SCHEME & SYLLABUS for 3rd and 4th Years
Guidelines for obtaining MINOR and HONORS
(With effect from 2022-23 Admitted Batch)

B. Tech
(Information Technology)

Department of Information Technology & Computer Applications

Andhra University College of Engineering (A)

Andhra University

Visakhapatnam - 530003

Guidelines for Obtaining MINOR in Information Technology:

Students belonging to other departments have to complete the following courses to obtain MINOR degree in Information Technology:

1. A student belonging to other departments have to study CPNM and Python Programming as Compulsory courses and any **TWO** of the following open electives as follows:
   OE I: Block Chain Technology
   OE II: Recommender Systems
   OE III: Information Retrieval
   OE IV: Business Analytics
   OE V: Bio Informatics

   OR

   One or two MOOCS courses from NPTEL related to Information Technology without repetition from subjects within the curriculum can be used in Lieu of any of the above Open electives.
2. The duration of NPTEL courses should **NOT** be less than 12 weeks.
3. The MOOCS course(s) chosen by students of other departments for obtaining a MINOR in IT should be taken prior permission/ approval from the Chairperson – BoS of the department of **IT&CA/CS&SE, AUCE(A)**.

Guidelines for Obtaining HONORS in Information Technology:

1. The student shall earn additional 15 credits beyond 160 credits from the same branch/ department/ discipline registered for major degree.
   (i) The students having 7.0 CGPA without any backlog subjects will be permitted to register for HONORS.
   (ii) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.
   (iii) Honors is to be completed simultaneously with B. Tech program.

2. To obtain Honors in Information Technology the following subjects are to be taken for obtaining Honors:
   (i) Social Media Analytics
   (ii) Malware Analysis
   (iii) Reinforcement Learning
   (iv) Software Metrics
   (v) MOOCs for 3 credits of 12 weeks duration related to any one of the above courses.
   (vi) MOOCs may be treated as optional to obtain Honors degree in IT. If a student completes MOOCs with good grade, then it may be considered as betterment for any of the above five Courses (1 to 5)

The above five courses and MOOCs may be completed or pursued during 3rd and 4th years of his/her study of B. Tech program

(with effect from 2022-23 AB)

B. Tech

INFORMATION TECHNOLOGY

III Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
IT3101	PC	Data Communications & Computer Networks	4	0	30	70	100	3
IT3102	PC	Artificial Intelligence	4	0	30	70	100	3
IT3103	PC	Object Oriented Software Engineering	4	0	30	70	100	3
IT3104	PE	Professional Electives - I	4	0	30	70	100	3
IT3105	OE	Open Electives - I	4	0	30	70	100	3
IT3106	PC	Data Communications & Computer Networks Lab	0	3	50	50	100	1.5
IT3107	PC	Object Oriented Software Engineering Lab	0	3	50	50	100	1.5
IT3108	SC	Soft Skills	1	2	50	50	100	2
IT3109	INT	Internship - I	0	0	50	50	100	2
Summer Internship 2 Months (Mandatory) after 2nd year (to be evaluated during III Year I Semester)								
Total Credits								**22**

IT3101 DATA COMMUNICATIONS & COMPUTER NETWORKS

Course Objectives:

- To study basics of data communication systems.
- To study the various types of transmission media.
- To study the various hardware concepts related to data communications.
- To make the students understanding of basic requirements of network hardware, software and its architecture.

Course Outcomes:

- Ability to understand concepts related to data communication hardware and its interface.
- Ability to understand concepts related to Signal encoding techniques and multiplexing.
- The student must be able to understand the concepts related to MAC sub layer.
- Understand the concepts related to network and transport layer.

Syllabus:

Introduction to Data Communications: A Communications Model, Network Models, Analog and Digital Data Transmission, Transmission Impairments.

Data Communication Interface: Asynchronous and Synchronous Transmission. Data Link Control Flow Control, Error Detection, Error Control, High-Level Data Link Control (HDLC).

Signal Encoding Techniques: Digital data to Digital signal, Digital to Analog Signal, Analog data to Digital Signal, and Analog Data to Analog signal.

Multiplexing: Frequency-Division Multiplexing, Synchronous Time-Division Multiplexing: Characteristics, Digital Carrier Systems Statistical Time-Division Multiplexing: Characteristics.

Medium Access Control Sublayer: Wireless LAN's:802.11Architecture and Protocol Stack, 802.11Frame structure.

Network Layer: Network Layer Design Issues, Shortest path routing algorithm, Congestion Control Algorithms, IP Protocol, IP Address.

Transport layer: Transport Service, Elements of Transport Protocols, TCP and UDP Protocols, Simple Network Management Protocol(SNMP).

Text Books:

1. Data Communications and Networking, Behrouz A Forouzan, Tata McGraw-Hill Co Ltd, Second Edition, ISBN: 0-07-049935-7.
2. Computer Networks, Andrews S Tanenbaum, 5th Edition, Pearson Edu.

References:

1. Data and Computer Communications, Eighth Edition, William Stallings, Pearson Education, Inc.

IT3102 ARTIFICIAL INTELLIGENCE

Course Objectives:

- To learn about AI problems, techniques and their modelling as state space search, problem characteristics, Production System categories.
- To learn different uninformed and heuristic search strategies for solving AI problems with examples.
- To learn theorem proving with predicate logic, resolution, rule based inference with forward and backward chaining.
- Inheritable knowledge representation using slot-filler structures and dealing with different forms of uncertain and implicit knowledge.
- To introduce essential concepts of plan generation, Natural Language understanding and Expert Systems.

Course Outcomes:

By the end of the course the Student understands, applies, evaluates and creates AI solutions as they are

- able to characterize and model AI problems in a state space search framework and identify appropriate production system category to solve them.
- able to understand and evaluate pros & cons of different heuristic search strategies and apply appropriate heuristic search for specific problem solving scenario.
- able to represent domain knowledge in the form of predicates / rules and applies logic and inference for deducing the validity of a given assertion.
- able to create problem specific slot-filler knowledge structures and apply statistical, fuzzy and non-monotonic reasoning methods aptly to solve real world problems involving any type of uncertainty.
- able to understand basic concepts and approaches to natural language processing, plan generation and expert system development.

Syllabus:

Introduction to Artificial Intelligence: Artificial Intelligence, AI Problems, AI Techniques, Defining the Problem as a State Space Search, Production Systems, control strategies, Un-informed search using BFS and DFS, Heuristic search, Problem Characteristics, Production system categories for AI problem solving.

Heuristic Search Techniques: Issues in The Design of Search Programs, Generate-And- Test, Hill Climbing and its variants, Best-First Search, A* Algorithm, Problem Reduction, AO*Algorithm, Constraint Satisfaction, Means-Ends Analysis.

Knowledge Representation using Predicate Logic and Rules: Propositional Logic, First Order Predicate Logic: Representing Instance and is-a Relationships, Computable Functions and Predicates, Resolution in propositional logic, Resolution in predicate logic with Clause form, Unification & Resolution algorithm, Question answering, Procedural Vs Declarative Knowledge, Logic programming with Prolog, Forward Vs Backward Reasoning and combining them, Matching Techniques, Matching with variables, RETE Algorithm, Conflict resolution.

Reasoning under Uncertainty: Introduction to Non-Monotonic Reasoning, Logics for Non-monotonic reasoning, Depth first search with Dependency-directed backtracking, Justification-based Truth Maintenance System, Statistical Reasoning: Bayes Theorem for probabilistic inference, Certainty Factors and Rule-Based Systems, Bayesian Belief Networks, Dempster-Shafer Theory, Fuzzy Logic.

Structured Representations of Knowledge: Semantic Nets, representing non-binary predicates, Partitioned Semantic Nets, Frames as sets and instances, Slots as full-fledged

Objects, Property Inheritance through tangled hierarchies, Conceptual Dependency, Conceptual Dependency Graphs, Scripts, examples in natural language understanding, merits and demerits of strong slot-filler structures.

Natural Language Processing: Steps in Natural Language Processing, Syntactic Processing and Augmented Transition Nets, Semantic Analysis and grammars, Discourse and pragmatic processing; Planning: Components of a Planning System, Goal Stack Planning, Non-linear Planning using Constraint Posting, Hierarchical Planning, Reactive Systems.

Experts Systems: Overview of an Expert System, Applications of expert systems, Components of an Expert Systems, Expert system development, Types of Expert Systems: Rule Based, Frame Based, Neural Network based, Black Board Architectures, Case studies of successful expert systems, Expert System Shells, Knowledge Acquisition and Validation Techniques.

Text Books:

1. Artificial Intelligence, Elaine Rich and Kevin Knight, Tata McGraw -Hill Publications.
2. Introduction To Artificial Intelligence & Expert Systems, Patterson, PHI publications.

References:

1. Artificial Intelligence, George F Luger, Pearson Education Publications.
2. Artificial Intelligence : A modern Approach, Russell and Norvig, Prentice Hall.

IT3103 OBJECT ORIENTED SOFTWARE ENGINEERING

Course Objectives:

- The students would be able to get the concepts of Object Orientation and software engineering perceptions and software process models.
- The students would be able to understand requirements engineering processes, Unified Modelling Language and its notations and diagrams.
- The students would be able to understand various architectural styles and the concepts of various architectural patterns and some design patterns.
- The students would be able to understand various types of testing and quality assurance issues.
- The students would be able to gain understanding about software process and project management activities.

Course Outcomes:

- The students will be able to understand the best practices of Object Oriented software engineering and will be able apply various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance.
- The students would be able to analyse, elicit and specify software requirements through a productive working relationship with various stakeholders of the project.
- The students would be able to create various design models for a software system to meet the user needs.
- Students can apply the knowledge, techniques, and skills in the development of a software product.
- The students would be able to evaluate the software through various types of testing and perform software process and project management and quality assurance activities.

Syllabus:

Introduction to Object Oriented Software Engineering: Nature of the Software, Types of Software, Software Engineering Projects, Software Engineering Activities, Software Quality, Introduction to Object Orientation, Software Process Models-Waterfall Model, Opportunistic Model, Phased Released Model, Spiral Model, Evolutionary Model, Concurrent Engineering Model

Requirements Engineering: Domain Analysis, Problem Definition and Scope, Requirements Definition, Types of Requirements, Techniques for Gathering and Analysing Requirements, Requirement Documents, Reviewing, Managing Change in Requirements.

Unified Modelling Language & Use Case Modelling: Introduction to UML, Modelling Concepts, Types of UML Diagrams with Examples; User-Centred Design, Characteristics of Users, Developing Use- Case Models of Systems, Use-Case Diagram, Use- Case Descriptions, Basics of User Interface Design, Usability Principles, User Interfaces.

Class Design and Class Diagrams: Essentials of UML Class Diagrams, Associations and Multiplicity, Other Relationships, Generalization, Instance Diagrams, Advanced Features of Class Diagrams, Interaction and Behavioural Diagrams: Interaction Diagrams, State Diagrams, Activity Diagrams, Component and Deployment Diagrams.

Software Design and Architecture: Process of Design, Principles Leading to Good Design, Techniques for Making Good Design Decisions, Good Design Document; Pattern Introduction, Design Patterns: Abstraction-Occurrence Pattern, General Hierarchical Pattern, Play-Role Pattern, Singleton Pattern, Observer Pattern, Delegation Pattern, Adaptor Pattern, Façade Pattern, Immutable Pattern, Read-Only Interface Pattern and The Proxy Pattern; Software

Architecture Contents of Architecture Model, Architectural Patterns: Multilayer, Client-Server, Broker, Transaction Processing, Pipe & Filter and MVC Architectural Patterns.

Software Testing: Overview of Testing, Testing Concepts, Testing Activities, Testing Strategies, Unit Testing, Integration Testing, Function Testing, Structural Testing, Class Based Testing Strategies, Use Case/Scenario Based Testing, Regression Testing, Performance Testing, System Testing, Acceptance Testing, Installation Testing, OOTest Design Issues, Test Case Design, Quality Assurance, Root Cause Analysis, Post-Mortem Analysis.

Software Process Management: Introduction to Software Project Management, Rationale Management, Configuration Management, Activities of Software Project Management, Structure of Project Plan, Software Engineering Teams, Software Cost Estimation, Project Scheduling, Tracking and Monitoring.

Text Books:

1. Object-Oriented Software Engineering Practical software development using UML and Java by Timothy C. Leth bridge & Robert, Langaniere Mcgraw-Hill
2. Software Engineering, K.K. Agarwal, New Age Publications2008
3. Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson Education Asia.

References:

1. Software Engineering: A Practitioner's Approach, Roger S Pressman.
2. A Practical Guide to Testing Object-Oriented Software, John D. McGregor; David A.Sykes, Addison-Wesley Professional.

IT3106 DATA COMMUNICATIONS & COMPUTER NETWORK LAB

Course Objectives:

- This course provides students with hands on training regarding the design, troubleshooting, modelling and evaluation of computer networks.
- To study the various hardware concepts related to data communications
- To make the students understand the basic requirements of network hardware, software and its architecture.
- To understand the various Error detection & control techniques
- To learn Socket programming techniques

Course Outcomes:

- About networking concepts and connecting systems
- To setup Local Area Network using packet tracer software
- To experiment in a real tested networking environment, network design and troubleshooting topics and tools.
- Simulator Error control and flow control techniques
- To write socket program and client server applications.

Syllabus:

Module I: Packet tracer software

1. Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.
2. Connect the computers in Local Area Network.
3. Study of basic network command Network configuration commands.
4. Configure a Network topology using packet tracer software.

Module II: Network simulator

1. Implementation of Error Detection/Error Correction Techniques
2. Implementation of Stop and Wait Protocol and sliding window
3. Implementation and study of Goback-N and selective repeat protocols
4. Implementation of High-Level Data Link Control
5. Study of Socket Programming and Client-Server model using Java
6. Write a socket program for Echo/Ping/Talk commands using Java
7. Study of Network simulator (NS) and simulation of Congestion Control Algorithms

IT3107 OBJECT ORIENTED SOFTWARE ENGINEERING LAB

Course Objectives:

- The purpose of the Software Engineering Lab course is to familiarize the students with modern software engineering methods and tools, The course is realized as a project-like assignment that can, in principle, by a team of two/three students working full time. Typically the assignments have been completed during the semester requiring approximately 60-80 hours from each project team.
- The goal of the Software Engineering Project is to have a walk through from the requirements, design to implementing and testing. An emphasis is put on proper documentation. Extensive hardware expertise is not necessary, so proportionate attention can be given to the design methodology.
- Despite its apparent simplicity, the problem allows plenty of alternative solutions and should be a motivating and educating exercise. Demonstration of a properly functioning system and sufficient documentation is proof of a completed assignment.
- Term projects are projects that a group student or might take through from initial specification to implementation. The project deliverables include.

Course Outcomes:

- Ability to define a problem and to translate end-user requirements into system and software requirements.
- Ability to generate a high-level design of the system from the software requirements.
- Ability to draw various design diagrams (UML, Architectural Designs, Database Design and User Interface Designs) for the requirements gathered.
- Ability to implement the designed problem in Object Oriented Programming Language.
- Will have experience and/or awareness of testing problems, test whether all the requirements specified have been achieved or not and will be able to develop a simple testing report.

Syllabus:

1. Documentation including
   - A. A problem statement
   - B. A requirements document
     - a. A Requirements Analysis Document.
     - b. A System Requirements Specification.
     - c. A Software Requirements Specification.
2. A design document
   - a. A Software Design Description and a System Design Document.
3. A Test specification.
4. Manuals/guides for
   - A. Users and associated help frames
   - B. Programmers
   - C. Administrators (installation instructions)
5. A project plan and schedule setting out milestones, resource usage and estimated costs.
6. A quality plan setting out quality assurance procedures
7. An implementation.

References:

1.Project-based software engineering: An Object-oriented approach, Evelyn Stiller, Cathie LeBlanc, Pearson Education
2.Visual Modelling with Rational Rose 2002 and UML, Terry Quatrini, Pearson Education
3.UML2 Toolkit, Hans -Erik Eriksson, etc; Wiley

IT3108 SOFT SKILLS (Skilled Course)

Course Objectives:

- To develop skills to communicate clearly.
- To aid students in building interpersonal skills.
- To enhance team building and time management skills.
- To inculcate active listening and responding skills.

Course Outcomes:

- Make use of techniques for self-awareness and self-development.
- Apply the conceptual understanding of communication into everyday practice.
- Understand the importance of teamwork and group discussions skills.
- Develop time management and stress management.

Syllabus

Introduction to Soft Skills: Communication – Verbal and Non Verbal Communication - Personal grooming (Etiquette, Attitude, Body Language), Posture, Gestures, Facial Expressions, Eye Contact, Space Distancing, Presentation Skills, Public Speaking, Just a Minute (JAM) sessions, Adaptability.

Goal Setting and Time Management: Immediate, Short term, Long term, Smart Goals, Strategies to Achieve goals, Types of Time, Identifying Time Wasters, Time Management Skills, Stress Busters.

Leadership and Team Management: Qualities of a Good Leader, Team Dynamics, Leadership Styles, Decision Making, Problem Solving, Negotiation Skills.

Group Discussions: Purpose (Intellectual ability, Creativity, Approach to a problem, Tolerance), Group Behaviour, Analysing Performance.

Job Interviews: Identifying job openings, Covering Letter and CVs / Resumes, Interview (Opening, Body-Answer Q, Close-Ask Q), Telephone Interviews, Types of Questions.

Reference Books:

1. Krannich, Caryl, and Krannich, Ronald L. Nail the Resume! Great Tips for Creating Dynamite Resumes. United States, Impact Publications, 2005.

2. Hasson, Gill. Brilliant Communication Skills. Great Britain: Pearson Education, 2012

3. Prasad, H. M. How to Prepare for Group Discussion and Interview. New Delhi: Tata McGraw-Hill Education, 2001.

4. Pease, Allan. Body Language. Delhi: Sudha Publications, 1998.

5. Rizvi, Ashraf M. Effective Technical Communication: India, McGraw-Hill Education. 2010

Thorpe, Edgar &Showick Thorpe. Winning at Interviews. 2nd Edition. Delhi: Dorling Kindersley,

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B. Tech

INFORMATION TECHNOLOGY

III Year - II Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
IT3201	PC	Internet of Things	4	0	30	70	100	3
IT3202	PC	Data warehouse & Data Mining	4	0	30	70	100	3
IT3203	PC	Cryptography & Network Security	4	0	30	70	100	3
IT3204	PE	Professional Elective - II	4	0	30	70	100	3
IT3205	OE	Open Elective - II	4	0	30	70	100	3
IT3206	PC	Internet of Things Lab	0	3	50	50	100	1.5
IT3207	PC	Data warehouse & Data Mining Lab	0	3	50	50	100	1.5
IT3208	PC	Cryptography & Network Security Lab	0	3	50	50	100	1.5
IT3209	SC	Python Programming	1	2	50	50	100	2
Industrial / Research Internship 2 months								
Total Credits								**21.5**

IT3201 INTERNET OF THINGS

Course Objectives:

- Understand IoT conceptual framework and design standardisation of IoT/M2M architectural layers and domains.
- Learning the usage of messaging protocols between connected devices and the web.
- Identify the functions and usage of data analytics and cloud services for IoT applications and business processes.
- Elucidate sensor technology for sensing the real world using analog and digital sensors.
- Develop the codes, design and test the embedded devices for IoT and M2M using IDEs and development platforms.

Course Outcomes:

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

- Understand the IoT Standards and design principles.
- Understand various web-communication protocols and their practical usage.
- Able to use IoT cloud-based services using the Xively, Nimbits.
- Able to learn various types of sensors and actuators, interfacing and use in IoT environment.
- Able to use number of device platforms of IDEs, such as Arduino, Intel Galileo, RPi, BB and mBed, provide development tools, libraries and framework, and are used for the development of embedded Software.

Syllabus:

The Internet of Things: An Overview of Internet of things, Internet of Things Conceptual Frame work, IoT architectural View, Technology behind IoT, Sources of IoT, M2M Communication, Examples of IoTs, Design Principles for Connected Devices Internet Connectivity: IoT/M2M System Layers and Design Standardization.

Design for Web Connectivity: Web communication protocols for connected devices, Message Communication protocols for connected devices, Web Connectivity for Connected-Devices Network using Gateway, SOAP, REST, HTTP RESTFUL, and Web Sockets, Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.

Data Acquiring, Organizing, Processing and Analytics: Data Acquiring and Storage, Organizing the Data, Transactions, Business Processes, Integration and Enterprise Systems. Analytics, Knowledge acquiring, managing and storing process.

Data Collection, Storage and Computing Using a Cloud Platform: Cloud Computing Paradigm for Data Collection, Storage and Computing. Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively, Nimbits and other platforms.

Sensor Participatory Sensing, RFID, Wireless Sensor Networks: Sensors Technology, Participatory Sensing, Actuator, Sensor Data Communication Protocols, RFID, WSN.

Prototyping and Designing the Software for IoT Applications: Prototyping embedded device Software, Devices, Gateways, Internet and Web/Cloud Services Software Development, Prototyping Online Component APIs and WebAPIs.

IoT Case Studies: Design Layers, Design Complexity and Designing Using Cloud PaaS. IoT Applications for Smart Homes, Cities, Environmental Monitoring and Agriculture. Connected Car and Its applications.

Text Books:

1. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education
2. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press,2015

Reference Books:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally,Wiley.
2. Getting Started with the Internet of Things,CunoPfister , Oreilly.

IT3202 DATA WAREHOUSING AND DATA MINING

Course Objectives:

- To understand the evolution of data warehousing and data mining systems
- To provide an understanding of data objects, similarity and dissimilarity metrics and
- preprocessing techniques.
- To impart knowledge about the basics of data warehousing and modelling using data
- cubes, OLAPs, AOI.
- To familiarize the concepts of mining frequent patterns based on Associations.
- To discuss about pattern mining using classification and clustering methods.

Course Outcomes:

- Understands data objects, attribute types, metrics, cleaning and transformation of data.
- Ability to represent and comprehend information with data warehousing technologies for multidimentional modelling and generalisation using Cubes, OLAPS and AOI.
- Grasp the concepts of Association mining using Apriori and FP- Growth.
- Learn about various approaches to supervised learning like classification approach.
- Learn about various approaches to unsupervised learning like clustering approach.

Syllabus:

Introduction to Data Mining: Importance of Data Warehousing and Data Mining, Kinds of data, Kinds of patterns, Technologies, Applications, Major Issues in Data Mining

Getting to know your data: Data Objects and Attributes Types, Statistical Descriptions of Data, Estimating Data Similarity and Dissimilarity, Data Visualization.

Data Preprocessing: Quality data, Data Cleaning, Data Integration, Data Reduction, Data Transformation, Discretization and Concept Hierarchy Generation.

Data Warehouse and OLAP Technology: Basic Concepts of Data warehouse, Data Modelling using Cubes and OLAP, DWH Design and usage, Implementation using Data Cubes and OLAPs, Data Generalization with AOI.

Mining Frequent Patterns Based on Associations and Correlations: Basic Concepts, Frequent Item set Mining Methods: Apriori Algorithm, Association Rule Generation, Improvements to A Priori, FP- Growth Approach, Pattern Evaluation Methods.

Classification and Prediction: Basic Concepts, Decision Tree Induction, Bayes Classification, Rule- Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy, Classification by Back Propagation, K-nearest neighbour classifier.

Cluster Analysis: Basic Concepts and issues in clustering, Requirements for Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Evaluation of Clustering Solutions.

Text Books:

1. Data Mining- Concepts and Techniques by Jiawei Han, Micheline Kamber and Jian Pei–Morgan Kaufmann publishers –--3rd edition
2. Data Mining Techniques, A.K.Pujari, University Press.

References:

1. Data mining concepts byTan, Steinbech, and Vipin Kumar - Pearson Edu Publishers.

CS3203 CRYPTOGRAPHY AND NETWORK SECURITY

Course Objectives:

- To understand the basic concepts of Cryptography and Network Security.
- To be able to understand message security, confidentiality and database security
- To learn about the various types of malwares and attacks.
- To learn about Intrusions, intrusion detection system and understand buffer overflow
- To understand various protocols used in network and various protection mechanisms against network attacks/Threats

Course Outcomes:

- After successful completion of the course, the students would be able to
- Realize the need and importance of network security, understand and apply the concepts of security towards data over network.
- Understand the principles of cryptography and network security and apply the knowledge to design cryptographic concepts and algorithms.
- Understand and analyze various types of malwares and several network attacks.
- Evaluate several intrusions and understand buffer overflow attacks.
- Understand and apply security standards and implement various network security protocols.

Syllabus:

Cryptography : Concepts and Techniques Need for Security, Security Approaches, Principles of Security, Threats-Attacks and Attack Types-Services-Mechanisms, Basic Mathematics for cryptography- Factorization, Prime numbers, Primality Testing, Modular Arithmetic, Discrete logarithms, Residues, Fermat's and Euler's Theorem, Chinese Reminder theorem

Symmetric and Asymmetric Cryptography Network Security Model: Plain Text-Cipher Text-Encryption-Decryption-Key, Key Range and Key Size, Classic Cryptography: Stream ciphers, Substitution-Transposition, Steganography. Basic Concept of Symmetric Cryptography, Algorithm Types and Modes, DES-AES-RC4, Principles of Public-Key Cryptography, Message Authentication, Hash functions, RSA, Concepts of Digital Signature.

Key Management and Integrity: Symmetric Key Distribution, Diffie-Hellman Key exchange, Public Key Distribution, Public Key infra structure(PKI) Digital Certificates (public key), Basic principles of Access control.

E-mail and IP Security: E-mail security -PGP/SMIME, IP Security and architecture, IPV6

Internet Security Protocols and Standards: Basic concepts, Secure Socket Layer (SSL) and Transport Layer Security(TLS), Secure hyper text transfer protocol(SHTTP), Time stamping protocol(TSP), Wireless Application Protocol(WAP), Secure Electronic Transaction(SET), security in GSM, Security in 3G.

Firewalls, Intrusion Detection System and Virtual Private Networks:

Types of Firewalls, Firewall Architectures, IDS- Signature and Anomaly based IDS, Basics of VPN, VPN architecture

Network Vulnerabilities :

Different types of Vulnerabilities in Network, Introduction to IP Spoofing, ICMP, ARP, DDOS, Buffer Overflow attacks.

Text Books:

1. Cryptography And Network Security by Atul kahate, McGrawHill
2. Network Security Essentials- Applications and Standards by William Stallings, 3 rd Edition, Pearson

Reference Books:

1. Cryptography and Network Security by William Stallings, Pearson Education Asia, New Delhi.
2. Network Security Essentials Applications and Standards, by William Stallings, Pearson Education Asia, New Delhi.

IT3206 INTERNET OF THINGS LAB

Course Objectives:

- To familiarize with different types of loT hardware platforms and programming
- To learn various sensors and their interfacing with loT hardware using C and Python.
- To master Internet of Things protocols and their practical applications.
- To learn how to write Cloud application for IoT.
- To design and development of a mini IoT application project.

Course Outcomes:

- Able to write Python programs with Intel Galileo Gen 2/Raspberry Pl/Node MCU board.
- Able to interface different types of sensors/actuators to Intel Galileo Gen 2/Raspberry Pl /Node MCU boards.
- Able to implement and use of loT Protocols in various applications.
- Able to manage loT applications on Cloud.
- Able to design and develop mini loT project with sensor and deploy in Cloud environment.

Syllabus:

List of Experiments:

Cycle 01

1. Understanding and setting up the Base IoT Hardware and Working with Python on Intel Galileo Gen 2 /Raspberry Pl
2. Interacting with Digital Outputs with Python on Intel Galileo Gen 2/Raspberry Pl
3. Working with a RESTful API and Pulse Width Modulation on Intel Galileo Gen 2/Raspberry Pl.
4. Implementing IoT Protocols CoAP, MQTT, WebServer on Intel Galileo Gen 2/Raspberry Pl
5. Retrieving Data from the Real World with Sensors
6. Interfacing analog accelerometer and digital accelerometer with Intel Galileo Gen 2/Raspberry Pl.
7. Measuring ambient temperature with an analog sensor
8. Measuring temperature and humidity with a digital sensor
9. Working with the Cloud
    a. (a)Publishing data to the cloud with dweepy.
    b. (b)Building a web-based dashboard with Freeboard.
    c. (c)Using MQTT with Mosquitto and Eclipse Paho
10. Interfacing with Intel Galileo Gen 2/Raspberry Pl.
11. Interfacing and Controlling Servo Motor
12. Interfacing with Stepper Motor.

Cycle 02

Mini Project

1.Implementing Smart Home Systems using Galileo Gen 2/Raspberry Pl/Node MCU

2.Implementing Smart Soil monitoring System Galileo Gen 2/Raspberry Pl/Node MCU

3.Any other mini projects on loT.

Text books:

1.Internet of Things with Python - Interact with the world and rapidly prototype loT applications using Python by Gaston C. Hillar, Packt Publishing,2016

2.Internet of Things with Intel Galileo, Miguel de Sousa, Packt Publishing,2015

3.Internet of Things with Raspberry Pi and Arduino by Rajesh Singh. Anita Gehlot, CRC Press, 2020

Reference books:

1. Building Arduino Projects for the Internet of Things: Experiments with Real-World Applications, Adeel Javed

IT3207 DATA WAREHOUSING AND DATA MINING LAB

Course Objectives:

- To study the various data analysis techniques in R Programming language.
- To apply the various data mining techniques available in WEKA for generating knowledge such as Association Analysis, Classification and Clustering to various standard datasets and own datasets.

Course Outcomes:

- Student will be able to write R programs to perform several data analytics operations on datasets
- Ability to extract patterns by applying appropriate data mining techniques from different types of datasets using WEKA.

Syllabus:

List of Experiments:

I. Exploratory data analysis using R

1. Load the 'iris. CSV' file and display the names and type of each column. Find statistics such as min, max, range, mean, median, variance, standard deviation for each column of data.
2. Write R program to normalize the variables into 0 to 1 scale using min-max Normalisation.
3. Generate histograms for any one variable (sepal length/ sepal width/ petal length/ petal width) and generate scatter plots for every pair of variables showing each species in different color .
4. Generate box plots for each of the numerical attributes. Identify the attribute with the highest variance.
5. Study of homogeneous and heterogeneous data structures such as vector, matrix, array, list, data frame in R.
6. Write R Program using 'apply' group of functions to create and apply normalization function on each of the numeric variables/columns of iris dataset to transform them into a value around 0 with z-score normalization.
7. a) Use R to apply linear regression to predict evaporation coefficient in terms of air velocity using the data given below:
   Air Velocity (cm/sec) 20,60,100,140,180,220,260,300,340,380
   Evaporation Coefficient(sqmm/sec).
   0.18, 0.37, 0.35, 0.78, 0.56, 0.75, 1.18, 1.36,1.17, 1.65
   b) Analyze the significance of residual standard-error value, R-squared value, F- statistic. Find the correlation coefficient for this data and analyze the significance of the correlation value.
   c) Perform a log transformation on the 'Air Velocity 'column, perform linear regression again, and analyze all the relevant values.
8. Write R Program using 'apply' group of functions to create and apply normalization function on each of the numeric variables/columns of iris dataset to transform them a value around 0 with z-score normalization.

II. WEKA Knowledge Extraction toolkit

9. Create an ARFF (Attribute-Relation File Format) file and read it in WEKA. Explore the purpose of each button under the preprocess panel after loading the ARFF file. Also, try to interpret using a different ARFF file, weather.arff, provided withWEKA.

10. Performing data preprocessing in Weka Study Unsupervised Attribute Filters such as Replace Missing Values to replace missing values in the given dataset, Add to add the new attribute Average, Discretize to discretize the attributes
into bins. Explore Normalize and Standardize options on a dataset with numerical attributes.
11. Classification using the WEKA toolkit

Demonstration of classification process using id3 algorithm on categorical dataset(weather).

Demonstration of classification process using naïve Bayes algorithm on categorical dataset ('vote').

Demonstration of classification process using Random Forest algorithm on datasets containing large number of attributes.

12. Classification using the WEKA toolkit – Part2

Demonstration of classification process using J48 algorithm on mixed type of dataset after discretizing numeric attributes.

Perform cross-validation strategy with various fold levels. Compare the accuracy of the results.

13. Performing clustering in WEKA

Apply hierarchical clustering algorithm on numeric dataset and estimate cluster quality. Apply DBSCAN algorithm on numeric dataset and estimate cluster quality.

14. Association rule analysis in WEKA

Demonstration of Association Rule Mining on supermarket dataset using Apriori Algorithm with different support and confidence thresholds.

Demonstration of Association Rule Mining on supermarket dataset using FP-
Growth Algorithm with different support and confidence thresholds.

References:

1. Practical data science with R, Nina Zumel and John Mount- Dreamtech Press.

IT3209 PYTHON PROGRAMMING (SC)

Course Objectives:

- familiarize students with key data structures in Python including lists and dictionaries and apply them in context of searching, sorting, text and file handling
- introduce students to calculation of statistical measures using Python such as measures of central tendency, correlation
- familiarize students with important Python data related libraries such as Numpy and Pandas and use them to manipulate arrays and data frames introduce students to data visualization in Python through creation of line plots, histograms, scatter plots, box plots and others
- Implementation of basic machine learning tasks in Python including pre-processing data, dimensionality reduction of data using PCA, clustering, classification and cross-validation.

Course Outcomes:

- After completion of the course the student should be able to:
- implement searching, sorting and handle text and files using Python data structures such as lists and dictionaries.
- calculate statistical measures using Python such as measures of central tendency, correlation.
- use Python data related libraries such as Numpy and Pandas and create data visualizations
- Use and generate Data Visualization techniques in Python.
- implement basic machine learning tasks pre-processing data, compressing data, clustering, classification and cross-validation.

Syllabus

1. Python Programs on lists & Dictionaries
2. Python Programs on Searching and sorting
3. Python Programs on Text Handling
4. Python Programs on File Handling
5. Python Programs for calculating Mean, Mode, Median, Variance, Standard Deviation
6. Python Programs for Karl Pearson Coefficient of Correlation, Rank Correlation
7. Python Programs on NumPy Arrays, Linear algebra with NumPy
8. Python Programs for creation and manipulation of Data Frames using Pandas Library
9. Write a Python program for the following.
    a) Simple Line Plots,
    b) Adjusting the Plot: Line Colours and Styles, Axes Limits, Labelling Plots,
    c) Simple Scatter Plots,
    d) Histograms,
    e) Customizing Plot Legends,
    f) Choosing Elements for the Legend,
    g) Boxplot
    h) Multiple Legends,
    i) Customizing Colorbars,
    j) Multiple Subplots,
    k) Text and Annotation,
    l) Customizing Ticks

10. Python Programs for Data pre-processing: Handling missing values, handling categorical data, bringing features to same scale, selecting meaningful features

11. Python Program for Compressing data via dimensionality reduction: PCA
12. Python Programs for Data Clustering
13. Python Programs for Classification
14. Python Programs for Model Evaluation: K-fold cross validation.

Reference Books

1. Core Python Programming, Second Edition, Wesley J. Chun, Prentice Hall.
2. Chris Albon, ―Machine Learning with Python Cookbook-practical solutions from pre-processing to Deep learning‖, O'REILLY Publisher,2018.
3. Mark Summerfield, Programming in Python 3--A Complete Introduction to the Python Language, Second Edition, Additson Wesley.
4. Phuong Vo.T.H , Martin Czygan, Getting Started with Python Data Analysis, Packt Publishing Ltd.
5. Armando Fandango, Python Data Analysis, Packt Publishing Ltd.
6. Magnus Vilhelm Persson and Luiz Felipe Martins, Mastering Python Data Analysis, Packt Publishing Ltd.
7. Sebastian Raschka & Vahid Mirjalili, ―Python Machine Learning‖, Packt Publisher, 2017.

(with effect from 2022-23 AB)

B. Tech

INFORMATION TECHNOLOGY

IV Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
IT4101	PE	Professional Elective– III	4	0	30	70	100	3
IT4102	PE	Professional Elective - IV	4	0	30	70	100	3
IT4103	PE	Professional Elective - V	4	0	30	70	100	3
IT4104	OE	Open Elective– III	4	0	30	70	100	3
IT4105	OE	Open Elective - IV	4	0	30	70	100	3
IT4106	HSSE	HSS Elective	4	0	30	70	100	3
IT4107	SC	Android App Programming	1	2	50	50	100	2
IT4108	INT	Internship -II	0	0	50	50	100	2
Industrial / Research Internship 2 months(Mandatory) after 3rd year (to be evaluated during IV Year I Semester)								
Total Credits								**22**

IT4107 ANDROID APP PROGRAMMING (SC)

Course Objectives:

The main objectives of this course are to:

- Provide basic knowledge on Android OS and tools required to develop android applications.
- Create applications on Android User Interface using Views, Pictures and Menus.
- Demonstrate various components that make up the user interface (UI) of an Android application.
- Explore views further to display images using various image views as well as display options in Android application.
- Introduce various techniques to store user data, file manipulation onto storage, and content sharing among different applications in an android device.

Course Outcomes:

After successful completion of the course, students will be able to:

- Equipped with the basic knowledge to explore sophisticated techniques for developing an Android application.
- Create user Interfaces in Android and how user interacts with the UIs using Views.
- Develop applications to display images using Views
- Develop applications to persist data using shared preferences, files and content providers
- Develop applications to communicate through Messaging and invoking Mailing services in Android**.**

Syllabus:

Getting started with android Programming: What is Android: Android Versions, Features of Android, Architecture of Android, Obtaining the required tools: Android Studio, Android SDK, creating Android Virtual Devices. Using Android Studio for development: Exploring the IDE, using code completion, Debugging and publishing application

Activities, Fragments and Intents: Understanding Activities, Linking Activities Using Intents, Fragments, Displaying Notifications.

The Android User Interface: Components of a Screen, adapting to Display Orientation, Managing Changes to Screen Orientation, Utilizing the Action Bar, Creating the User Interface Programmatically.

User Interface with Views: Using Basic Views, Using Picker Views, Using List Views to Display Long Lists, Understanding Specialized Fragments.

Pictures and Menus with Views: Using Image Views to Display Pictures, Using Menus with Views, Using Web View.

Data Persistence: Saving and Loading User Preferences, Persisting Data to Files, Creating and Using Databases.

Content Providers: Sharing data in Android, using a Content Provider, Creating Your Own Content Providers. Messaging: SMS Messaging, Sending E-Mail.

Text Book:

1. Beginning Android Programming with Android Studio, J. F. DiMarzio, 4th Edition, Wiley India (Wrox), 2017.

References:

1. Learning Mobile App Development, A Hands-on Guide to Building Apps with iOS and Android, J. Iversen, M. Eierman, Adison-Wesley, 2013

2. Android Studio Application Development: Create visually appealing applications using the new IntelliJ IDE Android Studio, B. C. Zapata, Packt Publishing, 2013.

3. Android Studio 3.0 Development Essentials - Android 8 Edition, N. Smith, CreateSpace Independent Publishing Platform, Year: 2017

(with effect from 2022-23 AB)

B. Tech

INFORMATION TECHNOLOGY

IV Year - II Semester

Course code	Category	Course Title	Internal Marks	External Marks	Total Marks	Credits
IT4201	PROJ	Project work	100	100	200	14
					Total Credits	**14**

PROFESSIONAL ELECTIVES (IT)

1. PRINCIPLES OF PROGRAMMING LANGUAGES
2. COMPILER DESIGN
3. SOFTWARE PROJECT MANAGEMENT
4. DISTRIBUTED SYSTEMS
5. GRID COMPUTING
6. SENSOR NETWORKS
7. CLOUD COMPUTING
8. DIGITAL IMAGE PROCESSING
9. MACHINE LEARNING
10. BIG DATA ANALYTICS
11. NATURAL LANGUAGE PROCESSING
12. SOFT COMPUTING
13. DEEP LEARNING
14. E-COMMERCE
15. EMBEDDED SYSTEMS

PRINCIPLES OF PROGRAMMING LANGUAGES
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

- To learn the underlying principles and concepts of programming language.
- To understand the programming language translation process.
- To expose students to the important paradigms of programming.
- To understand the concepts of distributed processing and network programming

Course Outcomes:

- Ability to compare different programming languages.
- Ability to discuss the significant achievements in programming language history.
- Ability to assess the programming languages in scientific manner
- Ability to understand the concepts of distributed processing and basics of networking

Syllabus:

Language design issues: Study programming Languages, History of programming Languages, role of programming Languages, Programming Environments.

Impact of Machine Architectures: Operation of a Computer, Virtual Computers and Binding Times; Language Translation Issues: Programming Language Syntax, Stages in Translation, Formal Translation Models, Recursive Descent Parsing; Modeling Language Properties: Formal Properties of Languages, Language Semantics.

Elementary Data Types: Properties of Types and Objects, Scalar Data Types, Composite Data Types Encapsulation: Structured Data Types, Abstract Data Types, Encapsulation by Subprograms, Type Definitions. Inheritance: Abstract Data Types Revisited, Inheritance, Polymorphism

Sequence Control: Implement and Explicit Sequence Control, Sequence with Arithmetic Expressions, Sequence Control Between Statements, Sequencing with Non-arithmetic Expressions.

Subprogram Control: Subprogram Sequence Control Attributes of Data Control, Parameter Transmission, Explicit Common Environment.

Storage Management: Elements Requiring Storage, Programmer- and System - Controlled Storage, Static Storage Management, Heap Storage Management

Distributed Processing: Variations on Subprogram Control, Parallel Programming, Hardware Developments, and Software Architecture. Network Programming: Desktop Publishing, The World Wide Web.

Text Books

1. Programming languages – Design and Implementation by Terrence W. Pratt Marvin V. Zelkowitz.3 rd Edition, Prentice Hall of India.

Reference Books

1.Concepts of Programming Languages by Robert L. Sebesta, 4th Edition,PearsonEducation.
2.Fundamentals of Programming Languages, Design & Implementation by SeyedH .Roosta. Vikas publications.
3.Programming Languages by Paradigm and Practice – Doris Appleby Julius J. Vendekopple Tata McGraw Hill Edition

COMPILER DESIGN
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

- To explain the basic understanding of grammars and language definition and introducing various phases of designing a compiler.
- To make the student to understand the concepts underlying the design and implementation of language processors and its mechanisms.
- To extend the knowledge of parser by parsing LL parser and LR parser.
- To enrich the knowledge in various phases of compiler ant its use, code optimization techniques, loop optimization techniques, machine code generation, and use of symbol table.

Course Outcomes:

- Ability to understand grammars, language definitions and various phases of designing a compiler.
- Ability to understand Language processors and different parsers.
- Ability to learn the new code optimization techniques to improve the performance of a program in terms of speed & space.
- Ability to do usage of registers in efficient manner during the program execution.
- Ability to acquire the knowledge of modern compiler & its features.

Syllabus:

Introduction: Introduction to Compilers and Language processors, Programming Language basics, Structure & Different Phases of a Compiler, Review of Compiler Structure, Structure of Optimizing Compilation, Compiler construction tools, Boot strapping, Cross compilers.

Finite Automata & Lexical Analysis : Introduction to Lexical Analysis, Lexical Analyzers, Approaches to design Lexical Analysers, Language for specifying lexical analyzers, Introduction to Finite automata, Regular Expressions & Languages, Recognition of Tokens, Transition Diagrams, Implementation of lexical analyzers, Lexical Analyzer Generator LEX.

Syntax Analysis: Syntactic Specification of Programming Languages, Context Free Grammars & Languages, Introduction to Parsers. Top-down parsing techniques: Brute force parsing, Recursive Descent Parsing, Predictive Parsing, Bottom–up Parsing: Shift reduce parsing, Operator parsing, LR (k) parsing.

Semantic Analysis and Intermediate Code Generation: Semantic Actions, Syntax Directed Translations, Translation on the parse Tree, Implementation of Syntax Directed Translator, Intermediate Codes, Syntax Directed translation to Postfix code, Syntax Trees, Intermediate Code Generation, Three Addr5ess Code-Translation of Expressions, Type Checking & Type Conversions.

Code Optimization: Principal sources of Code Optimization, Loop Optimization, Basic Blocks & Flow Graphs, DAG Representation of Basic Blocks, Applications of DAG, Local Optimization, Unreachable Code Elimination, Dead Code Elimination, Data Flow Analysis, Data Flow Equations & Computations, Peep-Hole Optimization. Machine Dependent Optimizations, Overview of Informal Compiler Algorithm Notation (ICAN), If Simplification, Loop Simplification, Loop Inversion, Branch Optimization and Prediction

Code Generation and Code Scheduling: Issues in Code Generation, Input to Code Generator, Instruction Selection, Register Allocation, Simple Target Machine Model, Program and Instruction Costs, Register allocation & Assignments, Code Generation Algorithm, Code Generators, Optimal Code Generation for Expressions, Code Generation From DAG.

Symbol Tables, Runtime Environment and Error Handling: Contents of a Symbol Table, Data Structures for Symbol Tables; Run time Environments, Implementation of a simple Stack allocation, Heap Management, Block Structured Languages; Error Detection & Recovery, Lexical Phase Errors, Syntactic & Semantic Errors, Error Handling Routines.

Text Books:

1. Principles of Compiler Design by Aho,D. Ullman, Lam and Ravi Sethi, Pearson Education Second Edition
2. Advanced Compiler Design and Implementation, Steven Muchnic, Elsevier Publications.

Reference Books:

1. Compiler Construction by Kenneth. C. Louden, Vikas Pub. House.
2. Compiler Design, A.A. Pentambekar, Technical Publications
3. Modern Compiler Design, Grune.D, Van Reeuwijk K, Bal H.E, Jacobs C J H, Lan gendoen K, Springer,

SOFTWARE PROJECT MANAGEMENT
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

- To understand the Software Project Planning and Evaluation techniques.
- To plan and manage projects at each stage of the software development life cycle (SDLC).
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management.
- To deliver successful software projects that support organization ‘s strategic goals.

Course Outcomes:

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

- Understand Project Management principles while developing software.
- Gain extensive knowledge about the basic project management concepts, framework and the process models.
- Obtain adequate knowledge about software process models and software effort estimation techniques.
- Estimate the risks involved in various project activities.
- Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
- Learn staff selection process and the issues related to people management

Syllabus:

Introduction to Software Project Management: Introduction to Project and Project Management, Reasons for IT project failure, Triple constraint of IT project management, Management spectrum of project, Overview of project life cycle models, Project manager skills and job description conceptualization and initiation of IT project, Business case.

Project Charter: Introduction, Project management process and their correlation with project life cycle phases, Introduction to Project Integration management and seven processes, Project Charter.

Project Scope Management: Introduction, Processes of scope management.

Project Human Resource Management: Introduction, Organizational structure – Function, Project and Matrix, Keys to managing people motivation theories and improving effectiveness, Project team selection.

Project Time and Cost Management: Introduction, Development of project schedule, CPM and PERT, Activities their sequencing and dependencies, Project network diagrams, Development of Gantt Charts, Earned Value Management, Introduction to Constructive Cost Model (COCOMO).

Project Risk Management: Introduction, Risk Management Process, Risk Identification for IT projects, Qualitative and Quantitative approaches to Risk Analysis, Risk Strategies, Risk Monitoring and Control, Risk Response and Evaluation Project Quality Management.

Project Communication Management: Introduction, Project Communication Plan, Project metrics, Information distribution, Performance Reporting. Project Change Management: Introduction, Impact of change, Change as a process, Change Management plan, Dealing with resistance and conflict, Configuration management.

Project Procurement Management: Introduction, Processes Planning Purchases and Acquisition, Contracting, Request Seller Responses, Select Sellers, Contract Administration, Contract Closure, Outsourcing of products and services.

Project Leadership and Ethics: Introduction, Project Leadership, Modern approaches, Styles of leadership, Ethical leadership, Making sound ethical decisions in the situations of conflict. Closure of a Project: Introduction, Project implementation, Administrative closure, Project Evaluation.

Text Book:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

References:

1. Robert K. Wysocki ―Effective Software Project Management – Wiley Publication, 2011.
2. Walker Royce: ―Software Project Management- Addison-Wesley, 1998.
3. Gopalaswamy Ramesh, ―Managing Global Software Projects – McGraw Hill Education (India), Fourteenth Reprint 2013

DISTRIBUTED SYSTEMS
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

The objective of this course is:

- To learn and understand distributed system design issues
- To study and examine communication protocols and models for distributed systems
- To study and analyze centralized and distributed algorithms for synchronization, processor allocation, fault tolerance and real time systems
- To study design and implementation issues for distributed file systems
- To examine and evaluate the approaches for distributed shared memory

Course Outcomes:

After completion of this course, the student shall be able to:

- Understand the advantages and usage of distributed systems over centralized systems
- Choose an appropriate communication protocol and model for implementing a distributed system.
- Evaluate alternate policies for processor allocation, fault tolerance and real time systems
- Choose appropriate distributed file system models for distributed applications
- Critically examine and choose appropriate distributed shared memory model

Syllabus:

Introduction to Distributed Systems: What is a Distributed System?, Hard ware concepts, Software concepts, Design issues.

Communication in Distributed Systems: Layered Protocols, ATM networks, The Client – Server model, Remote Procedure Call, Group communication.

Synchronization in Distributed System: Clock Synchronization, Mutual Exclusion, Election algorithms, Atomic transactions, Deadlocks in Distributed Systems.

Process Management: Threads, System Models, Processors allocation, Scheduling in Distributed System, Fault Tolerance, Real Time Distributed System.

Distributed File Systems: Distributed File System Design, Distributed File System implementation, Trends in Distributed File System.

Distributed Shared Memory: Introduction, What is Shared memory? Consistency models, Page based Distributed Shared Memory, Shared –Variable Distributed Shared Memory, Object based Distributed Shared Memory.

Text Book:

1. Distributed Operating Systems by Andrew S. Tanenbaum, Pearson Education

Reference Books:

1. Advanced Concepts in Operating Systems by Mukesh Singhal and Niranjan G.Shivaratri,Tata McGraw Hill
2. Distributed Systems- Concepts and Design by George Coulouris, Jean Dollimore, Tim Kindberg, Pearson Education

GRID COMPUTING
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

The student should be made to:

- Understand how Grid computing helps in solving large scale scientific problems.
- Gain knowledge on the concept of virtualization that is fundamental to cloud computing.
- Learn how to program the grid and the cloud.
- Understand the security issues in the grid and the cloud environment.

Course Outcomes:

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

- Apply grid computing techniques to solve large scale scientific problems
- Apply the concept of virtualization
- Use the grid and cloud tool kits
- Apply the security models in the grid and the cloud environment.

Syllabus:

Introduction The Data Centre, the Grid and the Distributed / High Performance Computing, Cluster Computing and Grid Computing, Metacomputing – the Precursor of Grid Computing, Scientific, Business and e-Governance Grids, Web Services and Grid Computing, Business Computing and the Grid – a Potential Win – win Situation, e-Governance and the Grid.

Technologies and Architectures for Grid Computing Clustering and Grid Computing, Issues in Data Grids, Key Functional Requirements in Grid Computing, Standards for Grid Computing, Recent Technological Trends in Large Data Grids

World Wide Grid Computing Activities, Organizations and Projects Standard Organizations, Organizations Developing Grid Computing Tool Kits, Framework, and Middleware, Grid Projects and Organizations Building and Using Grid Based Solutions, Commercial Organizations Building and Using Grid Based Solutions.

Web Services and the Service Oriented Architecture (SOA) History and Background, Service Oriented Architecture, how a Web Service Works, SOAP and WSDL, Description, Creating Web Services, Server Side. OGSA and WSRF OGSA for Resource Distribution, Stateful Web Services in OGSA, WSRF (Web Services Resource Framework), Resource Approach to Stateful Services, WSRF Specification.

Globus Toolkit History of Globus Toolkit, Versions of Globus Toolkit, Applications of GT4-Cases, GT4-Approaches and Benefits, Infrastructure Management, Monitoring and Discovery, Security, Data, Choreography and Coordination, Main Features of GT4 Functionality – a Summary, GT4 Architecture, GT4 Command Line Programs, GT4 Containers

The Grid and the Databases Issues in Database Integration with the Grid, The Requirements of a Grid-enabled Database, Storage Request Broker (SRB), How to Integrate the Databases with the Grid? The Architecture of OGSA-DAI for Offering Grid Database Services

Cluster Computing: Approaches to Parallel Computing, how to Achieve Low Cost Parallel Computing through Clusters, Definition and Architecture of a Cluster,

Cluster Middleware: An Introduction Levels and Layers of Single System Image (SSI), Cluster Middleware Design Objectives, Resource Management and Scheduling, Cluster Programming Environment and Tools . Early Cluster Architectures and High Throughput Computing Clusters: Early Cluster Architectures, High Throughput Computing Clusters, Condor.

Text Books:

1. C.S.R.Prabhu – ―Grid and Cluster Computing‖-PHI(2008) Chapters: 1 to 13, 16, 17.

Reference Books:

1. Jankiram, "Grid Computing Models: A Research Monograph", TMH (2005)

SENSOR NETWORKS
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

- To understand the concepts of sensor networks
- To understand the MAC and transport protocols for ad hoc networks
- To understand the applications and security concepts of sensor networks

Course Outcomes:

- Ability to understands concepts related to Wireless Sensor Networks and Single node architecture.
- Ability understands concepts related to MAC Protocol and Network architecture.
- Ability understands concepts related to Link layer protocol, naming and addressing.
- Understands the concepts of Data-centric, content-based networking, Transport layer and Quality of Service.

Syllabus:

Introduction: The vision of Ambient Intelligence, Application examples, Types of applications, Challenges for Wireless Sensor Networks (WSNs), Sensor networks vs Enabling Technologies for WSNs, **Single node architecture:** Hardware components, Energy consumption of sensor nodes, Some examples of sensor nodes, Operating systems and execution environments

Network Architecture: Sensor network scenarios, Optimization goals and figures of merit, Design principles for WSNs, Physical layer and transceiver design considerations in WSNs

MAC Protocols: Fundamentals of (wireless) MAC protocols, Low duty cycle protocols and wakeup concepts, Contention-based protocols, Schedule-based protocols.

Link layer protocols: Fundamentals: tasks and requirements, Error control, Framing, Link management

Naming and addressing: Fundamentals, Address and name management in wireless sensor networks, Assignment of MAC addresses

Data-centric and content-based networking: Introduction, Data-centric routing, Data aggregation, Data-centric storage

Transport layer and Quality of Service: The transport layer and QoS in wireless sensor networks, Coverage and deployment, Reliable data transport, Single packet delivery.

Text Books:

1. Protocols and Architectures for Wireless Sensor Networks, Holger Karl, Andreas Willig., John Wiley & Sons Ltd, 2005.
2. Network Management Fundamentals, Alexander Clemm CISCO Press 2007.

CLOUD COMPUTING
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

- To define Cloud Computing and expose the students to the frontier areas of Cloud Computing.
- To provide an in-depth and comprehensive knowledge of the Cloud Computing fundamental issues, technologies, applications and implementations.
- To introduce various levels of services that can be achieved by cloud.
- To gain knowledge on virtualization techniques.
- To understand the working methodology of existing clouds, such as, Amazon, Google and Azure.

Course Outcomes:

- Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing.
- Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, laaS, public cloud, private cloud, hybrid cloud, etc.
- Classify the Levels of Virtualization and mechanism of tools and Analyze Cloud Architectures.
- Assess Control Storage Systems.
- Get an idea and set up Private Clouds.

Syllabus:

History of Computing Paradigms: Overview of Distributed Computing, Cluster Computing, Grid Computing, Ubiquitous Computing, Peer-to-Peer Computing. Distributed System Models and Enabling Technologies

Introduction to Cloud Computing: Cloud Computing and Service Models- Public, Private, and Hybrid Clouds, Cloud Ecosystem and Enabling Technologies, Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS)

Virtual Machines and Virtualization: Implementation Levels of Virtualization, VMM Design Requirements and Providers, Virtualization Support at the OS Level, Middleware Support for Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management

Public Cloud Platform-Architectures and Programming: Google App Engine (GAE). Amazon Web Services (AWS), Microsoft Windows Azure. Service Oriented Architecture: REST, Publish Subscribe Model

Storage Systems: Storage Models, File Systems, and Databases, Distributed File Systems, General Parallel File System, Google File Systems, Apache Hadoop, Locks and Chubby: A Locking Service, Transaction Processing and NoSQL Databases, Big Table, Mega Store

Case Studies: The Grep The Web Application, Aneka Application of Maya Rendering Case Study

Text Books:

1. Kai Hwang, Geoffrey C. Fox, Jack K. Dongarra, Distributed and Cloud Computing: From parallel processing to Internet of Things, Morgen Kauffmann 2013.
2. Cloud Computing Theory and Practice, Dan C. Marinescu.

References:

1. Cloud Computing: A Hands-On Approach, Arshdeep Bagha & Vijay Madisetti, University Press, 2022 Edition
2. Cloud Computing: A Practical Approach Anthony T. Velte Toby J.Velte, Ph.D. Robert Elsenpeter
3. Cloud Computing Bible, Barrie Sosinsk
4. Cloud Computing Course (nptel.ac.in)

DIGITAL IMAGE PROCESSING
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

- To explain fundamentals of Image processing concepts.
- To provide mathematical foundation of image enhancement, image compression and image segmentation.
- To explain the students about Morphology and its applications in image processing.
- To explain various methods and techniques for image transformation.

Course Outcomes:

By the end of the course, the student should be able to :

- Understand the concepts of digital images and operations on the images
- Develop algorithms for fundamental concepts in Image processing.
- Perform image enhancement, image compression and image segmentation using various methods.
- Ability to implement Image transformation techniques

Syllabus:

Fundamentals of Image Processing: Image Acquisition, Image Model, Sampling, Quantization, Relationship Between Pixels, Distance Measures, Connectivity, Image Geometry, Photographic Film. Histogram: Definition, Decision Of Contrast Basing On Histogram, Operations Basing on Histograms Like Image Stretching, Image Sliding, Image Classification. Definition and Algorithm of Histogram Equalization.

Image Enhancement in Spatial Domain: Arithmetic and Logical Operations, Pixel or Point Operations, Size Operations; Smoothing Filters-Mean, Median, Mode Filters – Comparative Study.

Edge enhancement in spatial domain: Edge enhancement filters, Directorial Filters, Sobel, Laplacian, Robert, KIRSCH Homogeneity & DIFF filters, PREWITT Filter, Contrast based edge enhancement techniques, Comparative study, Low pass filters, High pass filters, Sharpening filters, Comparative study, Color fundamentals and color model

Image Compression: Run Length Encoding, modified run length encoding, Contour Coding, Huffman Code, Compression Due to Change in Domain, Compression Due to Quantization Compression at the Time of Image Transmission. Brief Discussion on: - Image Compression Standards.

Image Segmentation: Definition of segmentation, Characteristics of Segmentation, Detection of Discontinuities, Thresholding. Pixel Based Segmentation Method. Region Based Segmentation Methods, Segmentation by Pixel Aggregation, Segmentation by Sub Region Aggregation, Histogram Based Segmentation, Spilt and Merge Technique, Segmentation of moving objects.

Morphology: Dilation, Erosion, Opening, Closing, Hit-And-Miss Transform, Thinning, Thickening, Skeletons, Pruning Extensions to Gray – Scale Images Application of Morphology in I.P

Image Transforms: A Detail Discussion On Fourier Transform, DFT, FFT, Properties of Fourier transform, WALSH Trans Form, WFT, HADAMARD Transform, DCT Image Enhancement in Frequency Domain: Design of Low Pass, High Pass, EDGE

Enhancement, Smoothening Filters in Frequency Domain. Butter Worth Filter, Homomorphic Filters in Frequency Domain Advantages of Filters in Frequency Domain, Comparative Study of Filters in Frequency, Domain and Spatial Domain.

Text Book:

1. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, Addision Wesley

Reference Books:

1. Fundamentals Of Electronic Image Processing By Arthyr – R – Weeks, Jr.(PHI)
2. Image Processing, Analysis, And Machine Vision By Milan SonkaVaclanHalavac Roger Boyle, Vikas Publishing House.
3. Digital Image Processing, S. Jayaraman, S. Esakkirajan & T. Veera Kumar, TMH
4. Fundamentals of Digital Image Processing, Chris Solomon, Tobi Breckon, WileyBlackwell

MACHINE LEARNING
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

This course introduces the essential concepts and techniques of machine learning to the students and more specifically

- provides a good foundation to machine learning concepts and paradigms
- introduces Bayes Decision theory and Maximum likelihood estimation for learning model parameters as a tradeoff between bias and variance
- Explains multi-variate data exploration methods like missing value imputation, dimensionality reduction for classification and regression.
- introduce semi-parametric approaches for mixture models with clustering and Expectation Maximization
- introduces non-parametric methods for density estimation, smoothening, regression, etc
- Demonstrates the applicability of Decision Trees, linear discriminants and SVMs for classification and regression and explains the comparative analysis of their performance.

Course Outcomes:

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

- understand different types of ML, applications of ML in different domains, VC dimension and PAC learning for concept learning and supervisory model selection
- create Bayesian discriminant functions for decision regions with maximum likelihood estimation of parameters considering bias-variance tradeoff
- Understand and apply methods for missing value imputation, parameter estimation and dimensionality reduction on Multi-variate datasets
- Explore data applying various approaches like Expectation Maximization, clustering and non-parametric methods like nearest neighbors
- Able to solve classification and regression problems with Decision Trees, linear discriminants and SVMs and analyze the performance of classification algorithms

Syllabus:

Introduction to Machine Learning, Types and applications of Machine learning, **Supervisory Learning**: Learning classes from examples, Vapnik-Charvonenkis (VC) Dimension, Probably Approximately Correct(PAC) Learning, noise, learning multiple classes, regression, model selection and generalization, dimensions of supervised machine learning algorithms.

Bayesian Decision Theory: Classification, losses and risks, discriminant functions, Association Rules, **Parametric Methods**: Maximum likelihood estimation, evaluating an estimator with bias and variance, Bayes' estimator, parametric classification, regression, tuning model complexity: bias vs variance dilemma, model selection procedures

Multivariate methods: Multivariate data, parameter estimation, missing value imputation, Multivariate normal distribution, Multivariate classification, Tuning complexity, Discrete features, Multivariate regression, **Dimensionality Reduction**: Subset selection, PCA, Factor Analysis, SVD and Matrix factorization, multi-dimensional scaling, LDA

Clustering: Mixture densities, K-means clustering, Expectation Maximization algorithm, Supervised learning after clustering, Feature embedding, Laplacian Eigenmaps, Spectral clustering, Hierarchical clustering, choosing number of clusters.

Non-parametric methods: Non-parametric density estimation methods like Histograms, kernel estimators, K-nearest neighbor estimators, generalization to multivariate data, nonparametric classification, condensed nearest neighbors, Distance based classification, outlier detection, non-parametric regression: smoothing models, choosing smoothing parameters.

Decision Trees and Assessing Classification algorithms: Decision Tree purpose and structure, Uni-variate Trees for classification and regression, rule extraction from trees, Learning Rules from data, Multivariate trees, **Assessing and comparing classification Algorithms**: Cross-validation and resampling methods, measuring error, interval estimation, Hypothesis testing, assessing performance of a classifier, comparing two classification algorithms.

Linear Discrimination: Generalizing linear model, two class and multi-class geometry of linear discriminant, pairwise separation, gradient descent, logistic discrimination for binary and multi-class problems, discrimination by regression, learning to rank.

Kernel Machines: features of Support vector machines, optimal separating hyperplane, Soft margin hyperplane for non-separable spaces, kernel Trick, Vectorial kernels, SVM for regression.

Text Book:

1. Introduction to Machine Learning by Ethem Alpaydin, Prentice-Hall of India, 3rd Edition, 2019.

Reference books:

1. Machine Learning, Peter Flach, Cambridge University Press, 2012
2. Machine Learning, Tom Mitchell , McGraw Hill, 1997

BIG DATA ANALYTICS
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

This course is aimed at enabling the students to

- Provide an overview of an exciting growing field of big data analytics.
- Introduce the tools required to manage and analyse big data like Hadoop, NoSQL, Map Reduce, HIVE, Cassandra, Spark.
- Teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
- Optimize business decisions and create competitive advantage with Big Data analytics

Course Outcomes:

After the completion of the course, student will be able to

- Illustrate on big data and its use cases from selected business domains.
- Interpret and summarize on NoSQL, Cassandra
- Analyze the HADOOP and Map Reduce technologies associated with big data analytics and explore Big Data Applications Using Hive.
- Make use of Apache Spark, RDDs etc. to work with datasets and real time processing with Spark streaming .

Syllabus:

Introduction big data: why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

Introduction to NoSQL: aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer- peer replication, sharding and replication, consistency, relaxing consistency, version stamps, Working with Cassandra, Table creation, loading and reading data.

Data formats, analyzing data with Hadoop: scaling out, Architecture of Hadoop distributed file system (HDFS), fault tolerance with data replication, High availability, Data locality , Map Reduce Architecture, Process flow, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization.

Introduction to Hive: data types and file formats, HiveQL data definition, HiveQL data manipulation, Logical joins, Window functions, Optimization, Table partitioning, Bucketing, Indexing, Join strategies.

Apache spark: Advantages over Hadoop, lazy evaluation, In memory processing, DAG, Spark context, Spark Session, RDD, Transformations- Narrow and Wide, Actions, Data frames, RDD to Data frames, Catalyst optimizer, Data Frame Transformations, Working with Dates and Timestamps, Working with Nulls in Data,

Working with Complex Types: Working with JSON, Grouping, Window Functions, Joins, Data Sources, Broadcast Variables, Accumulators, Deploying Spark- On-Premises Cluster Deployments, Cluster Managers- Standalone Mode, Spark on YARN, Spark Logs, The Spark UI- Spark UI History Server, Debugging and Spark First Aid

Spark-Performance Tuning: Stream Processing Fundamentals, Event-Time and State full Processing - Event Time, State full Processing, Windows on Event Time- Tumbling Windows, Handling Late Data with Watermarks, Dropping Duplicates in a Stream, Structured Streaming Basics - Core Concepts, Structured Streaming in Action, Transformations on Streams, Input and Output.

Text Books:

1. Big Data, Big Analytics: Emerging, Michael Minnelli, Michelle Chambers, and AmbigaDhiraj
2. SPARK: The Definitive Guide, Bill Chambers & MateiZaharia, O'Reilley, 2018Edition
3. Business Intelligence and Analytic Trends for Today's Businesses", Wiley,2013
4. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World Polyglot Persistence", Addison-Wesley Professional,2012
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley,2012
6. Big Data Analytics - Chandramouli Subramanian, Asha A George, C R Rene Robin D Doreen Hephzibah Miriam, J Jasmine Christina Magdalene, University Press, 2024

Reference Books:

1. "Hadoop Operations", O'Reilley, Eric Sammer,2012
2. "Programming Hive", O'Reilley, E. Capriolo, D. Wampler, and J. Rutherglen,2012
3. "HBase: The Definitive Guide", O'Reilley, Lars George,2011
4. "Cassandra: The Definitive Guide", O'Reilley, Eben Hewitt,2010
5. "Programming Pig", O'Reilley, Alan Gates,2011

NATURAL LANGUAGE PROCESSING
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

This course introduces the fundamental concepts and techniques of Natural Language Processing (NLP).

- Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
- The course examines text representations and NLP algorithms using both the traditional symbolic and the more recent statistical and distributional approaches.
- Enable students to develop NLP models for text classification, information extraction, and dialog systems
- Provides a comprehensive study on NLP applications in a wide variety of domains

Course Outcomes:

After completion of this course the student will be able to:

- Understand the basic concepts and challenges of NLP and different stages of NLP-Pipeline
- Understand and analyze various representational approaches starting from vectorization-based to distribution-based embeddings for processing natural language text
- Build and interpret machine learning and deep learning models for Text Classification
- Understand basic concepts of information extraction for building different variants of NER systems and the concepts and challenges underlying the development of dialog systems / chatbots.
- Understand the approach and analyze the effectiveness of NLP applications in different domains.

Syllabus:

Introduction to NLP and NLP Pipeline:

NLP tasks and applications, building blocks of language, NLP challenges, Basic approaches to NLP -Heuristics based NLP, Machine Learning for NLP, Deep Learning for NLP. NLP Pipeline- Data Acquisition, Text Extraction and Cleanup, Pre-processing, Feature Engineering, Building the model, Evaluation.

Text Representation:

Vector space models, Basic Vectorization approaches, Distributed representations, Distributed representations beyond words and characters, Universal Text Representations, visualizing embeddings.

Text Classification:

Applications of text classification, Pipeline for building Text classification systems, One pipeline-many classifiers- Naïve Bayes, Logistic regression, SVM, Using Neural Embeddings in Text Classification, Deep Learning for Text Classification, Interpreting text classification models, Learning with no or less data and adapting to new domains, case study on corporate ticketing.

Information Extraction:

Information Extraction-IE Applications, IE Tasks, General IE Pipeline, Keyphrase Extraction, Named Entity Recognition, Building an NER System, Building an NER System using existing library, using active learning, Named Entity Disambiguation and Linking, Relationship Extraction and other IE tasks.

Chatbots:

Chatbots- Applications, Taxonomy of Chatbots, Pipeline for building Dialog Systems, Components of a Dialog system, other dialog pipelines with end-to-end approach, Deep Reinforcement learning for dialog generation, human-in-the-loop, case study on recipe recommender, open-ended generative chatbots

BRIEF OVERVIEW ON NLP APPLICATIONS:

Search and Information Retrieval- Components of Search Engine, Topic Modeling, Text Summarization, Recommender Systems for textual data, Machine Translation, Question- Answering Systems.

NLP APPLIED TO SOCIAL MEDIA AND E-COMMERCE:

Applications and challenges of NLP for Social Media, Issues related to NLP for social media data, NLP for supporting e-commerce acivities, Search in E-commerce, Building E-commerce catalog, Review analysis, recommendations for e-commerce

Text Books:

1. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta and Harshit Surana, "*Practical Natural Language Processing*", O'Reilly Media Inc., 2021, ISBN: 978-93-8588-918-9.

Reference Books:

1. Lewis Tunstall, Leandro von Werra, Thomas Wolf, "Natural Language Processing with Transformers: Building Language Applications with Hugging Face", O'Reilly Media Inc., 2022
2. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2ndEdition, Daniel Jurafsky, James H. Martin -Pearson Publication,2014.

SOFT COMPUTING
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

- To explain the role of Soft Computing in addressing the imprecision and uncertainty in real world scenarios.
- To explain fuzzy systems, fuzzy logic and its applications.
- To explain Artificial Neural Networks and various categories of ANN.
- Design hybrid system to revise the principles of soft computing in various applications.
- To explain Genetic algorithms and rough set.

Course Outcomes:

By the end of the course, the student should be able to obtain:

- Ability to represent Uncertainty / imprecision data.
- Understand perceptrons and counter propagation networks.
- Ability to select a suitable method of Soft Computing to solve a particular problem.
- Ability to build hybrid systems using Soft Computing techniques.
- Analyze the genetic algorithms and their applications.

Syllabus:

Soft Computing: Introduction to Fuzzy Computing, Neural Computing, Genetic Algorithms, Associative Memory, Adaptive Resonance Theory, Different Tools and Techniques, Usefulness and Applications.

Fuzzy Sets and Fuzzy Logic: Introduction, Fuzzy Sets Versus Crisp Sets, Operations on Fuzzy Sets, Extension Principle, Fuzzy Relations and Relation Equations, Fuzzy Numbers, Linguistic Variables, Fuzzy Logic, Linguistic Hedges, Applications,

Interference in fuzzy logic: fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzifications and Defuzzificataions, Fuzzy Controller, Fuzzy Controllers, Fuzzy Pattern Recognition, Fuzzy Image Processing, Fuzzy Database.

Artificial Neural Network: Introduction, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, re-current networks. Various learning techniques, perception and convergence rule, Auto-associative and hetro-associative memory, Hebb's Learning, Adaline, Perceptron.

Multilayer Feed Forward Network: Back Propagation Algorithms, Different Issues Regarding Convergence of Multilayer Perceptron, Competitive Learning, Self-Organizing, Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.

Evolutionary and Stochastic Techniques: Genetic Algorithm (GA), Genetic Representations, (Encoding) Initialization and Selection, Different Operators of GA, Analysis of Selection Operations, Hypothesis of Building Blocks, Schema Theorem and Convergence of Genetic Algorithm, Simulated Annealing and Stochastic Models, Boltzmann Machine, Applications.

Rough Set: Introduction, Imprecise Categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables and Applications. Hybrid Systems: Neural Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic and Genetic Algorithm for Optimization, Applications

Text Books:

1. Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, S.Rajsekaran and G.A. VijayalakshmiPai, Prentice Hall of India.
2. Rough Sets, Z.Pawlak, Kluwer Academic Publisher, 1991.
3. Intelligent Hybrid Systems, D. Ruan, Kluwer Academic Publisher, 1997

References Books:

1. Artificial Intelligence and Intelligent Systems, N.P.Padhy, Oxford University Press.
2. Neural Fuzzy Systems, Chin-Teng Lin & C. S. George Lee, Prentice Hall PTR. Addison-Wesley
3. Learning and Soft Computing, V. Kecman, MIT Press, 2001
4. Fuzzy Sets and Fuzzy Logic, Klir & Yuan, PHI, 1997

DEEP LEARNING
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

From the course the student will learn

- Knowledge and expertise for building deep learning models.
- Various architectures for deep learning and their suitability to specific problems
- Program development and evaluation support from Tensorflow
- Q-learning and the other methods for deep reinforcement learning
- Different types of auto-encoders for unsupervised feature extraction

Course Outcomes:

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

- Build feed forward neural networks with appropriate options using Tensorflow
- Write Tensorflow programs for learning using convolution neural networks.
- Apply the concepts of recurrent NNs with LSTM and attention for learning word embeddings and NLP tasks
- Apply various methods for deep reinforcement learning
- Use the appropriate type of auto-encoders for problem solving.

Syllabus:

Feed forward neural networks:perceptrons, cross-entropy loss estimation, derivatives and Stochastic Gradient descent, NN implementation issues, matrix representation of NNs, Data independence,

Tensorflow: preliminaries, simple TF program, Multi-layered NNs, setting checkpoints, tensordot, initialization of TF variables, simplifying TF graph creation. PyTorch basics and uses

Convolutional Neural Networks: Filters, strides and padding, simple TF Convolution program, Multilevel Convolution, convolution details, biases, layers with convolution, pooling

Recurrent NNs and Word Embeddings: Word Embeddings for Language Models,Building feed forward LMs, Improving Feed forward models, Overfitting, Recurrent Neural networks, Long-Short term Memory cells, TF implementation

Sequence to sequence Learning: Seq2Seq paradigm, writing a Seq2Seq Machine Translation program, Attention in Seq2Seq,Multilength Seq2Seq, Implementation in TF

Deep Reinforcement Learning: Value Iteration, Q-learning,Basic deep Q-learning,Policy gradient methods,Actor-critic methods, Experience replay

Unsupervised NN Models: Basic autoencoding, Convolutional autoencoding, variational autoencoding, Generative adversarial networks.

Textbook:

1. Eugene Charniak, “Introducing to Deep Learning”, MIT press, 2018
2. Sherin Thomas,Sudhanshu Passi, “PyTorch Deep Learning hands-On”, Packt publishers
3. Ian Goodfellow, YoshuaBengio and Aaron Courville, “Deep Learning”, MIT press, 2016

Reference Books:

1. Jeremy Howard and Sylvain Gugger, “Deep Learning for coders with Fastai and Pytorch”, OReilly, 2020
2. John Krohn, etal, “Deep Learning Illustrated”, Pearson edu. India, 2020

E-COMMERCE
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

- Introduce students to electronic commerce and its various applications
- Provide knowledge of electronic payment systems and risks involved, electronic data interchange, inter-organizational and intra-organizational commerce
- Introduce students to concepts of information based marketing including online marketing, advertising on internet, consumer search
- Provide knowledge of multimedia concepts including digital video and electronic commerce, video conferencing and video processing.

Course Outcomes:

- Understand the framework of electronic commerce and its various applications
- Explain the types of electronic payment systems and risks involved in such systems
- Understand online marketing and information based marketing concepts including consumer search, information retrieval, advertising on internet.

Syllabus:

Introduction: Electronic Commerce-Frame Work, Anatomy of E-Commerce Applications, E-Commerce Consumer Applications, E-Commerce Organization Applications. Consumer Oriented Electronic Commerce - Mercantile Process Models.

Electronic Payment Systems – Types of Electronic Payment Systems, Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment Systems, Designing Electronic Payment Systems

Electronic Data Inter Change, Inter Organizational Commerce - EDI, EDI Implementation, Value Added Networks.

Intra Organizational Commerce, Macro Forces and Internal Commerce, Work Flow Automation and Coordination, Customization and Internal Commerce, Supply Chain Management.

Business Cases for Document Library, Digital Document Types, Corporate Data Ware-Houses.

Advertising And Marketing: Information Based Marketing, Advertising On Internet, Online Marketing Process, Market Research. Consumer Search and Resource Discovery, Information Search and Retrieval, Commerce Catalogues, Information Filtering.

Multimedia-Key Multimedia Concepts, Digital Video and Electronic Commerce, Desktop Video Processing, Desktop VideoConferencing.

Text Book:

1. Frontiers of Electronic Commerce, Kalakata and Whinston,Pearson.

Reference Books:

1. E-Commerce fundamentals and Applications, Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, JohnWiley.
2. E-Commerce, S.Jaiswal,Galgotia.
3. E-Commerce, Efrain Turbon, Jae Lee, David King, H.MichaelChang.
4. E-Commerce - Business, Technology and Society, Kenneth C.Taudon, Carol uyericoTraver.

EMBEDDED SYSTEMS
PROFESSIONAL ELECTIVE
SYLLABUS

Course Objectives:

- To study the basics of embedded systems and its examples.
- To study the 8051 Microcontroller architecture and its instruction set.
- To discuss various software architectures in embedded systems.
- To discuss Inter Task Communication procedures in RTOS and design issues of RTOS.
- To study various embedded software development tools and debugging techniques.

Course Outcomes:

- Student will be understanding the basic architecture of 8051 micro controllers.
- ability to write ALP programs using 8051 instruction set.
- Ability to understand the concepts related to RTOS and its Inter Task Communication methods.
- Ability to understand various design issues of RTOS.
- Understand about embedded software development tools.

Syllabus:

Introduction to Embedded Systems: Examples, Typical Hardware, Memory, Microprocessors, Busses; Introduction to 8051 Microcontroller, Architecture, Instruction set, Programming. Interrupts: Interrupt Basics, Shared-Data problem, Interrupt Latency.

Software Architectures: Round-Robin Architecture, Round-Robin with Interrupts Architecture, Function-Queue Scheduling Architecture, Real-Time Operating Systems Architecture, Selection of Architecture.

Real Time Operating System: Tasks and Task States, Tasks and Data, Semaphores and Shared Data, Semaphore Problems, Semaphore variants.

Inter Task Communication: Message Queues, Mailboxes, Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in RTOS Environment.

Design issues of RTOS: Principles, Encapsulation Semaphores and Queues, Hard Real-time Scheduling Considerations, Saving Memory Space, Saving Power.

Embedded Software Development Tools: Host and Target Machines, Linker/Locator for Embedded Software, Getting Embedded Software into the Target System.

Embedded Software Debugging Techniques: Testing on your Host Machine, Instruction Set Simulators, Laboratory Tools used for Debugging.

Introduction to the Internet of Things: History of IoT, IoT Architecture, M2M – Machine to Machine, Web of Things, IoT protocols, The Layering concepts, IoT Communication Pattern, IoT protocol Architecture.

Text Books:

1. The 8051 Microcontroller Architecture, Programming & Applications, Kenneth J. Ayala, Penram International.
   An Embedded Software Primer, David E. Simon, Pearson Education, 2005.
   Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Marina Ruggieri & Homayoun Nikookar, River Publishers Series in Communications.

Reference Book:

1. Embedded Systems: Architecture, Programming and Design, Raj Kamal, Tata McGraw-Hill Education, 2008

OPEN ELECTIVES

1. CYBER SECURITY & DIGITAL FORENSICS
2. BLOCKCHAIN TECHNOLOGY
3. MOBILE COMPUTING
4. MOBILE ADHOC NETWORKS
5. RECOMMENDER SYSTEMS
6. NOSQL DATABASES
7. DATA SCIENCE
8. INFORMATION RETRIEVAL
9. DATABASE AND WEB APPLICATION SECURITY
10. BUSINESS ANALYTICS
11. HUMAN COMPUTER INTERACTION
12. BIO-INFORMATICS
13. INDUSTRY 4.0

OPEN ELECTIVES for other departments - (MINOR)

1. BLOCK CHAIN TECHNOLOGY
2. RECOMMENDER SYSTEMS
3. INFORMATION RETRIEVAL
4. BUSINESS ANALYTICS
5. BIO INFORMATICS

CYBER SECURITY & DIGITAL FORENSICS
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- Understand the threats in networks and security concepts.
- Apply authentication applications in different networks.
- Understand security services for email.
- Awareness of firewall and it applications.

Course Outcomes:

By the end of the course, the student should be able to:

- Differentiate among different types of security attacks.
- Define computer forensics.
- Identify the process in taking digital evidence.
- Describe how to conduct an investigation using methods of memory, operating system, network and email forensics with different forensic tools.

Syllabus:

Introduction to Information Security Fundamentals and Best Practices: Protecting Your Computer and its Contents, Securing Computer Networks--Basics of Networking, Compromised Computers, Secure Communications and Information Security Best Practices, Privacy Guidelines, Safe Internet Usage.

Ethics in Cyber Security & Cyber Law: Privacy, Intellectual Property, Professional Ethics, Freedom of Speech, Fair User and Ethical Hacking, Trademarks, Internet Fraud, Electronic Evidence, Cybercrimes.

Penetration Testing: Overview of the web from a penetration testers perspective, Exploring the various servers and clients, Discussion of the various web architectures, Discussion of the different types of vulnerabilities, defining a web application test scope and process, Defining types of penetration testing.

Web Application Security: Common Issues in Web Apps, what is XSS, SQL injection, CSRF, Password Vulnerabilities, SSL, CAPTCHA, Session Hijacking, Local and Remote File Inclusion, Audit Trails, Web Server Issues.

Forensics & Network Assurance: Forensic Technologies, Digital Evidence Collection, Evidentiary Reporting, Layered Defense, Surveillance and Reconnaissance, Outsider Thread Protection

Information Risk Management: Asset Evaluation and Business Impact Analysis, Risk Identification, Risk Quantification, Risk Response Development and Control, Security Policy, Compliance, and Business Continuity. Forensic investigation using Access Data FTK, En-Case

Cyber Incident Analysis and Response: Incident Preparation, Incident Detection and Analysis. Containment, Eradication, and Recovery. Proactive and Post-Incident Cyber Services, CIA triangle.

Text Books:

1. Cyber Security & Digital Forensics by Anas Zakir, Clever Fox Publishing, Publication Date- 2022
2. “Beginners Guide To Ethical Hacking and Cyber Security “, by Abhinav Ojha, Khanna Publishers, First Edition, Publication Date-2023

Reference Books:

1. The Official CHFI Study Guide for Computer Hacking Forensic Investigator by Dave Kleiman
2. CISSP Study Guide, 6th Edition by James M. Stewart

BLOCKCHAIN TECHNOLOGY
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- To understand the basic concepts block chain technology and to explore the driving force behind the crypto currency Bitcoin.
- To understand about the different methods of Decentralization using Block Chain and different Bitcoins and Alternative Coins.
- To understand about Ethereum and applications using Smart contracts and Block Chain Applications.
- To get familiarity with future currencies and to create own crypto token.

Course Outcomes:

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

- Explore the primitives of the distributed computing and cryptography related to blockchain
- Understand the types, benefits and limitation of block chain.
- Enumerate the Bitcoin features and its alternative options.
- Understand the modern currencies and its market usage.
- Implement and deploy the smart contracts in different environments like Ethereum.
- Usage of smart contracts in various real world application domains.

Syllabus:

Block Chain and its History: History of blockchain, Types of blockchain, Blockchain Components – Permissioned Blockchain Permission less Blockchain – Consortium Blockchain – basics of Consensus Algorithms, Architecture & Properties of Blockchain.

Decentralization and Consensus Algorithms: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations, Distributed systems, Distributed ledger, Merkle tree, structure of a block, Consensus

Algorithms- Proof of Work, Proof of Stack, Proof of Burn, Proof of Elapsed Time, Proof of Activity, Proof of Concept.

Bitcoin and Alternative Coins: Bitcoin, Transactions, Bitcoin payments, Bitcoin properties – Transaction life cycle – creation of coin –sending payments – double spending using blockchain – bitcoin anonymity – Ether: Ethercoin properties, Alternative Coins, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash

Ethereum and smart contracts: Ethereum Architecture, solidity programming basics, Smart Contract, Deploying Smart Contracts, Integration with UI.

Blockchain Applications: Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media, Secure Voting and Digital Identity, Real Estate, Education.

Text Books:

1. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1-78712-544-5, 2017
2. Bitcoin and Cryptocurrency Technologies, Author- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016
3. Blockchain Technology, Author- Chandramouli Subramanian, Asha A George, Abhilash K A, Meena Karthikeyan, University Press (India) Private Limited, 2021

Reference Book:

1. Blockchain Basics: A Non-Technical Introduction in 25 Steps, Author- Daniel Drescher, Apress, First Edition, 2017

MOBILE COMPUTING
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- To introduce the basic concepts and principles in mobile computing. This includes major techniques involved, and networks & systems issues for the design and implementation of mobile computing systems and applications.
- To explore both theoretical and practical issues of mobile computing.
- To provide an opportunity for students to understand the key components and technologies involved and to gain hands-on experiences in building mobile applications.

Course Outcomes:

On successful completion of course learner will be able:

- To identify basic concepts and principles in mobile communication & computing, cellular architecture.
- To describe the components and functioning of mobile networking.
- To classify variety of security techniques in mobile network.
- To describe and apply the concepts of mobility management

Syllabus:

Introduction: Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture, Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices, GSM - Services, System Architecture, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS-network operation, data services and applications

(Wireless) Medium Access Control (MAC): Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN/(IEEE 802.11)

Mobile Network & Transport Layers: IP and Mobile IP Network Layers, Packet Delivery and Handover, Management, Location Management, Registration, Tunnelling and Encapsulation, Route Optimization, DHCP, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks

Database Issues: Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation Transactional Models, Query processing, Data Recovery Process & QoS Issues

Data Dissemination and Synchronization: Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization – Introduction, Software and Protocols.

Mobile Ad hoc Networks (MANETs): Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR,AODV,DSDV, etc., Mobile Agents, Service Discovery

Protocols and Platforms for Mobile Computing:
Basic of WAP, Bluetooth, XML, J2ME, JavaCard, PalmOS, Windows CE, SymbianOS, Linux for Mobile Devices, Android.

Text Books:

1. Jochen Schiller, "Mobile Communications", Addison-Wesley, Second Edition, 2009
2. Raj Kamal, "Mobile Computing", Oxford University Press, 2007, ISBN: 0195686772

Reference Books:

1. ASOKE K TALUKDER, HASAN AHMED, ROOPA R YAVAGAL, "Mobile Computing, Technology Applications and Service Creation" Second Edition, Mc Graw Hill.
2. UWE Hansmann, Lother Merk, Martin S. Nocklous, Thomas Stober, "Principles of Mobile Computing," Second Edition, Springer.

MOBILE ADHOC NETWORKS
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- To understand the concepts of mobile adhoc networks
- To understand the concepts of wireless LANs, wireless adhoc networks, types and their routing protocols.
- To introduce students to mobile communications and mobile computing.
- To understand basics of HIPERLAN, Wireless ATM technologies.

Course Outcomes:

By the end of the course, the student should be able to obtain:

- Ability to understand the state-of-the-art research in the emerging subject of Mobile Adhoc Networks
- Understand GSM, TDMA, CDMA, IS-95 technology
- Understand wireless LANs, IEEE 802.11 WLANs.
- Understand Wireless ATM and HIPERLAN, Adhoc networking and WPAN.

Syllabus:

GSM and TDMA Technology: Introduction, What is GSM, Mechanisms to support a Mobile Environment, Communications in the Infrastructure.

CDMA Technology,IS-95, and IMT-2000: Introduction, Reference Architecture for North American Systems, What is CDMA, IMT-2000.

Mobile Data Networks: Introduction, The Data-Oriented CDPD Network, GPRS and Higher Data Rates, Short Messaging Service in GSM, Mobile Application Protocols.

Introduction to Wireless LANs: Introduction, Historical Overview of the LAN Industry, Evolution of the WLAN Industry, New Interest from Military and Service Providers, A New Explosion of Market and Technology, Wireless Home Networking.

IEEE 802.11 WLANs: Introduction, What is IEEE 802.11, The PHY Layer, MAC sub layer, MAC Management sub layer.

Wireless ATM and HIPERLAN: Introduction, What is Wireless ATM, What is HIPERLAN, HIPERLAN-2.

Ad Hoc Networking and WPAN: Introduction, What is IEEE 802.15 WPAN, What is HomeRF, What is Bluetooth, Interference between Bluetooth and 802.11

Wireless Geolocation Systems: Introduction, What is Wireless Geolocation, Wireless Geolocation System Architecture, Technologies for Wireless Geolocation, Geolocation Standards for E-911 Services, Performance measures for Geolocation Systems.

Text Books:

1.Principles of Wireless networks KavethPahlavan, K.Prasanth Krishnamurthy, Pearson Publications, Asia,2002

RECOMMENDER SYSTEMS
OPEN ELECTIVE
SYLLABUS

Course Objectives:

To understand the

- Basic concepts of recommender systems
- Various approaches for building Recommender systems
- Personalization algorithms, evaluation tools, and user experiences
- Various attacks and privacy aspects on collaborative recommender systems
- Several applications of Recommender systems

Course Outcomes:

By the end of the course, the student should be able to:

- Describe basic concepts behind Recommender Systems
- Explain a variety of approaches for building recommender systems
- Describe system evaluation methods from both algorithmic and users' perspectives
- Describe various attacks and privacy aspects on collaborative recommender systems.
- Describe applications of recommender systems in various domains

Syllabus:

Collaborative recommendations: User-based nearest neighbor recommendation, Item - based nearest neighbor recommendation, About ratings, Model-based and Preprocessing-based approaches, Recent practical approaches and Systems.

Content- based recommendation: Content representation and content similarity, Similarity-based retrieval, Other text classification methods.

Knowledge-based recommendation: Introduction ,Knowledge representation and reasoning, Interacting with constraint--based recommenders, Interacting with case-based recommenders, Example applications.

Hybrid recommendation approaches: Opportunities for hybridization , Monolithic hybridization design, Parallelized hybridization design, Pipelined hybridization design.

Evaluating recommender systems: Introduction , General properties of evaluation research, Popular evaluation designs, Evaluation on historical datasets, Alternate evaluation designs.

Attacks on collaborative recommender systems: A first example, Attack dimensions , Attack types, Evaluation of effectiveness and countermeasures, Countermeasures, Privacy aspects - distributed collaborative filtering.

Online consumer decision making: Introduction , Context effects, Primacy/recency effects, Further effects, Personality and social psychology.

Recommender systems and the next-generation web: Trust aware recommender systems, Folksonomies and more, Ontological filtering, Extracting semantics from the web.

Text Book:

1.Recommender Systems: An Introduction by Dietmar Jannach, Markus Zanker, Alexander Felfernig, Gerhard Friedrich, Cambridge University Press.

Reference Book:

1. Recommender Systems: The Textbook by Charu C. Aggarwal, Springer Publications.

NoSQL DATABASES
OPEN ELECTIVE
SYLLABUS

Course Objectives:
Upon successful completion of this course, a student will be able to:
- Define NoSQL, its characteristics and history, and the primary benefits for using NoSQL data.
- Define the major types of NoSQL databases including a primary use case and advantages/disadvantages of each type
- Create wide-column, document, key-value, graph and object-oriented databases, add content, and run queries.
- Describe the NoSQL data architecture patterns
- Perform basic database administration tasks.
- Develop NoSQL desktop and cloud database solutions.

Course Outcomes:
On completion of this course, the student will be able to :
- Enumerate different features of NOSQL Databases
- Compare different data models
- Design a Key-Value Database for a real world problem
- Design a Document Database for a real world problem
- Design a Graph Database for a real world problem

Syllabus:
Introduction to NoSQL. The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters,The Emergence of NoSQL.
Aggregate Data Models, Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases.
More Details on Data Models, Relationships, Graph Databases, Schemaless Databases, Materialized Views, Modeling for Data Access, Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication, Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums
Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, When Not to Use, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets
Document Databases, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, When Not to Use, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure
Column-Family Stores, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters.

Graph Databases, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services Recommendation Engines

Text Books:

1 Sadalage, P. & Fowler, M., NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence. (1st Ed.). Upper Saddle River, NJ: Pearson Education, In, 2012.

Reference Books:

2. Gauravvaish, Getting started with NoSQL , PACKT publishing, ISBN: 978184969488
3. Redmond, E. & Wilson, J., Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement (1st Ed.), 2012
4. Raleigh, NC: The Pragmatic Programmers, LLC. ISBN-13: 978- 1934356920 ISBN-10: 1934356921

DATA SCIENCE
OPEN ELECTIVE
SYLLABUS

Course Objectives:
From the course the student will learn
- Knowhow and expertise to become a data scientist.
- Essential concepts of statistics and machine learning that are vital for data science;
- Significance of exploratory data analysis (EDA) in data science.
- Critically explore and analyze data visualizations presented on the dashboards
- Suitability and limitations of tools and techniques related to data science process

Course Outcomes:
At the end of the course, student will be able to
- Describe the steps involved in Data Science process and the technologies needed for a data scientist.
- Identify suitable ML techniques for data modelling and apply them for decision support.
- handle large datasets with distributed storage and processing system
- use appropriate tools for data collection, EDA and model building for specific types of data
- build a prototype application of Data Science as a case study.

Syllabus:
Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data
ecosystem and data science.
Data Science process: Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them
Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modelling process for feature engineering, model selection, validation and prediction, types of ML including semi-supervised learning
Handling large data: problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems.
NoSQL movement for handling Big data: Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling
Tools and Applications of Data Science: Introducing Neo4j for dealing with graph databases, graph query language Cipher, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts
Data Visualization and Prototype Application Development: Data Visualization options, Cross filter, the JavaScript Map Reduce library, Creating an interactive dashboard with dc.js, Dashboard development tools, Applying the DS process for respective engineering problem solving scenarios as a detailed case study.

Textbook:

1) Davy Cielen, Arno D.B.Meysman, and Mohamed Ali, “Introducing to Data Science using Python tools”, Manning Publications Co, Dreamtech press, 2016
2) Prateek Gupta, “Data Science with Jupyter” BPB publishers, 2019 for basics

Reference Books:

1) Joel Grus, “Data Science From Scratch”, OReilly, 2019
2) Doing Data Science: Straight Talk From the Frontline, 1 st Edition, Cathy O’Neil and Rachel Schutt, O’Reilly, 2013

INFORMATION RETRIEVAL
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- To provide an overview of Information Retrieval.
- To introduce students about insights of the several topics of Information retrieval such as inverted files, signature files, Boolean retrieval model, Vector space model.
- To provide comprehensive details about various stemming algorithms.
- To provide comprehensive details about various search and evaluation methods.

Course Outcomes:

At the end of the course the students will

- Get the understanding of different information retrieval models.
- Get to know about the various evaluation and information retrieval models.
- Get to know the challenges associated with Information retrieval.

Syllabus:

Introduction to Information storage and retrieval systems: Domain Analysis of IR systems, IR and other types of Information Systems, IR System Evaluation, Introduction to Data structures and algorithms related to Information Retrieval: Basic Concepts, Data structures, Algorithms.

Inverted Files: Introduction, Structures used in Inverted Files, Building an Inverted files using a sorted array, Modifications to the Basic Techniques.

Signature Files: Introduction, Concepts of Signature files, Compression, Vertical Partitioning, Horizontal Partitioning.

New Indices for Text: PAT Trees and PAT Arrays: Introduction, PAT Tree structure, Algorithms on the PAT Trees, Building PAT Trees as PATRICA Trees, PAT representation as Arrays.

Lexical Analysis and Stop lists: Introduction, Lexical Analysis, Stop lists.

Stemming Algorithms: Introduction, Types of Stemming algorithms, Experimental Evaluations of Stemming, Stemming to Compress Inverted Files.

Thesaurus Construction: Introduction, Features of Thesauri, Thesaurus Construction, Thesaurus construction from Texts, Merging existing Thesauri.

String Searching Algorithms: Introduction, Preliminaries, The Naive Algorithm, The Knutt-Morris-Pratt Algorithm, The Boyer-Moore Algorithm, The Shift-Or Algorithm, The Karp-Rabin Algorithm.

Text Books:

1. Introduction to Information Retrieval, Christopher D.Manning, Raghavan, Cambridge University Press
2. Modern Information Retrieval, Ricardo Baeza-Yates, Neto, PEA,2007.
3. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark Academic Press,2000.

Reference Books:

1. Information Retrieval: Algorithms and Heuristics , Grossman, OphirFrieder,2/e, Springer,2004.
2. Information Retrieval Data Structures and Algorithms ,Frakes, Ricardo Baeza-Yates, PEA
3. Information Storage and Retrieval, Robert Korfhage, John Wiley &Sons.

DATABASE & WEB APPLICATION SECURITY
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- Introduce various threats and vulnerabilities in database security, Context and control based access control
- Introduce the basic principles of web application security, Authentication, Authorization
- Introduce the basics of IT security and mobile device security
- Introduce the basics of security testing and penetration testing

Course Outcomes:

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

- Explain the various threats and vulnerabilities in database security
- Understand the basic principles of web application security, Authentication, Authorization
- Explain the basics of IT security and mobile device security
- Apply security testing and penetration testing

Syllabus:

Database security – Introduction includes threats, vulnerabilities and breaches, Basics of database design, DB security – concepts, approaches and challenges, types of access controls, Oracle VPD,

Discretionary and Mandatory Access Control – Principles, applications and poly-instantiation, Database inference problem, types of inference attacks, distributed database, security levels, SQL-injection: types and advanced concepts.

Security in relational data model, concurrency controls and locking, SQL extensions to security (oracle as an example), System R concepts, Context and control based access control, Hippocratic databases, Database watermarking, Database intrusion, Secure data outsourcing,

Web Application security, Basic principles and concepts, Authentication, Authorization, Browser security principles; XSS and CSRF, same origin policies, File security principles, Secure development and deployment methodologies, Web DB principles, OWASP – Top 10 – Detailed treatment,

IoT security – OWASP Top 10 – Detailed treatment, Mobile device security – Introduction, attack vector and models, hardware centric security aspects, SMS / MMS vulnerabilities, software centric security aspects, mobile web browser security,

Application security – Concepts, CIA Triad, Hexad, types of cyber attacks, Introduction to software development vulnerabilities, code analyzers – Static and dynamic analyzers,

Security testing/Penetration testing – Principles and concepts, PT work flows and examples, blind tests, ethical hacking techniques, synthetic transactions, interface testing and fuzzing, SDLC phases and security mandates.

Text Books:

1. Michael Gertz and Sushil Jajodia, "Handbook of Database Security— Applications and Trends", Springer, 2008.
2. Bryan and Vincent, "Web Application Security, A Beginners Guide ",McGraw-Hill, 2011
3. Bhavani Thuraisingham, "Database and Applications Security", Integrating Information Security and Data Management, Auerbach Publications, 2005.
4. Alfred Basta, Melissa Zgola, "Database Security", Course Technology, 2012 - Delmar Cengage Learning

BUSINESS ANALYTICS
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- To introduce students to problem solving with Business Analytics and the use of spreadsheets for descriptive analytics, data queries and visualization
- To introduce students to statistical sampling, sampling distributions, confidence intervals and statistical inference
- To learn the basic arithmetic functions used in MS Excel
- To familiarize students with various types of regression including simple linear regression and multiple linear regression

Course Outcomes:

After completion of the course the student should be able to:

- Describe data and models used for Business Analytics and apply various descriptive analytic techniques to analyze data
- Estimating population parameters, interval estimates, construct confidence intervals and perform hypothesis testing
- Estimate and interpret the parameters of simple linear regression and multiple linear regressions

Syllabus:

Foundations of Business Analytics: Evolution of Business Analytics, Scope, data and models for Business Analytics, problem solving with Business Analytics, Analytics on spreadsheets, Excel functions for Database queries, Add-ons for Business Analytics. Descriptive Analytics: Data visualization, creating charts in MS Excel, Data Queries, Tables, sorting and filtering, Data summarization with statistics, Data exploration using Pivot tables

Statistical Sampling: methods, estimating population parameters, sampling error, sampling distributions, interval estimates, confidence intervals, using confidence intervals for decision making, prediction intervals Statistical Inference: Hypothesis testing, one-sample Hypothesis testing, two-tailed test of Hypothesis for mean, two-sample Hypothesis testing, Analysis of variance, chi-square test for independence

Trendliness and Regression: Modelling Relationships and trends in data, Simple linear regression, least squares regression, regression on analysis of variance, testing hypothesis for regression coefficients, Confidence intervals for regression coefficients, Residual analysis and regression assumptions, Multiple linear regression, building regression models, regression with categorical independent variables with two or more levels, regression with nonlinear terms, advanced techniques for regression modelling

Forecasting Techniques: Qualitative and judgmental forecasting, statistical forecasting models, forecasting models for stationary time series, forecasting models for time series with linear trend, forecasting models for time series with seasonality, selecting appropriate time-series-based forecasting models, regression forecasting with casual variables, practice of forecasting

Spreadsheet modeling and Analysis: Strategies for predictive decision modelling, Implementing models on spreadsheet, spreadsheet applications in Business analytics, Model assumptions, complexity and realism, developing user-friendly applications, analyzing uncertainty and model assumptions, model analysis using analytics solver platform

Linear Optimization & Applications: Building Linear Optimization Models on spreadsheets, solving Linear Optimization models, Graphical interpretation of linear optimization, Using optimization

models of prediction and insight, Types of constraints in optimization models, process selection models, Blending Models, Portfolio Investment models

Text Book:

1.“Business Analytics: Methods, Models, and Decisions” James R. Evans, Pearson Publications,Second edition

Reference Book:

1.“Business Analytics: The Science of Data-Driven Decision Making”, U.Dinesh Kumar, Wiley Publications

HUMAN COMPUTER INTERACTION
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- To gain an overview of Human-Computer Interaction, with an understanding of user interface design in general, and alternatives to traditional "keyboard and mouse" computing
- Be able to predict user performance in various human-computer interaction tasks
- Appreciate the importance of a design that maintains a focus on the user; be familiar with a variety of both conventional and non-traditional user interface paradigms

Course Outcomes:

By the end of the course, the student should be able to:

- Apply HCI and principles for interaction and design.
- Appreciate importance of user documentation and information search

Syllabus:

Introduction: Usability of Interactive Systems- introduction, usability goals and measures, usability motivations, universal usability, goals for our profession Managing Design Processes: Introduction, Organizational design to support usability, Four pillars of design, development methodologies, Ethnographic observation, Participatory design, Scenario Development, Social impact statement for early design review, legal issues, Usability Testing and Laboratories

Menu Selection, Form Fill-In and Dialog Boxes: Introduction, Task- Related Menu Organization, Single menus, Combinations of Multiple Menus, Content Organization, Fast Movement Through Menus, Data entry with Menus: Form Fill-in, dialog Boxes, and alternatives, Audio Menus and menus for Small Displays

Command and Natural Languages: Introduction, Command organization Functionality, Strategies and Structure, Naming and Abbreviations, Natural Language in Computing Interaction Devices: Introduction, Keyboards and Keypads, Pointing Devices, Speech and Auditory Interfaces, Displays- Small and large

Quality of Service: Introduction, Models of Response-Time impacts, Expectations and attitudes, User Productivity, Variability in Response Time, Frustrating Experiences Balancing Function and Fashion: Introduction, Error Messages, Nonanthropomorphic Design, Display Design, Web Page Design, Window Design, Color

User Documentation and Online Help: Introduction, Online Vs Paper Documentation, reading from paper Vs from Displays, Shaping the content of the Documentation, Accessing the Documentation, Online tutorials and animated documentation, Online communities for User Assistance, The Development Process

Information Search: Introduction, searching in Textual Documents and Database Querying, Multimedia Document Searches, Advanced Filtering and Searching Interfaces

Information Visualization: Introduction, Data Type by Task Taxonomy, Challenges for Information Visualization.

Text Books:

1. Designing the User Interface, Strategies for Effective Human Computer Interaction, 5ed, Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven M Jacobs, Pearson
2. The Essential guide to user interface design,2/e, Wilbert O Galitz, Wiley DreamaTech.

Reference Books:

1. Human Computer, Interaction Dan R.Olsan, Cengage ,2010.
2. Designing the user interface. 4/e, Ben Shneidermann , PEA.

BIO INFORMATICS
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- To import fundamental concepts in the area of Bioinformatics.
- To understand the concept of DNA Sequence analysis and Protein Information Resources.
- To learn Pairwise alignment techniques and Secondary database searching.
- To gain competence in Analysis packages.

Course Outcomes:

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

- Get introduced to the basic concepts of Bioinformatics and its significance in biological data analysis
- Overview about types and biological data and database search tools
- Explain about the methods to characterize and manage the different types of biological data.
- Classify different types of Biological Databases
- Implement the algorithms for single and multiple sequence alignments

Syllabus:

Introduction: Definition, History and Application areas of Bioinformatics. Major Information Resources: NCBI, EBI, ExPasy, TIGR, JGI, DDBJ Biological Databases: Primary & Secondary; Structure Databases, Specialized Databases, Chemical Databases.File Formats in Bioinformatics- Genbank, EMBL, Swissprot/Uniprot, PDB, Clustal, FASTA etc.

Sequence Similarity Searching: Basics of sequence alignment, Local and Global Sequence Alignment, similarity, Identity, homology, Sensitivity/Selectivity, Scoring System & Substitution Matrices: Distance and Similarity matrices, Identity Matrices, PAM & BLOSUM matrices & their Derivation DNA sequence databases, specialized genomic resources

Similarity Searching Tools: BLAST and FASTA, Theory and Algorithms, variants of BLAST and FASTA, PSI & PHI Blast, Statistical Significance. Sequence Pattern and Profiles: Concepts of motif, pattern and profile. Profile construction and its application in Bioinformatics. Gene Identity and identification tools

Tools for DNA & Protein Sequence Analysis: EMBOSS, PHYLIP, Mega2 Tools at NCBI, EBI, DDBJ, Microarray data analysis tools

Markov models: Hidden Markov models – The evaluation, decoding and estimation problem and the algorithms. Application in sequence analysis.

Molecular phylogeny: maximum Parsimony, distance Matrix and maximum likelihood methods. Concepts of adaptive evolution.

Application of graph theory in Biology: Biochemical Pathway, Protein-protein interaction network, Regulatory network and their analysis.

Text Books:

1. T.K Attwood & D.J Parry-Smith. Delhi. “Introduction to Bioinformatics”. Pearson Education (Singapore) Pte.Ltd., 2001.
2. Bioinformatics: David Mount

Reference Books:

3. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic acids, R.
4. Durbin, S.R. Eddy, A. Krogh and G. Mitchison**.**

INDUSTRY 4.0
OPEN ELECTIVE
SYLLABUS

Course Objectives:

- This course provides students with an introduction to Industry 4.0, its building blocks, its applications and advantages compared to conventional production techniques.
- Learners get a deep insight into components and technologies of industry 4.0 can be used to build up the production of the future.
- It is also important that the theory is deepened by means of roadmap technologies with
- phase wise developments.
- To impart knowledge of smart manufacturing, IIot for industry 4.0.
- To expand Robotic technology with Augmented reality for Industry 4.0 and obstacle
- with framework conditions for Industry 4.0

Course Outcomes:

- Students will be able to:
- Describe Industry 4.0 and scope for Indian Industry
- Demonstrate conceptual framework and road map of Industry 4.0
- Describe IIoT, cloud computing and big data, smart factories role in Industry 4.0
- Describe Robotic technology and Augmented reality for Industry 4.0
- Demonstrate obstacle and framework conditions for Industry 4.0

Syllabus:

Introduction to Industry 4.0

Introduction, Idea of Industry 4.0, Various Industrial Revolutions, Origin concept of Industry 4.0, Industry 4.0 Production system, How is India preparing for Industry 4.0, Comparison of Industry Factory and Today's Factory.

Trends in Industry 4.0

Introduction, Main Concepts and Components of Industry 4.0, State of Art Technologies, Proposed Framework for Industry 4.0, Trends of Industrial Big Data and Smart Business Transformation.

Roadmap for Industry 4.0

Introduction, Proposed Framework for Technology Roadmap: Strategy Phase, Development Phase, Smart Manufacturing, Types of Smart Devices, Smart Logistics, Smart Cities, Predictive Analytics.

Advances in the Era of Industry 4.0

Introduction, Recent Technological Components of Robots- Advanced Sensor Technologies, Internet of Things, Industrial Robotic Applications- Manufacturing, Maintenance and Assembly, IIoT- Industrial IoT.

The Role of Industry 4.0 and Future Aspects

Introduction, Challenges & Future of Works and Skills for Workers in the Industry 4.0 Era, Strategies for competing in an Industry 4.0 world.

Text Books:

1. Alp Ustundag and Emre Cevikcan,"Industry 4.0: Managing the Digital Transformation".
2. Bartodziej, Christoph Jan,"The Concept Industry 4.0".
3. Klaus Schwab,"The Fourth Industrial Revolution".
4. Christian Schröder, "The Challenges of Industry 4.0 for Small and Medium-sized Enterprises".

References:

List of Open Source Software/learning website:

1. www.nptel.ac.in/
   (Material Is Readily Available On Internet)

HSS ELECTIVES

1. OPERATIONS RESEARCH
2. ORGANIZATIONAL BEHAVIOUR
3. INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP
4. FINANCIAL MANAGEMENT FOR ENGINEERS

OPERATIONS RESEARCH
HSS ELECTIVE
SYLLABUS

Course Objectives:

Upon completion of this course, you will be able to:

- Formulate a real-world problem as a mathematical programming model
- Understand the theoretical workings of the simplex method for linear programming and perform iterations of it by hand
- Understand the relationship between a linear program and its dual, including strong duality and complementary slackness
- Solve specialized linear programming problems like the transportation and assignment problems
- Solve network models like the shortest path, minimum spanning tree, and maximum flow problems

Course Outcomes:

After learning the course, the students should be able to:

- Students will be able to describe characteristics and scope of OR.
- Students will be able to define and formulate mathematical problems.
- Students will be able to select optimal problems solving techniques for a given problem using LP.
- Students will be able to formulate and solve transportation, travelling sales man and transshipment problems.
- Students will be able to formulate and solve optimization problems related to job/ work assignments.
- Students will be able to demonstrate and solve simple models of Game theory.
- Students will be able to evaluate optimum solution using dynamic programming for different applications.

Syllabus:

Overview of Operations Research: Types of OR Models, Phases of Operations Research–OR Techniques, Introduction to Linear Programming, Formulation of Linear Programming Problem, Graphical Solution; Graphical Sensitivity Analysis.

Standard Form of LPP: Basic Feasible Solutions, Unrestricted Variables, Simplex Algorithm, Artificial Variables, Big M Method, Two Phase Simplex Method, Degeneracy,
Alternative Optimal, Unbounded Solutions, Infeasible Solutions, Primal and Dual Problems and Their Relations, Dual Simplex Method

Transportation Problem: LPP, Initial Solutions, North West Corner Rule, Lowest Cost Method, Vogel's Approximation Method, Optimum Solutions of TPP, Degeneracy in Transportation, Transportation Algorithms

Assignment Problem: Assignment Problem as LPP, Hungarian Method, Travelling Salesman Problem, Solutions of TSP, Sequencing Problems, N-Jobs Two Machine Problems, N Jobs K Machines Problems, Two-Jobs M- Machine Problems, Crew Scheduling Problems

Network Representation of a Project: CPM and PERT, Critical Path Calculations, Time – Cost Optimizations, PERT Analysis and Probability Considerations, Resource Analysis in Network Scheduling.

Replacement Problems: Individual and Group Replacement Policy, Reliability & System Failure Problems, Inventory-Factors Effecting Inventory-EOQ, Inventory Problems with and Without Shortages, Inventory Problems with Price Breakups, Multi Item Deterministic Problems. Probabilistic Inventory Problems

Game Theory: Two Person Zero Sum Games, Mixed Strategy Games and Their Algorithms.

Textbooks:

1. Operations Research, KantiSwaroop, P.K. Gupta, ManMohan, Sulthan Chand & Sons Education
2. Operations Research–An Introduction, HandyATaha–Pearson Education

References:

1. Taha.H.A, Operations Research : An Introduction, McMilan publishing Co., 1982. 7 th ed.
2. Ravindran A, Philips D.T & Solberg.J.J, Operations Research: Principles and practice, John Wiley & Sons, New York, 1987.
3. Frank S. Budnick, Dennis Mcleavey and Richard Mojena, Principles of Operations Research for Management. All India Traveler Book seller, Delhi.
4. Gillet.B.E., Introduction to Operations Research - A Computer oriented algorithmic approach, McGraw Hill, 1987.
5. Joseph.G.Ecker& Michael Kupper Schimd, Introduction to Operations Research, John Wiley & Sons, 1988.
6. Hillier.F.S & Liberman.G.J, Operations Research, Second Edition, Holden Day Inc, 1974.
7. Kanti Swarup, Gupta.P.K. & Man Mohan, Operations Research, S.Chand& Sons

ORGANIZATIONAL BEHAVIOUR
HSS ELECTIVE
SYLLABUS

Course Objectives:

- To understand the basic concepts of organizational behaviour, its foundations and importance.
- To enable students to have a basic perspective of Motivation and Motivation theories.
- To acquaint the students about group behaviour in organizations, including communication, leadership conflicts and organizational change and how these are linked to and impact organizational performance.

Course Outcomes:

- Identifying fundamental aspects of organizational dynamics.
- Evaluate main theories of motivation and formulating suitable motivational strategies.
- Analyse the behaviour of individuals and groups in organizations.
- Understanding of Leadership theories and Leadership behaviour.
- Apply relevant theories, concepts to address important Organizational Behaviour questions.

Syllabus:

Organizational Behaviour : Concept of Organisation - Concept of Organizational Behaviour - Nature of Organizational Behaviour - Role of Organizational behaviour - Disciplines contributing to Organizational Behaviour.

Motivation: Definition - Nature of Motivation - Role of Motivation - Theories of Motivation: Maslow's Need Hierarchy Theory, Herzberg's Motivation Hygiene Theory and Mc Gregor's Theory X and Theory Y.

Group Dynamics: Meaning - Concept of Group - Types of groups -Formal and Informal groups - Group development - Group cohesiveness and factors affecting group cohesiveness.

Leadership: Concept of Leadership - Difference between Leadership and Management - Importance of Leadership - Leadership styles: Autocratic leadership, Participative leadership and Free Rein leadership.

Communication: Meaning - Communication Process - Forms of communication: Oral, Written and Non- Verbal communication - Direction of communication: Downward, Upward and Horizontal communication.

Organizational conflits: Concept of conflict - Reasons for conflict - Types of Conflict: Intrapersonal conflict, Interpersonal conflict, Intragroup conflict, Intergroup conflict, Interorganisational conflict - Conflict management.

Organizational Change: Nature - Factors in Organizational change -Planned change: Process of planned change - Resistance to change: Factors in resistance to change - Overcoming resistance to change.

Text Books:

1. .L.M.Prasad: Organizational Beaviour, Sultan Chand & Sons, New Delhi -110002
2. K. Aswathappa: Organizational Behaviour, Himalaya Publishing House, New Delhi

Reference Books:

Stephen Robbins: Organizational Behaviour, Pearsons Education, New Delhi.

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP
HSS ELECTIVE
SYLLABUS

Course Objectives:

- To familiarize the students with the concepts of Management.
- To relate the concepts of Management with industrial organizations.
- To explain the factors affecting productivity and how productivity can be increased in an Industrial undertaking.
- To set forth a basic framework for understanding Entrepreneurship.

Course Outcomes:

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

- Understand the roles, skills and functions of management.
- Distinguish the different types of business organizations.
- Identify the factors involved in Production Operations Management.
- Diagnose organizational problems and take suitable decisions.
- Establish good Human Resource Management practices.
- Acquire necessary knowledge and skills required for organizing and carrying out

Syllabus:

Basic Concepts of Management: Definition, Nature and Importance; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management;

Forms of Business Organizations: Introduction, Types of Business organizations: Private Sector- Individual Ownership, Partnership, Joint stock companies and Co-Operative organizations**;** Public sector- Departmental Organizations, Public Corporations and Government Companies; The Joint Sector Management.

Production and operations Management: Plant location- Factors to be considered in the selection of Plant location; Break - even analysis- Significance and managerial applications; Importance of Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance.

Entrepreneurship: Definition, Characteristics and Skills, Types of Entrepreneurs, Entrepreneur vs. Professional Managers, , Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea generation: Sources and Techniques; Stages in Project formulation ; Steps for starting a small enterprise - Incentives for Small Scale Industries by Government.

Text Books:

1. Sharma,S.C, and Banga, T.R., Industrial Organization & Engineering Economics, Khanna Publishers, Delhi, 2000.
2. Vasant Desai , (The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth),HImalayan Publishing House, 2018.

Reference Books:

1. Aryasri , A.R., Management Science, McGraw HIll Education (India Private Limited , New Delhi 2014.
2. Sheela, P. , and Jagadeswara Rao**,** K., Entrepreneurship, Shree Publishing House, Guntur, Andhra Pradesh, 2017.

FINANCIAL MANAGEMENT FOR ENGINEERS
HSS ELECTIVE
SYLLABUS

Course Objectives:

- To provide awareness and understanding of the ways finance helps in reaching business objectives.
- To familiarise with the form, content and analysis of financial statements and the accounting principles and techniques.
- To Identify signals pointing to deterioration in financial condition and analyse the reasons for variances between the actual and budgeted results
- To facilitate in the improvement of organizations‘ performance by pointing out the importance of cost control, breakeven and variance analysis.
- To equip with the ability to communicate comfortably with Financial Executives and discuss the financial performance of the organization effectively.

Course Outcomes:

- Ability to Analyse financial statements
- Understanding costs and methods to reduce them
- Taking decisions regarding the price of the products services, or both
- Skill to practice different Budgeting Systems in organisations.

Syllabus:

Accounting concepts and systems - Elements of Financial Statements - Trading, Profit & Loss Statement- Cash Flow Statements - Notes to Accounts - Profits vs. Cash Flows

Analysis of Financial Statements - Financial Analysis - Financial Ratios and their Interpretations covering: Profitability Ratios; Liquidity Ratios; Return on Capital Ratios; - Management of Working Capital: Capital and Its Components - Working Capital Cycle - Working Capital Financing.

Management Decision Making: Cost concepts and its application in Decision Making - Types of cost – Direct & Indirect, Fixed & Variable - Cost Sheet - Cost Volume Profit Analysis - Understanding Cost behaviour – Cost concepts and its application in Decision Making - Relevance of Activity Based Costing- Marginal Costing - Make or Buy - Shut down or continue - Sell or process further - Domestic vs. Export Sales

Budgets and Budgetary Control: Different types of Budgets (Departmental, Function based, Cash, Master) - Budgeting systems (ABC / ZBB / Rolling/ Incremental / Planning) - Variance Analysis - Capital Budgeting and Investment Appraisals - Meaning of Capital Budgeting - Relevance of Capital Budgeting - Techniques of Capital Budgeting - Payback Period - Accounting Rate of Return - Net Present Value - Internal Rate of Return - Discounted Payback Period

Means of Finance: Financial Instruments - Shares, Debentures, Derivatives - Share Capital Vs. Term Loans - Leasing - Financial Markets - Capital Markets - Stock Exchanges.

Suggested Books:

1. Finance for Non-Finance People by Sandeep Goal (2017), Publisher: Taylor and Francis.
2. Finance for Non-Finance Managers by B.K. Chatterjee (1988), Jaico Publishing House, Sold by Amazon
3. Finance for Nonfinancial Managers: Finance for Small Business, Basic Finance Concepts (Accounts and Finance) by Murugesan Ramaswamy (2021), Repro Books-On-Demand.