Architecture of a Spark Application; Developing Spark Applications – Writing and Launching Applications; Deploying Cluster to run Spark Applications, Monitoring Landscape. **[T1]**

UNIT V:	(08 hrs)

Streaming: Stream Processing Fundamentals – Use Cases, Advantages and Challenges, Spark's Streaming APIs; Structured Streaming – Basics and Core Concepts. **[T1]**

UNIT VI:	(07 hrs)

Advanced Analytics and Machine Learining: Overview – A Sort Primer on Advanced Analytics, Spark's Toolkit, High-Level MLib Concepts; Preprocessing and Feature Engineering – Feature Selection; Classification – Types, Models, Decision

Trees, Random Forest and Gradien-Boosted Trees, Naïve Bayes and Evaluation Metrics. **[T3]**

List of Experiments:

1. Perform setting up and Installation of Apache Spark.
2. Create and implement various operations on spark DataFrames.
3. Implement RDD transformations in RDD programming with the help of examples.
4. Implement actions in RDD programming with the help of examples.
5. Write a Spark program to count the number of words in a text document.
6. Write a Spark program to count number of occurrences of each character in a text document.
7. Build a distributed stream data processing application using Spark to show trending
   Twitter hashtags.
8. Develop a supervised machine learning application using MLlib API.
9. Build and evaluate a machine Learning model with Spark ML.
10. Predict the labels from the feature vectors of a sample dataset using the Logistic Regression algorithm.

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Analyze various components of Spark framework. **[L4]**
CO2:	Develop SQL statements on very large data sets using Apache SparkSQL and the Apache Spark DataFrame API. **[L3]**
CO3:	Create Apache Spark applications on a Hadoop cluster. **[L6]**
CO4:	Evaluate machine learning algorithms to solve real time problems. **[L5]**

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	-	-	-	-	-	-	-	3	-
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	-
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3

TEXT BOOKS:

1.	Spark: The Definitive Guide, Bill Chambers, Matei Zaharia, O'Reilly, 2018.

REFERENCE BOOKS:

1.	Big Data Analytics with Spark, Mohammed Guller, Apress Media, 2015.
2.	Scala and Spark for Big Data Analytics, Md. Rezaul Karim, Sridhar Alla, Packt Publishing, 2017.
3.	Big Data Processing Using Spark in Cloud, Mamta Mittal, Valentina E. Balas, Springer, 2019.
4.	SPARK: Big Data Cluster Computing in Production, Ilya Ganelin, Ema Orhian, Wiley, 2016.

Courseera Courses:
1. Big Data Specialization -- Offered by UC San Diego.
2. Introduction to Data Analytics – Offered by IBM.

MANAGEMENT SCIENCE

Subject Code: UGMB7T0120		L	T	P	C
IV Year / I Semester		3	0	0	3

PRE-REQUISITES:
- General awareness about Principles of Management.   - To have an insight about Production and Operations Management.   - To be able to acquire knowledge about Human Resource Management, Marketing, Strategic Management.
COURSE OBJECTIVE:
- To create awareness about different Managerial concepts like Management, Production, Marketing, Human Resource and Strategic Management.   - To make the students equip with knowledge on techniques of PERT and CPM in project management.

SYLLABUS:	
UNIT I:	**(08 hrs)**
Introduction to Management : Concept and importance of Management, Functions of management, Evaluation of Management thought, Fayol's principles of Management, Maslow's need hierarchy & Herzberg's two factor theory of Motivation, Decision making process, Designing organizational structure, Principles of Organization, Types of organization structures.	
UNIT II:	**(08 hrs)**
Operations Management: Plant Location Principles and types of plant Layout , Work study, Materials Management: Objectives - Need for inventory control-Inventory control techniques EOQ , ABC, HML, SDE, VED and FSN analysis.	
UNIT III:	**(08 hrs)**
Human Resources Management (HRM): Concepts of HRM, Basic functions of HR manager, Job Evaluation and Merit Rating, Performance Appraisal, Methods of Performance appraisal Concepts Compensation.	
UNIT IV:	**(08 hrs)**
Marketing Management: Functions of marketing, Marketing Mix, Marketing strategies based on Product life cycle, Channels of distribution (Place), Promotional Mix.	
UNIT V:	**(10 hrs)**
Project Management (PERT/CPM): Network analysis, Program Evaluation and Review Technique (PERT), Critical path method (CPM) - Identifying critical path, Difference between PERT & CPM (simple problems).	

UNIT VI:	(08 hrs)
Strategic Management: Mission, Goals, objectives, policy, strategy, Environmental scanning, SWOT analysis, Steps in strategy formulation and implementation Generic strategy alternatives.	

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Understand the fundamentals of Management with specific insight as its function and role
CO2:	Learn the concepts of production, Management of human Resources and Management of Marketing activities along with business environment
CO3:	Apply the problem solving skills to demonstrate logical solution to real life problems
CO4:	Create the awareness of business strategies to deal with the dynamic business environment

MAPPING OF COs TO POs:

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CO2	-	-	-	-	-	2	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	2	-	-	-

TEXT BOOKS:

1.	Management Science, Dr. Arya Sri, TMH 2011.
2.	Principles & Practices of Management, L.M. Prasad, Sultan chand & Sons, 2007.

REFERENCE BOOKS:

1.	Production and Operations Management, K. Aswathappa and K. Sridhara Bhat, Himalaya Publishing House, 2010.
2.	Marketing Management, Philip Kotler Philip Kotler, Kevin Keller, Mairead Brady, Malcolm Goodman, Torben Hansen, Pearson Education Limited, 2016.

IOT LAB

Subject Code: UGAI7K1420		L	T	P	C
IV Year / I Semester		1	0	2	2

PRE-REQUISITES:
➢ Basic Programming skills and knowledge in electronics.
COURSE OBJECTIVE:
➢ To enable students to understand scope of Internet of things in Industry. ➢ To introduce the concept of Internet of things ➢ To develop and apply Advance method for Implementation of Internet of Things
SYLLABUS:
Architecture of IoT Architecture of IoT Introduction of IoT, Introduction Industry 4.0, Need of IoT for Industry 4.0, Block Diagrams of IoT System, Virtual Private server and IoT Cloud, Application Programming Interface(API). **Development of Things using Arduino Platform:** Introduction of IoT Node with Sensor and Actuator, Interface sensors &devices, NodeMCU and ESP 32 wifi Microcontroller, Network. **Communication protocol :** Introduction of Internet Protocol , Internet Layer: IP Transport layer-TCP,UDP , Application Layer- HTTP, MQTT, FTP, CoAP, SPDY **IoT Platform and Application** Customized IoT Platform using Virtual Private Server, Google API, Blynk, Cayenne, Thingsboard, Thigspeak. Case Study of applications.
EXPERIMENTS:

Experiment 1:
    a) Exploring the features and components of an Arduino Board and IDE
    b) Using ArduinoIDE write a program to blink LED at timely intervals at specific time intervel.
    c) Read the values of Temperature and Humidity form the environment and if temperature is above 30^{0}C then blink red LED otherwise green LED.
    d) Display the values of Temperature and Humidity to LCD Screen.
 	
Experiment 2:
    a) Using IR Sensor find if there is any obstacle and display the distance on Serial Monitor.
    b) Using Soil Moisture Sensor read the moisture level in soil and display them on a Serial Monitor.
    c) Develop a Real Time Heart Rate monitoring system and display them on Serial Plotter.
Experiment 3:
    a) Design and interface Water level indicator using Node MCU controller
    b) Send messages to a mobile number using GSM module if the heart rate crosses a threshold value.

c) Start logging data of Temperature and Heart rate to an SD card using Arduino.

Experiment 4:
a) To perform programming for Interfacing NodeMCU to Cloud Thingsboard/Thingspeak.
b) To perform programming for sending DHT Temperature sensor data to cloud.
c) Upload the data of Temperature and Heart Rate to Cloud and show the graphical representation of the heart rate.

Experiment 5:
To perform programming for control home appliance using NodeMCU controller and cloud.

Experiment 6:
a) Explore the features and components of a Raspberry Pi.
b) Glow an LED using a Raspberry Pi.

Experiment 7:
a) Read the Values Temperature and Humidity form the environment and setting a threshold value blink an LED using Raspberry Pi.
b) Log the data of Temperature and Humidity to an onboard SD card of Raspberry Pi.

Experiment 8:
Develop an innovative application for Smart Cities using any of Arduino or Raspberry Pi.

Experiment 9:
Perform Automatic Plant Irrigation controlling System using NodeMCU and Cloud

Additional Experiments:
a) Design and Perform smart Garbage indication system using NodeMCU controller and GLCD.
b) Design and Perform IoT Based Agriculture monitoring system using Wifi ESP8266 [Thinkspeak Cloud]

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1:	Analyze various IoT devices and its technology. **[L3]**
CO2:	Select and use of appropriate IoT technologies & Gateways protocols for application development. **[L4]**
CO3:	Design and development of IoT application as a team or individual with the use of different cloud technology. **[L5]**

MAPPING OF COs TO POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	-	2	3	-	-	-	-	-	-	-	-	-
CO2	-	2	3	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	3	2	3	-	-	-	3	-	-	-	-	-

TEXT BOOKS:

1.	The Internet of Things by Samuel Greengard, The MIT Press Essential Knowledge series, 2015.
2.	The Fourth Industrial Revolution" by Klaus Schwab, 2017.
3.	Getting started with Internet of Things by CunoPfister, O'Reilly, Maker Media Publisher, 2011.

REFERENCE BOOKS:

1.	Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud by CunoPfister, O'Reilly, (Make: Projects) 2018
2.	Designing the Internet of Things Kindle Edition by Adrian McEwen & Hakim Cassimally Wiley Publisher,2013.

ONLINE RESOURCES:

1.	Introduction to Internet of Things, IIT Kharagpur, NPTEL.
2.	An introduction to Programming the Internet of Things(IoT), university of California, Coursera