NATURAL LANGUAGE PROCESSING

(Professional Elective IV)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:		Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To show how language related algorithms and techniques can be applied to important real-world problems (Spell Checking, Text Document Search, Part-of-Speech Tagging).
2. To introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics

UNIT - I

Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches.

UNIT - II

Syntax Analysis: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues.

UNIT - III

Semantic Analysis: Introduction, Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation.

UNIT - IV

Discourse Processing: Cohesion, Reference Resolution, Discourse Cohesion and Structure.
Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems.

UNIT - V

Natural Language Generation: Introduction, Architectures of NLG systems, Generation tasks and Representations, Applications of NLG.
Machine Translation: Introduction, Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation approaches, Direct Machine Translation**,** Rule-Based Machine Translation, Corpus-based Machine Translation, Knowledge-based Machine Translation systems.

Course Outcomes: After completion of course, students will be able to

CO 1 : Understand parts- of- speech tagger based on HMMs and transformation based learning.
CO 2 : Able to construct statistical models over strings and trees using supervised and unsupervised training methods
CO 3 : Able to design, implement, and analyze NLP algorithms.
CO 4 : Understand how a system would able to communicate with humans via language.
CO 5 : Able to design different language modeling Techniques

Test Books:

1. Steven Biord, Ewan Klein and Edward Loper, *"Natural Language Processing with Python" Analyzing text with Natural Language Toolkit*,
2. Tanvier Siddiqui, U.S. Tiwary, *Natural Language Processing and Information Retrieval*, Oxford University Press, 2008

References:

1. Daniel Jurafsky & James H Martin, *Speech and Natural Language Processing*, 2nd Edition, Pearson Publications, 2008.

ETHICAL HACKING

(Professional Elective IV)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:		Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

2. To understand numerous methods of real-world information intelligence.
3. To learn about vulnerability scanners.
4. To understand techniques used to sniff traffic across a network.
5. To familiarize with the methodologies that can be used to hack into a target.
6. To appreciate the wide variety of attacks that can be performed against a wireless network

UNIT I - Introduction To Hacking

Terminologies, Categories of Penetration Test, Writing Reports, Structure of a Penetration Testing Report, Vulnerability Assessment Summary, Risk Assessment, Methodology.

UNIT II - Information Gathering Techniques

Active, Passive and Sources of information gathering, Copying Websites Locally, NeoTrace, Cheops-ng, Intercepting a Response, WhatWeb, Netcraft, Basic Parameters, Xcode Exploit Scanner, Interacting with DNS Servers, Fierce, Zone Transfer with Host Command and Automation, DNS Cache Snooping- Attack Scenario, Automating Attacks, SNMP - Problem, Sniffing Passwords.

UNIT III - Network Sniffing

Introduction to Vulnerability Assessment - Pros and Cons, NMap, Updation of database, Testing SCADA Environments with Nmap, Nessus, Sniffing: Types, Hubs versus Switches, Modes, MITM Attacks, ARP Protocol Basics- working, Attacks, DoS Attacks, Dsniff tool, Using ARP Spoof to Perform MITM Attacks, Sniffing the Traffic with Dsniff, Sniffing Pictures with Drifnet, Urlsnarf and Webspy, Sniffing with Wireshark, Ettercap- ARP Poisoning, Hijacking Session with MITM Attack, ARP Poisoning with Cain and Abel, Sniffing Session Cookies with Wireshark, Hijacking the Session

UNIT IV - Basics Of Exploitation

Remote Exploitation: Understanding Network Protocols, Attacking Network Remote Services, Common Target Protocols, tools for cracking network remote services, Attacking SMTP, Attacking SQL Servers

UNIT V – Wireless Hacking

Wireless Hacking : Requirements , Aircracking , Hidden SSIDs , Monitor Mode , Monitoring Tool-Beacon Frames on Wireshark ,Airodump-ng , Wireless Adapter in Monitor Mode , Determining the Target , Cracking a WPA/WPA2 Wireless Network Using Aircrack-ng , Capturing Packets and Four-Way

Course Outcomes: At the end of the course, the student should be able to

CO 1 : Understand the core concepts related to malware, hardware and software vulnerabilities and their causes
CO 2 : Understand ethics behind hacking and vulnerability disclosure
CO 3 : Appreciate the Cyber Laws and impact of hacking
CO 4 : Exploit the vulnerabilities related to computer system and networks using state of the art tools and technologies
CO 5 : Analyze and trouble shoot the problems related to system or network security issues.

Text Books:

1. Rafay Baloch, *Ethical Hacking and Penetration Testing Guide*, CRC Press, 2015.

References:

2. Patrick Engebretson, *The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy*, Syngress Media, Second Revised Edition, 2013.
3. Michael T. Simpson, Kent Backman and James E. Corley, *Hands On Ethical Hacking and Network Defense*, Cengage Learning, 2012.

SOFT COMPUTING

(Professional Elective IV)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:		Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To make the students to understand role of artificial intelligence, neural networks, fuzzy sets, fuzzy logic and genetic algorithms to solve real world problems.
2. To solve real world problems using soft computing techniques.

UNIT I - Al Problems and Search

Al problems, Techniques, Problem Spaces and Search, Heuristic Search Techniques- Generate and Test, Hill Climbing, Best First Search, Problem reduction, Constraint Satisfaction, and Means-Ends Analysis. Approaches to Knowledge Representation, Using Propositional Logic and Predicate Logic.

UNIT II - Artificial Neural Networks

Introduction, Basic models of ANN , important terminologies, Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back propagation Network. Associative Memory Networks. Training Algorithms for pattern association , BAM and Hopfield Networks.

UNIT III - Unsupervised Learning Network

Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks.

UNIT IV – Classical Sets and Fuzzy Sets

Introduction to Classical Sets (crisp Sets) and Fuzzy Sets- operations and Fuzzy sets. Classical Relations and Fuzzy Relations- Cardinality, Operations, Properties and composition. Tolerance and equivalence relations. Membership Features, Fuzzification, membership value assignments, Defuzzification.

UNIT V - Fuzzy Arithmetic

Fuzzy Arithmetic and Fuzzy Measures, Fuzzy Rule Base and Approximate Reasoning, Fuzzy Decision making, Fuzzy Logic Control Systems. Genetic Algorithm- Introduction, and basic operators and terminology.

Course Outcomes: At the end of the course, the student should be able to

CO 1 : Comprehend AI problems and apply various problems solving techniques like Hill climbing, Best first search, Means End Analysis
CO 2 : Explain Supervised learning networks and their training algorithms
CO 3 : Understand Unsupervised learning networks, their specific features and their applications
CO 4 : Comprehend fuzzy sets, their operations and their applications
CO 5 : Appreciate and apply fuzzy arithmetic and fuzzy logic control systems

Text Books:

1. S N Sivanandam and S N Deepa, *Principles of Soft Computing*, 2nd Edition, Wiley India, 2007.
2. Fakhreddine O Karray, *Soft Computing and Intelligent System Design*, 3rd Edition, Pearson Edition, 2004.

References:

1. Amit Konar, *Artificial Intelligence and Soft Computing-Behavioural and Cognitive Modelling of the Human Brain*, 3rd Edition, CRC press, Taylor and Francis Group, 2011.

2. Elaine Rich and Kevin Knight, *Artificial Intelligence*, 2nd Edition TMH, 1991,(Reprint)2008.
3. N.P.Padhy, *Artificial Intelligence and Intelligent Systems*, 2nd Edition, Oxford University Press, 2013.

SOFTWARE TESTING METHODOLOGIES

(Professional Elective IV)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:		Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To acquire knowledge on basic principles, concepts on different testing techniques and m methodologies and to demonstrate how they can uncover different errors(bugs)
2. To understand the taxonomy of bugs & testing and the stages at which different tests are to be performed
3. To design the test cases and execute to uncover errors related to internal processing logic within modules interfacing, and functionality of software.
4. To gain theory and knowledge to design and implement testing tools with an aim to enhance the performance of testing.

UNIT I – Introduction and Overview of Testing

Purpose of Testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs.
Overview of Unit & Integration testing, and white box & black box testing.

UNIT II - Flow Graphs, Path Testing, Paths, Path Products and Regular Expressions

Flow Graphs, Path Testing: Basic Concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.
Paths, Path Products and Regular Expressions: Path products and path expression, reduction procedure, applications, regular expressions and flow anomaly detection.

UNIT III – Data Flow Testing and Domain Testing

Dataflow Testing**:** Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing.
Domain Testing: Domains and paths, domain testing, domains and interface testing, domains and testability.

UNIT IV – Logic Based Testing, States, State Graphs and Transition Testing

Logic Based Testing: Overview, decision tables, path expressions, kv charts, specifications.
States, State Graphs and Transition Testing: Overview, state bugs, transition bugs, state testing.

UNIT V – Graph Matrices and Application

Integration Testing, Graph Matrices and Application: Motivational Overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools.
System and Acceptance Testing: Functional system testing, Non-functional system testing, and Acceptance testing.
Testing Object Oriented Systems: Introduction of Object Oriented testing concepts, Differences in OO Testing.

Course Outcomes: At the end of the course, the student should be able to

- CO 1 : Apply basic concepts of testing, path testing, path expression, flow graph and predicate testing for testing code
- CO 2 : Acquire knowledge of domain errors, types domain bugs and sources of domain errors.
- CO 3 : Appreciate the purpose of logic based testing using decision tables, reducing using KV charts and integration testing as a phase of testing.
- CO 4 : Represent a problem using graph matrices, node reduction algorithm; understand the functional and non-functional system testing techniques.
- CO 5 : Select test cases for Acceptance testing based on required criteria, and understand different concepts of Object Oriented testing.

Text Books:

1. Boris Beizer, *Software Testing techniques*, 2nd Edition, Dreamtech, 2009.
2. Srinivasan D and Gopalswamy R, *Software Testing: Principles and Practices*, Pearson Education, 2008.

References:

1. Sagar Naik, *Software Testing and Quality Assurance: Theory and Practice*, Wiley, 2008.
2. Edward Kit, *Software Testing in the Real World,* Pearson Education, 2008.
3. E.William Perry, *Effective methods of Software Testing*, 3rd Edition, John Wiley, 2006.

REAL TIME SYSTEMS

(Professional Elective IV)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:		Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To discuss the characteristics and elements of real time systems
2. To introduce the task abstraction and the scheduling models
3. To model the fault tolerance problems

Unit – I: Introduction to Real Time Systems

Introduction: Applications, Characteristics of Real Time Systems, Basic Model, Types of Real time Tasks, Timing constraints and modelling

Unit- II: Real Time Task Scheduling

Types of Task Scheduling, Clock Driven Scheduling -Table Driven Scheduling, Cyclic Scheduling, Event Driven Scheduling - EDF and RMA

Unit –III: Resource Sharing and Scheduling Real Time tasks in Distribute Systems

Priority Inversion, PIP, HLP, PCP, Different Types of Priority Inversions under PCP, Issues in Resource Sharing Protocol

Dynamic Allocation of Tasks, Fault Tolerant Scheduling of Tasks, Clock Synchronization

Unit-IV: Real Time Communication and Real Time Databases

Real time communication in a LAN, Soft and Hard Real Time Communication in LAN, Bounded Access Protocols in LAN, Real Time Routing, Resource Reservation, Rate Control, QoS Models

Real Time Databases, Characteristics of Temporal Data, Concurrency Control in Real Time Databases

Unit- V: Fault Tolerance Techniques and Commercial RTOS

Fault tolerance: Introduction, Types of Faults, Fault Detection, Redundancy, Byzantine Failures

Real Time Operating System, Unix as RTOS, VxWorks, RT Linux.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Characterize the real time systems and understand the criticalities in design an embedded system.
CO 2	:	Implement real time task scheduling algorithms
CO 3	:	Extend the scheduling algorithms to distributed environment.
CO 4	:	Implement real time routing protocols and consistency models in data bases
CO 5	:	Model fault tolerance algorithms and gain insight into various real time operating systems.

Text Books:

1. Rajib Mall, *Real Time Systems: Theory and Practice*, Pearson Education, 2007
2. C.M Krishna and Kang G. Shin, *Real Time Sytems*, Mc Graw Hill, 1997

References:

1. Jane W.S. Liu, *Real-Time Systems*, Pearson, 2005
2. Quing Li, *Real Time concepts for Embedded Systems*, Elsevier, 2011.

COMPUTER VISION

(Professional Elective V)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:		Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To review image processing techniques for computer vision.
2. To perform feature analysis, 3D image analysis
3. To explore the concept of Hough Transform and its applications.

UNIT I - Image filters and Operations

Image Processing Operations, Convolutions and Point Spread Functions, Sequential Versus Parallel Operations, Noise Suppression by Gaussian Smoothing, Median Filters, Mode Filters, Rank Order Filters, Reducing Computational Load , Sharp Unsharp Masking, Shifts Introduced by Median Filters, Discrete Model of Median Shifts, Shifts Introduced by Mode Filters , Mean and Gaussian Filters, Rank Order Filters, Shifts in Rectangular Neighborhoods, The Role of Filters in Industrial Applications of Vision, Color in Image Filtering.

UNIT II - Thresholding Techniques and Feature Detection

Region-Growing Methods, Thresholding, Adaptive Thresholding, More Thoroughgoing Approaches to Threshold Selection, The Global Valley Approach to Thresholding, Histogram Concavity Analysis, Basic Theory of Edge Detection, The Template Matching Approach, Theory of 333 Template Operators, Design of Differential Gradient Operators, The Concept of a Circular Operator and implementation, The Systematic Design of Differential Edge Operators, Hysteresis Thresholding, The Canny Operator, The Laplacian Operator, Active Contours,

UNIT III - Corner and Interest Point Detection

Template Matching, Second-Order Derivative Schemes, A Median Filter-Based Corner Detector, The Harris Interest Point Operator, Corner Orientation, Local Invariant Feature Detectors and Descriptors. Binary Shape Analysis: Connectedness in Binary Images, Object Labeling and Counting, Size Filtering, Distance Functions and Their Uses, Skeletons and Thinning, Other Measures for Shape Recognition.

UNIT IV - Boundary Analysis:

Boundary Tracking Procedures, Centroidal Profiles, Problems with the Centroidal Profile Approach, (s, ψ) Plot, Tackling the Problems of Occlusion, Accuracy of Boundary Length Measures, Line Detection: Application of the Hough Transform to Line Detection, The Foot-of-Normal Method, Application of the Foot-of-Normal Method, Longitudinal Line Localization, Final Line Fitting, Using RANSAC for Straight Line Detection, Circle and Ellipse Detection : Hough-Based Schemes for Circular Object Detection, The Problem of Unknown Circle Radius, Ellipse Detection, Human Iris Location, Hole Detection.

UNIT V - Three-Dimensional World

3-D Vision—the Variety of Methods, Projection Schemes for Three-Dimensional Vision, Shape from Shading, Photometric Stereo, The Assumption of Surface Smoothness, Shape from Texture, Three-Dimensional Object Recognition Schemes. Ambiguity of Pose under Weak Perspective Projection, Obtaining Unique Solutions to the Pose Problem.

Course Outcomes: At the end of the course, the student should be able to

CO 1 : Understand fundamental image processing techniques required for computer vision.
CO 2 : Implement Thresholding Techniques and edge detection methods
CO 3 : Implement Corner and Intersect point Detection.
CO 4 : Apply Hough Transform for line, circle, and ellipse detections.
CO 5 : Design 3D object recognition schemes.

Textbooks:

1. Davies E.R., *Computer and Machine Vision, Theory, Algorithms, Practicalities*, Academic Press, in print of Elsevier, IV th Edition, 2012

References:

2. D. L. Baggio et al., *Mastering OpenCV with Practical Computer Vision Projects*, Packt Publishing, 2012.
3. Jan Erik Solem, *Programming Computer Vision with Python: Tools and algorithms for analyzing images*, O'Reilly Media, 2012.
4. Mark Nixon and Alberto S. Aquado, *Feature Extraction & Image Processing for Computer Vision*, Third Edition, Academic Press, 2012.
5. R. Szeliski, *Computer Vision: Algorithms and Applications*, Springer, 2011.

BLOCK CHAIN TECHNOLOGIES

(Professional Elective V)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:		Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. This course aims to provide conceptual understanding of the function of Block chains as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
2. It covers the technological underpinnings of block chain operations as distributed data structures and decision making systems, their functionality and different architecture types.
3. It provides a critical evaluation of existing "smart contract" capabilities and platforms, and examines their future directions, opportunities, risks and challenges.

UNIT I - **Introduction to Block chain**

Introduction to Block chain: The growth of Block chain technology, Distributed systems, The history of Block chain and Bitcoin, Types of Block chain, Consensus, CAP theorem and Block chain

Decentralization: Decentralization using block chain, Methods of decentralization, Routes to decentralization, Block chain and full ecosystem decentralization, Smart contracts, Decentralized Organizations, Platforms for decentralization

UNIT II - Bitcoins

Bitcoins: Introducing Bitcoin, Digital keys and addresses, Transactions, Block chain: The structure of a block, Mining

Bitcoin Network and Payments: The Bitcoin network, Wallets, Bitcoin payments: Innovation in Bitcoin, Bitcoin Clients and APIs: Bitcoin installation, Alternative Coins, Bitcoin limitations.

UNIT III - Smart Contracts

Smart Contracts: History, Definition, Ricardian contracts, Introduction to Ethereum, Components of the Ethereum ecosystem, Further Ethereum, Programming languages.

UNIT IV - Ethereum Development Environment

Ethereum Development Environment: Test networks, Setting up a private net, Starting up the private network, Development Tools and Frameworks, Compilers, Solidity compiler (solc), Installation on Linux, Installation on macOS, Integrated Development Environments (IDEs)

Solidity language**:** Solidity language, Types, Value types, Literals, Enums, Function types, Reference types, Global variables, Control structures, Layout of a Solidity

UNIT V - HyperLedger

Hyperledger: Projects under Hyperledger, Hyperledger as a protocol,The reference architecture, Requirements and design goals of Hyperledger Fabric, Hyperledger Fabric, Membership services, Block chain services, Consensus services, Distributed ledger

Beyond Cryptocurrency: applications of block chain in cyber security, integrity of information, E-Governance and other contract enforcement mechanisms, Limitations of block chain as a technology, and myths vs. reality of block chain technology.

Course Outcomes: At the end of the course, the student should be able to

CO 1 : Understand the structure of a block chain and why/when it is better than a simple distributed database

CO 2 : Evaluate the setting where a block chain based structure may be applied, its potential and its limitations

CO 3 : Understand what constitutes a "smart" contract, what are its legal implications and what it can and cannot do, now and in the near future

CO 4 Attain awareness of the new challenges that exist in monetizing businesses around block chains and smart contracts

CO 5 Describe and understand the differences between the most prominent block

chain structures and permissioned block chain service providers, as well as rising alliances and networks

Text Books:

1. Imran Bashir, *Mastering Block Chain*, Second Edition, Packt Publishing, March 2018.
2. Andreas M. Antonopoulos, *Mastering Bitcoin Programming the Open Block Chain*, 2nd Edition, "O'Reilly Media, Inc.", June,2017 .

References:

1. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
2. Publisher: https://www.packtpub.com/big-data-and-business-intelligence/hands-blockchain-hyperledger
3. Public github repository with code samples: https://github.com/HyperledgerHandsOn/trade-finance-logistics

SPATIAL INFORMATICS

(Professional Elective V)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:		Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To identify, store, manipulate and analyze spatial data using state-of-the-art software.
2. To understand and interpret data in different ways, that reveal relationships.
3. To explore the commercial trends in the form of tools.

UNIT I - Introduction

Application domains, Compare a SDBMS with a GIS, Categories of Users, An example of an SDBMS application, Spatial concepts, Models of Spatial Information, Three-Step Database Design, Extending ER with Spatial Concepts, Spatial query languages: Standard Database Query Languages, Relational Algebra, Basic SQL Primer, Extending SQL for Spatial Data, Example Queries that emphasize spatial aspects, Trends: Object-Relational SQL. (Textbook 1)

UNIT II - Spatial Data Management

Storage: Disk and Files, Spatial Indexing, Trends, Evaluation of Spatial Operations, Query Optimization, Analysis of Spatial Index Structures, Distributed Spatial Database Systems, Parallel Spatial Database Systems (Textbook 1)

UNIT III - Spatial Networks

Example Network Databases, Conceptual, Logical and Physical Data Models, Query Language for Graphs, Graph Algorithms, Trends: Access Methods for Spatial Networks (Textbook 1)

UNIT IV - Spatial Analysis

Understanding the Context and Relevance of Spatial Analysis, Spatial Analysis Using a GIS Timeline, Geographic Data: Properties, Strengths, and Analytical Challenges, Making Scientific Observations and Measurements in Spatial Analysis, Using Statistical Measures to Analyze Data Distributions, Descriptive Statistics, Deriving a Weighted Mean Using the Frequency Distributions in a Set of Observations, Spatial Statistics: Measures for Describing Basic Characteristics of Spatial Data, Spatial Measures of Central Tendency, Spatial Measures of Dispersion (Text book 2).

UNIT V - Commercial Systems (Tools)

Interacting with a GIS or with a Spatial DBMS, ArcInfo, ArcView GIS, ArcView Spatial Model, Smallworld Oracle Extension for Handling Spatial Data, PostgreSQL. (Text book 3)

Course Outcomes: At be the end of the course, the student should able to

CO 1	:	Understand spatial concepts, spatial data models and spatial query languages.
CO 2	:	Implement the spatial operations, spatial queries and query optimization.
CO 3	:	Design data models with networks. Implement accessing methods.
CO 4	:	Analyze the spatial data using GIS timeline, and also perform statistical analysis on spatial data.
CO 5	:	Work on Commercial software or tools and can analyze the commercial trend in spatial information industry.

Text Books:

1. Shashi Shekhar, Sanjay Chawla, *Spatial Databases- A Tour*, P.H, 2003.
2. Margai, Florence M Oyana, Tonny J, *Spatial analysis - statistics, visualization, and computational methods*-CRC Press, 2015.
3. Philippe Rigaux, Michel Scholl and Agn`es Voisard, *Spatial DBs With Application to GIS*, Morgan Kaufman Publishers, 2002.

References:

1. Jingxiong Zhang, Peter Atkinson, Michael Goodchild, *Scale in Spatial Information and Analysis*-CRC Press Taylor and Francis, 2014.
2. Ian Heywood, Sarah Cornelius, Steve Carver, *An Introduction to Geographical Information Systems*, Prentice Hall 2006.
3. Atsuyuki Okabe, Kokichi Sugihara, *Spatial Analysis along Networks-Statistical and Computational Methods,* Wiley Publications, 2012.

HUMAN COMPUTER INTERACTION

(Professional Elective V)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:		Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To learn the foundation of Human Computer Interaction
2. To be familiar with the design technologies for individuals and persons with disabilities
3. To be aware of mobile human computer interaction

Unit I - Human :I/O channels -Memory

Reasoning and problem solving ; The computer; Devices-Memory-Processing and networks; Interaction; Models-frameworks- Ergonomics-Styles-Elements Interactivity Paradigms

Unit II - Interactive Design Basics

Process-scenarios-navigation-screen design-Iteration and Prototyping, HCI in software process-software life cycle-usability engineering-prototyping in practice-design rationale.
Design Rules-principles , standards, guidelines, rules. Evaluation Techniques-Universal Design

Unit III - Cognitive models

Socio- Organizational issues and stake holder requirements-communication and collaboration models- Hypertext, multimedia and WWW.

Unit IV - Mobile Ecosystem

Platforms, Application frameworks-Types of Mobile Applications; Widgets, Applications, Games-Mobile Information Architecture, Mobile 2.0.
Mobile Design: Elements of Mobile Design, Tools.

Unit V - Designing Web Interfaces

Drag and Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual pages, Process flow.
Case-studies. Recent Trends: Speech Recognition and Translation, Multi modal System

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Understand the guidelines influencing human computer interaction
CO 2	:	Design an interactive web interface on the basis of models studied
CO 3	:	Understand the structure of models of vision
CO4	:	Describe typical Human Computer Interaction(HCI) models
CO5	:	Analyze and identify stakeholder requirements of HCI systems

Text Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, *Human Computer Interaction*, 3rd Edition,Peraon Education,2004
2. Brian Fling, *Mobile Design and Development*,1st Edition, Oreilly Media Inc.,2009

References:

1. Yvonne Rogers, Helen Sharp, Jenny Preece, *Interaction Design: Beyond Human Computer interaction*, 3rd Edition, Wiley, 2011.
2. Mackenzie, *Human-Computer Interaction :An Emperical Research Perspective*, Morgan Kaufmann Elsevier Science and Technology Books, 2012
3. Bill Scott and Theresa Neil, *Designing Web Interfaces*, 1st Edition,O'Reilly,2009

WIRELESS AD HOC AND SENSOR NETWORKS

(Professional Elective V)

Instruction	:	3 Periods / week	Continuous Internal Evaluation	:	30 Marks
Tutorial	:		Semester End Examination	:	70 Marks
Credits	:	3	Semester End Exam Duration	:	3 Hours

Course Objectives:

1. To understand the applications of ad hoc and sensor networks
2. To understand the MAC and transport protocols for ad hoc networks
3. To understand the concepts of sensor networks
4. To understand the security of sensor networks

Unit I - Introduction to Ad Hoc Wireless Networks

Introduction to Ad Hoc Wireless Networks: Characteristics of MANETs, Applications of MANETs, Challenges.

Routing in MANETs: Topology-based versus Position-based approaches, Topology based routing protocols, Position based routing, Other Routing Protocols.

Unit II - Data Transmission in MANETs

Data Transmission in MANETs: The Broadcast Storm, Multicasting, Geocasting

TCP over Ad hoc Networks: TCP Protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc networks

Unit III - Basics of Wireless Sensors and Applications

Basics of Wireless Sensors and Applications: introduction, The Mica Mote, Sensing and Communication Range, Design issues, Energy consumption, Clustering of Sensors, Applications of WSNs.

Data Retrieval In Sensor Networks: Classification of WSNs, MAC layer, Routing layer, High level application layer support, Adapting to the inherent dynamic nature of WSNs.

Unit IV - Security

Security: Security in Ad hoc Wireless Networks, Key Management, Secure Routing, Cooperation in MANETs, Intrusion Detection Systems.

Sensor Network Platforms and Tools: Sensor Network Hardware, Sensor Network Programming Challenges, Node-Level Software Platforms

Unit V – Operating System

Operating System **-** TinyOS, Imperative Language: nesC, Dataflow style language: T1nyGALS, Node- Level Simulators, ns-2 and its sensor network extension, TOSSIM

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Understand basics of MANETs and routing protocols
CO 2	:	Understand how TCP modified for wireless networks
CO 3	:	Design of different layers of WSN
CO4	:	Understand issues and challenges of security in WSNs
CO5	:	Design and implement sensor network protocols in the NesC/TinyOS

Text Books:

1. Carlos De Morais Cordeiro and Dharma Prakash Agrawal, *Ad Hoc and Sensor Networks: Theory and Applications*, World Scientific Publications /Cambridge University Press, March 2006.
2. Feng Zhao and Leonidas Guibas, *Wireless Sensor Networks: An Information Processing Approach*, Elsevier Science imprint, Morgan Kauffman Publishers, Reprint 2009.

References:

1. C.Siva Ram Murthy and B.S.Murthy, *Ad hoc Wireless Networks: Architectures and Protocols*, Pearson Education, 2004.
2. Fei Hu, Xiaojun Cao, *Wireless Sensor Networks: Principles and Practice*, Auerbach / CRC Press, Taylor & Francis Group, 2010.
3. Subir Kumar Sarkar et al., *Wireless Ad hoc Mobile Wireless Networks: Principles, Protocols and Applications*, Auerbach Publications, Taylor & Francis Group, 2008.
4. Charles E.Perkins, *Ad hoc Networking*, Pearson Education, 2001.
5. Shih-Liri Wu and Yu-Chee Tseng, *Wireless Ad hoc Networking* , Auerbach Publications, Taylor & Francis Group, 2007