**References:**


1. "Database System Concepts" By Silberschatz, Korth, Sudarshan, 4th Edition, McGraw Hill Publication.
2. "Database Systems, Concepts. Design and Applications" By S.K.Singh, Pearson Education.
3. "Database Management Systems" By Raghu Ramakrishna. Johannes Gehrke. McGraw Hill Publication.
4. "Fundamentals of Database Systems" By Elmsari, Navathe, 5th Edition, Pearson Education (2008).


| OET 2.1 | COMPUTER CONCEPTS | Credits: 2 | Contact Hours: 32 | Theory 02 Hrs/week |
|---|---|---|---|---|
| Internal assessment: 10 marks | | Term end exam: 40 marks | Exam duration: $1\frac{1}{2}$hrs | |

**Course Outcomes (COs)**: At the end of the course, students will be able to:

- Describe the basics of computers and number systems
- Discuss types of Operating systems and Networks

**Unit-I** **12 HrsBasics**: History and Generations of Computer. Basic Concepts of Digital Computers-Control Unit, ALU, Input/output function and Memory. Hardware-Input/Output devices, Software-Classification of software, Memory Unit: Types of Memory- Ram, Rom, Types of Ram and Rom

**Unit-II** **10 HrsNumber System:** Binary,Octal, Decimal and Hexa-Decimal. Number Base Conversion.

**Unit-III** **10 HrsOperating System and Networks:**Definition, Functions, Types of Operating system, Definition of Network, Types of Network (Lan Man & Wan). Internet and Its Applications.

**References:**


1. Computer Concepts & C Programming. P.B.Kottur. Sapna Beck House Bangalore 2000
2. Computer Fundaments. V. Rajaraman Prentice Hall of India.2008 12225
3. Computer Fundamental P.K. Sinha. Prentice Hall Of India, Oth Edition. 1902
4. Fundamentals of Information Technology Second Edition. Alexis Leon.2009
5. Microsoft Office-Complete Reference Curt Simmons, Mc Graw Hill 2006


## M.Sc. (Comp. Sc.) III semester Syllabus w.e.f. 2024-25 onwards

| HCT 3.1 | Computer Networks | Credits: 4 | Contact Hours: 52 | Theory 04 Hrs/week |
|---|---|---|---|---|

| Internal assessment: 20 marks | Term end exam: 80 marks | Exam duration: 03 hrs |
|---|---|---|

**Course Outcomes (COs)**: At the end of the course, students will be able to:

- To understand the basics of data communication and various types of computer networks
- To learn the transmission technique of digital data between two or more computers.
- To analyse and Compare various Network architectures.
- To study details about ISO/OSI model layer, its functions, type of data transmission and speed of data transmission.

**UNIT-I:** **10hrsFoundation-** Building a Network, Application, Requirement, Architecture, Software, Performance.
**Direct Links-** Connecting To A Network, Technology Landscape, Encoding, Error Detection. Reliable Transmission, Multi- Access Networks.

**Unit-II** **10hrsInternetworking:**
Switching Basics, Switched Ethernet, Spanning Tree Algorithm. Broadcast and Multicast, Virtual LANs (Vlans), What Is An Internetworking? Service Model, Global Addresses, Datagram Forwarding In Ip. Subnetting and Classless Addressing. Address Translation (Arp), Host Configuration (Dhcp), Error Reporting (Icmp). Virtual Networks and Tunnels, Routing- Network As A Graph, Distance- Vector (Rip), Link State (Ospf), Metrics.

**Unit-III** **12hrsGlobal Internet-**
Routing Areas. Inter-Domain Routing (Bgp)
**Ip Version 6-** Historical Perspective, Addresses and Routing, Packet Format. Advanced Capabilities
**Multicast-** Multicast Addresses, Multicast Routing, (Dvmrp. Pim. Msdp)
**Muiltiprotocal Label Switching-** Destination- Based Forwarding, Explict Routing. Virtual Private Networks and Tunnels.

**Unit-IV** **10hrs**
**Simple DE multiplexor (Udp)**
**Reliable Byte Stream (Tcp)-** End Issues, Segment Format. Connection Establishment and Termination. Sliding Window Revisited. Triggering Transmission, Adaptive Retransmissioning
**Remote-Procedure Call-** (Rtp)- Requirements, Rtp Design, Control Protocol
**Congestion Control- Tcp Congestion Control**

**Unit-V** **10hrs**
**Applications-Traditional Applications-** Electronic Mail 9smtp, Mime. Imap), World Wide Web (Http), Web Services
**Multimedia Applications-** Session Control and Call Control (Sdp. Sip. H.323). Resource Allocation for Multimedia Applications

**References:**


1. Larry Peterson, "Computer Networks- A System Approach". 5edition. Elsevier
2. Kurose and Rose. "Computer Networking-A Top Down Approach". 6th Edition. Pearson.2013
3. Andrew Tanenbaum, "Computer Networks". Prentice Hall

4. Behrouz Forouzan, "Data Communications and Networking". 4th Edition. McGraw Hill. 2017

| HCT 3.2 | Software Engineering | Credits: 4 | Contact Hours: 52 | Theory 04 Hrs/week |
|---|---|---|---|---|
| Internal assessment: 20 marks | | Term end exam: 80 marks | Exam duration: 03 hrs | |

**Course Outcomes (COs)**: At the end of the course, students will be able to:

- To understand the concept of software process models, Project Management Concepts
- To understand Software Project Planning Risk Analysis and Management,Analysis Modelling
- Use of Design Concepts and Principles
- To learn software testing approaches and to differentiate different testing methodologies

**Unit: I** **10hrs**

**The Product and The Process:** Evolving Role Of Software, Software, Characteristics and Components, Crises, Software Myths, Software Engineering A Layered Technology, Software Process, Linear Sequential Model, Prototyping Model, Prototyping Model, Rad Model, Evolutionary Software Process Model.

**Project Management Concepts:** The Management Spectrum, the People, the Product, the Process, and The Project W5hh Principle.

**Software Process and Project Metrics:** Measures, Metric Indicators, Metric in Process and TheProject Domains, Software Measurement, Metrics For Software Quality.

**Unit-II** **12hrs**

Software Project Planning: Project Planning Objectives, Software Project Estimation, Decomposition Techniques, Empirical Estimation Models.

Risk Analysis and Management: Software Risks, Risk Identification, Risk Projection, Risk Refinement and Risk Mitigation, Monitoringand Management

**Unit-III** **10hrs**

**Analysis Concepts and Principles:** Requirement Analysis, Communication Techniques, Analysis Principles, Software Prototyping and Specification.

**Analysis Modeling:** Elements of Analysis Model, Data Modeling, Functional Modeling, Behavioral Modeling, the Mechanics of Structured Analysis, Data Dictionary, Other Classical Analysis Methods.

**Unit-IV** **10hrs**

**Design Concepts and Principles:** Software Design and Software Engineering Design Process Design Principles, Design Concepts, Design Methods, Data Design, Architectural Design and Process, Transform and Transaction Mappings, Design Post Processing, Architectural Design Optimization, Interface Design, Procedural Design.

**Unit-V** **10hrs**

**Software Testing Techniques and Strategies**: Fundamentals, Test Case Design, White Box Testing, Basis Path Testing, Control Structure Testing, Black Box Testing, Software Testing Strategies.

**Software Configuration Management:** Configuration Management, Maintenance Costs, Maintenance Side Effects, Maintenance Tissues.

**Software Quality Assurance:** Quality Concepts, Software Quality Assurance, Ftr, Iso 9001, Iso-9002, Iso-9003, Introduction To Case, Dod Standard 2167 A.

**References:**


1. Software Engineering, Fifth Edition, Roger- Pressman, Mcgraw Hill.
2. Software Engineering, Ian Sommerville, International Computer Science, Series
3. Software Engineering, Schooma, Mcgraw Hill
4. Object Oriented Design and Analysis, Booch, Benjamin/ Cummings,
5. Software Engineering, A Practitioner's Approach 7th Edition, Roger- Pressman, TataMcgraw-Hill Education (2010)


| HCT 3.3 | Web Technologies | Credits: 4 | Contact Hours: 52 | Theory 04 Hrs/week |
|---|---|---|---|---|
| Internal assessment: 20 marks | | Term end exam: 80 marks | Exam duration: 03 hrs | |

**Course Outcomes (COs)**: At the end of the course, students will be able to:

- To study the use of HTML in web design environment
- To learn and implement HTML, XML Language and CSS.
- Understand the JAVA Script programming language and Basics, Origins, uses of Client Side andServer side programming.

**Unit-1:** **10 Hrs**

Web Essentials -W3c -Clients -Servers -Communication -Markup Languages -XHTML- Simple XHTML Pages Style Sheets – CSS.

**Unit-II:** **12 Hrs**

Client Side Programming: Introduction to Java Script, Basic Syntax, Variables and Data Types. Statements, Operators, Literals, Functions, Objects, Arrays, Built-In Objects, Java ScriptDebuggers. Host Objects Browsers and the Dom: Introduction to Document Object Model, Dom History and Levels, Intrinsic Event Handling, Modifying Element Style, the Document Tree, Dom Event Handling.

**Unit-III:** **12 Hrs**

Server Side Programming: (Java Servlets) - Servlet Architecture Overview, A "Hello World!" Servlet, Servlet Generating Dynamic Content, Servlet Lifecycle, Parameter Data, Sessions.Cookies, URL Rewriting, Other Servlet Capabilities, Data Storage, Servlets and Concurrency. Separating Programming and Presentation (JSP Technology): Introduction to Java Server Pages,JSP and Servlets, Running JSP Applications, Basic JSP, Java Beans Classes and JSP. Tag Libraries And Files, Support For The Model - View Controller Paradigm.

**Unit-IV:** **08 Hrs**

Representing Web Data: XML, XML Document and Vocabularies, XML Declaration, XML Namespaces, Java Script and XML: Ajax, Dom Based XML Processing, Event-Oriented Parsing: Sax, Transforming XML Documents, Selecting XML Data: XPATH Template-Based Transformation: XSLT, Displaying XML Documents In Browsers.

**Unit-V:** **10Hrs**

Web Services: JAX-RPC, WSDL, XML Schema and Soap: Web Service Concepts. Writing a Java

Web Service, Writing a Java Web Service Client, Describing Web Services: WSDL. Representing Data Types: XML Schema, Communicating Object Data: Soap. Databases and Java Servlets, Databases and JSP

**References**


1. JeffreyCJackson,"WebTechnology-AComputerSciencePerspective".PersonEducation, 2007.
2. ChrisBates,"WebProgramming-BuildingInternetApplications, "WileyIndia,2006


| | | | | |
|---|---|---|---|---|
| **HCT 3.4** | **Mobile Computing** | Credits: 4 | Contact Hours: 52 | Theory 04 Hrs/week |
| Internal assessment: 20 marks | | Term end exam: 80 marks | | Exam duration: 03 hrs |

**Course Outcomes (COs)**: At the end of the course, students will be able to:

- Evaluate wireless technologies and standards used in Mobile Computing system.
- Understand the architecture, protocols, and security concerns in mobile computing environments.
- Design basic applications using mobile computing concepts for real-time communication.

**Unit-I** **10hrs**

**Mobile Computing Architecture:** An Overview, Mobile IP, Cellular and WLAN Wi-Fi IEEE 802.11X Networks, Ad Hoc Networks, Wireless Personal Area Network, Mobile Enterprise Network,Mobile Cloud Network, Mobile Computing, Mobile Computing Operating System, Mobile Computing Architecture, Design Considerations for Mobile Computing, MobileComputing and the Apps, Limitations of Mobile Devices, Security Issues

**Unit-II** **12hrs**

**Mobile Client Devices and Pervasive Computing:** Moving beyond Desktops, Pervasive Computing, Mobile Devices-Classifications and Characteristics, Tablet and e-Book Reader, Smart Identification Devices: Smart Cards, Labels, and Tokens, RFID, Smart Sensors, Actuators, and Mobile Robotic Systems, Smart Home and Appliances, Limitations and Devices Design Constraints, Automotive Systems

**Unit-III** **10hrs**

**Second-generation Architecture—GSM, GPRS, and Others:** GSM Services, GSM System Architecture, Call Routing, Public Land Mobile Network (PLMN) Interface, GSM Subscriber Addresses and Identities, Protocols, Localization, Call Handling, Handover, Security, Introduction to SMS, General Packet Radio Service, High- speed Circuit-switched Data

**Unit-IV** **10hrs**

**Wireless Medium Access Control, CDMA, 3G, WiMax, 4G and 5G Networks:** Modulation, Medium Access Control, Exposed and Hidden Terminal Problem, Near and Far Terminal Problem, and Power Control for Medium Access, MAC Algorithms, WLAN and CAMA/CA Wireless Protocols, Applications of 3G Mobile Services, 3G Mobile Services: IMT2000 and UMTs, CDMA 2000: 3G, WCDMA 3G, OFDM, High-speed Packet Access, Long-term Evolution and WiMax 16E, 4G Networks: HS-OFDM, LTE Advanced and WiMax 16M, Upcoming 5G NetworkFeatures.

**Unit-V** **10hrs**

**Mobile IP Network Layer:** Mobile IP, Packet Delivery and Handover Management, Location Management, Registration, IP Header: Encapsulation and Routes Optimization, Mobility Binding, Tunneling, and Reverse Tunneling, Dynamic Host Configuration Protocol, Cellular IP, Mobile IP with IPv6, Voice over IP, IP Security.

**References:**


1. RajKamal,"Mobile Computing",3rdedition, oxfordUniversitypress.
2. Pattnaik,"Fundamentalsofmobilecomputing", 2ndedition,PHI
3. UweHansmann,"Principlesofmobilecomputing",2ndedition,Springerinternational,2014


| HCT 3.5 | **Digital Images Processing** | Credits: 4 | Contact Hours: 52 | Theory 04 Hrs/week |
|---|---|---|---|---|
| Internal assessment: 20 marks | | Term end exam: 80 marks | | Exam duration: 03 hrs |

**Course Outcomes (COs)**: At the end of the course, students will be able to:

- Develop a theoretical foundation of fundamental Digital Image Processing concepts.
- To explore the image processing techniques.

**Unit-I** **10hrs**

Digital ImageProcessing:Origins of Digital Image Processing, FundamentalSteps inDigital Image Processing, Components of an Image Processing System. Digital Image Fundamentals: Elementsof Visual Perception, Light and The Electromagnetic Spectrum, Image Sensing and Acquisition, ImageSamplingand Quantization,BasicRelationshipBetweenPixels,MathematicalToolsUsed In Digital Image Processing.

**Unit-II** **12hrs**

**Image Transformation and Spatial Filters:** Basic Intensity Transformation Functions, Histogram Processing,Fundamentals ofSpatialFiltering,SmoothingSpatialFilters,SharpeningSpatialFilters, Combining Spatial Enhancement Methods, Fuzzy Techniques For Intensity Transformation And Spatial Filtering. Filtering In The Frequency Domain: Preliminary Concepts, Sampling And The Fourier Transforms of Sampled Functions, The Discrete Fourier Transform (DFT), Properties ofThe 2-D DFT, Filtering In The Frequency Domain, Image Smoothing and Sharpening Using Frequency Domain Filters, Selective Filtering.

**Unit-III** **10hrs**

**Image Restoration and Reconstruction:** A Model of The Image Degradation Restoration Process, Noise Models, Restoration In The Presence of Noise Only-Spatial Filtering, Periodic Noise Reduction By Frequency Domain Filtering, Linear, Position-Invariant Degradations, EstimatingThe Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Square Filtering, Geometric Mean Filter, Image Reconstruction FromProjections. Image Segmentation: Fundamentals, Point, Line and Edge Detection, Thresholding, Region-Based Segmentation, Segmentation Using Morphological Watersheds, Use of Motion in Segmentation.

**Unit-IV** **10hrs**

**ColorImage Processing:**ColorFundamentals, ColorModels, Pseudo color ImageProcessing, Full Color Image Processing, Color Transformation, Smoothing and Sharpening, Image Segmentation

Based on Color, Noise in Color Images. Wavelets and Multi resolution Processing: Background, Multi resolution Expansion, Wavelet Transforms In One Dimension, The Fast Wavelet Transform, Wavelet Transforms In Two Dimensions, Wavelet Packets. Image Compression: Fundamentals, Basic Compression Methods, Digital Image Watermarking.

**Unit-V** **10hrs**

**Morphological Image Processing:** Erosion and Dilation, Opening and Closing, the Hit-Or- Miss Transformation, Basic Morphological Algorithms, Gray-Scale Morphology. Object Recognition: Patterns and Pattern Classes, Recognition Based On Decision-Theoretic Methods, Structural Methods.

**TextBook:**

1. Digital Image Processing, Rafael C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson Education, 2008.

Unit I:Chapter1And2
UnitII:Chapter3And4
UnitIIIChapter5And 10
Unit IV:Chapter6,7And8
UnitV: Chapter9 And 12

**References**

1. Digital Image Processing Using MATLAB, Rafael C. Gonzalez, Richard E. Woods, 2nd Edition, Prentice Hall of India, 2002.
2. FundamentalsofDigital ImageProcessing, A.Jain,PrenticeHall ofIndia, 2010.
3. Digital ImageProcessing,WillliamKPratt,JohnWilley,2002.

| **HCT 3.6** | **Soft Computing** | Credits: 4 | Contact Hours: 52 | Theory 04 Hrs/week |
|---|---|---|---|---|
| Internal assessment: 20 marks | | Term end exam: 80 marks | | Exam duration: 03 hrs |

**Course Outcomes (COs)**: At the end of the course, students will be able to:

- Summarize about the Introduction to Soft Computing, Artificial Neural Network
- Understand about Fuzzy Logic & its application
- Explore Genetic algorithm and Evolutionary Programming and Swarm Intelligence

**Unit-I** **10hrs**

**Introduction to Soft Computing-** Introduction, Artificial Intelligence, Artificial Neural Networks, Fuzzy Systems, Genetic Algorithm and Evolutionary Programming, Swarm Intelligent Systems, Expert Systems.

**Unit-II** **12hrs**

**Artificial Neural Networks- First Generation-** Introduction to Neural Networks, Biological Inspiration, Biological Neural Networks to Artificial Neural Networks, Classification of ANNs, First- Generation Neural Networks.

**Unit-III** **10hrs**

**Fuzzy Logic-** Introduction To Fuzzy Logic, Human Learning Ability, Imprecision, andUncertainty, Un-decidability, Probability Theory Vs. Possibility Theory, Classical Sets and Fuzzy Sets Operations, Fuzzy Relations Fuzzy Composition. **Fuzzy Logic Application:** Introduction to Fuzzy

Logic Applications, Fuzzy Controllers.

**Unit-IV** **10hrs**

**Genetic Algorithms and Evolutionary Programming** - Introduction to Genetic Algorithms, Genetic Algorithms, Procedures of GAS, Working of Gas, Genetic Algorithm Applications.

**Unit-V** **08hrs**

**Introduction to Swarm Intelligence** - Background of Swarm Intelligent Systems, Ant Colony System, Working of Ant Colony Optimization, Ant Colony Optimization Algorithm For TSP.

**TextBook:**

1. SoftComputingWithPprogramming,N.P.Padhy,S.P.Simon,OxfordUniversityPress,First Edition, 2015
   UNIT1:Chapter1-1.1To1.7(Except 1.8)
   UNIT2: Chapter2-2.1 To2.5 (Except2.6 To 2.8).
   UNIT3: Chapter5-5.1 To5.8, Chapter6 (6.1, 6.2)
   UNIT4: Chapter7-7.1 To 7.5.
   UNIT5: Chapter8-8.1 To 8.5.

**References:**

2. PrinciplesOfSoftComputing,S.N.SivanandamAndS.N.Deepa,WileyIndiaEdition,2ndEdition, 2013.
3. NeuralNetworks,SimonHaykin,PearsonEducation, 2003.
4. Fuzzy Logic-Intelligence Control & Information, John Yen & Reza Langari, Pearson Education, New Delhi, 2003
5. Artificial IntelligenceAndIntelligentSystems, N.P.Padhy,OxfordUniversityPress,2013.

| HCT 3.7 | DATA MINING AND WAREHOUSING | Credits: 4 | Contact Hours: 52 | Theory 04 Hrs/week |
|---|---|---|---|---|
| Internal assessment: 20 marks | | Term end exam: 80 marks | Exam duration: 03 hrs | |

**Course Outcomes (COs)**: At the end of the course, students will be able to:

- Understand about Data Mining Concepts, application and Data visualization
- Explore Data warehousing and OLAP, Design and Usage,Data generalization by attribute oriented Induction
- Review the basic Concept of various classification of techniques.
- Understand the Basic Concepts and Methods of Cluster Analysis

**Unit-I** **10hrs**

**Introduction** - WhyData Mining? - What is Data Mining? - What Kinds of Data Can Be Mined? - What Kinds of Patterns Can Be Mined? - Which Technologies Are Used? Which Kinds of Applications Are Targeted? Major Issues in Data Mining. Getting to Know You're Data: Data Objects and Attribute Types - Basic Statistical Descriptions of Data - Data Visualization - Measuring Data Similarity and Dissimilarity.

**Unit-II** **10hrs**

**Data Preprocessing**: Data Preprocessing An Overview - Data Cleaning - Data Integration Data

Reduction - Data Transformation and Data Discretization - Data Warehousing and OnlineAnalyticalProcessing:DataWarehouse:BasicConceptsDataWarehouseModeling:DataCubeand OLAP - Data Warehouse Design and Usage Data Warehouse Implementation Data Generalization by Attribute-Oriented Induction.

**Unit-III** **12hrs**

**Mining Frequent Patterns, Associations, and Correlations**: Basic Concepts and Methods Frequent Item set Mining Methods Which Pattern Are Interesting? Pattern Evaluation Methods. Advanced Pattern Mining: Pattern Mining: A Road Map - Pattern Mining in Multilevel, Multidimensional Space- Constraint-Based Frequent Pattern Mining - Mining High- Dimensional DataandColossalPatterns-MiningCompressedorApproximatePatterns -PatternExplorationand Application.

**Unit-IV** **10hrs**

**Classification**: Basic Concepts - Basic Concepts - Decision Tree Induction - Bayes Classification Methods Rule-Based Classification- Model Evaluation and Selection-Techniques to Improve Classification Accuracy.

**Unit-V** **10hrs**

**Cluster Analysis Basic Concepts and Methods:** Cluster Analysis - Partitioning Methods - Hierarchical Methods - Density Based Methods - Grid Based Methods -Evaluation of Clustering.

**TextBook:**

1. DataMiningConceptsandTechniques-ThirdEdition,JiaweiHan,MichelineKamber,JianPei, Morgan Kaufmann Publisher, 2012.
   Unit1Chapters1and 2
   UnitIIUnitIIIChapters3and4Chapters6and7 Unit IV Chapter 8
   UnitV Chapter10

**References:**

2. Insight into Data mining Theory and Practice, K.P. Soman, ShyamDiwakar and V. Ajay, Easter Economy Edition, Prentice Hall of India, 2006.
3. Introduction to Data Mining with Case Studies, G. K. Gupta, Easter Economy Edition, Prentice Hall of India, 2006.
4. IntroductiontoDataMiningPang-NingTan,MichaelSteinbachandVipinKumar,,Pearson Education, 2007.
5. Modern Data Warehousing, Mining and Visualization, Marakas, George M, Pearson Education, 2011.

| | | | | |
|---|---|---|---|---|
| **SCT 3.1** | **Machine Learning** | Credits: 4 | Contact Hours: 52 | Theory 04 Hrs/week |
| Internal assessment: 20 marks | | Term end exam: 80 marks | | Exam duration: 03 hrs |

**Course Outcomes (COs)**: At the end of the course, students will be able to:

- Describe the different forms of learning
- Use the probability theory in machine learning.
- Examine the classification techniques on given datasets.
- Design clustering algorithms to classify given sample in machine learning

**Unit-I** **15hrs**

AssociationRule mining-

- The applications of Association Rule Mining: Market Basket, Recommendation Engines,etc.
- Amathematicalmodelforassociation analysis;Largeitemsets;Association Rules
- Apriori: Construct large item sets with mini sup by iterations; Interestingness of discovered association rules;

**Supervised Learning – Regression:**Regression in supervised learning is the technique of understanding the relationship between a dependent and an independent variable. It is used to predict continuous outcomes in predictive modelling.

- IntroductiontoRegression:Definition,types,and use cases
- LincarRegression:Theory, costfunction,gradient descent,and assumptions
- PolynomialRegression:Addingpolynomialterms,degreeselection,andoverfitting
- LassoandRidgeRegression:Regularizationtechniquesforcontrollingmodelcomplexity
- Evaluationmetricsforregressionmodels:MeanSquareError(MSE),R-Squared,andMean Absolute Error (MAE)

**Classification**

Another application of supervised learning is classification, where the machine learning model tries to predict the right label for a given input data. This section introduces you to Classification, its types and use cases, alongwith knowledge of logistic regression, decision trees and random forests. You will also learn about the evaluation metrics for classification models Introduction to Classification

- Logistic Regression: Theory, logistic Function, binary and multiclass classification
- Decision Trees: Construction, splitting criteria, pruning, and visualization
- Random Forests: Ensemble learning, bagging, and feature importance
- Evaluation metrics for classification models: Accuracy, Precision, Recall, F1-score, and ROC curves

**Unit-II** **15hrs**

**SVM, KNN & Naive Bayes -** SVM, KNN and Naive Bayes are the three popular supervised learning algorithms. You will learn them all from this segment in detail.

- Support Vector Machine (SVM): Study SVM theory, different kernel functions (linear, polynomial, radial basis function), and the margin concept. Implement SVM classification and regression and evaluate the models.
- K-Nearest Neighbors (KNN): Understand the KNN algorithm, distance metrics, and the concept of K in KNN. Implement KNN classification and regression and evaluate the models.
- Navie Bayes: Learn about the Naive Bayes algorithm, conditional probability, and Bayes theorem. Implement Navie Bayes classification and evaluate the model's performance

**EnsembleMethodsandBoosting**

- AdaBoost: Boostingtechnique,weaklearners,and iterativeweightadjustment
- Gradient Boosting (XGBoost): Gradient boosting algorithm, Regularization, and hyperparameter tuning
- Evaluationandfine-tuningofensemblemodel:Cross-validation,gridsearch,andmodel selection

Handlingimbalanceddatasets:Techniquesfordealingwithclassimbalance,suchas oversampling and

under sampling.

**Unit-III** **12hrs**

**UnsupervisedLearning-Clustering**

- IntroductiontoClustering:Definition,types,and use cases
- K-meansClustering:Algorithmsteps,initializationmethods,andelbowmethodfor determining the number of clusters
- DBSCAN(Density-BasedSpatialClusteringofApplicationswithNoise):Corepoints, density reachability, and epsilon-neighborhoods
- Evaluationofclusteringalgorithms:Silhouettescore,cohesion, andseparationmetrics

**DimensionalityReduction**

- Introduction to Dimensionality Reduction: Curse of dimensionality, feature extraction, and feature selection.
- PrincipalComponentanalysis(PCA):Eigenvectors,eigenvalues,varianceexplained,and dimensionality reduction

**Unit-IV** **10hrs**

**ReinforcementLearning –**

- IntroductiontoReinforcement Learning:Agent, environment,state,action, andreward
- MarkovDecisionProcesses(MDP):Markovproperty,transitionprobabilities,andvalue functions
- Q-Learningalgorithm:Explorationvs.exploitation,Q-table,andlearningrate

**TextBooks**


1. Marc PeterDeisenroth,A.AldoFaisal,Cheng soonOng,MathematicsforMachineLearning, Cambridge University Press (23 April 2020)
2. TomM.Mitchell-MachineLearning-McGrawHillEducation, International Edition
3. AurelienGeron Hands-On Machine Learningwith Scikit-Learn, Keras, and Tensorflow, O'Reilly Media, Inc. 2nd Edition


**References**


1. lanGoodfellow, YoshouaBengio, and Aaron Courville Deep learning MIT Press Ltd, Illustrated edition
2. ChristopherM.BishopPatternRecognitionand Machine Learning-Springer,2nd edition
3. Trevor Hastie, Robert Tibshirani, and Jerome Friedman - The Elements of Statistical Learning:Data Mining, Inference and Prediction-Springer, 2nd edition


| | | | | |
|---|---|---|---|---|
| **OET 3.1** | **SPSS TOOLS** | Credits: 2 | Contact Hours: 32 | Theory 2 Hrs/week |
| Internal assessment: 10 marks | | Term end exam: 40 marks | | Exam duration: 1 ½hrs |

**Course Outcomes (COs)**: At the end of the course, students will be able to:

- Understand the PASW/SPSS environment.
- Understand fundamental data management tasks, manipulate and prepare data for analysis.
- Execute essential data transformation.
- Numerically describe and summarize data.

**SPSS TOOLTotal 32 Hrs**

**Unit-I** **16 Hrs.**

**Table of contents**: Overview of PASW statistics, Introduction to PASW: Menus, Tool Bar, Dialogue Box, Designate Window, Basic steps for performing any statistical Procedure.

**Data Management:** Creating a Data File, Defining Variables, Entering the Data, Saving Data, Opening an existing Data file, Inserting Variables, Inserting Cases, Identifying Duplicate Cases, Identifying Unusual Cases, Sorting Cases, Merging a File : Add Cases, For Adding Variables, Data Aggregation , Splitting File, Selecting Cases, Listing Cases.

**Unit-II** **16 Hrs.**

**Data Transformation**: Computing a New Variable, Recoding Variables, Automatic Recode, Visual Binning, Rank Cases.

**Describing Data Numerically:** Types of Measurement Scales, Summary Measures, Frequencies, Descriptive Statistics, Explore, Crosstabs.

## References:-


1) SPSS in simple steps by Kiran Pandya Smruti Bulsari Sanjay Sinha,Dream Tech Press(2011)
2) Applied Statistics With SPSS by Eelko Huizingh, New Edition ,Sage Publications(CA) (2007)
3) SPSS: A User Friendly approach by Jeffrey E.Aspelmeier,Thomas W.Pierce Worth Publishers(2009)
4) Statistical Methods for Practice and Research: A Guide to Data Analysis using SPSS 0002 Edition, Response Books(2009)