# VIGNANA BHARATHI ®
## Institute of Technology

(A UGC Autonomous Institution, Approved by AICTE, Accredited by NBA & NAAC-A Grade, Affiliated to JNTUH)

# DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEM (CSBS)
## IV YEAR I SEMESTER

| S.No | Course Code | Course Title | Category | L | T | P | C |
|------|-------------|--------------|----------|---|---|---|---|
| 1 | 19BU4111 | Marketing Management and Research | PC | 3 | - | - | 3 |
| 2 | 19BU4112 | Design Thinking | PC | 2 | - | - | 2 |
| 3 | **Professional Elective – IV** | | | | | | |
| | 19BU4171 | Big Data Analytics | PE | 3 | - | - | 3 |
| | 19DS4172 | Natural Language Processing | PE | | | | |
| | 19BU4172 | Service Oriented Architectures | PE | | | | |
| | 19BU4173 | DevOps | PE | | | | |
| | 19BU4174 | Information Storage Management | PE | | | | |
| 4 | **Professional Elective – V** | | | | | | |
| | 19BU4175 | Artificial Intelligence | PE | 3 | - | - | 3 |
| | 19BU4176 | Digital Payment Systems | PE | | | | |
| | 19BU4177 | Image Processing | PE | | | | |
| | 19BU4178 | Social Media Analytics | PE | | | | |
| | 19BU4179 | Block chain Technology | PE | | | | |
| 5 | **Open Elective II** | | OE | 3 | - | - | 3 |
| | | | | | | | |
| 6 | 19BU4152 | Product Design Lab | PC | - | - | 3 | 1.5 |
| 7 | 19BU4182 | Mini Project* | PW | - | - | - | 2 |
| 8 | 19BU4181 | Major Project Phase – I | PW | - | - | 6 | 3 |
| | | **Total Credits** | | **14** | **-** | **9** | **20.5** |

**\*Note:** Industrial Oriented Mini Project/ Summer Internship is to be carried out during the summer vacation between 6th and 7th semesters. Students should submit report of Industrial Oriented Mini Project/ Summer Internship for evaluation.

### IV YEAR II SEMESTER

| S.No | Course Code | Course Title | Category | L | T | P | C |
|------|-------------|--------------|----------|---|---|---|---|
| 1 | 19BU4211 | Human Resource Management | PC | 3 | - | - | 3 |
| 2 | **Professional Elective – VI** | | | | | | |
| | 19BU4271 | Innovation IP Management and Entrepreneurship | PE | 3 | - | - | 3 |
| | 19BU4272 | Decision Support Systems | PE | | | | |
| | 19BU4273 | Deep Learning | PE | | | | |
| | 19BU4274 | Data Visualization Techniques | PE | | | | |
| | 19BU4275 | Cyber Security | PE | | | | |
| 3 | **Open Elective III** | | OE | 3 | - | - | 3 |
| | | | | | | | |
| 4 | 19BU4281 | Major Project Phase – II | PW | - | - | 14 | 7 |
| | | **Total Credits** | | **9** | **0** | **14** | **16** |

# 19BU4111 -MARKETING MANAGEMENT AND RESEARCH

**B.Tech. IV Year I Sem.**
**L T P C**
**3 - - 3**

**Course ObjectiveS:**
1. To understand the scope of marketing, philosophies and environment.
2. To analyze various marketing opportunities and product development.
3. To analyze markets and design customer driven strategies.
4. To communicate the decisions towards business development with superior customer value.
5. To understand the Product Research and Promotional Research for the Test Marketing.

**Course OutcomeS:**
1. The students will be able to understand the scope of marketing, philosophies and environment.
2. The students will be able to analyze various marketing opportunities and product development.
3. The students will be able to analyze markets and design customer driven strategies.
4. The students will be able to communicate the decisions towards business development with superior customer value.
5. The students will be able to understand the Product Research and Promotional Research for the Test Marketing

**UNIT – I:**
Introduction to Marketing and Market Research: Importance and scope of Marketing, Core Marketing Concepts, Marketing Philosophies, Marketing Environment, Marketing Strategies & Plans, Changing Marketing landscape

**UNIT – II:**
Analyzing Marketing Opportunities, Customer Value and Marketing Mix: Consumer, Decision Making, Building Customer Value, Analyzing Consumer Markets – Consumer Behavior –Cultural, Social & Personal Factors, developing products & brands – product levels; classifyingproducts, product range, product line & product mix, Product Life Cycles, new product development., New Service Development, Stages of Product/ Service innovation development, The process of adoption, Branding.

**UNIT – III:**
Designing a Customer Driven Strategy: Market segmentation - STP Process -segmentation of consumer market, business market, requirement for effective segmentation, Market Targeting – evaluating market segmentation, selecting target market segmentation, positioning –Positioning and repositioning positioning maps, product positioning strategies.

**UNIT – IV:**
Marketing Research: Introduction, Management uses of marketing research design, Types of Marketing Research and Significance, Marketing Research Process, Problem Formulation & steps in decision Making Process, Marketing Information systems..

**UNIT – V:**

Marketing Research & Ethics, International Marketing Research, Product Research, Advertising Research, Copy Testing, Test Marketing, Media Selection, Research Report.

**TEXTBOOKS:**

1. Philip Kotler, Gray Armstrong, Principles of Marketing, 15e, Pearson Education, 2016.
2. Marketing Research- Text and Cases Harper W. Boyd Jr., Ralph Westfall

**REFERENCE BOOKS:**

1. Lamb, Hair, Sharma, Mc Daniel, Principles of Marketing, A South Asian Perspective Cengage Learning, 2016.
2. Paul Baines, Chris Fill, Kelly Page, Piyush Sinha, Marketing, Asian Edition, Oxford University Press, 2015.
3. Arun Kumar & N. Meenakshi, Marketing Management, Vikas, 2012
4. Rajan Saxena, Marketing Management, 3e, Tata Mc Graw Hill, 2012.
5. Kenneth E Clow, Donald Baack, Cases in Marketing Management, Sage South Asia edition, 2012.
6. Research for Marketing Decisions Paul E. Green, Donald S. Tull

Counselling Code : VBIT

**VIGNANA BHARATHI** ®
Institute of Technology
(A UGC Autonomous Institution, Approved by AICTE, Accredited by NBA & NAAC-A Grade, Affiliated to JNTUH)

# 19BU4112 - DESIGN THINKING

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 2 | - | - | 2 |

## COURSE OBJECTIVES:

1. To inculcate core design principles and applied creativity to develop innovative strategies that better connect engineers with their end users
2. To build mind-set leading to flow of creative ideas, validating those ideas and prioritizing the best ones
3. To incorporate tools that designers need to take a design project from inspiration and insights to ideation and implementation
4. To instil full scope of organizational innovation and strategy through knowledge, insight and analytical skills
5. To Identify and resolve issues with working in diverse teams

**COURSE OUTCOMES:** After completion of the course, the student should be able to

1. Use design thinking and hypothesis-driven innovation processes to develop viable solutions to user challenges
2. Use multiple brainstorming techniques to find innovative solutions
3. Develop and test a business model or business case to support the viability of the solution
4. Prototype a solution to a user challenge
5. Investigate the cultural, emotional, technological and business factors relevant to developing new product or service design concept

## UNIT-I

**Revisiting Design Thinking:** Creative thinking as basis of innovation; Empathy process for deep understanding of challenge with practical ingenuity; Making sense of observations and insights; Defining a point of view and context Design thinking skills for Problem Discovery, Definition, and Ideation – Identifying problems in daily lives and in the world at large, Understanding user and customer perspectives, Thinking from the problem before thinking of a solution

## UNIT-II

**Ideation Process:** Clear Articulation of problem statement with focus on latent needs;
Brainstorming
potential solutions; Ideation methods with case-study based approach to using Systematic Inventive Thinking (SIT) Methods such as Addition, Subtraction, Multiplication, Division and Task Unification Strategic Innovation for competition in future: Linear Innovation vs. non-linear innovation, Understanding and identifying weak signals, 3-box thinking, 3-Box framework and Box-3 ideation

## UNIT-III

**Designing Customer Experience:** Understanding Innovation through Design Thinking; Enhancing Customer Experience; Service Design and Development Process and Case Studies; Service Experience Cycle and Case Studies

**UNIT-IV**
**Sustainable Design Approaches:** Concern for Environment and Sustainability in Design, Case Studies to understand good Design for Environment (DFE) Decisions; Design Considerations in the five stages of the Product Life Cycle.

**UNIT-V**
**Integrative Engineering Design Solutions:** Identifying and resolving issues with working in diverse teams, Modularising, prototype building by different engineering disciplines within the team, validated learning with accessible metrics, Capstone Project (Interdisciplinary)
Applying Design Thinking Principles and Methods for Ideation and Prototyping, Testing Solution, Refining Solution, and Taking the Solution to the Users

**TEXT BOOKS:**
1. 101 Design Methods: A Structured Approach for Driving Innovation in your organization, Vijay Kumar, John Wiley & Sons, ISBN: 978-1118083468, 2012
2. Living with Complexity, Donald A Norman, MIT Press, ISBN: 978-0262528948, 2016
3. Design Thinking for Entrepreneurs and Small Businesses: Putting the Power of Design to Work, Beverly Rudkin Ingle, A Press, ISBN: 978-1430261810, 2013

**REFERENCE BOOKS:**
1. Emotionally Durable Design: Objects, Experiences and Empathy, Jonathan Chapman, 2nd Edition, Routledge, ISBN: 978-0415732161, 2015
2. Innovation Design: How Any Organization Can Leverage Design Thinking to Produce Change, Drive New Ideas, and Deliver Meaningful Solutions, Thomas Lockwood, Edgar Papke, New Page Books, ISBN: 978-1632651167, 2017
3. Design Thinking Business Analysis: Business Concept Mapping Applied, Thomas Frisendal, Springer, ISBN: 978-3642434822, 2012
4. Chapter 1: A Simple Framework for Leading Innovation, The Three Box Solution, HBR Press, 2016
5. Design a Better Business: New Tools, Skills and Mindset for Strategy and Innovation, Patrick Van Der Pijl, Justin Lokitz, Lisa Kay Solomon, Erik van der Pluijm, Maarten van Lieshout, Wiley, ISBN: 978-8126565085, 2016

## 19BU4171 - BIG DATA ANALYTICS (Professional Elective – IV)

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

Course Objectives:
1. To provide the students with the knowledge of Big data Analytics .
2. To provide the students with the knowledge of Big data Technologies.
3. To Impart knowledge on Hadoop
4. To provide knowledge on Hadoop architecture
5. This course is also designed to give an exposure of Data Analytics and Machine Learning

Courses Outcomes:
1. Ability to explain the foundations, definitions, and challenges of Big Data and various Analytical tools.
2. Understand Big data Technologies.
3. Ability to program using HADOOP and Map reduce.
4. Ability to understand Hadoop Architecture
5. Understand implementation of Data Analytics with R and Machine Learning algorithms

### UNIT - I
**Introduction to Big Data**: Big Data and its Importance – Four V's of Big Data – Drivers for Big Data – Introduction to Big Data Analytics – Big Data Analytics applications.

### UNIT - II
**Big Data Technologies:** Hadoop's Parallel World – Data discovery – Open source technology for Big Data Analytics – cloud and Big Data –Predictive Analytics – Mobile Business Intelligence and Big Data

### UNIT - III
**Introduction Hadoop:** Big Data – Apache Hadoop & Hadoop Eco System – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

### UNIT - IV
**Hadoop Architecture:** Hadoop: RDBMS Vs Hadoop, Hadoop Overview, Hadoop distributors, HDFS, HDFS Daemons, Anatomy of File Write and Read., Name Node, Secondary Name Node, and Data Node, HDFS Architecture, Hadoop Configuration, Map Reduce Framework, Role of HBase in Big Data processing, HIVE, PIG.

### UNIT - V
**Data Analytics with R Machine Learning:** Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering, Social Media Analytics, Mobile Analytics, Big Data Analytics with BigR.

TEXT BOOKS:
1. Big Data Analytics, Seema Acharya, Subhasini Chellappan, Wiley 2015.
2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Michael Minelli, Michehe Chambers, 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.
3. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O'Reilly Media, 2012.
4. Big Data Analytics: Disruptive Technologies for Changing the Game, Arvind Sathi, 1st Edition, IBM Corporation, 2012.

REFERENCE BOOKS:
1. Big Data and Business Analytics, Jay Liebowitz, Auerbach Publications, CRC press (2013)
2. Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop, Tom Plunkett, Mark Hornick, McGraw-Hill/Osborne Media (2013), Oracle press.
3. Professional Hadoop Solutions, Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, Wiley, ISBN: 9788126551071, 2015.
4. Understanding Big data, Chris Eaton, Dirk deroos et al. McGraw Hill, 2012.
5. Intelligent Data Analysis, Michael Berthold, David J. Hand, Springer, 2007.
6. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks, 1st Edition, Wiley and SAS Business Series, 2012.

Counselling Code : VBIT

**VIGNANA BHARATHI**®
Institute of Technology
(A UGC Autonomous Institution, Approved by AICTE, Accredited by NBA & NAAC-A Grade, Affiliated to JNTUH)

19DS4172 - NATURAL LANGUAGE PROCESSING

(Professional Elective – IV)

**B.Tech. IV Year I Sem.**                                                             **L   T    P  C**

                                                                                                   **3   -   - 3**

**Prerequisites:** Data structures, finite automata and probability theory

**Course Objectives:**

1. Introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics.
2. Introduce to NLP problems and solutions relation to linguistics and statistics.
3. Introduce to Regular expression and probabilistic model with n-grams.
4. Introduce to Recognizing Speech and parsing with grammar.
5.  To learn basis of semantic analysis and discourse analysis.

**Course Outcomes:**

1. Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
2. Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
3. Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
4. Able to design, implement, and analyze NLP algorithms
5. Able to design different language modeling Techniques.

## 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 Parsing:** Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.

## UNIT - IV
Predicate-Argument Structure, Meaning Representation Systems, Software.

**UNIT - V**

**Discourse Processing:** Cohesion, Reference Resolution, Discourse Cohesion and Structure Language Modelling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modelling Problems, Multilingual and Cross Lingual Language Modelling

**TEXT BOOKS:**
1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary

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

## 19BU4172 - SERVICE ORIENTED ARCHITECTURES
## (Professional Elective – IV)

**B.Tech. IV Year I Sem.**                                   **L  T   P C**
                                                             **3  -  - 3**

**Course Objectives:**

1. To establish essential coverage of service oriented architectural models
2. To study underlying design paradigm,
3. To learn SOA principles
4. To establish documentation of the SOA methodology.
5. To learn SOA design

**Course Outcomes:**
1. Understand case studies of service-oriented architectures
2. Solving problems in service orientation
3. Understanding principles of SOA
4. Knowledge on characteristics of SOA
5. Perform service-oriented analysis and design

**UNIT - I**
**Introduction, Case Study Backgrounds:** Case Studies -Transit Line Systems, Inc., Midwest University Association

**UNIT - II**
**Understanding Service-Orientation:** Introduction to Service-Orientation, Problems Solved by Service-Orientation, Effects of Service-Orientation on the Enterprise, Goals and Benefits of Service-Oriented Computing, Four Pillars of Service-Orientation

**UNIT - III**
**Service-Orientation Principles:** A profile for the Standardized Service Contract principle, A profile for the Service Loose Coupling principle, A profile for the Service Abstraction principle, A profile for the Service Reusability principle, A profile for the Service Autonomy principle, A profile for the Service Statelessness principle, A profile for the Service Discoverability principle, A profile for the Service Composability principle (Appendix-A of the Textbook)

**UNIT - IV**
**Understanding SO Architectures:** Introduction to SOA, The Four Characteristics of SOA, The Four Common Types of SOA, The End Result of Service-Orientation and SOA, SOA Project and Lifecycle Stages

**UNIT - V**
**Service-Oriented Analysis and Design:** Web Service Modelling Process, Decompose the Business Process (into Granular Actions), Filter Out Unsuitable Actions,  Define Entity Service Candidates,

Counselling Code : VBIT

**VIGNANA BHARATHI** ®
Institute of Technology
(A UGC Autonomous Institution, Approved by AICTE, Accredited by NBA & NAAC-A Grade, Affiliated to JNTUH)

Identify Process-Specific Logic, Apply Service-Orientation, Identify Service Composition Candidates, Analyze Processing Requirements, Define Utility Service Candidates, Define Microservice Candidates, Apply Service-Orientation, Revise Service Composition Candidates, Revise Capability Candidate Grouping

TEXT BOOK:
    1. Thomas Erl, Service-Oriented Architecture Concepts, Technology and Design, PH

REFERENCE BOOKS:
1. **SOA in Practice: The Art of Distributed System Design Nicolai M. Josuttis, O'Reilly Media, Inc.**
2. Java Web Service Architecture, James McGovern, Sameer Tyagi et al., Elsevier
3. Building Web Services with Java, 2$^{nd}$ Edition, S. Graham and others, Pearson Edn.
4. Java Web Services, D.A. Chappell & T. Jewell, O'Reilly,SPD.
5. Web Services, G. Alonso, F. Casati and others, Springer.

# VIGNANA BHARATHI
## Institute of Technology

(A UGC Autonomous Institution, Approved by AICTE, Accredited by NBA & NAAC-A Grade, Affiliated to JNTUH)

## 19BU4173 - DEVOPS

## (Professional Elective – IV)

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

### Course Objectives: The objective of this course is to:

1. To describe the agile relationship between development and IT operations.
2. To understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
3. To implement automated system update and DevOps lifecycle.
4. To illustrate the types of version control systems, continuous integration tools, continuous monitoring tools.
5. To analyze the concepts of test automation and deployment automation.

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

1. Identify components of Devops environment.
2. Describe Software development models and architectures of DevOps.
3. Apply different project management, integration and testing tools.
4. Apply different code deployment tools.
5. Assemble and adopt Devops in real-time projects.

### *UNIT - I*
**Introduction:** Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples

### *UNIT - II*
**Software development models and DevOps:** DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing.
**DevOps influence on Architecture:** Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Microservices, and the data tier, DevOps, architecture, and resilience.

### *UNIT - III*
**Introduction to project management:** The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.

### *UNIT - IV*
**Integrating the system:** Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures.

### *UNIT - V*
**Testing Tools and automation:** Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development

**VIGNANA BHARATHI**®
Institute of Technology

(A UGC Autonomous Institution, Approved by AICTE, Accredited by NBA & NAAC-A Grade, Affiliated to JNTUH)

**Deployment of the system:** Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker

*TEXT BOOKS:*
1. Joakim Verona. Practical Devops, Second Edition. Ingram short title; 2nd edition (2018). ISBN-10: 1788392574
2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

*REFERENCE BOOK:*
1. *Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10.*

# VIGNANA BHARATHI
## Institute of Technology

(A UGC Autonomous Institution, Approved by AICTE, Accredited by NBA & NAAC-A Grade, Affiliated to JNTUH)

## 19BU4174 - Information Storage Management

## (Professional Elective – IV)

**B.Tech. IV Year I Sem.**

L T P C
3 - - 3

### Course Objectives:

1. To understand the basic components of Storage System Environment.
2. To understand the Storage Area Network Characteristics and Components.
3. To examine emerging technologies including IP-SAN.
4. To describe the different backup and recovery topologies and their role in providing disasterrecovery and business continuity capabilities.
5. To understand the local and remote replication technologies.

### Course Outcomes:

1. Understand the logical and physical components of a Storage infrastructure.
2. Evaluate storage architectures, including storage subsystems, DAS, SAN, NAS,and CAS.
3. Understand various types of Storage and Distinguish different remote replication technologies.
4. Describe the different roles in providing disaster recovery and businesscontinuity capabilities.
5. Understand various forms of securing storage and Storage Virtualization.

## UNIT - I

**Introduction to Storage Technology:** Data proliferation and the varying value of data with time & usage, Sources of data and states of data creation, Data center requirements and evolution to accommodate storage needs, Overview of basic storage management skills and activities, The five pillars of technology, Overview of storage infrastructure components, Evolution of storage, InformationLifecycle Management concept, Data categorization within an enterprise, Storage and Regulations.

## UNIT - II

**Storage Systems Architecture:** Intelligent disk subsystems overview, Contrast of integrated vs. Modular arrays, Component architecture of intelligent disk subsystems, Disk physical structure- components, properties, performance, and specifications, Logical partitioning of disks, RAID & parity algorithms, hot sparing, Physical vs. logical disk organization, protection, and back end management, Array caching properties and algorithms, Front end connectivity and queuing properties, Front end to host storage provisioning, mapping, and operation, Interaction of file systems with storage, Storage system connectivity protocols.

## UNIT - III

**Introduction to Networked Storage:** JBOD, DAS, SAN, NAS, & CAS evolution, Direct Attached Storage (DAS) environments: elements, connectivity, & management, Storage Area Networks (SAN): elements & connectivity, Fiber Channel principles, standards, & network management principles, SAN management principles, Network Attached Storage (NAS): elements, connectivity options, connectivity protocols (NFS, CIFS, ftp), & management principles, IP SAN elements, standards (iSCSI, FCIP, iFCP), connectivity principles, security, and management principles, Content Addressable Storage (CAS): elements, connectivity options, standards, and management principles, Hybrid Storage - solutions overview including technologies like virtualization & appliances.

## UNIT - IV

**Introductions to Information Availability:** Business Continuity and Disaster Recovery Basics, Local business continuity techniques, Remote business continuity techniques, Disaster Recovery principles & techniques. **Managing & Monitoring:** Management philosophies (holistic vs. system & component), Industry management standards (SNMP, SMI-S, CIM), Standard framework applications, Key management metrics (thresholds, availability, capacity, security, performance), Metric analysis methodologies & trend analysis, Reactive and proactive management best practices, Provisioning &configuration change planning, Problem reporting, prioritization, and handling techniques, Management tools overview.

## UNIT - V

**Securing Storage and Storage Virtualization:** Define storage security. List the critical security attributes for information systems, describe the elements of a shared storage model and security extensions, Define storage security domains, List and analyze the common threats in each domain, Identify different virtualization technologies, describe block-level and file level virtualization technologiesandprocesses.

## TEXT BOOKS:

1. Marc Farley Osborne, "Building Storage Networks", Tata McGraw Hill, 2001.
2. Robert Spalding and Robert Spalding, "Storage Networks: The Complete Reference", TataMcGraw Hill, 2003.
3. Meeta Gupta, "Storage Area Network Fundamentals", Pearson Education Ltd., 2002.

## REFERENCE BOOKS:

1. Gerald J Kowalski and Mark T Maybury," Information Storage Retrieval Systems theory &Implementation", BS Publications, 2000.
2. Thejendra BS, "Disaster Recovery & Business continuity", Shroff Publishers & Distributors,2006.

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Pre-requisites:**

- A course on "Computer Programming and Data Structures"
- A course on "Advanced Data Structures"
- A course on "Design and Analysis of Algorithms"
- A course on "Mathematical Foundations of Computer Science"
- Some background in linear algebra, data structures and algorithms, and probability will all be helpful

**. Course Objectives: The objective of this course is to:**

1. Learn the distinction between optimal reasoning Vs. human like reasoning
2. Understand the concepts of state space representation, exhaustive search, and heuristic search together with the time and space complexities.
3. Learn different knowledge representation techniques.
4. Understand the applications of AI, namely game playing, theorem proving, and machine learning.
5. Know about the various applications of AI.

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

1. Ability to formulate an efficient problem space for a problem expressed in natural language.

2. Select a search algorithm for a problem and estimate its time and space complexities.

3. Possess the skill for representing knowledge using the appropriate technique for a given problem.

4. Possess the ability to apply AI techniques to solve problems of game playing, and machine learning.

5. Apply AI techniques to real-world problems to develop intelligent systems.

**UNIT - I**
**Problem Solving by Search - I:** Introduction to AI, Intelligent Agents
**Problem Solving by Search - II:** Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform cost search, Depth-first search, Iterative deepening Depth-first search, Bidirectional search, Informed (Heuristic) Search Strategies: Greedy best-first search, A* search, Heuristic Functions, Beyond Classical Search: Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces, Searching with Non-Deterministic Actions, Searching wih Partial OBUervations, Online Search Agents and Unknown Environment.

## UNIT - II
### Problem Solving by Search - II and Propositional Logic
**Adversarial Search:** Games, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real-Time Decisions. Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems. Propositional Logic: Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses, Forward and backward chaining, Effective Propositional Model Checking, Agents Based on Propositional Logic.

## UNIT - III
### Logic and Knowledge Representation
**First-Order Logic:** Representation, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic.
**Inference in First-Order Logic:** Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.
**Knowledge Representation:** Ontological Engineering, Categories and Objects, Events. Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information.

## UNIT - IV
### Planning
**Classical Planning:** Definition of Classical Planning, Algorithms for Planning with State-Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches.
**Planning and Acting in the Real World:** Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent Planning.

## UNIT - V
**Uncertain knowledge and Learning Uncertainty:** Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use, **Probabilistic Reasoning:** Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First-Order Probability, Other Approaches to Uncertain Reasoning; Dempster-Shafer theory.
**Learning:** Forms of Learning, Supervised Learning, Learning Decision Trees. Knowledge in Learning: Logical Formulation of Learning, Knowledge in Learning, Explanation-Based Learning, Learning Using Relevance Information, Inductive Logic Programming.

### TEXT BOOK:
1. Artificial Intelligence A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

**REFERENCE BOOKS:**

1. Artificial Intelligence, 3rd Edn, E. Rich and K.Knight (TMH)
2. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, Pearson Education.
3. Artificial Intelligence, Shivani Goel, Pearson Education.
4. Artificial Intelligence and Expert systems – Patterson, Pearson Education

# 19BU4176 - DIGITAL PAYMENT SYSTEMS (Professional Elective – V)

**B.Tech. IV Year I Sem.**

```
L  T   P C
3  -   - 3
```

## Course Objectives:

1. Impart knowledge on various types of Payment Cards and their processing mechanism
2. Know the need of UPI payments and various E-Wallets
3. Discuss the players and processes involved in secure e-payments transactions.
4. Discuss the different categories and potential uses of smart cards.
5. Include topics on EMV$^{TM}$ regulatory framework and ICC architecture

## Course Outcomes:
1. Understand the shifts that are occurring with regard to digital payments.
2. Acquire a comprehensive understanding of different tasks associated in usage of digital payment systems.
3. Understand risks involved in e-payments and their counter-measures to provide secure transactions.
4. Understand the need of Card holder verification and issuer authentication in real time transactions.
5. Understand and analyse chip card technology and application processing for digital payment systems.

## UNIT - I
Introduction, Magnetic stripe debit and Credit cards, Chip Migration with EMV$^{TM}$, Remote debit and credit with EMV$^{TM}$
**Payment Card Processing:** Roles involved in payment card processing, payment card brands, Credit and debit payment cards, Focusing on the magnetic stripe card, Threats and security protections, Processing at the point of service, Payment network and interchange message, On-line authorization, Clearing and Settlement.

## UNIT - II
A business case for chip migration, An overview of the chip card technology, proprietary payment application, interoperable payment application, EMV$^{TM}$ data elements, EMV$^{TM}$ file system, EMV$^{TM}$ application selection.
SMS Payments, USSD Payments, UPI Payments, Mobile Wallets, Bharat Bill Payments, NEFT, IMPS, QR Code, Merchants Payments, Internet Banking & Payments. ATM Payments, Interoperable Payments.

## UNIT - III
Certification mechanism and algorithm, Public key certificate for RSA scheme, Entities and certifiers, Entity public key remainder, EMV$^{TM}$ certification chain, Issuing EMV$^{TM}$ public key certificates, Verifying EMV$^{TM}$ public key certificates, issuing signed static application data, Verifying the signed static application data.

## UNIT - IV
Overview of the EMV$^{TM}$ debit/credit transaction, Initiate application processing, Read application data, Off-line data authentication, Processing restrictions, Cardholder

Verification, Terminal risk management, Terminal action analysis, On-line processing and issuer authentication.

## UNIT - V
EMV$^{TM}$ regulatory framework, Deriving ICC specifications by issuers, Selection criteria of the ICC architecture, Multiplication ICC, Issuer's business case, adaptive initiate application processing, Design criteria for CAM selection, Design criteria for CVM, Processing restrictions, Card risk management.

## TEXT BOOK:
1. Cristian Radu, Artech House, Implementing Electronic Card Payment Systems, Computer Security Series.

## REFERENCE BOOKS:
1. Electronic Payment Systems for E-Commerce by Donal O'Mahony, Michael Peirce and Hitesh Tewari, Artech House, Computer Security Series
2. David A. Buchanan, James McCalman, High Performance Work Systems: The Digital Experience, Routledge
3. David A. Montague, Essentials of Online payment Security and Fraud Prevention, Wiley

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Pre-requisites:**

- Students are expected to have knowledge in linear signals and systems, Fourier Transform,
  basic linear algebra, basic probability theory and basic programming techniques;
  knowledge of Pre-processing and data enhancement
  Digital Signal Processing is desirable.
- A course on "Computational Mathematics"
- A course on "Computer Oriented Statistical Methods"

**Course OBJECTIVES:**

1. Provide a theoretical and mathematical foundation of fundamental Digital Image Processing concepts
2. Provides the knowledge of image acquisition, sampling and quantization.
3. To know Preprocessing and enhancement.
4. Know Image restoration, and segmentation.
5. To gain Knowledge of different image compression techniques.

**COURSE OUTCOMES:**

1. Understand the theoretical and mathematical foundations of Digital Image Processing.
2. Explain different image acquisition, sampling and quantization methods.
3. Perform Preprocessing and image enhancement operations on given images.
4. Apply different Image restoration, and segmentation techniques
5. Perform different image compression techniques.

**UNIT - I**
**Digital Image Fundamentals:** Digital Image through Scanner, Digital Camera. Concept of Gray Levels. Gray Level to Binary Image Conversion. Sampling and Quantization. Relationship between Pixels. Imaging Geometry. 2D Transformations-DFT, DCT, KLT and SVD.

**UNIT - II**
Image Enhancement in Spatial Domain Point Processing, Histogram Processing, Spatial Filtering, Enhancement in Frequency Domain, Image Smoothing, Image Sharpening.

**UNIT - III**
Image Restoration Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

**UNIT - IV**

Image Segmentation Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region Oriented Segmentation.

**UNIT - V**

Image Compression Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Source Encoder and Decoder, Error Free Compression, Lossy Compression.

**TEXT BOOK:**
   1. Digital Image Processing: R.C. Gonzalez & R. E. Woods, Addison Wesley/ Pearson Education, 2$^{nd}$ Ed, 2004.

**REFERENCE BOOKS:**
   1. Fundamentals of Digital Image Processing: A. K. Jain, PHI.
   2. Digital Image Processing using MAT LAB: Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins: Pearson Education India, 2004.
   3. Digital Image Processing: William K. Pratt, John Wilely, 3rd Edition, 2004.

**B.Tech. IV Year I Sem.**

**L  T   P  C**
**3   -   - 3**

**Course Objectives:**
1. To enable students to understand its fundamental concepts of Social Media and Social Networking systems.
2. To understand and analyze social Media analytics and tools.
3. To study its various types of Social Media text analytics.
4. To understand and analyze social Media Actions, Actions Analytics.
5. To study its various types of Hyperlink Analytics, Hyperlink Analytics.

**Course Outcomes:**
1. The students will be able to understand its fundamental concepts of Social Media and Social Networking systems.

2. The students will be able to gain knowledge on layers of Social Media analytics.
3. The students will be able to apply text analytics tools on Social Media data.
4. The students will be able to know the importance of Social Media action and action analytics.
5. The students will be able to understand and analyse various types of Hyperlink Analytics, Hyperlink Analytics

UNIT - I:
Introduction to Social Media: World Wide Web, Web 1.0, Web 2.0, Web 3.0, Social Media, Core Characteristics of Social Media, Types of Social Media, Social Networking Sites, Using Facebook For Business Purposes, Content Communities.

UNIT- II:
Social Media Analytics Overview: Purpose of Social Media Analytics, Social Media Vs. Traditional Business Analytics, Seven Layers of Social Media Analytics, Types of Social Media Analytics, Social Media Analytics Cycle, Challenges to Social Media Analytics, Social Media Analytics Tools.
Case Study: The Underground Campaign That Scored Big

UNIT - III:
Social Media Text Analytics: Types of Social Media Text, Purpose of Text Analytics, Steps in Text Analytics, Social Media Text Analysis Tools.Case Study: Tapping into Online Customer Opinions

UNIT -IV:
Social Media Actions Analytics: Introduction to Actions Analytics, Common Social Media Actions, Actions Analytics Tools.Case Study: Cover-More Group

UNIT - V:
Social Media Hyperlink Analytics: Types of, Types of Hyperlink Analytics, Hyperlink Analytics Tools.Case Study: Hyperlinks and Viral YouTube Videos

TEXT BOOK:
1. Seven Layers of Social Media Analytics Mining Business Insights from Social Media Text, Actions, Networks, Hyperlinks, Apps, Search Engine, And Location Data by Gohar F. Khan ISBN: 1507823207, Isbn-13: 9781507823200

**REFERENCE BOOKS:**
1. Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media by Matthew Ganis, AvinashKohirkar, Pearson Education.
2. Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, Marshall Sponder, MGH.
3. Big DataandAnalytics,Seema Acharya, SubhasininChellappan, Wiley Publications.
4. Big Data, Black Book™, Dreamtech Press, 2015 Edition.

**B.Tech. IV Year I Sem.**

<table>
<tr><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td></tr>
</table>

**Prerequisites**
- Knowledge in security and applied cryptography;
- Knowledge in distributed databases

**Course Objectives:**

1. To Introduce block chain technology and Crypto currency
2. To give exposure on Block chain concepts
3. Provide knowledge on Block chain Science
4. To know types of Digital Currency
5. Provide knowledge on technical challenges in Block chain implementation

**Course Outcomes:**
1. Learn about Block chain technology and Crypto currency.
2. Understand Extensibility of Blockchain concepts
3. Understand and Analyse Block chain Science
4. Understand various Crypto Currency transaction strategies
5. Understand Technical challenges, Business model challenges

## UNIT - I

Introduction: Block chain or distributed trust, Protocol, Currency, Cryptocurrency, How a Cryptocurrency works, Crowdfunding

## UNIT - II

Extensibility of Blockchain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Blockchain Environment

## UNIT - III

Blockchain Science: Gridcoin, Folding coin, Blockchain Genomics, Bitcoin MOOCs

## UNIT - IV

Currency, Token, Tokenizing, Campuscoin, Coindrop as a strategy for Public adoption, Currency Multiplicity, Demurrage currency

## UNIT - V

Technical challenges, Business model challenges, Scandals and Public perception, Government Regulations

TEXT BOOK:
1. Melanie Swan, Blockchain Blueprint for Economy, O'reilly.

REFERENCE BOOKS:
1. Building Blockchain Apps, Michael Juntao Yuan, Pearson Education
2. Daniel Drescher, Blockchain Basics: A Non-Technical Introduction in 25 Steps 1st Edition
3. Bradley Lakeman, Blockchain Revolution: Understanding the Crypto Economy of the Future. A Non-Technical Guide to the Basics of Cryptocurrency Trading and Investing, ISBN: 1393889158

OPEN ELECTIVE-II

# 19BU4152 - PRODUCT DESIGN LAB

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| - | - | 3 | 1.5 |

**Prerequisite:** Design Thinking

**Course Objectives:** The focus of Product Design and Development is integration of the marketing, design, and manufacturing functions of the firm in creating a new product.

**Course Outcomes:**
1. Understand a set of tools and methods for product design and development.
2. Knowledge for enhancing our abilities to create a new product.
3. Awareness of the role of multiple functions in creating a new product (e.g. marketing, finance, industrial design, engineering, production).

**List of Experiments:**
1. Problem Statement (Clearly mention the problem your group would like to solve)
   a) Mission Statement (Why is it important to solve this problem? Who will be the beneficiaries? What is the market opportunity?)
   b) Value Proposition (Clearly state the redefined problem with specific issues the team would like to solve)
2. a) Assumptions (What are the current/existing considerations/limitations regarding the problem your team would like to address?)
   b) Stakeholders (List all the stakeholder groups that can influence or can be influenced by a change. Which stakeholder group(s) will be benefitted? Which stakeholder group(s) has your team interacted with? – Identify which user group you would like to target the solution - Mainstream, Extreme or Latent users)
3. Empathy Tool Used (What/How/Why, Empathy Map, AEIOU method, Beginner's mindset, Story/Share capture, etc.)
4. Data Collection (Research, Questionnaires, Interviews, Surveys, Stakeholder groups, Statistics, etc.)
5. Insights (Document all points from data collection stage to form insights about the problem)
6. Ideation Method Used (Mind Map, Brainstorming, SIT method, SCAMPER, Three-Box Thinking)

**TEXT BOOK:**
1. Ulrich, Karl, and Steven Eppinger. Product Design and Development. 3rd ed. New York, NY: McGraw-Hill, 2004. ISBN: 9780072471465.

REFERENCE BOOKS:
1. Building Product DesignApps, Michael Juntao Yuan, Pearson Education
2. https://ed.iitm.ac.in/img/files/Prodect%20Design.pdf

# 19BU4182 - Mini Project

**B.Tech. IV Year I Sem.**

**L T P C**

**- - - 2**

# 19BU4181 - Major Project Phase – I

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| - | - | 6 | 3 |

# 19BU4211 -HUMAN RESOURCE MANAGEMENT

**B.Tech. IV Year II Sem.**　　　　　　　　　　　　　　　　　　　　　**L　T　 P　C**
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　**3　 -　 -　3**

**Course Objectives:**

1. To understand various functions of HRM and able to manage the human resources of any organization effectively.
2. To Understand basics of Job Analysis and Talent Management Process.
3. To highlight different types of training and development methods
4. To make students aware of components of compensation Management and legislations
5.  To Understand Employee Retention Strategies, Importance of Employee welfare and grievance        Redressed

**Course Outcomes:**
1. Understand Fundamentals of HR concepts
2. Understand the process of recruitment and selection
3. To make Students aware of training need analysis and how to design training programs and their Implementation.
4. Students know about employee benefits and employee welfare schemes
5. Understand Employee retention strategies and Importance of Labour Acts to manage Employee Relations.

**UNIT - I:**
Introduction of HRM: Introduction to HRM – Line Managers – HR Role and responsibilities, New Approaches to Organizing HR – Globalization & Competition Trends – Technological Trends – Trends in Nature of Work – Workforce and Demographic Trends – Economic Challenges – High Performance Work System's – Labour Legislation in India – Equal Employment Opportunity – HR Score Card developed. Human Resource Information System.

**UNIT - II:**
Recruitment and Selection: Basics of Job Analysis and talent Management process – Methods for Collecting Job Analysis Information – Job Descriptions and specifications – Job Satisfaction– Job Enlargement, Job Enrichment, Job Rotation, HR Planning – Recruitment & Selection Process – Planning & Forecasting of human resources – Sources of Recruitment – Recruitment on Diverse Work Force – Employee Testing and Selection – Basic types of Interviews – Errors in Interviews

**UNIT - III:**
Training and Developing and Performance Management – Importance of Training and Development – Training process - Analyzing Training needs &Designing the program – Implementation of training programmes – training methods – Management development process – Evaluation of training and development programmes. Performance Management - Concept of Performance management and appraisal, the performance appraisal process, Techniques for Performance Appraisal – Career Management.

**UNIT - IV:**
Compensation and Employee welfare – Basic factors in determining pay rates – Job evaluation methods - Establishing pay rates – Pricing Managerial and Professional JoBU – Performance based pay -Benefits – Insurance – Retirement Benefits – Employee Welfare facilities. Salient Features of Workmen Compensation Act & Minimum Wages Act.

**UNIT - V:**
Employee Relations – Labour Movement – Collective Bargaining Process – Grievances – Grievances handling procedure – Employee Separation – Employee Safety and Health – Occupational Safety Law – Work Place Health Hazards Problems & Remedies – Salient features of Industrial Disputes Acts 1947 – Factories Act.

**TEXTBOOKS:**
1. Gary Dessler, Biju Varkkey, Human Resource Management, 4e, Pearson 2017.
2. Robert L.Mathis, John H.Jackson, Manas Ranjan Tripathy, Human Resource Management, Cengage Learning 2016.
3. Uday Kumar Haldar, Juthika Sarkar, Human Resource Management, Oxford UniversityPress2013.

**REFERENCE BOOKS:**
1. Aswathappa, Human Resource Management, Text and Cases, TMH, 2011.
2. Sharon Pande and SwapnalekhaBasak, Human Resource Management, Text andCases,Vikas Publishing, 2e, 2015.

# 19BU4271 - INNOVATION IP MANAGEMENT & ENTREPRENEURSHIP (Professional Elective – VI)

**B.Tech. IV Year II Sem.**                                            **L  T   P C**
                                                                       **3  -  - 3**

**Course Objectives:**
1. To develop Entrepreneurship skills of students by enriching knowledge about substantive aspects of management, strategy and legal literature.
2. To discuss intellectual property strategy to protect inventions and innovations of new ventures.
3. The course will make the students understand the different types of IP and make them aware of IP Protection.
4. The course will enable students to strategize IP lifecycle effectively throughout the journey of start-up, in a time when it is aspired highly by the economy and society.
5. Students will learn the fundamentals and advanced strategies of IP. They will be given the opportunity for understanding the same in the MSME sector. They will finally be provided brief exposure about the valuation techniques and audits of IP.

**Course Outcomes:**
1. Describe the requirements and responsibilities put on management, board members and shareholders in different development situations
2. define the needs for resources as well as obstacles in the early stages of the development of a business
3. independently formulate a business plan based on a business idea in technology
4. students will be able to plan and implement a development project in a team
5. Describe the fundamentals of intellectual property rights and legislation, particularly in the biotech industry.

## UNIT - I:
**Entrepreneurship:** Introduction, Relation between IP and Entrepreneurship, Role of IP identifying threshold innovative entrepreneurs. Innovative entrepreneurship, Opportunity recognition and entry strategies. Competitive advantage through IP protection, IP protection for Start-ups.

## UNIT - II:
**Innovation:** Introduction to innovation, Creativity, Different types of innovation, Open innovation, Adaptability of an innovation, Innovation vs. Invention, Divergent and convergent thinking, Idea generation, Idea validation, Idea protection, Necessity of innovation in current business world.

## UNIT - III:
**Intellectual Property:** Introduction, Traditional knowledge vs. Intellectual Property, Different types of IP, Copyrights, Trademarks, Geographical Indications, Trade secrets, Patents; Transforming IP into Economy; IP protection in developed nations, and developing

nations. Position of India in IP protection (Agriculture, Pharmaceutical and engineering sectors).

**UNIT - IV:**
**IPR and Technical Inventions:** Patent, Patentability requirements, Patent drafting, Patent lifecycle; Software Patents: Design Patents; Protection of Various aspects of Embodied Inventions; Integrated circuit designs protection; Software Inventions or algorithms: Copyright vs Patent.

**UNIT - V:**
**IP strategy and Entrepreneurship:** IP strategy for start-up and MSME, IP transaction, IP valuation, Government Initiatives: Incubators, research parks, Various Government policies, Integrative approach – Entrepreneurship & IP strategy, Fee relaxations for patents for Start-ups and small entities.

**TEXT BOOKS:**
1. Ove Granstrand, The Economic and management of Intellectual Property, (1999)
2. Narayanan, V. K., Managing technology and innovation for competitive advantage, first edition, Pearson education, New Delhi, (2006)
3. Idris, K. (2003), Intellectual property: a power tool for economic growth, second edition, WIPO publication no. 888, Switzerland
4. Bosworth D. &WeBUter E, The Management of Intellectual Property, Edward Elgar.

**REFERENCE BOOKS:**
1. Berman, Ideas to Assets, Wiley publications
2. Richard Dorf& Thomas Byers, Technology ventures from idea to enterprise, 2 nd edition.

**ADDITIONAL READING:**WIPO - http://www.wipo.int/patents/en/

# 19BU4272 - DECISION SUPPORT SYSTEMS (Professional Elective – VI)

**B.Tech. IV Year II Sem.**                                                                                 **L  T   P  C**
                                                                                                           **3  -  - 3**

**Course objectives:**
1. To introduce decision support systems
2. Inculcate Decision Styles for Decision making systems
3. Show their relationship to other computer-based information systems, demonstrate DSS development approaches.
4. Provide knowledge on MSS modelling
5. Show students how to utilize DSS capacities to support different types of decisions.

**Course Outcomes:**
1. Understand the decision-making process.
2. Perform decision analysis and modelling.
3. Develop a DSS and Analyze the role of knowledge management in DSS.
4. Understand knowledge-based system and knowledge engineering.
5. Design Advanced Intelligent Systems.

## UNIT - I
**Decision Making and Computerized Support:** Computerized Decision Support and the Supporting Technologies; A Framework for Decision Support; The Concept of Decision Support Systems and Decision support systems applications

## UNIT - II
**Decision-Making Systems, Modelling, and Support Decision-Making:** Introduction and Definitions; Systems; Models; Phases of the Decision- Making Process; The Intelligence Phase; The Design Phase; The Choice Phase; The Implementation Phase; How Decisions Are Supported; Personality Types, Gender, Human Cognition, and Decision Styles; The Decision-Makers

## UNIT - III
**Decision Support Systems:** An Overview DSS Configurations; What Is a DSS?; Characteristics and Capabilities of DSS; Components of DSS; The Data Management Subsystem; The Model Management Subsystem ; The User Interface (Dialog) Subsystem, The Knowledge-Based Management Subsystem ; The User; DSS Hardware; DSS Classifications\

## UNIT - IV
**Modelling and Analysis:** MSS Modelling; Static and Dynamic Models; Certainty, Uncertainty, and Risk; Influence Diagrams; MSS Modelling with Spreadsheets; Decision Analysis of a Few Alternatives (Decision Tables and Decision Trees); The Structure of MSS Mathematical Models; Mathematical Programming Optimization; Multiple Goals, Sensitivity Analysis, What-If, and Goal Seeking; Problem-Solving Search Methods

**UNIT - V**

**Decision Support System Development:** Introduction to DSS Development; The Traditional System Development Life Cycle; Alternative Development Methodologies; Prototyping: The DSS Development Methodology; Change Management; DSS Technology Levels and Tools; DSS Development Platforms; DSS Development Tool Selection; Team-Developed DSS; End User Developed DSS.

**TEXT BOOKS:**
1. Efraim Turban and Jay E. Aronson. Decision Support Systems and Intelligent Systems, 8th edition, Prentice Hall, 2007
2. Burstein F., Holsapple C.W. (eds.) Handbook on Decision Support Systems, Springer, 2008

**REFERENCE BOOKS:**
1. Decision Management Systems: A Practical Guide to Using Business Rules and Predictive Analytics, 1 edition (October 10, 2011), by James Taylor. IBM Press;
2. Decision Support Systems, 2nd Edition, by George Marakas, Prentice-Hall, 2003. aking Hard Decisions, 2nd Edition, Robert Clemen, Duxbury, 2001.
3. Understanding Decision Support Systems and Expert Systems, by Efrem Mallach, Irwin, 1994.
4. Value-Focused Thinking: A Path to Creative Decision making, Ralph L. Keeney, Harvard University Press, 1996.
5. Decision Support Systems Hyperbook, Power, D.J., accessed August, 2006

# 19BU4273 - DEEP LEARNING (Professional Elective – VI)

**B.Tech. IV Year II Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

**Course Objectives:** Students will be able:
1. To understand complexity of Deep Learning algorithms and their limitations
2. To be capable of performing experiments in Deep Learning using real-world data.
3. Introduce major deep learning algorithms,
4. Learn the problem settings, and their applications to solve real world problems.
5. Learn Deep Learning to NLP

**Course Outcomes:**
1. Implement deep learning algorithms, understand neural networks and traverse the layers of data
2. Learn topics such as convolutional neural networks, recurrent neural networks, training deep networks and high-level interfaces
3. Understand applications of Deep Learning to Computer Vision
4. Understand and analyze Applications of Deep Learning to NLP

## UNIT - I
**Introduction:** Feed forward Neural networks, Gradient descent and the back-propagation algorithm, Unit saturation, the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima, Heuristics for faster training, Nestors accelerated gradient descent, Regularization, Dropout

## UNIT - II
**Convolutional Neural Networks:** Architectures, convolution/pooling layers, Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. Deep Unsupervised Learning: Auto encoders, Variational Auto-encoders, Adversarial Generative Networks, Auto-encoder and DBM Attention and memory models, Dynamic Memory Models

## UNIT- III
**Applications of Deep Learning to Computer Vision:** Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models, Attention Models for computer vision tasks

## UNIT -IV
**Applications of Deep Learning to NLP:** Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Words model (CBOW), Glove, Evaluations and Applications in word similarity

## UNIT -V
**Analogy reasoning:** Named Entity Recognition, Opinion Mining using Recurrent Neural Networks: Parsing and Sentiment Analysis using Recursive Neural Networks: Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs.

**TEXT BOOKS:**
1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. TiBUhirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.

**REFERENCE BOOKS:**
1. Bishop, C,M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G., H., and Van Loan, C. F., Matrix Computations, JHU Press, 2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

# 19BU4274 - DATA VISUALIZATION TECHNIQUES
## (Professional Elective – VI)

**B.Tech. IV Year II Sem.**                                               **L  T   P C**

                                                                         **3  -  - 3**

Course Objective:
1. To learn about different Visualization Techniques
2. To study the Interaction techniques in information visualization fields
3. To understand various abstraction mechanisms
4. To create interactive visual interfaces
5. To learn data modeling and data processing


Course Outcomes:
1. Visualize the objects in different dimensions.
2. Design and process the data for Virtualization.
3. Apply the visualization techniques in physical sciences, computer science, applied mathematics and medical science.
4. Apply core skills for visual analysis
5. Apply visualization techniques for various data analysis tasks

UNIT - I
Introduction and Data Foundation: Basics - Relationship between Visualization and Other Fields -The Visualization Process - Pseudo code Conventions - The Scatter plot. Data Foundation - Types of Data - Structure within and between Records - Data Pre-processing - Data Sets

UNIT - II
Foundations for Visualization: Visualization stages - Semiology of Graphical Symbols - The Eight Visual Variables - Historical Perspective - Taxonomies - Experimental Semiotics based on Perception GiBUon's Affordance theory – A Model of Perceptual Processing.

UNIT - III
Visualization Techniques: Spatial Data: One-Dimensional Data - Two-Dimensional Data – Three-Dimensional Data - Dynamic Data - Combining Techniques. Geospatial Data: Visualizing Spatial Data - Visualization of Point Data -Visualization of Line Data - Visualization of Area Data - Other Issues in Geospatial Data Visualization Multivariate Data: Point-Based Techniques - Line- Based Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and Networks- Displaying Arbitrary Graphs/Networks.

UNIT - IV
Interaction Concepts and Techniques: Text and Document Visualization: Introduction - Levels of Text Representations - The Vector Space Model - Single Document  Visualizations -Document  Collection Visualizations - Extended Text  Visualizations Interaction Concepts:

Interaction Operators - Interaction Operands and Spaces - A Unified Framework. Interaction Techniques: Screen Space - Object-Space -Data Space -Attribute Space- Data Structure Space - Visualization Structure - Animating Transformations -Interaction Control

UNIT - V
Research Directions in Virtualizations: Steps in designing Visualizations – Problems in designing effective Visualizations- Issues of Data. Issues of Cognition, Perception, and Reasoning. Issues of System Design Evaluation, Hardware and Applications.

**TEXT BOOKS:**
1. Matthew Ward, Georges Grinstein and Daniel Keim, "Interactive Data Visualization Foundations, Techniques, Applications", 2010.
2. Colin Ware, "Information Visualization Perception for Design", 2nd edition, Margon Kaufmann Publishers, 2004.

**REFERENCE BOOKS:**
1. Robert Spence "Information visualization – Design for interaction", Pearson Education, 2 nd Edition, 2007.
2. Alexandru C. Telea, "Data Visualization: Principles and Practice," A. K. Peters Ltd, 2008.

# 19BU4275 - CYBER SECURITY (Professional Elective – VI)

**B.Tech. IV Year II Sem.**                                              L   T   P  C
                                                                         3   -   -  3

Course objectives:
1. To understand various types of cyber-attacks and cyber-crimes
2. To learn threats and risks within context of the cyber security
3. To have an overview of the cyber laws & concepts of cyber forensics
4. To study the defensive techniques against these attacks
5. To learn identifying and addressing Privacy issues

**Course Outcomes:**
1. Analyze and evaluate the cyber security needs of an organization.
2. Understand Cyber Security Regulations and Roles of International Law.
3. Provide knowledge on security issues in Mobile and Wireless Devices..
4. Understand Organizational implications on cost of Cybercrime and IPR issues.
5. Understand fundamental concepts of data privacy attacks

### UNIT - I
**Introduction to Cyber Security:** Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

### UNIT - II
**Cyberspace and the Law & Cyber Forensics:** Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.
Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics

### UNIT - III
**Cybercrime: Mobile and Wireless Devices:** Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Organizational security Policies and Measures in Mobile Computing Era, Laptops.

### UNIT- IV
**Cyber Security: Organizational Implications:** Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations

**UNIT - V**

**Privacy Issues:** Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc

Cybercrime: Examples and Mini-Cases

**Examples:** Official WeBUite of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances. **Mini-Cases:** The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

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

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