IV Year - I Semester

S.No	Category	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	PE	UGCS7T0120 UGCS7T0220 UGCS7T0320 UGCS7T0420	**Professional Elective-III** 1. Deep Learning 2. Software Project Management 3. Image Processing 4. DevOps	3	-	-	3	30	70	100
2	PE	UGCS7T0520 UGCS7T0620 UGCS7T0720 UGCS7T0820	**Professional Elective-IV** 1. Natural Language Processing 2. Quantum Computing 3. Human Computer Interaction 4. Cyber Security	3	-	-	3	30	70	100
3	PE	UGCS7T0920 UGCS7T1020 UGCS7T1120 UGCS7T1220	**Professional Elective-V** 1. Soft Computing 2. Ethical Hacking 3. Semantic Web and Social Networks 4. E-Commerce	3	-	-	3	30	70	100
4	OE/JOE	UGCS7T1320 UGCS7T1420 UGCS7T1520 UGCS7T1620	**Job Oriented Elective-I** 1. Augmented Reality and Virtual Reality 2. Big Data Technologies 3. Information Security 4. .NET Programming	2	-	2	3	30	70	100
5	OE/JOE	UGCS7T1720 UGCS7T1820 UGCS7T1920 UGCS7T2020	**Job Oriented Elective-II** 1. Blockchain Technologies 2. Cloud Computing 3. Go Programming 4. Robotic Process Automation	2	-	2	3	30	70	100
6	HSSE	UGMB7T0120	Management Science	3	-	-	3	30	70	100
7	SOC	UGCS7K2120	Amazon Web Services	1	-	2	2	50	-	50
8	Internship	UGCS7I2220	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	UGCS8J0120	Major Project & Internship (6 Months)	-	-	20	10	100	100	200
2	Seminar	UGCS8S0220	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, OE/JOE - Open Elective/Job Oriented Elective, PE - Professional Elective, HSSE - Humanities & Social Science Elective

IV Year
I Semester

DEEP LEARNING
(PROFESSIONAL ELECTIVE-III)

Subject Code: UGCS7T0120	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Familiarity with Probability & Statistics, Design and Analysis of Algorithms.

Course Objectives: The objective of the course is to provide exposure to these advances and facilitate in depth discussions on deep learning.

Syllabus:

UNIT I: (8 Lectures)

Machine Learning Basics

Learning Algorithms, Capacity, Over fitting and Under fitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Estimation Bayesian Statistics.

Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Descent, Building a Machine Learning Algorithm, Challenges Motivating Deep Learning.

UNIT II: (8 Lectures)

Deep Feedforward Networks

Example: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms.

UNIT- III: (8 Lectures)

Regularization for Deep Learning

Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multitask Learning.

UNIT IV: (8 Lectures)

Optimization for Training Deep Models

How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms.

UNIT V: (10 Lectures)

Convolutional Networks

The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basis for Convolutional Networks.

UNIT VI: **(8 Lectures)**

Sequence Modeling: Recurrent and Recursive Nets

Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Optimization for Long-Term Dependencies, Explicit Memory.

Course Outcomes:

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

CO 1. Demonstrate the basics of Machine Learning.

CO 2. Analyze the importance of deep feed forward networks.

CO 3. Summarize the significance of regularization for Deep Learning.

CO 4. Implement optimization in DL.

CO 5. Perceive the importance of Convolutional Networks and its significance.

CO 6. Illustrate the knowledge on Sequence Modeling.

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	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	3	-	-	-	-	3	-	3	-	3
CO5	3	3	3	3	-	-	-	3	-	-	-	3	-	3
CO6	3	3	3	3	-	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1. Goodfellow, I., Bengio, Y., Courville, A., & Bengio, Y. Deep learning,Vol. 1. Cambridge: MIT press.
2. François Duval , Deep Learning: Deep Learning for Beginners. Practical Guide with Python and Tensorflow, Data Sciences Publishing.

REFERENCE BOOKS:

1. Sebastian Raschka, Vahid Mirjalili,Python Machine Learning: Machine. Learning and Deep Learning with Python, scikit-learn, and TensorFlow, 2nd Edition, Packt Publishing.

SOFTWARE PROJECT MANAGEMENT
(PROFESSIONAL ELECTIVE-III)

Subject Code: UGCS7T0220	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Basic concepts of Software Engineering.

Course Objectives:
This course enables the learners to understand the importance of software project management in a product life cycle in IT industry. It focuses on various principles and methods related to management of cost, time, human resources, risks, procurement, monitoring and controlling related to a product development. Learners will get insights to various real time project management practices to build quality products through this course.

Syllabus:

UNIT I: (8 Lectures)
INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT
Project Stakeholders, Project Management Knowledge Areas, Project Management Tools and Techniques, Program and Project Portfolio Management, The Role of the Project Manager, The Project Management Profession, Project Phases and the Project Life Cycle.

UNIT II: (8 Lectures)
SOFTWARE PROJECT TIME MANAGEMENT
The Importance of Project Schedules, Estimating Activity Resources, Estimating Activity Durations, Developing the Schedule, Controlling the Schedule, Using Software to Assist in Project Time Management.

UNIT III: (8 Lectures)
SOFTWARE PROJECT COST MANAGEMENT
Cost management: The Importance of Project Cost Management, Basic Principles of Cost Management, Estimating Costs, Types of Cost Estimates, Cost Estimation Tools and Techniques, Determining the Budget, Controlling Costs.

UNIT IV: (7 Lectures)
HUMAN RESOURCES MANAGEMENT
The Importance of Human Resource Management, Keys to Managing People, Developing the Human Resource Plan, Acquiring the Project Team, Developing the Project Team, Managing the Project Team, Using Software to Assist in Human Resource Management.

UNIT V: (12 Lectures)
RISK MANAGEMENT
Planning Risk Management, Common Sources of Risk on Information Technology Projects, Identifying Risks, Performing Qualitative Risk Analysis, Performing

Quantitative Risk Analysis, Planning Risk Responses, Monitoring and Controlling Risks, Using Software to Assist in Project Risk Management.

UNIT VI: (7 Lectures)

PROJECT INTEGRATION MANAGEMENT

Strategic Planning and Project Selection : Developing a Project Charter, Developing a Project Management Plan, Directing and Managing Project Execution. Monitoring and Controlling : Project Work, Performing Integrated Change Control, Closing Projects or Phases.

Course Outcomes:

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

CO 1. Interpret the importance of software project management with roles and responsibilities of the team in the real-time project life cycle.

CO 2. Classify different methods required in project management related to time, cost and human resource management.

CO 3. Identify risks in project life cycle and plan for risk management strategies.

CO 4. Develop a project charter by integrating all the project management knowledge areas.

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	2	-	-
CO2	2	-	2	-	2	-	-	-	2	2	3	2	-	-
CO3	3	-	3	-	2	-	-	-	2	2	3	2	-	-
CO4	2	-	2	-	2	-	-	-	-	-	3	2	-	-

TEXT BOOKS:

1. Kathy Schwalbe, Information Technology Project Management, 6th edition, Cengage Learning, 2011.
2. Walker Royce, Software Project Management A Unified Framework, Pearson Edition.

REFERENCE BOOKS:

1. Ramesh, Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.
2. Jalote, "Software Project Management in Practice", Pearson Education, 2002.

IMAGE PROCESSING
(PROFESSIONAL ELECTIVE–III)

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

Prerequisites: Basic knowledge in Mathematics and Computer Graphics.

Course Objectives: 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: INTRODUCTION (8 Lectures)
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: IMAGE ENHANCEMENT (8 Lectures)
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: IMAGE RESTORATION & RE-CONSTRUCTION (9 Lectures)
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: COLOR IMAGE PROCESSING (9 Lectures)
Color fundamentals, Color models, Pseudo color Image Processing, Basics of full color image processing, Color transformations, Smoothing and sharpening.

UNIT V: IMAGE COMPRESSION AND WATER MARKING (8 Lectures)
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: SEGMENTATION & MORPHOLOGICAL PROCESSING (7 Lectures)
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 completion of this course, the students will be able to:

CO 1. Understand the fundamentals steps in image processing.

CO 2. Analyze different filters and transformations for the enhancement of an image.

CO 3. Apply image processing techniques for restoration, reconstruction and compression of images.

CO 4. Compare various color models to perform color image processing.

CO 5. Understand 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.

DEVOPS
(PROFESSIONAL ELECTIVE-III)

Subject Code: UGCS7T0420	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Good exposure to Software Engineering concepts and Software Development Methodologies.

Course Objectives:
To get an expertise on the culture of DevOps in Software Development Methodologies for finding ways to adapt and innovate social structure, culture and technology together in order to work more effectively in the Enterprises.

Syllabus:

UNIT I: (8 Lectures)
Introduction to DevOps: What is DevOps, A History of DevOps, Fundamental Terminology and Concepts – Software Development Methodologies, Operations Methodologies, Systems Methodologies, Development Release and Deployment Concepts, Infrastructure Concepts, Cultural Concepts. DevOps Misconceptions and Anti-Patterns, the Four Pillars of Effective DevOps.

UNIT II: (8 Lectures)
Collaboration: Defining Collaboration, Individual Differences and Backgrounds, Opportunities for Competitive Advantage, Mentorship, Introducing Mindsets, Mindsets and Learning Organizations, The Role of Feedback, Reviews and Rankings, Communication and Conflict Resolution Styles, Empathy and Trust, Humane Staffing and Resources, Misconceptions and Troubleshooting of Collaboration.

UNIT III: (9 Lectures)
Affinity: What Makes a Team, Teams and Organizational Structure, Finding Common Ground Between Teams, Benefits of Improved Affinity, Requirements for Affinity, Measuring Affinity, Misconceptions and Troubleshooting of Affinity.

UNIT IV: (9 Lectures)
Tools: Software Development, Automation, Monitoring, Evolution of the Ecosystem,The Value of Tools to People, What Are Tools?, The Right Tools for Real Problems, Embracing Open Source, Standardization of Tools, Consistent Processes for Tool Analysis, Exceptions to Standardization, Irrelevance of Tools, The Impacts of Tools on Culture, Selection of Tools, Auditing Your Tool Ecosystem, Elimination of Tools, Misconceptions and Troubleshooting of Tools.

UNIT V: (8 Lectures)
Scaling: Understanding Scaling, Considering Enterprise DevOps, Organizational Structure, Team Flexibility, Organizational Lifecycle, Complexity and Change, Scaling for Teams, Team Scaling and Growth Strategies, Scaling for Organizations, Misconceptions and Troubleshooting of Scaling.

UNIT VI: **(6 Lectures)**

DevOps Practices: Implementing CI/CD and continuous deployment, Understanding IaC practices, DevOps Best Practices: Automating everything, Choosing the right tool,Writing all your configuration in code, Designing the system architecture, Building a good CI/CD pipeline, Integrating tests, Applying security with DevSecOps, Monitoring your system, Evolving project management.

Course Outcomes:

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

- **CO 1.** Make use the Influence of DevOps on Software Development Methodologies along with its Misconceptions and Anti-Patterns.
- **CO 2.** Illustrate the Methodologies of Four Pillars of DevOps and Troubleshoot the common problems that can arise in the effective DevOps.
- **CO 3.** Inference the culture of DevOps to the Enterprises for achieving agility and innovation in its business units.

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	-	-	-
CO2	3	3	3	3	-	-	-	-	-	-	3	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	3	-	-	-

TEXT BOOKS:

1. Jennifer Davis, RynDaniels, Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale, O'Reilly.

2. Mikael Krief, Learning DevOps, Packt Publications.

REFERENCE BOOKS:

1. Verona, Joakim. Practical DevOps. Packt Publishing Ltd.

2. By Jez Humble and David Farley, Continuous Delivery: Reliable Software Releases through Build, Test and Deployment Automation, Addison-Wesley Professional

3. Mandi Walls,Building a DevOps Culture, O'Reilly publications.

4. Sanjeev Sharma, "The DevOps Adoption Playbook – A Guide to Adopting DevOps in a Multi-Speed IT Enterprise", Wiley Publications.

NATURAL LANGUAGE PROCESSING
(PROFESSIONAL ELECTIVE-IV)

Subject Code: UGCS7T0520	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Familiarity with Compiler Design.

Course Objectives: The main objective of the course is to learn how to develop practical computer systems capable of performing intelligent tasks on natural language analyze, understand and generate written text.

Syllabus:

UNIT I: (8 Lectures)
Introduction: What is Natural Language Processing, NLP tasks in syntax, semantics, and pragmatics. Applications such as information extraction, question answering, and machine translation. The problem of ambiguity. The role of machine learning. Brief history of the field.

UNIT II: (8 Lectures)
N-gram Language Models: The role of language models, Simple N-gram models. Estimating parameters and smoothing. Evaluating language models.
Part of Speech Tagging and Sequence Labeling: Lexical syntax. Hidden Markov Models. Maximum Entropy Models. Conditional Random Fields.

UNIT III: (8 Lectures)
Syntactic Parsing: Grammar formalisms and tree banks. Efficient parsing for context-free grammars (CFGs). Statistical parsing and probabilistic CFGs (PCFGs). Lexicalized PCFGs.

UNIT IV: (10 Lectures)
Semantic Analysis: Lexical semantics and word-sense disambiguation. Compositional semantics. Semantic Role Labeling and Semantic Parsing.

UNIT V: (8 Lectures)
Information Extraction (IE) and Machine Translation (MT): Named entity recognition and relation extraction. IE using sequence labeling. Basic issues in MT. Statistical translation, word alignment, phrase-based translation, and synchronous grammars. Dialogues: Turns and utterances, grounding, dialogue acts and structures.

UNIT VI: (8 Lectures)
Natural Language Generation: Introduction to language generation, architecture, discourse planning (text schemata, rhetorical relations).

Course Outcomes:

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

CO 1. Relate the basics of NLP and study the role of machine learning in processing NLP.

CO 2. Analyze various Language Models and process part of speech tagging for static NLP.

CO 3. Discover how to analyze the words and extract meaning from the text.

CO 4. Identify various ways to draw inferences from text and language translation.

CO 5. Summarize the mechanisms to generate natural language.

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	1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	2	3	-	2	-	-	-	-	-	3	-	-
CO3	-	3	3	-	-	2	-	-	-	-	-	3	-	-
CO4	-	3	3	-	-	2	-	-	-	-	-	3	-	3
CO5	-	2	2	2	-	-	-	-	-	-	-	3	-	3

TEXT BOOKS:

1. D. Jurafsky, J. H. Martin, Speech and Language Processing- An introduction to Language Processing, Computational Linguistics, and Speech Recognition, Pearson Education.
2. Manning and Schutze, Foundations of Statistical Natural Language Processing, MIT Press.

REFERENCE BOOKS:

1. Allen, James Benjamin/Cummings, Natural Language Understanding, Benjamin-Cummings Publishing Co, 2ed.
2. Bharathi, A., Vineet Chaitanya and Rajeev Sangal, Natural Language Processing-A Pananian Perspective, Prentice Hll India, Eastern Economy Edition.

QUANTUM COMPUTING
(PROFESSIONAL ELECTIVE-IV)

Subject Code: UGCS7T0620	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Familiar with calculus, linear algebra and probability.

Course Objectives:
The objective of this course is to provide the students an introduction to quantum computation. It focuses on concepts like Quantum Computation techniques, Quantum Architecture, Quantum Algorithms, Quantum Programming, Quantum Cryptography, Quantum Information Theory and Quantum Hardware.

SYLLABUS:

UNIT I: (8 Lectures)
Introduction: History of quantum computation and quantum information, Classical Deterministic Systems, Probabilistic Systems, Quantum Systems, Assembling Systems, Quantum States, Observables, Measuring, Dynamics, Assembling Quantum Systems.

UNIT II: (10 Lectures)
Quantum Architecture: Bits and Qubits, Classical Gates, Reversible Gates, Quantum Gates.

UNIT III: (9 Lectures)
Quantum Algorithms: Deutsch's Algorithm, The Deutsch–Jozsa Algorithm, Simon's Periodicity Algorithm, Grover's Search Algorithm, Shor's Factoring Algorithm.

UNIT IV: (9 Lectures)
Quantum Programming: Programming in a Quantum World, Quantum Assembly Programming, Toward Higher-Level Quantum Programming, Quantum Computation before Quantum Computers.

UNIT V: (8 Lectures)
Quantum Cryptography: Classical Cryptography, Quantum Key Exchange I: The BB84 Protocol, Quantum Key Exchange II: The B92 Protocol, Quantum Key Exchange III: The EPR Protocol, Quantum Teleportation.
Quantum Information Theory: Classical Information and Shannon Entropy, Quantum Information and Von Neumann Entropy, Classical and Quantum Data Compression, Error-Correcting Codes.

UNIT VI: (8 Lectures)
Quantum Hardware: Goals and Challenges, Ion Traps, Linear Optics, NMR and Superconductors, Future of Quantum Ware.

Course Outcomes:

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

CO 1 Analyze Quantum Computations techniques related to Mathematics and Physics.

CO 2 Demonstrate Quantum Circuits and applications Methods.

CO 3 Evaluate the mechanisms of Quantum Algorithms with suitable methods.

CO 4 Use various Quantum programming languages.

CO 5 Demonstrate Quantum Cryptography and Information Theories.

CO 6 Discuss various the Quantum Hardware techniques.

Mapping of COs to POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	3	3	-	-	-	-	-	-	-	3	-	3
CO3	3	3	3	2	3	-	-	-	-	-	-	3	-	3
CO4	3	3	3	3	3	-	-	-	-	-	-	3	-	3
CO5	2	3	3	3	3	-	-	-	-	-	-	2	-	3
CO6	2	3	3	3	3	-	-	-	-	-	-	2	-	3

Text Books:

1. Noson S. Yanofsky, Mirco A. Mannucci, "Quantum computing for computer scientists", Cambridge University Press.
2. Michael A. Nielsen and Isaac L. Chuang, "Quantum computation and quantum information", Cambridge University Press.

Reference Books:

1. Chris Bernhardt," Quantum Computing for Everyone" The MIT Press.
2. P Kaye, R Laflamme and M Mosca, "An Introduction to Quantum Computing" , Oxford.
3. Benenti G., Casati G. and Strini G.," Principles of Quantum Computation and Information" , Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific Publishing.
4. Eleanor Rieffel and Wolfgang Polak "QUANTUM COMPUTING", The MIT Press.
5. Eric R. Johnston, Nic Harrigan, Mercedes and Gimeno-Segovia "Programming Quantum Computers: Essential Algorithms And Code Samples", O'Reilly.
6. Dr. Christine Corbett Moran, "Mastering Quantum Computing with IBM QX: Explore the world of quantum computing using the Quantum Composer and Qiskit", Packt Publishing.
7. David McMahon, "Quantum computing explained" Wiley-interscience, John Wiley & Sons Inc.
8. V.K Sahni, "Quantum Computing", McGrawHill.

HUMAN COMPUTER INTERACTION
(PROFESSIONAL ELECTIVE-IV)

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

Prerequisites: Basic concepts of system analysis and design and exposure to various user interface designs related to web and mobile.

Course Objectives:

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: (10 Lectures)

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 Lectures)

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: (8 Lectures)

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: (8 Lectures)

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: (9 Lectures)

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 VI: (9 Lectures)

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

CO 1. Interpret the basic principles of user interface & GUI design concepts.

CO 2. Apply interactive design principles in real-time application development with client and system requirements.

CO 3. 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. 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
(PROFESSIONAL ELECTIVE-IV)

Subject Code: UGCS7T0820	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Familiarity with Computer Networks and Information Security.

Course Objectives: The course will focus on the models, tools, and the techniques for enforcement of cyber security policies, with some emphasis on the use of cryptography.

Syllabus:

UNIT I: (8 Lectures)
Introduction to Computer Security: Definition, Threats to security, Government Requirements, Information Protection and Access Controls, Computer Security Efforts, Standards, Computer Security Mandates and Legislation, Privacy Considerations, International Security Activity.

UNIT II: (7 Lectures)
Cyber Crime Issues: Unauthorized Access to Computers, Computer Intrusions, White Collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital Laws and Legislation, Law Enforcement Roles and Responses.

UNIT III: (10 Lectures)
Secure System Planning and Administration: Introduction to the Orange Book, Security Policy Requirements, Accountability, Assurance and Documentation Requirements, Network Security, The Red Book and Government Network Evaluations.

UNIT IV: (10 Lectures)
Information Security Policies and Procedures: Corporate Policies, Tier 1, Tier 2 and Tier3 Policies, Process Management, Planning and Preparation, Developing Policies, Asset Classification Policy, Developing Standards.

UNIT V: (8 Lectures)
Information Security: Fundamentals, Employee Responsibilities, Information Classification, Information Handling, Tools of Information Security, Information Processing, Secure Program Administration.

UNIT VI: (7 Lectures)
Organizational and Human Security: Adoption of Information Security Management Standards, Human Factors in Security, Role of Information Security Professionals.

Course Outcomes:

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

CO 1. Specify tools and architectures to help secure computer and information systems both proactively and reactively.

CO 2. Describe how cyber attacks against an organization can be monitored and investigated for actionable intelligence.

CO 3. Apply skills and knowledge to create new responses to emerging cyber security problems so that they can respond to new attacks as they evolve.

CO 4. Identify components of a modern information system and the threats that challenge their security.

CO 5. Identify the risks an organization faces due to cyber threats and recommend steps to combat those risks.

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	2	2	-	-	-	3	3	3
CO2	3	2	2	2	2	3	3	3	-	-	-	2	-	-
CO3	3	3	3	3	2	3	2	3	-	-	-	3	3	3
CO4	3	2	2	-	2	2	2	2	-	-	-	3	-	-
CO5	3	2	2	3	2	3	3	2	-	-	-	3	-	3

TEXT BOOKS:

1. Debby Russell and Sr. G.T Gangemi, "Computer Security Basics (Paperback)", 2ndEdition, O' Reilly Media.
2. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi.
3. Thomas R. Peltier, "Information Security policies and procedures: A Practitioner's Reference", 2nd Edition, Prentice Hall.

REFERENCE BOOKS:

1. Kenneth J. Knapp, "Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions", IGI Global.
2. Thomas R Peltier, Justin Peltier and John blackley, "Information Security Fundamentals", 2nd Edition, Prentice Hall.
3. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics ", Tata McGraw -Hill, New Delhi.

SOFT COMPUTING
(PROFESSIONAL ELECTIVE-V)

Subject Code: UGCS7T0920	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Basic knowledge in Mathematics and Artificial Intelligence.

Course Objectives The main objective of the course is to expose the students to soft computing, various types of soft computing techniques and applications of soft computing.

Syllabus:

UNIT I: (8 Lectures)
Introduction: Neuron, Nerve Structure and Synapse, Artificial Neuron and its Model, Activation Functions.

UNIT II: (8 Lectures)
Neural Network Architecture: Single Layer and Multilayer Feed Forward Networks, Recurrent Networks. Various Learning Techniques, Perception and Convergence Rule, Auto-Associative and Hetro-Associative Memory.

UNIT III: (10 Lectures)
Backpropagation Networks Architecture: Perceptron Model, Solution, Single Layer Artificial Neural Network, Multilayer Perception Model, Back Propogation Learning Methods, Effect of Learning Rule Co-Efficient, Back Propagation Algorithm, Factors Affecting Backpropagation Training, Applications.

UNIT IV: (8 Lectures)
Fuzzy Logic Introduction: Basic Concepts of Fuzzy Logic, Fuzzy Sets and Crisp Sets, Fuzzy Set Theory and Operations, Properties of Fuzzy Sets, Fuzzy and Crisp Relations, Fuzzy to Crisp Conversion.

UNIT V: (8 Lectures)
Fuzzy Membership and Rules: Membership Functions, Interference in Fuzzy Logic, Fuzzy If-Then Rules, Fuzzy Implications and Fuzzy Algorithms, Fuzzyfications and Defuzzificataions, Fuzzy Controller, Industrial Applications.

UNIT VI: (8 Lectures)
Genetic Algorithms: Basic Concepts, Working Principle, Procedures of GA, Flow Chart of GA, Genetic Representations, (Encoding) Initialization and Selection, Genetic Operators, Mutation, Generational Cycle, Applications.

Course Outcomes:
Upon completion of this course, the students will be able to:
CO 1. Demonstrate the working of neuron and activation procedure.
CO 2. Demonstrate the architecture of Neural Network.
CO 3. Implement and see how forward and back propagation works.

CO 4. Analyze the importance of Fuzzy Logic in addressing various real time problems.

CO 5. Evaluate the fuzziness in the terms of rules and various other parameters.

CO 6. Understand and implement the basics of genetic 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	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	3	-	3
CO5	3	3	3	3	3	-	-	-	-	-	-	3	-	3
CO6	3	3	3	3	3	-	-	-	-	-	2	3	2	3

TEXT BOOKS:

1. S. Rajsekaran, G.A.Vijayalakshmi Pai ,Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications, , Prentice Hall of India.
2. N.P Padhy ,Artificial Intelligence and Intelligent Systems, Oxford University Press.

REFERENCE BOOKS:

1. Simon Haykin, Neural Networks, Prentice Hall of India.
2. Timothy J.Ross ,Fuzzy Logic with Engineering Applications, McGraw-Hill.
3. Davis E.Goldberg, Genetic Algorithms: Search, Optimization and Machine Learning, , Addison Wesley, N.Y.

ETHICAL HACKING
(PROFESSIONAL ELECTIVE-V)

Subject Code: UGCS7T1020	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Familiarity with Computer Networks and Information Security.

Course Objectives: 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: Introduction (9 Lectures)
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: Malicious Software (7 Lectures)
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: Pre – Attack Phase (9 Lectures)
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: Data Security (8 Lectures)
Physical Security - Attacks and Protection, Steganography – Methods, Attacks and Measures, Cryptography – Methods and Types of Attacks, Wireless Hacking, Windows Hacking, Linux Hacking.

UNIT V: Network Protection System (9 Lectures)

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: Ethical Hacking Laws and Tests (8 Lectures)

Legal, Professional and Ethical Issues, Ethical Responsibilities, Professional Integrity, Host Reconnaissance, Session Hijacking, Hacking Web servers, Databases, Password Cracking, Methodical Penetration Testing.

Course Outcomes:

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

CO 1. Interpret several types of hacking, elements and challenges in information security, penetration testing methodology for data protection.

CO 2. Learn techniques to detect and protect networks and computers from malicious software's by using Foot Printing and Scanning Tools.

CO 3. Summarize data protection techniques and network protection systems.

CO 4. Choose relevant legal and ethical hacking laws to apply on Hackers and Intruders.

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	-	3
CO3	3	3	-	-	-	-	-	3	2	2	-	3	-	-
CO4	3	3	-	-	3	3	-	3	2	2	-	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.

SEMANTIC WEB AND SOCIAL NETWORKS
(PROFESSIONAL ELECTIVE-V)

Subject Code: UGCS7T1120	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Familiarity with the concepts of databases and web.

Course Objectives:
The objective of this course is to provide insights to students about the context based semantic integration of multiple web resources and expose semantically enriched social data to the public domain. This course also focuses on various concepts such as knowledge representation, management, extraction, aggregating information across heterogeneous sources and analysis related o semantic web and social networks.

Syllabus:

UNIT I: (9 Lectures)
Web Intelligence: Thinking and Intelligent Web Applications, The Information Age, The World Wide Web, Limitations of Today's Web, The Next Generation Web, Web Architecture and Business Logic, The Semantic Web, Berners-Lee, Competing Web Standards, Semantic Web Road Map, Semantic Web Services, Logic on the semantic Web, Semantic Web Capabilities and Limitations.

UNIT II: (8 Lectures)
Knowledge Representation on the Semantic Web: Ontologies and their role in the semantic web, Ontology Languages for the Semantic Web – Resource Description Framework(RDF), Ontology Web Language(OWL).

UNIT III: (8 Lectures)
Ontology Engineering: Ontology Engineering, Constructing Ontologies, Ontology Example, Ontology Methods, Ontology Libraries, Ontology Matching, Ontology Mapping, Ontology Mapping Tools, Logic and Inference, Monotonic and Nonmonotonic Rules, Descriptive Logic, Inference Engines.

UNIT IV: (9 Lectures)
Semantic Web Applications, Services and Technology: Semantic Web applications and services, Semantic Search, e-learning, Semantic Bio-informatics, XML Based Web Services, Next Generation Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods.

UNIT V: (8 Lectures)
Social Network Analysis: What is network analysis? Development of Social Network Analysis, Key concepts and measures in network analysis. Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities, Web-based networks.

UNIT VI: (8 Lectures)

Developing Social Semantic Applications: Building Semantic Web applications with social network features, Flink- the social networks of the Semantic Web community, Open academia: distributed, semantic-based publication management.

Course Outcomes:

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

- **CO 1.** Interpret the need of transformation of WWW and basic concepts of semantic web technology.
- **CO 2.** Build knowledge base for semantic web using ontology engineering.
- **CO 3.** Develop semantic web applications by using semantic technology and services for various domains.
- **CO 4.** Illustrate social network analysis and develop social semantic applications.

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

TEXT BOOKS:

1. Berners Lee, Godel, and Turing, "Thinking on the Web", Wiley.
2. Peter Mika, Social Networks and the Semantic Web, Springer.

REFERENCE BOOKS:

1. J.Davies,Rudi Studer, and Paul Warren, Semantic Web Technologies,Trends and Research in Ontology Based Systems, John Wiley & Sons.
2. Liyang Lu Chapman and Hall, Semantic Web and Semantic Web Services, CRC Publishers. (Taylor & Francis Group)
3. Heiner Stuckenschmidt and Frank Van Harmelen, Information Sharing on the semantic Web, Springer Publications.

E-COMMERCE
(PROFESSIONAL ELECTIVE-V)

Subject Code: UGCS7T1220	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Basic concepts of business approach, marketing, project management, computer architecture, computer algorithms and online business transactional process.

Course Objectives:
This course enables the learners to have exposure towards modern e-business and e-commerce systems in the present era. It focuses on various principles, challenges and implementation processes related to electronic payment systems, inter-organizational commerce, corporate digital library, consumer search and resource discovery, and multimedia. Learners will get exposure to various real-time practices and approaches of the e-commerce systems through this course.

Syllabus:

UNIT I: (8 Lectures)
Electronic Commerce: Framework, Anatomy of E-Commerce Applications, E-Commerce Consumer Applications, E-Commerce Organization Applications, Consumer Oriented Electronic Commerce.

UNIT II: (7 Lectures)
Electronic Payment Systems: Digital token based Electronic payment systems, Smart Cards and Electronic payment systems, Credit Cards based Electronic Payment Systems, Risks and Electronic Payment systems.

UNIT III: (8 Lectures)
Inter Organizational Commerce: EDI, EDI Layered Architecture, EDI Standards, EDI Software implementation, Value Added Networks.
Intra Organizational Commerce Workflow Automation, Customization and Internal Commerce, Supply Chain Management.

UNIT IV: (8 Lectures)
Corporate Digital Library: Document Library, Digital Document Types, Corporate Data Warehouses, Advertising and Marketing - Information Based Marketing, Advertising on Internet.

UNIT V: (8 Lectures)
Consumer Search and Resource Discovery: Information Search and Retrieval, Electronic Commerce Catalogs or Directories, Information Filtering.

UNIT VI: (7 Lectures)
Multimedia: Key Multimedia Concepts, Digital Video and Electronic Commerce, Desktop Video Processings, Desktop Video Conferencing.

Course Outcomes:

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

CO 1. Interpret the basic principles of E-commerce systems and its applications from different perspectives.

CO 2. Classify different types of electronic payment systems and inter-organizational commerce.

CO 3. Make use of technology trends, consumer search and resource discovery to manage e-commerce.

CO 4. Interpret different multimedia concepts applicable in e-business.

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	-	-
CO2	3	-	-	-	2	-	-	-	2	2	-	2	-	-
CO3	2	-	2	-	3	2	-	-	2	2	-	2	-	-
CO4	2	-	2	-	2	2	-	-	-	-	-	2	-	-

TEXT BOOKS:

1. Kalakata and Whinston, Frontiers of electronic commerce , Pearson.

REFERENCE BOOKS:

1. Hendry Chan, Raymond Lee, Tharam Dillon and Ellizabeth Chang, E-Commerce Fundamentals and Applications, John Wiley.
2. S.Jaiswal, E-Commerce, Galgotia.
3. Efrain Turbon, Jae Lee, David King, H.Michael Chang, E-Commerce, Pearson.
4. Gary P.Schneider , Electronic Commerce, Thomson.

AUGMENTED REALITY AND VIRTUAL REALITY
(JOB ORIENTED ELECTIVE-I)

Subject Code: UGCS7T1320	**L**	**T**	**P**	**C**
IV Year / I Semester	**2**	**0**	**2**	**3**

Prerequisites: The students should have basic knowledge on programming and computer graphics.

Course Objectives:
To introduce the basic concepts of Augmented Reality and Virtual Reality and to gain knowledge on various devices required for interaction and applications.

Syllabus:

UNIT I: (8 Lectures)
Introduction: Virtual Reality, Augmented Reality, Mixed Reality, Augmented Virtuality, Extended Reality, History, VR Features, VR Controllers, Current issues with VR, AR Mobile devices, AR headsets, AR glasses, AR Controllers, Current issues with AR.

UNIT II: (8 Lectures)
Consuming Content in VR : High-end devices, Mid-tier devices, Low-end devices, Near-Future Hardware.
Consuming Content in AR: Microsoft HoloLens, Meta 2, Magic Leap, Mira Prism, Apple ARKit, Google ARCore, Near-Future Hardware.

UNIT III: (9 Lectures)
Creating Content in VR and AR: Evaluating Your Project, Planning Your Virtual Reality Project, Planning Your Augmented Reality Project, Assessing Design Software, Capturing Real Life, Assessing Development Software, Distributing Your Content.

UNIT IV: (8 Lectures)
Cross-Platform Theory: Role of Game Engines, Understanding 3D Graphics, The Virtual Camera, Degrees of Freedom, Portability Lessons from Video Game Design, Simplifying the Controller Input.
Virtual Reality Toolkit: History of VRTK, SteamVR Unity Toolkit, VRTK v4, Future of VRTK, Success of VRTK, Getting Started with VRTK 4.

UNIT V: (6 Lectures)
Best Practices: Handling Locomotion in VR & AR, Effective Use of Audio in VR & AR, Common Interactions Paradigms, Inventory for VR, Augmented Reality Raycasts.

UNIT VI: (8 Lectures)
Applications: Travel, Museums, Aerospace, Retail, Military, Education, Entertainment, Real Estate, Advertising and Marketing, Mobile Apps for Experiencing Augmented Reality, Future of Virtual Reality and Augmented Reality.

Course Outcomes:

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

CO 1. Gain knowledge on AR & VR and various components involved in manifesting the same.

CO 2. Plan content creation and identify necessary software required in implementing AR & VR.

CO 3. Analyze the portability issues and understand the best practices.

CO 4. Understand how to implement various applications using AR and VR technologies.

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	-	3	-	-	-	-	-	-	-	-	-
CO4	3	3	3	-	3	-	-	-	-	-	-	-	3	-

TEXT BOOKS:

1. Paul Mealy, Virtual & Augmented Reality For Dummies, John Wiley & Sons, Inc

2. Erin Pangilinan, Steve Lukas and Vasanth Mohan, Creating Augmented and Virtual Realities, O'Reilly Media Inc.

REFERENCE BOOKS:

1. Kelly S. Hale, Kay M. Stanney, Handbook of Virtual Environments: Design, Implementation, and Applications, Second Edition, CRC Press.

2. Gregory C. Burdea & Philippe Coiffet, John, Virtual Reality Technology, Second Edition, Wiley & Sons, Inc.

3. William R.Sherman, AlanCraig, Understanding Virtual Reality, interface, Application and Design, Elsevier (Morgan Kaufmann).

4. John Vince, Virtual Reality Systems, Pearson Education.

5. Andrew Davison, Killer Game Programming in Java, Oreilly-SPD.

6. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann.

7. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann

8. Steve Aukstakalnis, "Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR", Addison Wesley.

9. Brett S. Martin, "Virtual Reality", Norwood House Press.

10. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi

11. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill.

BIG DATA TECHNOLOGIES
(JOB ORIENTED ELECTIVE-I)

Subject Code: UGCS7T1420	**L**	**T**	**P**	**C**
IV Year / I Semester	**2**	**0**	**2**	**3**

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

Course Objectives: The student will be able to understand Big Data as a popular term used to describe the exponential growth, availability and use of information, both structured and unstructured. It is imperative that organizations and IT leaders focus on the ever-increasing volume, variety and velocity of information that forms Big Data. Hadoop is the core platform for structuring BigData, and solves the problem of making it useful for Analytics.

Syllabus:

UNIT I: (8 Lectures)

Introduction to Big Data: What is Big Data and where it is produced? Rise of Big Data, Compare Hadoop vs traditional systems, Limitations and Solutions of existing Data Analytics Architecture, Attributes of Big Data, Types of Data, Use Cases of Big Data, Other technologies vs Big Data.

UNIT II: (9 Lectures)

Hadoop Architecture and HDFS: What is Hadoop? Hadoop History, Distributing Processing System, Core Components of Hadoop, HDFS Architecture, Hadoop Master – Slave Architecture, Daemon Types, Name node, Data node, Secondary Name node.

Hadoop Clusters and the Hadoop Ecosystem- What is Hadoop Cluster? Pseudo Distributed mode, Type of Clusters, Hadoop Ecosystem: Pig, Hive, Flume, SQOOP.

UNIT III: (9 Lectures)

Hadoop MapReduce Framework: Overview of MapReduce Framework, MapReduce Architecture, Job Tracker and Task Tracker, Use Cases of Map Reduce, Anatomy of Map Reduce Program.

MapReduce Programs in Java: Basic MapReduce API Concepts, Writing MapReduce Driver, Mappers, and Reducers in Java, Speeding up Hadoop Development by Using Eclipse, Word Count Example and Weather Dataset Example.

UNIT IV: (8 Lectures)

Hive and HiveQL- What is Hive? Hive vs MapReduce, Hive DDL : Create/Show/Drop Tables, Internal and External Tables, Hive DML : Load Files & Insert Data, Hive Architecture & Components, Difference between Hive and RDBMS, Partitions in Hive.

UNIT V: **(8 Lectures)**

Pig: Pig vs MapReduce, Pig Architecture & Data types, Shell and Utility components, Pig Latin Relational Operators, Pig Latin: File Loaders and UDF, Programming structure in UDF, Pig Jars Import and limitations of Pig.

UNIT VI: **(9 Lectures)**

Apache SQOOP: Why and What is SQOOP?, SQOOP Architecture, Benefits of SQOOP, Importing Data Using SQOOP.

Apache Flume: Introduction, Flume Model and Goals, Features of Flume, Flume Use Cases.

Course Outcomes:

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

CO 1. Outline importance of Big Data in solving real time problems in data analytics.

CO 2. Illustrate Hadoop ecosystem and its components in detail.

CO 3. Make use of distributed file systems and Hadoop and can write MapReduce programs to solve complex problems.

CO 4. Explore the Hadoop ecosystems core components and apply in real-time scenarios.

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	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3

TEXT BOOKS:

1. Tom White, Hadoop : The Definitive Guide, 3rd Edition, O'reilly

2. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", 1st Edition, TMH.

REFERENCE BOOKS:

1. Alex Holmes, Hadoop in Practice, MANNING Publications.

2. Srinath Perera, Thilina Gunarathne, Hadoop MapReduce Cookbook, Packt publishing.

INFORMATION SECURITY
(JOB ORIENTED ELECTIVE-I)

Subject Code: UGCS7T1520	**L**	**T**	**P**	**C**
IV Year / I Semester	**2**	**0**	**2**	**3**

Prerequisites: Familiarity with Probability & Statistics and Computer Networks.

Course Objectives: To make the student learn different encryption techniques along with hash functions, MAC, digital signatures and their use in various protocols for network security and system security.

Syllabus:

UNIT I: (9 Lectures)
Introduction: Security Attacks, Security Services, Security Mechanisms, and a Model for Network Security. Non-Cryptographic Protocol Vulnerabilities - DoS, DDoS, Session Hijacking and Spoofing, Software Vulnerabilities - Phishing, Buffer Overflow, Format String Attacks, SQL Injection. Basics of Cryptography – Steganography, Symmetric Cipher Model, Substitution Techniques, Transportation Techniques, Other Cipher Properties - Confusion, Diffusion, Block and Stream Ciphers.

UNIT II: (9 Lectures)
Secret Key Cryptography: S-DES, Data Encryption Standard (DES), Strength of DES, Block Cipher Design Principles and Modes of Operations, Triple DES, AES.
Number Theory: Divisibility and the Division Algorithm, Prime and Relatively Prime Numbers, Modular Arithmetic, Fermat's and Euler's Theorems, the Chinese Remainder Theorem, Discrete Logarithms.

UNIT III: (9 Lectures)
Public Key Cryptography: Principles of Public Key Cryptosystems, RSA Algorithm, Diffie-Hellman Key Exchange, Introduction to Elliptic Curve Cryptography.
Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Secure Hash Algorithm, Message Authentication Codes – Message Authentication Requirements and Functions, HMAC, Digital signatures, Digital Signature Standards.

UNIT IV: (9 Lectures)
Authentication Applications: Kerberos, Key Management and Distribution, X.509 Directory Authentication service, Public Key Infrastructure, Electronic Mail Security: Pretty Good Privacy.

UNIT V: (9 Lectures)
IP Security: Overview, Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange.
Web Security: Web Security Considerations, Secure Sockets Layer and Transport Layer Security, Electronic Payment.

UNIT VI: (8 Lectures)
System Security: Malicious Software – Types, Viruses, Virus Countermeasures, Worms.

Firewalls: Characteristics, Types of Firewalls, Placement of Firewalls, Firewall Configuration, Trusted systems.

Course Outcomes:

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

CO 1. Identify the basic concepts of cryptography.
CO 2. Classify the symmetric encryption techniques.
CO 3. Apply various public key cryptography techniques, implement Hashing and Digital Signature.
CO 4. Design authentication applications like Kerberos and PGP to provide reliable authentication over open and insecure networks.
CO 5. Analyze and design network security protocols such as IPSec, SSL and TLS.
CO 6. Apply security mechanisms to detect and prevent various attacks.

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	-	-	-	2	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	3	-	-	-	-
CO5	3	3	3	3	2	-	-	2	-	-	-	3	3	3
CO6	3	3	3	3	3	-	-	-	-	-	-	2	-	-

TEXT BOOKS:

1. William Stallings, Cryptography and Network Security, 4th Edition, Pearson Education,.
2. Atul Kahate, Cryptography and Network Security, 2nd Edition, Mc Graw Hill.

REFERENCE BOOKS:

1. Mark Stamp, Information Security - Principles and Practice, Wiley India.
2. Forouzan Mukhopadhyay, Cryptography and Network Security, 2nd Edition, Mc Graw Hill.
3. C K Shyamala, N Harini, Dr T R Padmanabhan, Cryptography and Network Security: 1st Edition, Wiley India.

.NET PROGRAMMING
(JOB ORIENTED ELECTIVE-I)

Subject Code: UGCS7T1620	**L**	**T**	**P**	**C**
IV Year / I Semester	**2**	**0**	**2**	**3**

Prerequisites: Familiarity with any programming language.

Course Objectives:
To introduce the concepts of Microsoft .NET Framework for developing web applications.

Syllabus:

UNIT I: (6 Lectures)
.NET Introduction: Understanding .NET, Writing code using Visual Studio Code, Compiling and Running code using the .NET CLI, Writing top-level programs, Using Git with Visual Studio Code, Looking for help.

UNIT II: (8 Lectures)
C# Basics: C# grammar, Variables, Null values, Exploring console applications, Operators, Selection statements, Iteration statements, Casting and converting between types, Arrays, Functions.

UNIT III: (8 Lectures)
C# Object-Oriented Programming: Classes, Objects, Storing data within fields, Methods, Properties and Indexers, Pattern matching with objects, Records, Simplifying Methods, Raising and Handling Events, Interfaces, Generics, Inheritance.

UNIT IV: (8 Lectures)
.NET Types: Understanding .NET components, Publishing your applications for deployment, Working with Common .NET Types – Numbers, Text, Pattern matching with regular expressions, Collections, Spans, Indexes, Ranges, Network resources, Types and Attributes, Images.
Files & Streams: Managing the file system, Reading and writing with streams.

UNIT V: (8 Lectures)
Working with Databases: Using Entity Framework Core, Querying and Manipulating Data Using LINQ.
ADO.NET: Using Database Connections, Commands, Asynchronous Data Access, Transactions with ADO.NET, Transactions with System.Transactions.

UNIT VI: (8 Lectures)
ASP.NET: Understanding app models for .NET, Understanding web development, Understanding ASP.NET Core, Exploring Razor Pages, Using Entity Framework Core, Using Razor class libraries, Configuring services and the HTTP request pipeline, Building Websites using the MVC Pattern, Building and Consuming Web Services.

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

CO1: Understand the .NET Framework.

CO2: Write various applications using C# Language.
CO3: Access databases using LINQ and ADO.NET
CO4: Develop web applications using ASP.NET

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	3	3	3	-	-	3	3	3	-	3	3	-
CO3	3	-	2	2	3	-	-	-	-	-	-	-	3	-
CO4	3	-	3	3	3	-	-	3	3	3	-	-	3	-

TEXT BOOKS:

1. Mark J. Price, C# 9 and .NET 5 – Modern Cross-Platform Development, Packt Publisher.
2. Christian Nagel et al. "Professional C# 7 with .NET CORE 2.0", Wiley India

REFERENCE BOOKS:

1. Jamie Chan, Learn C# in One Day and Learn It Well, LCF Publishing.
2. Joseph Albahari, C# 9.0 Pocket Reference: Instant Help for C# 9.0 Programmers, O'Reilly
3. Ian Gariffiths, "Programming C# 8.0: Build Windows, Web, and Desktop Applications", O'Reilly.
4. Kevin Hoffman, "Microsoft Visual C#", Pearson Education.
5. S. Thamarai Selvi, R. Murugesan, "A Text Book on C#", Pearson Education.
6. Andrew Troelsen, C# and the .NET Platform, APress.

BLOCKCHAIN TECHNOLOGIES
(JOB ORIENTED ELECTIVE-II)

Subject Code: UGCS7T1720	**L**	**T**	**P**	**C**
IV Year / I Semester	**2**	**0**	**2**	**3**

Prerequisites: Familiarity with Information Security and Computer Networks.

Course Objectives: This course introduces the fundamentals and implementation issues of Blockchain Technologies.

Syllabus:

UNIT I: (8 Lectures)

Grasping Blockchain Fundamentals

Tracing Blockchain's Origin, The shortcomings of current transaction systems,The emergence of bitcoin,The birth of blockchain,Revolutionizing the Traditional Business Network,Exploring a blockchain application, Recognizing the key business benefits, Building trust with blockchain.

UNIT II: (8 Lectures)

Taking a Look at How Blockchain Works

Why It's Called "Blockchain", What Makes a Blockchain Suitable for Business?, Shared ledger, Permissions, Consensus, Smart contracts ,Identifying Participants and Their Roles.

UNIT III: (10 Lectures)

Propelling Business with Blockchains

Recognizing Types of Market Friction, Information frictions, Interaction frictions, Innovation frictions, Moving Closer to Friction-Free Business Networks, Reducing information friction, Easing interaction friction, Easing innovation friction, Transforming Ecosystems through Increased Visibility.

UNIT IV: (8 Lectures)

Blockchain in Action: Use Cases

Financial Services,Commercial financing,Trade finance,Cross-border transactions, Insurance, Government, Supply Chain Management, Healthcare, Electronic medical records Healthcare payments pre-authorization, Internet of Things(IoT).

UNIT V: (8 Lectures)

Hyperledger, a Linux Foundation Project

Hyperledger Vision, Hyperledger Fabric, How Can IBM Help Developers Innovate With Blockchain? Offering an easily accessible cloud and development platform, Individualized attention and industry expertise.

UNIT VI: **(8 Lectures)**

Problems with Block chain

Security and Safeguards, Protection from attackers, Hacks on exchanges, What is stopping adoption?, Scalability problems, Network attacks to destroy bitcoin, Case Study: Failed currencies & blockchain.

Course Outcomes:

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

CO 1. Infer and summarize the fundamentals of Blockchain.

CO 2. Analyze the working of Blockchain.

CO 3. Explain how business can be easily made with Blockchain.

CO 4. Interpret how Blockchain can be integrated with various current technologies.

CO 5. Examine and test the Blockchain strength in providing solutions.

CO 6. Investigate and understand the Problems with Blockchain.

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	2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	3	-	-
CO4	3	2	3	3	-	-	-	-	-	3	-	3	-	-
CO5	3	3	3	3	2	-	-	-	-	-	-	3	-	3
CO6	3	3	3	3	3	-	-	-	-	-	-	3	-	3

TEXT BOOKS:

1. Manav Gupta, Blockchain for Dummies, IBM Limited Edition, John Wiley & Sons.

REFERENCE BOOKS:

1. Swan, Melanie. Blockchain: Blueprint for a new economy. O'Reilly Media, Inc.

CLOUD COMPUTING
(JOB ORIENTED ELECTIVE-II)

Subject Code: UGCS7T1820	**L**	**T**	**P**	**C**
IV Year / I Semester	**2**	**0**	**2**	**3**

Prerequisites: Familiarity with Operating Systems, Computer Networks and Database Management Systems.

Course Objectives: The objective of this course is to provide students with the comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications.

Syllabus:

UNIT I: (10 Lectures)
Introduction to Cloud Computing: Trends in Computing - Distributed Computing, Grid Computing, Cluster Computing, Utility Computing, Cloud Computing, Definition of Cloud Computing, Characteristics, Service Models, Deployment Models, Cloud Service Models Providers, Advantages and Disadvantages of Cloud Computing, Cloud-based Services & Applications.

UNIT II: (8 Lectures)
Cloud Concepts & Technologies: Virtualization and its types, Software Defined Networking, Network Function Virtualization(NFV).
Cloud Services: Compute Services, Storage Services, Database Services, Application Services.

UNIT III: (8 Lectures)
Cloud Application Design: Design Considerations for Cloud Applications, Reference Architectures for Cloud Applications, Cloud Application Design Methodologies: SOA, Cloud Component Model, and MVC, Data Storage Approaches.

UNIT IV: (8 Lectures)
Cloud Security: Cloud Security Architecture(CSA), Authentication, Authorization, Identity & Access Management, Data Security, Key Management.

UNIT V: (7 Lectures)
Migrating into a Cloud: Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Migration Risks and mitigation, Phases of Migrating to Cloud, benefits and risks of Migrating to Cloud.

UNIT VI: (9 Lectures)
SLA Management in Cloud Computing: Service Level Agreements(SLA), Considerations for SLA, SLA Requirements, Types of SLA, Life Cycle of SLA, SLA Management in Cloud. **Case Study:** Amazon AWS: EC2, Amazon Simple DB, Amazon S3, Amazon Cloud Front and Amazon SQS.

Course Outcomes:

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

CO 1. Illustrate key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing.

CO 2. Choose the appropriate methodologies and considerations for Cloud application design.

CO 3. Interpret the core issues of Cloud Computing such as security, Privacy and Interoperability.

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	2	-	-	-	-	-	-	-	-	-	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	-	3
CO3	3	3	-	3	-	2	-	-	-	-	-	-	-	3

TEXT BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, Cloud Computing : A Hands-on Approach, Universities Press.
2. Rajkumar Buyya, James Brogerg, Andrzej Goscinski, Cloud Computing : Principles and Paradigms, WILEY Publication.

REFERENCE BOOKS:

1. Michael Miller, "Cloud Computing – Web Based Applications That Change the way you Work and Collaborate Online", Pearson Education.
2. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing : A Practical Approach", McGraw-Hill.

GO PROGRAMMING
(JOB ORIENTED ELECTIVE-II)

Subject Code: UGCS7T1920	**L**	**T**	**P**	**C**
IV Year / I Semester	**2**	**0**	**2**	**3**

Prerequisites: Familiarity with any programming language.

Course Objectives:
The course is designed to cover the basics and then dive into more advanced features of the Go programming language.

Syllabus:

UNIT I: (7 Lectures)
Introduction: Origins and evolution, Languages that influenced Go, Why a new language?, Targets of the language, Guiding design principles, Characteristics of the language, Uses of the language, Missing features, Programming in Go.
Program Structure: Names, Declarations, Variables, Assignments, Type Declarations, Packages and Files, Scope.

UNIT II: (9 Lectures)
Basic Data Types: Integers, Floating-Point Numbers, Complex Numbers, Booleans, Strings, Constants.
Control Structures: if else construct, switch construct, for construct, break, continue and labels.
Composite Types: Arrays, Slices, Maps, Structs, JSON,Text and HTML Templates.

UNIT III: (9 Lectures)
Functions: Function Declarations, Recursion, Multiple Return Values, Errors, Function Values, Anonymous Functions, Variadic Functions, Deferred Function Calls, Panic, Recover.
Methods: Method Declarations, Methods with a Pointer Receiver, Composing Types by Struct Embedding, Method Values and Expressions, Encapsulation.

UNIT IV: (9 Lectures)
Interfaces: Interfaces as Contracts, Interface Types, Interface Satisfaction, Parsing Flags with flag.Value, Interface Values, The error Interface, Type Assertions, Discriminating Errors with Type Assertions, Querying Behaviors with Interface Type Assertions, Type Switches.
Reading and Writing: Reading input from the user, Reading from and writing to a file, Copying files, Reading arguments from the command-line, Reading files with a buffer, Reading and writing files with slices, Using defer to close a file.

UNIT V: (9 Lectures)
Goroutines and Channels: Goroutines, Concurrent Clock Server, Concurrent Echo Server, Channels, Looping in Parallel, Concurrent Web Crawler, Multiplexing with select, Concurrent Directory Traversal, Cancellation, Chat Server.

Concurrency with Shared Variables: Race Conditions, Mutual Exclusion, Read/Write Mutexes, Memory Synchronization, Lazy Initialization, The Race Detector, Concurrent Non Blocking Cache, Goroutines and Threads.

UNIT VI: (8 Lectures)

Packages and Go Tool: Introduction, Import Paths, The Package Declaration, Import Declarations, Blank Imports, Packages and Naming, The Go Tool.

Testing: Go Test Tool, Test Functions, Coverage, Benchmark Functions, Profiling, Example Functions.

Course Outcomes:

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

- **CO 1.** Study the basic constructs of Go Programming and learn its structural elements in detail.
- **CO 2.** Develop modular programming and make use of functions and methods.
- **CO 3.** Implement the Interfaces and Goroutines for executing the program independently and simultaneously.
- **CO 4.** Perform Testing and apply concurrency in Go programs and examine different packages in Go.

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	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	-

TEXT BOOKS:

1. Alan A. A. Donovan, Brian W. Kernighan, "The Go Programming Language", Addison-Wesley.
2. Ivo Balbaert, "The Way to GO – A Thorough Introduction to the Go Programming Language", i-Universe Publisher.

REFERENCE BOOKS:

1. Mark Summerfield, Programming in Go: Creating applications for the 21st century. Addison-Wesley.
2. Caleb Doxsey, An Introduction to Programming in Go.
3. Tarik Guney, "Hands-On Go Programming: Explore Go by solving real-world challenges", Packt Publishing.
4. John P. Baugh, "Go Programming", CreateSpace Publisher.
5. Mat Ryer, Go Programming Blueprints, Packt Publishing.

ROBOTIC PROCESS AUTOMATION
(JOB ORIENTED ELECTIVE-II)

Subject Code: UGCS7T2020	**L**	**T**	**P**	**C**
IV Year / I Semester	**2**	**0**	**2**	**3**

Prerequisites: A little bit of C programming knowledge, analytical and logical thought procedure to build a process is required.

Course Objectives: This course will give you an overview of robotic process automation (RPA) technology. You will learn the characteristics, benefits, risks, and challenges of RPA. You will learn about the RPA landscape, how RPA is transforming businesses and how it is affecting accounting and finance professionals.

Syllabus:

UNIT I: (7 Lectures)
RPA Foundations: RPA, Flavors of RPA, History of RPA, Benefits of RPA, Downsides of RPA, RPA Compared to BPO, BPM, and BPA; Consumer Willingness for Automation, Workforce of the Future and RPA Skills.

UNIT II: (8 Lectures)
Planning: RPA Consulting: Some Case Studies, What to Automate? ROI for RPA, RPA Use Cases, The Plan and RPA Vendor Evaluation.
Center of Excellence: CoE, Need of CoE, Forming the Team, Business Analyst, Developer, RPA Solution Architect, RPA Supervisor, What Should a CoE Do?, Communication, Change Management.

UNIT III: (10 Lectures)
Bot Development: Installation of UiPath, Activities, Flowcharts and Sequences, Log Message, Variables, Loops and Conditionals, Switch, Debug, Common UiPath Functions, The UiPath Orchestrator, Best Practices.
Deployment and Monitoring : Testing, Going into Production, Monitoring, Security, Scaling.
Data Preparation: Types of Data, Big Data, Issues with Big Data, Data Process, Types of Algorithms, Bias and Open Source RPA.

UNIT IV: (8 Lectures)
Using Blue Prism: Building the first Blue Prism process, Pages, Data Items, Blocks, Collections, Loops, Actions, Decisions, Choices and Calculations.

UNIT V: (9 Lectures)
Implementing Business Objects: Creating a business object, Business Studio, Renaming actions, Application Modeller, Using the Navigate stage, Publishing an action, Using a custom Business Object from a process.
Spying Elements: Spying elements on a web page, How does spying work?, Tweaking and Tightening the match criteria, Adding and Categorizing elements, More spy modes, UI Automation mode, UI Automation navigator, Surface automation with region mode.

Write, Wait, and Read: Creating the search action, Writing to text boxes, Clicking buttons, Wait stage, Read stage, Reading the search results, Using dynamic match attributes.

UNIT VI: (9 Lectures)

Excel & Email Automation: Reading the shopping list, Importing the Excel VBO, Using MS Excel VBO, Opening an Excel file, Reading an entire worksheet into a collection, Writing to a cell, Considerations for CSV, Sending and Receiving Emails.

Control Room and Work Queue: Publishing a process, Running a process, Scheduling processes and work queues.

Exception Handling: Expected and unexpected exceptions, Raising exceptions, Handling exceptions, Debugging and troubleshooting from the control room.

Course Outcomes:

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

CO1. Understand the different RPA tools and its architecture for process development.

CO2. Acquire the basic knowledge on UiPath and Blue Prism softwares.

CO3. Apply the different stages to create and demonstrate static processes.

CO4. Demonstrate the Blue Prism business studio and its stages by creating real time applications.

CO5. Classify the exception handling and error management techniques with different stages in RPA.

Mapping of COs to POs:

PO/ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	-	-	-	2	-	2	3	-
CO2	3	3	3	3	2	3	-	-	-	2	-	3	2	-
CO3	2	2	3	2	3	3	-	-	-	2	-	3	3	-
CO4	2	3	3	3	3	3	-	-	-	2	-	2	2	-
CO5	3	3	3	3	3	3	-	-	-	2	-	2	3	-

TEXT BOOKS:

1. Tom Taulli, The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems, Apress.
2. Lim Mei Ying, Robotic Process Automation with Blue Prism Quick Start Guide, Packt Publishing.

REFERENCE BOOKS:

1. Alok Mani Tripathi, Learning Robotic Process Automation, Packt Publishing Ltd.
2. Kelly Wibbenmeyer, The Simple Implementation Guide to Robotic Process Automation (RPA): How to Best Implement RPA in an Organization, iUniverse.

MANAGEMENT SCIENCE
(Common to all branches)

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

Prerequisites:

- 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 Objectives:

1. To create awareness about different Managerial concepts like Management, Production, Marketing, Human Resource and Strategic Management.
2. To make the students equip with knowledge on techniques of PERT and CPM in project management.

SYLLABUS:

UNIT-I: [8 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: [8 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: [8 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: [8 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: **[8 Hrs]**

Strategic Management: Mission, Goals, objectives, policy, strategy, Environmental scanning, SWOT analysis, Steps in strategy formulation and implementation Generic strategy alternatives.

Course Outcomes:

Upon completing the course, student will be able to

COs	Description	Blooms Level
CO 1	Understand the fundamentals of Management with specific insight as its function and role	Understanding
CO 2	Learn the concepts of production, Management of human Resources and Management of Marketing activities along with business environment	Understanding
CO 3	Apply the problem solving skills to demonstrate logical solution to real life problems	Applying
CO 4	Create the awareness of business strategies to deal with the dynamic business environment	Creating

Mapping of COs to POs:

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO 1	-	-	-	-	-	-	-	-	2	-	-	-	-	-
CO 2	-	-	-	-	-	2	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO 4	-	-	-	-	-	-	-	-	-	-	2	-	-	-

Text Books:

T1. Dr. Arya Sri, "Management Science", TMH 2011.

T2. L.M. Prasad, "Principles & Practices of Management" Sultan chand & Sons, 2007.

Reference Books:

R1. K. Aswathappa and K. Sridhara Bhat, "Production and Operations Management", Himalaya Publishing House, 2010.

R2. Philip Kotler Philip Kotler, Kevin Keller, Mairead Brady, Malcolm Goodman, Torben Hansen, "Marketing Management" Pearson Education Limited, 2016.

AMAZON WEB SERVICES
(Skill Oriented Course)

Subject Code: UGCS7K2120	**L**	**T**	**P**	**C**
IV Year / I Semester	**1**	**0**	**2**	**2**

Prerequisites: Familiarity with basics of cloud computing.

Course Objective: The objective of this course is to get the skills pertaining to Amazon Web services.

Syllabus:

AWS Compute Services: Amazon Elastic Compute Cloud, Different types of instances in Amazon Web Services- General purpose instances, Compute Optimized instances, Memory Optimized instances, Accelerated Computing instances, Storage Optimized instances.

AWS Storage Services: Different types of AWS Storage Services, Amazon Simple Storage Service, Amazon Elastic Block storage, Amazon Glacier storage service.

AWS Database Services: Types of Database services in AWS environment - Relational and Key value types- Amazon DynamoDB.

AWS Security: AWS Security Groups, AWS Virtual Private Cloud.

Experiments:

1. Launch an EC2 instance in AWS environment using a general purpose instance (either in Windows environment or Linux environment).
2. Create a sample web application which runs in AWS to store the data by using AWS S3 service.
3. Launch an EC2 Linux instance in AWS environment then attach and mount EBS volume to EC2 instance.
4. Launch an AWS DynamoDB instance which supports the type i.e. key value pair databases (Unstructured data)
5. Create a Virtual Private Cloud in Amazon Web Services and launch an EC2 instance of your own choice i.e. either Linux or windows instance

Course Outcomes:

Upon completion of this course, the students will be able to:
CO1 Deploy virtual instances on AWS platform using Amazon EC2 Service.
CO2 Demonstration of storage services on AWS platform.
CO3 Deployment of Database instances on AWS platform.
CO4 Apply security on AWS platform.

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	-	-	-	2	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	-	-	-	-	3
CO4	3	2	3	-	3	-	-	-	-	-	-	-	-	3

Text Books:

1. Mark Wilkins, Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud, Pearson Education.
2. Bernard Golden, Amazon Web Services for Dummies, John Wiley & Sons.

Reference Books:

1. Andreas Wittig & Michael Wittig, Amazon Web Services in Action, Manning Publications.
2. Aurobindo Sarkar, Amit Shah, Learning AWS, Packt Publishing.
3. Richard Derry, Amazon Web Services: The Complete Guide From Beginners For Amazon Web Services,
4. Joe Baron, Hisham Baz, Tim Bixler, AWS Certified Solutions Architect Official Study Guide, Wiley
5. Bert David, Amazon Web Services Tutorial for Beginners, Lightning Source
6. George Sammons, Introduction to AWS Beginner's Guide Book
7. https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/concepts.html
8.https://docs.aws.amazon.com/whitepapers/latest/aws-overview/storage-services.html
9. https://docs.aws.amazon.com/whitepapers/latest/aws-overview/database.html
10. https://docs.aws.amazon.com/lex/

SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN (AUTONOMOUS)
BHIMAVARAM – 534202
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Course Structure – R20
(With effect from 2020-2021)

Honors Syllabus
(For CSE students)

S.No.	Course Code	Course Title	L	T	P	C
1	UGCS0H0120	Artificial Intelligence	3	1	-	4
2	UGCS0H0320	Natural Language Processing	3	1	-	4
3	UGCS0H0420	Neural Networks	3	1	-	4
4	UGCS0H0520	Deep Learning	3	1	-	4
5	UGCS0H3420	MOOC1	2	-	-	2
6	UGCS0H3520	MOOC2	2	-	-	2

ARTIFICIAL INTELLIGENCE

Subject Code: UGCS0H0120

L	T	P	C
3	1	0	4

Prerequisites: Familiarity with Discrete Mathematics, Linear Algebra and Probability.

Course Objectives: The objective of the course is to present an overview of artificial intelligence principles and approaches.

Syllabus:

UNIT I: (7 Lectures)

Introduction to artificial intelligence: Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-toe game playing, development of AI languages, current trends in AI. **Problem solving: state-space search and control strategies:** Introduction, general problem solving, characteristics of problem.

UNIT II: (7 Lectures)

Search Strategies: exhaustive searches, heuristic search techniques, a*, constraint satisfaction.

UNIT III: (7 Lectures)

Logic concepts: Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic.

UNIT IV: (8 Lectures)

Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames.

Advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure, cyc theory.

UNIT V: (8 Lectures)

Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools.

UNIT VI: (7 Lectures)

Uncertainty measure: probability theory: Introduction, probability theory, Bayesian belief networks, certainty factor theory, dempster-shafer theory.

Course Outcomes:

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

- **CO 1** Summarize and formulate appropriate logic concepts and AI methods for solving a problem.
- **CO 2** Applying various searching, game playing, and knowledge representation techniques to solve the real world problems.
- **CO 3** Analyze different expert systems and its applications.
- **CO 4** Explain the concepts of probability theory, fuzzy sets and fuzzy logic for uncertainty measure.

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	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1. Saroj Kaushik, Artificial Intelligence, CENGAGE Learning.
2. Stuart Russel, Peter Norvig, Artificial intelligence, A modern Approach, 2nd ed, PEA.
3. Rich, Kevin Knight, Shiv Shankar B Nair, Artificial Intelligence, 3rd ed, TMH.
4. Patterson, Introduction to Artificial Intelligence, PHI.

REFERENCE BOOKS:

1. George F Lugar ,Artificial intelligence, structures and Strategies for Complex problem solving, 5th ed, PEA.
2. Ertel, Wolf Gang, Introduction to Artificial Intelligence, Springer.
3. Nils J Nilsson, A new Synthesis Artificial Intelligence, Elsevier.

NATURAL LANGUAGE PROCESSING

Subject Code: UGCS0H0320

L	T	P	C
3	1	0	4

Prerequisites: Familiarity with Compiler Design.

Course Objectives: The main objective of the course is to learn how to develop practical computer systems capable of performing intelligent tasks on natural language analyze, understand and generate written text.

Syllabus:

UNIT I: (8 Lectures)

Introduction: What is Natural Language Processing, NLP tasks in syntax, semantics, and pragmatics. Applications such as information extraction, question answering, and machine translation. The problem of ambiguity. The role of machine learning. Brief history of the field.

UNIT II: (8 Lectures)

N-gram Language Models: The role of language models, Simple N-gram models. Estimating parameters and smoothing. Evaluating language models.

Part of Speech Tagging and Sequence Labeling: Lexical syntax. Hidden Markov Models. Maximum Entropy Models. Conditional Random Fields.

UNIT III: (8 Lectures)

Syntactic Parsing: Grammar formalisms and tree banks. Efficient parsing for context-free grammars (CFGs). Statistical parsing and probabilistic CFGs (PCFGs). Lexicalized PCFGs.

UNIT IV: (10 Lectures)

Semantic Analysis: Lexical semantics and word-sense disambiguation. Compositional semantics. Semantic Role Labeling and Semantic Parsing.

UNIT V: (8 Lectures)

Information Extraction (IE) and Machine Translation (MT): Named entity recognition and relation extraction. IE using sequence labeling. Basic issues in MT. Statistical translation, word alignment, phrase-based translation, and synchronous grammars. Dialogues: Turns and utterances, grounding, dialogue acts and structures.

UNIT VI: (8 Lectures)

Natural Language Generation: Introduction to language generation, architecture, discourse planning (text schemata, rhetorical relations).

Course Outcomes:

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

CO 1. Relate the basics of NLP and study the role of machine learning in processing NLP.

CO 2. Analyze various Language Models and process part of speech tagging for static NLP.

CO 3. Discover how to analyze the words and extract meaning from the text.

CO 4. Identify various ways to draw inferences from text and language translation.

CO 5. Summarize the mechanisms to generate natural language.

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	1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	2	3	-	2	-	-	-	-	-	3	-	-
CO3	-	3	3	-	-	2	-	-	-	-	-	3	-	-
CO4	-	3	3	-	-	2	-	-	-	-	-	3	-	3
CO5	-	2	2	2	-	-	-	-	-	-	-	3	-	3

TEXT BOOKS:

1. D. Jurafsky, J. H. Martin, Speech and Language Processing- An introduction to Language Processing, Computational Linguistics, and Speech Recognition, Pearson Education.
2. Manning and Schutze, Foundations of Statistical Natural Language Processing, MIT Press.

REFERENCE BOOKS:

1. Allen, James Benjamin/Cummings, Natural Language Understanding, Benjamin-Cummings Publishing Co, 2ed.
2. Bharathi, A., Vineet Chaitanya and Rajeev Sangal, Natural Language Processing- A Pananian Perspective, Prentice Hll India, Eastern Economy Edition.

NEURAL NETWORKS

Subject Code: UGCS0H0420

L	T	P	C
3	1	0	4

Prerequisites: Familiarity with Linear Algebra and basic knowledge in programming.

Course Objectives: Understand the difference between biological neuron and artificial neuron, Explore the building

blocks of neural networks and its application areas in order to design and develop applications using neural networks.

Syllabus:

UNIT I: (7 Lectures)

Introduction: Key Features, Historical Overview, Potential Application Areas, Biological Neuron, Artificial Neuron, Performance Parameters, Main Architectures of Artificial Neural Networks, Training Processes and Properties of Learning.

UNIT II: (8 Lectures)

Perceptron Network: Operating Principle of the Perceptron, Mathematical Analysis of the Perceptron, Training Process of the Perceptron.

ADALINE Network and Delta Rule: Operating Principle of the ADALINE, Training Process of the ADALINE, Comparison Between the Training Processes of the Perceptronand the ADALINE.

UNIT III: (8 Lectures)

Multilayer Perceptron Networks: Operating Principle, Training Process, Multilayer Perceptron Applications, Topological Specifications for MLP Networks, Implementation Aspects.

UNIT IV: (9 Lectures)

Radial Basis Function Networks: Training Process of the RBF Network, Applications of RBF Networks.

Recurrent Hopfield Networks: Operating Principles, Stability Conditions, Associative Memories, Design Aspects of the Hopfield Network, Hardware Implementation Aspects.

Self-Organizing Kohonen Networks: Competitive Learning Process, Kohonen Self-Organizing Maps.

UNIT V: (8 Lectures)

LVQ and Counter-Propagation Networks: Vector Quantization Process, LVQ Networks, Counter-Propagation Networks.

Adaptive Resonance Theory Networks: Topological Structure, Adaptive Resonance Principle, Learning Aspects of the ART-1 Network, Training Algorithm of the ART-1 Network, Aspects of the ART-1 Original Version.

UNIT VI: (7 Lectures)

Applications: Introduction, Direct applications, Application areas, Computer Network Traffic Analysis Using SNMP Protocoland LVQ Networks, Forecast of Stock Market Trends Using Recurrent Networks, Disease Diagnostic System Using ART Networks.

Course Outcomes:

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

CO1. Explore the structure and functionality of an artificial neuron and networks formed by it.

CO2. Demonstrate the mathematical analysis involved to activating the neurons.

CO3. Building multi-layer networks and understand how a network can be trained with forward and backward propagation.

CO4. Explore different types of networks and its application areas.

CO5. Building working prototypes to see the real working nature of an Artificial Neural Network.

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	1	-	-	-	-	-	-	-	-	-		-
CO2	3	3	1	-	-	-	-	-	-	-	-	-		-
CO3	3	3	3	-	2	-	-	-	-	-	-	-	2	2
CO4	-	3	3	-	3	-	-	-	-	-	2	1	2	2
CO5	-	3	3	3	3	2	-	-	2	1	2	2	3	3

TEXT BOOKS:

1. Ivan Nunes da Silva, etal., Artificial Neural Networks : A Practical Course, Springer.
2. B Yegnanarayana, Artificial neural networks, Prentice Hall of India Ltd.

REFERENCE BOOKS:

1. Simon Haykin, Neural Networks and Learning Machines, Pearson Education.
2. Daniel Graupe, Principles of Artificial Neural Networks, World Scientific Publishing
3. James A. Anderson, "An Introduction to Neural Networks", PHI.
4. James A Freeman and Davis Skapura, Neural Networks: Algorithms, Applications, and Programming Techniques, Pearson Education.
5. S. Sivanandam, Introduction to Artificial Neural Networks, Vikas Publishing.
6. Sateesh Kumar, "Neural Networks: A Class Room Approach", TMH.
7. S.N. Sivanandam, S.Sumathi, S.N.Deepa, Introduction to Neural Networks using MATLAB 6.0, TMH.
8. Ananda Rao, Srinivas, "Neural Networks", Narosa.
9. Simon Haykin, "Neural networks A comprehensive foundations", Pearson Education.

DEEP LEARNING

Subject Code: UGCS0H0520

L	T	P	C
3	1	0	4

Prerequisites: Familiarity with Probability & Statistics, Design and Analysis of Algorithms.

Course Objectives: The objective of the course is to provide exposure to these advances and facilitate in depth discussions on deep learning.

Syllabus:

UNIT I: (8 Lectures)

Machine Learning Basics

Learning Algorithms, Capacity, Over fitting and Under fitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Estimation Bayesian Statistics.

Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Descent, Building a Machine Learning Algorithm, Challenges Motivating Deep Learning.

UNIT II: (8 Lectures)

Deep Feedforward Networks

Example: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms.

UNIT- III: (8 Lectures)

Regularization for Deep Learning

Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multitask Learning.

UNIT IV: (8 Lectures)

Optimization for Training Deep Models

How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms.

UNIT V: (10 Lectures)

Convolutional Networks

The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basis for Convolutional Networks.

UNIT VI: **(8 Lectures)**

Sequence Modeling: Recurrent and Recursive Nets

Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Optimization for Long-Term Dependencies, Explicit Memory.

Course Outcomes:

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

CO 1. Demonstrate the basics of Machine Learning.

CO 2. Analyze the importance of deep feed forward networks.

CO 3. Summarize the significance of regularization for Deep Learning.

CO 4. Implement optimization in DL.

CO 5. Perceive the importance of Convolutional Networks and its significance.

CO 6. Illustrate the knowledge on Sequence Modeling.

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	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	3	-	-	-	-	3	-	3	-	3
CO5	3	3	3	3	-	-	-	3	-	-	-	3	-	3
CO6	3	3	3	3	-	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1. Goodfellow, I., Bengio, Y., Courville, A., & Bengio, Y. Deep learning,Vol. 1. Cambridge: MIT press.
2. François Duval , Deep Learning: Deep Learning for Beginners. Practical Guide with Python and Tensorflow, Data Sciences Publishing.

REFERENCE BOOKS:

1. Sebastian Raschka, Vahid Mirjalili,Python Machine Learning: Machine. Learning and Deep Learning with Python, scikit-learn, and TensorFlow, 2nd Edition, Packt Publishing.