### University of Mumbai
**B.E Information Technology**
**Scheme of Instruction and Evaluation**

#### Fourth Year - Semester VII

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<th>Sr. No</th>
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**Elective - I (Semester VII)**

1. Wireless Network
2. Multimedia Systems
3. Evolutionary Algorithms
4. IT in Construction
5. Nanotechnology
6. Geographical Information Systems
7. Artificial Intelligence
DATA WAREHOUSING AND MINING & BUSINESS INTELLIGENCE

CLASS B.E. (INFORMATION TECHNOLOGY) SEMESTER VII

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**Prerequisite:** Data Base Management System

**Objective:** Today is the era characterized by Information Overload – Minimum knowledge. Every business must rely extensively on data analysis to increase productivity and survive competition. This course provides a comprehensive introduction to data mining problems concepts with particular emphasis on business intelligence applications.

The three main goals of the course are to enable students to:

1. Approach business problems data-analytically by identifying opportunities to derive business value from data.
2. know the basics of data mining techniques and how they can be applied to extract relevant business intelligence.

1. **Introduction to Data Mining:** Motivation for Data Mining, Data Mining-Definition & Functionalities, Classification of DM systems, DM task primitives, Integration of a Data Mining system with a Database or a Data Warehouse, Major issues in Data Mining.

2. **Data Warehousing – (Overview Only):** Overview of concepts like star schema, fact and dimension tables, OLAP operations, From OLAP to Data Mining.

3. **Data Preprocessing:** Why? Descriptive Data Summarization, Data Cleaning: Missing Values, Noisy Data, Data Integration and Transformation. Data Reduction:- Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Data Discretization and Concept hierarchy generation for numerical and categorical data.

4. **Mining Frequent Patterns, Associations, and Correlations:** Market Basket Analysis, Frequent Itemsets, Closed Itemsets, and Association Rules, Frequent Pattern Mining, Efficient and Scalable Frequent Itemset Mining Methods, The Apriori Algorithm for finding Frequent Itemsets Using Candidate Generation, Generating Association Rules from Frequent Itemsets, Improving the Efficiency of Apriori, Frequent Itemsets without Candidate Generation using FP Tree, Mining Multilevel Association Rules, Mining Multidimensional Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining.
5. **Classification & Prediction**: What is it? Issues regarding Classification and prediction:
   - **Classification methods**: Decision tree, Bayesian Classification, Rule based
   - **Prediction**: Linear and non linear regression
   Accuracy and Error measures, Evaluating the accuracy of a Classifier or Predictor.


7. **Mining Stream and Sequence Data**: What is stream data? Classification, Clustering Association Mining in stream data. Mining Sequence Patterns in Transactional Databases.

8. **Spatial Data and Text Mining**: Spatial Data Cube Construction and Spatial OLAP, Mining Spatial Association and Co-location Patterns, Spatial Clustering Methods, Spatial Classification and Spatial Trend Analysis. **Text Mining** Text Data Analysis and Information Retrieval, Dimensionality Reduction for Text, Text Mining Approaches.


10. **Data Mining for Business Intelligence Applications**: Data mining for business Applications like Balanced Scorecard, Fraud Detection, Clickstream Mining, Market Segmentation, retail industry, telecommunications industry, banking & finance and CRM etc.

**Text Books:**
1. Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann 2nd Edition
2. P. N. Tan, M. Steinbach, Vipin Kumar, “Introduction to Data Mining”, Pearson Education

**Reference Books:**
2. G. Shmueli, N.R. Patel, P.C. Bruce, “Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner”, Wiley India.
9. Chakrabarti, S., “Mining the Web: Discovering knowledge from hypertext data”,

**Term Work:**
Term work shall consist of at least 10 experiments covering all topics. Term work should consist of at least 6 programming assignments and one mini project in Business Intelligence and two assignments covering the topics of the syllabus. One written test is also to be conducted.
Distribution of marks for term work shall be as follows:

1. Laboratory work (Experiments and Journal) 15 Marks
2. Test (at least one) 10 Marks

The final certification and acceptance of TW ensures the satisfactory Performance of laboratory Work and Minimum Passing in the term work.

**Suggested Experiment List**
1. Students can learn to use WEKA open source data mining tool and run data mining algorithms on datasets.
2. Program for Classification – Decision tree, Naïve Bayes using languages like JAVA
3. Program for Clustering – K-means, Agglomerative, Divisive using languages like JAVA
4. Program for Association Mining using languages like JAVA
5. Web mining
6. BI projects: any one of Balanced Scorecard, Fraud detection, Market Segmentation etc.
7. Using any commercial BI tool like SQLServer 2008, Oracle BI, SPSS, Clementine, and XLMiner etc.

**ORAL EXAMINATION**
An oral examination is to be conducted based on the above syllabus.


5. **Image Segmentation and Representation**: Detection of Discontinuities, Laplacian of Gaussian, Derivative of Gaussian, Canny Edge Detection, Thresholding in Hierarchical Data Structures, Border Tracing, Edge linking and Boundary Detection, Thresholding, Region Based Segmentation. Representation Schemes.

6. **Image Data Compression**: Fundamentals, Redundancies: Coding, Interpixel, Psycho-visual, Error Free Compression, Lossy Image Compression: Lossy Predictive Coding, JPEG, MPEG, Subband Coding using Wavelet Transform, Vector Quantization

7. **Morphological Image Processing**: Introduction, Dilation, Erosion, Opening, Closing, Hit-or-Miss transformation, Basic Morphological Algorithms on binary images

8. **Applications of Image Processing**: Case Study on Digital Watermarking, Biometric Authentication (Face, Finger Print, Signature Recognition), Vehicle Number Plate Detection and Recognition, Object Detection using Correlation Principle, Person Tracking using DWT, Handwritten and Printed Character Recognition, Contend Based Image Retrieval, Text Compression.
Text Books:
1. J.G. Proakis, “Introduction to Digital Signal Processing”, PHI

Reference Books:

Term Work:
Term work should consist of at least 10 Practical and Assignments on every topic of the syllabus. A term work test shall be conducted with a weightage of 10 marks.

Marks:
Distribution of marks for term work shall be as follows:

1. Laboratory work(Experiment and Journal) 15 Marks
2. Test (at least one) 10 Marks

The final certification and acceptance of Term Work ensures the satisfactory performance of laboratory work and minimum passing in term work.

List of Experiments:

Topic -1 Digital Signal Processing  [ Any two Experiments ]

1. To find Linear Convolution, Circular Convolution
2. To find output of Digital FIR filter using convolution principle.
3. To find output of Digital IIR filter using recursive difference equation.
4. To plot Magnitude spectrum using DFT/FFT
5. To find output of real time signal using FFT based Overlap Add Method
6. To find output of real time signal using FFT based Overlap Save Method

Topic-2 Image Transform [ Any two Experiments ]

1. To find DFT/FFT forward and Inverse Transform of Image.
2. To find DCT forward and Inverse Transform of Image.
3. To find DWT forward and Inverse Transform of Image.
4. To find Walsh-Hadamard forward and Inverse Transform of Image.

**Topic-3 Image Enhancement [ Any two Experiments ]**

1. To enhance image using Histogram Equalization
2. To enhance image using Contrast Stretching
3. To perform Colour Image Enhancement
4. To enhance image using Smoothing and Sharpening Filters

**Topic-4 : Image Segmentation and Morphology [ Any two Experiments ]**

1. To find edges using LOG and DOG
2. To find Edges using Prewit/ Sobel/ Fri-chen / Robert operators.
3. To find edges using canny Edge Detection.
4. To implement Image Border Tracing

**Topic-5 : Application using OpenCV Library / Java [ Any Two Experiments ]**

1. Digital Watermarking
2. Biometric Authentication such as Face / Finger Print / Signature Recognition
3. Vehicle Number Plate Detection and Recognition,
4. Object Detection using Correlation Principle,
5. Person Tracking using DWT,
6. Handwritten and Printed Character Recognition,
7. Contend Based Image Retrieval,
8. Text file Compression.
9. Morphological Toolkit Development
10. Currency Recognition
11. Human Expression Detection
12. Image Enhancement using Adaptive Histogram Equalization(AHE), Modified AHE(MAHE), Technique.
13. Image Compression using Vector Quantization
14. Image Compression using DWT
**SIMULATION AND MODELING**

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**Prerequisite:** Probability and Statistics

**Objective:** The objective of this course is to teach students methods for modeling of systems using discrete event simulation. Emphasis of the course will be on modeling and on the use of simulation software. The students are expected to understand the importance of simulation in IT sector, manufacturing, telecommunication, and service industries etc. By the end of the course students will be able to formulate simulation model for a given problem, implement the model in software and perform simulation analysis of the system.

1. **Introduction to Simulation and Modeling:** Simulation – introduction, appropriate and not appropriate, advantages and disadvantage, application areas, history of simulation software, an evaluation and selection technique for simulation software, general – purpose simulation packages. System and system environment, components of system, type of systems, model of a system, types of models and steps in simulation study.

2. **Manual Simulation of Systems:** Simulation of Queuing Systems such as single channel and multi channel queue, lead time demand, inventory system, reliability problem, time-shared computer model, job-shop model.

3. **Discrete Event Formalisms:** Concepts of discrete event simulation, model components, a discrete event system simulation, simulation world views or formalisms, simulation of single channel queue, multi channel queue, inventory system and dump truck problem using event scheduling approach.

4. **Statistical Models in Simulation:** Overview of probability and statistics, useful statistical model, discrete distribution, continuous distribution, empirical distribution and Poisson process.

5. **Queueing Models:** Characteristics of queueing systems, queueing notations, long run measures of performance of queueing systems, Steady state behavior of Markovian models (M/G/1, M/M/1, M/M/c) overview of finite capacity and finite calling population models, Network of Queues.
6. **Random Number Generation**: Properties of random numbers, generation of true and pseudo random numbers, techniques for generating random numbers, hypothesis testing, various tests for uniformity (Kolmogorov-Smirnov and chi-Square) and independence (runs, autocorrelation, gap, poker).

7. **Random Variate Generation**: Introduction, different techniques to generate random variate:- inverse transform technique, direct transformation technique, convolution method and acceptance rejection techniques.

8. **Input Modeling**: Introduction, steps to build a useful model of input data, data collection, identifying the distribution with data, parameter estimation, suggested estimators, goodness of fit tests, selection input model without data, covariance and correlation, multivariate and time series input models.

9. **Verification and Validation of Simulation Model**: Introduction, model building, verification of simulation models, calibration and validation of models:- validation process, face validity, validation of model, validating input-output transformation, t-test, power of test, input output validation using historical data and Turing test.

10. **Output Analysis**: Types of simulations with respect to output analysis, stochastic nature of output data, measure of performance and their estimation, output analysis of terminating simulators, output analysis for steady state simulation.

11. **Case Studies**: Simulation of manufacturing systems, Simulation of Material Handling system, Simulation of computer systems, Simulation of supermarket, Cobweb model, and any service sectors.

**Text Book:**

**Reference Books:**

**Term Work:**
Term work shall consist of at least 10 experiments covering all topics and one written test.
Distribution of marks for term work shall be as follows:

3. Laboratory work (Experiments and Journal) 15 Marks
4. Test (at least one) 10 Marks

The final certification and acceptance of TW ensures the satisfactory Performance of laboratory Work and Minimum Passing in the term work.

Suggested Experiment list
The experiments should be implemented using Excel, simulation language like GPSS and/or any simulation packages. Case studies from the reference book can be used for experiment.

1. Single Server System
2. Multi serve system like Able – Baker
3. (M, N) - Inventory System
4. Dump Truck Problem
5. Job-Shop Model
6. Manufacturing System
7. Cafeteria
8. Telecommunication System
9. Uniformity Testing
10. Independence Testing
SOFTWARE TESTING & QUALITY ASSURANCE

CLASS B.E. (INFORMATION TECHNOLOGY) SEMESTER VII

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Prerequisite: Software Engineering

Objective: This course equips the students with a solid understanding of:
- Practices that support the production of quality software
- Software testing techniques
- Life-cycle models for requirements, defects, test cases, and test results
- Process models for units, integration, system, and acceptance testing
- Quality Models

1. **Introduction**: Software Quality, Role of testing, verification and validation, objectives and issues of testing, Testing activities and levels, Sources of Information for Test Case Selection, White-Box and Black-Box Testing, Test Planning and Design, Monitoring and Measuring Test Execution, Test Tools and Automation, Test Team Organization and Management.

2. **Unit Testing**: Concept of Unit Testing, Static Unit Testing, Defect Prevention, Dynamic Unit Testing, Mutation Testing, Debugging, Unit Testing in eXtreme Programming.

3. **Control Flow Testing**: Outline of Control Flow Testing, Control Flow Graph, Paths in a Control Flow Graph, Path Selection Criteria, All-Path Coverage Criterion, Statement Coverage Criterion, Branch Coverage Criterion, Predicate Coverage Criterion, Generating Test Input, Examples of Test Data Selection.


7. **Functional Testing:** Equivalence Class Partitioning, Boundary Value Analysis, Decision Tables, Random Testing, Error Guessing, Category Partition.

8. **System Test Design:** Test Design Factors, Requirement Identification, Characteristics of Testable Requirements, Test Design Preparedness Metrics, Test Case Design Effectiveness


**Text Book**

**References:**
Term Work:
Term work shall consist of at least 10 experiments covering all topics and one written test.
Distribution of marks for term work shall be as follows:

5. Laboratory work (Experiments and Journal)  15 Marks
6. Test (at least one)  10 Marks
The final certification and acceptance of TW ensures the satisfactory Performance of laboratory Work and Minimum Passing in the term work.
Elective – I : WIRELESS NETWORKS

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**Prerequisite:** Networking Technology for Digital Devices, Convergence Technology for Networking in Communication, C/C++/Java

**Objective:** The main objective of this course is to get acquainted of Wireless Communication Systems and their Applications through today’s technologies.

1. **Introduction to Wireless Networks:** Evolution of Wireless Networks, Challenges, Overview of various Wireless Networks.


3. **First Generation (1G) Cellular Systems:** Introduction, Advanced Mobile Phone System (AMPS), Nordic Mobile Telephony (NMT).

4. **Second Generation (2G) Cellular Systems:** Introduction, D-AMPS, cdmaOne (IS-95), GSM, IS-41, Data Operations, Cordless Telephony (CT).


8. **Fixed Wireless Access Systems:** Wireless Local Loop versus Wired Access, Wireless Local Loop, Wireless Local Loop Subscriber Terminals (WLL), Wireless Local Loop Interfaces to the PSTN, IEEE 802.16 Standards.


11. **Personal Area Networks (PANs)**: Introduction to PAN Technology and Applications, Commercial Alternatives: Bluetooth, Commercial Alternatives: HomeRF.


**Text Book:**

**References:**

**Term Work:**
Term work shall consist of at least 10 experiments covering all topics and one written test. Distribution of marks for term work shall be as follows:

7. Laboratory work (Experiments and Journal) 15 Marks
8. Test (at least one) 10 Marks

The final certification and acceptance of TW ensures the satisfactory Performance of laboratory Work and Minimum Passing in the term work.

**Suggested Experiment List**
1. Study and analysis of wireless device and product specifications.
2. Implementation of spread spectrum techniques like DSSS and FHSS.
3. Use simulation tools like ANSim to study and simulate Ad-Hoc Network.
4. Implementation of MACA as RTS/CTS communication.
5. Study the wireless markup language and develop small application using it.
6. Study and implementation of wireless access and wireless application protocol.
7. Study and implementation of security issues in wireless network.
8. Case study implementation given in the syllabus.
Elective – I: MULTIMEDIA SYSTEMS

CLASS B.E. (INFORMATION TECHNOLOGY)               SEMESTER VII

HOURS PER WEEK

LECTURES : 04
TUTORIALS : --
PRACTICALS : 02

HOURS  MARKS

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ORAL        --   25
TERM WORK   --   25

Prerequisite: Computer Graphics

Objective: Students will be able to understand the relevance and underlining infrastructure of multimedia system. The purpose of the course for the students is to apply contemporary theories of multimedia learning to the development of multimedia products. Analyze instructional and informational media (audio/visual materials, web based materials, games and simulations etc).


6. Basic Video Compression Techniques: Introduction to Video Compression, Video Compression Based on Motion Compensation, Search for Motion Vectors, H.261, H.263 303.


10. **Multimedia Network Communications and Applications**: Quality of Multimedia Data Transmission, Multimedia over IP, Multimedia over ATM Networks, Transport of MPEG-4, Media-on-Demand (MOD), Multimedia over Wireless Networks.

11. **Content-Based Retrieval in Digital Libraries**: How Should We Retrieve Images?, C-BIRD—A Case Study, Synopsis of Current Image Search Systems, Relevance Feedback, Quantifying Results, Querying on Videos, Querying on Other Formats, Outlook for Content-Based Retrieval.


15. **Multimedia Databases**: Design and Architecture of a Multimedia Database, Organizing Multimedia Data based on the Principal of Uniformity, Media Abstractions, Query Languages for Retrieving Multimedia Data, Indexing SMDSs with Enhanced Inverted Indices, Query Relaxation/Expansion, Conclusions and Selected Commercial Systems.

**Text Books:**

**Reference Books:**

**Term Work:**
Term work shall consist of at least 10 experiments covering all topics and one written test.
Distribution of marks for term work shall be as follows:

9. Laboratory work (Experiments and Journal)                      15 Marks
10. Test (at least one)                                                                10 Marks

The final certification and acceptance of TW ensures the satisfactory Performance of laboratory Work and Minimum Passing in the term work.

**Suggested Experiment List**
1. Study of multimedia I/O devices.
2. Calculator for blind
3. Media player application
4. Design advertisement using flash/macromedia
5. Design a web application using dream viewer and fireworks
6. Create multimedia database for student ID card preparation
7. Study and use of different MPEG file formats.
8. Construction of website using pictures, videos, audio etc with proper layout.
9. Implementation Huffman algorithm for six character long string.
10. Edit the movie clip using adobe premiere.
11. Record a speech and perform compresession and decompression.
12. Design a game/application in flash.
13. Convert BMP file to JPG file using any programming language.
Elective – I: EVOLUTIONARY ALGORITHMS

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**Prerequisite:** Data Structures and Algorithms, Knowledge of Programming Language / Tool (C / C++ / Java).

**Objective:** The objective of the course is to understand the working of Evolutionary algorithms such as Genetic Algorithm, Genetic Programming, Evolutionary Algorithms and Evolutionary Programming with their application is the various aspects of Computer engineering.


3. **Advanced Operators in GA:** Diploidy, Dominance and Abeyance, Multiploid, Inversion and Reordering, Niche and Speciation, Micro-operators, Non-binary Representation, Multi-objective Optimization, Combinatorial Optimization, GA classifications: SGA, Parallel GA, Hybrid GA.


5. **Foundations of Evolutionary Algorithms:** Schemas and the two-armed bandit problem, Mathematical models for simple genetic algorithms, Where to use
evolutionary algorithms? Theoretical advantages and disadvantages of evolutionary algorithms over alternative methods (hill-climbing, simulated annealing, etc.), Co-evolutionary Algorithms: Cooperative co-evolution, Competitive co-evolution, Swarm intelligence and ant colony optimization.


7. **Evolutionary Programming (EP)**: Introduction, Comparison with GA, GP & ES. Selection mechanism, Applications of ES.

8. **Multi-Objective Evolutionary Optimization**: Pareto optimality, Multi-objective evolutionary algorithms. Learning Classifier Systems: Basic ideas and motivations, Main components and the main cycle. Theoretical Analysis of Evolutionary Algorithms: Schema theorems, Convergence of EAs, Computational time complexity of EAs, No free lunch theorem.


**Text Book:**


**Reference Books:**

**Term Work:**
Term work shall consist of at least 10 experiments covering all topics and one written test.
Distribution of marks for term work shall be as follows:

11. Laboratory work (Experiments and Journal) 15 Marks
12. Test (at least one) 10 Marks

The final certification and acceptance of TW ensures the satisfactory Performance of laboratory Work and Minimum Passing in the term work.

**Suggested Experiment list**
A mini-project based on the following (not Restricted to) topic:
- Flow Shop Scheduling Problem.
- Traveling Sales-person Problem.
- Santa-Fe-trial.
- John Muir Trail.
- Designing Texture Filters with Genetic Algorithm.
- Knowledge Acquisition on Image Processing.
- Object Localization in Images Using Genetic Algorithm.
- Russian Roulette
**Elective I - NANOTECHNOLOGY**

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**Prerequisite:** -

**Objective:** Students are expected to learn both some basic science and technology and at the same time, some techniques for understanding the social and cultural significance, role, and possible effects of this emerging science.

1. **Introduction to Physics of the Solid States:** Structure, energy bands, localized particles.

2. **Methods of Measuring Properties:** Introduction, structures, microscopy, spectroscopy.

3. **Properties of Individual Nanoparticles:** Introduction, metal nanoclusters, semiconducting nanoparticles, rare gas and molecular clusters, methods of synthesis.

4. **Mechanical & Magnetic Properties:** Strength of nano crystalline SiC, preparation for strength measurements, mechanical properties, magnetic properties. Super-paramagnetism, material preparation, magnetization of nano particles of magnetite, Mössbauer data of nano particles of magnetite, ESR spectroscopy, small angle neutron scattering.

5. **Electrical & Optical Properties:** Switching glasses with nanoparticles, Electronic conduction with nano particles. Optical properties, special properties and the coloured glasses.

6. **Investigating and Manipulating materials in the Nanoscale:** Electron microscopics, scanning probe microscopics, optical microscopics for nano science and technology, X-ray diffraction.

7. **Optics and Electronics:** Light energy, its capture, and photovoltaics, light production, light transmission, light control and manipulation, electronics, carbon nano tubes, soft molecule electronics, memories, gates & switches, architectures.
8. **NanoTechnology-Enabled Sensor**: Possibilities, relentless integration, advances in processing, diverse nanomaterials, new tools, realities, intensified design problems, the risk of commercialization, diverse applications.


10. **Smarter Computers, Faster Internet, Cheaper Energy**: Building a better Digital brain, routing information at the speed of light, nano flying electronics, getting energy and a cleaner environment with nanotech.

11. **Nano Medicins**: Developing of Nanomedicins, Nanosystems in use, Protocols for nanodrug Administration, Nanotechnology in Diagnostics applications, materials for used in Diagnostics and Therapeutic applications, Molecular Nanomechanics, Molecular devices, Nanotribology, studying tribology at nanoscale, Nanotribology applications.

12. **Nanobusiness**: Boom, Bust, and nanotechnology:- the next industrial revolution?, nanobusiness today, high tech, bio tech, nanotech.

13. **Nanotechnology and You**: Nanotechnology:- here and now, the nature of ethics, ethics of individual behavior, nano ethics, converging technologies, practical responses, promise of nanotechnology.

**Reference Books:**
3. “Nano Essentials”, T. Pradeep, TMH.
6. “Nanotechnology – the fun and easy way to explore the science of mater’s smallest particles”, Richard Booker and Earl Boysen, Wiley.

**Term Work:**
Term work shall consist of at least 10 experiments covering all topics and one written test.
Distribution of marks for term work shall be as follows:

- **13. Laboratory work (Experiments and Journal)** 15 Marks
- **14. Test (at least one)** 10 Marks

The final certification and acceptance of TW ensures the satisfactory Performance of laboratory Work and Minimum Passing in the term work.

**Suggested Experiment list**
A group of maximum three students should be formed to carry out the research in various application areas of nano technology as mentioned in the syllabus. As a term work they need to submit a report of maximum five pages on each application they explored on top of the syllabus.
## Elective – I: GEOGRAPHICAL INFORMATION SYSTEMS

**CLASS B.E. (INFORMATION TECHNOLOGY) SEMESTER VII**

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**HOURS**

**MARKS**

**Prerequisite:** Computer Graphics

**Objective:** To understand fundamental concepts and principles of Geographical Information Systems.


2. **Data Management, Models and Quality Issues:** Conceptual Models, Geographical Data Models, Data Primitives, Data Types - Raster and Vector Approach, Digital Terrain Modeling, Approaches to digital terrain data modeling, Acquisition of digital terrain data, Data Modeling and Spatial Analysis, Sources of Geographical Data, Data Collectors and Providers, Creating Digital Data Sets, Data Presentation, Data Updating, Data Storage, Spatial Data Costs, Quality of GIS Output, Sources of Errors in Spatial Data, Factors affecting Reliability of Spatial Data, Faults from Assumptions, spatial autocorrelation, Quadrat counts and Nearest – Neighbour analysis, Trend surface analysis, Gravity models.


6. **GIS Project Design and Management:** Software engineering as applied to GIS, GIS project planning, System analysis and study of user requirement, Geographic database design methodology, GIS application software design methodology, system implementation, system maintenance and support.

7. **Issues and Applications in GIS:** Changes in Technology, Data Supply and Users, Role of Satellite Imagery and Data Sets, Trends in GIS, GIS users, Urban and Municipal Applications, Other Applications.

**Reference Books:**

**Term Work:**
Term work shall consist of at least 10 experiments covering all topics and one written test.
Distribution of marks for term work shall be as follows:

15. Laboratory work (Experiments and Journal) 15 Marks
16. Test (at least one) 10 Marks

The final certification and acceptance of TW ensures the satisfactory Performance of laboratory Work and Minimum Passing in the term work.
ELECTIVE – I : ARTIFICIAL INTELLIGENCE

CLASS B.E. (INFORMATION TECHNOLOGY) SEMESTER VII

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**Prerequisite:** programming language like JAVA or Python

**Objective:** This course will introduce the basic ideas and techniques underlying the design of intelligent computer systems. Students will develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents. This course will attempt to help students understand the main approaches to artificial intelligence such as heuristic search, game search, logical inference, decision theory, planning, machine learning, neural networks and natural language processing. Students will be able to recognize problems that may be solved using artificial intelligence and implement artificial intelligence algorithms for hands-on experience.

1. **Artificial Intelligence:** Introduction to AI, History of AI, Emergence Of Intelligent Agents

2. **Intelligent Agents:** PEAS Representation for an Agent, Agent Environments, Concept of Rational Agent, Structure of Intelligent agents, Types of Agents.


4. **Constrained Satisfaction Problems:** Constraint Satisfaction Problems like, map Coloring, Crypt Arithmetic, Backtracking for CSP, Local Search.

5. **Adversarial Search:** Games, Minimax Algorithm, Alpha Beta pruning.

6. **Knowledge and Reasoning:** A knowledge Based Agent, Introduction To Logic, Propositional Logic, Reasoning in Propositional logic, First Order Logic: Syntax and Semantics, Extensions and Notational Variation, Inference in First Order Logic, Unification, Forward and backward chaining, Resolution.

7. **Knowledge Engineering:** Ontology, Categories and Objects, Mental Events and Objects.

9. **Uncertain Knowledge and Reasoning**: Uncertainty, Representing knowledge in an Uncertain Domain, Overview of Probability Concepts, Belief Networks, Simple Inference in Belief Networks


11. **Agent Communication**: Communication as action, Types of communicating agents, A formal grammar for a subset of English

**Text Book:**

**Reference Books:**
5. Dan W. Patterson, Introduction to Artificial Intelligence and Expert System, PHI.
6. Efraim Turban Jay E.Aronson, "Decision Support Systems and Intelligent Systems" PHI.

**Term Work:**
Term work shall consist of at least 10 experiments covering all topics and one written test.
Distribution of marks for term work shall be as follows:

17. Laboratory work (Experiments and Journal) 15 Marks
18. Test (at least one) 10 Marks

The final certification and acceptance of TW ensures the satisfactory Performance of laboratory Work and Minimum Passing in the term work.

**Suggested Experiment list:** (Can be implemented in JAVA)
1. Problem Formulation Problems
2. Programs for Search
3. Constraint Satisfaction Programs
4. Game Playing Programs
5. Assignments on Resolution
6. Building a knowledge Base and Implementing Inference
7. Assignment on Planning and reinforcement Learning
8. Implementing Decision Tree Learner
9. Neural Network Implementation
10. Bayes’ Belief Network (can use Microsoft BBN tool)
11. Assignment on Agent Communication – Grammar Representation For Simple Domains

**ORAL EXAMINATION**

Oral examination is to be conducted based on the above syllabus.
**PROJECT – I**

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**Objective:** To help students to develop some of the following
- Relate theory with real time applications
- Experiencing the issues involved with creation & design of simple products and processes
- Initiating them to technical writing and documentation for reuse
- Developing proficiency in carrying out critical analysis, review and study of existing Literature on technological experimentation and finding out of scholastic investigation

**Guidelines to carry out project**

1. **Project Topic and group size:**
   - Project shall be carried out within the campus making use of library and laboratory facility and group size of students working on same project topic shall not exceed 4 (Four)
   - Project shall be any one of the following
     - Creation of software, hardware or middleware related with all kinds of electronic, communication or control system devices
     - Critical study, analysis or review of Information Communication Technology literature in the public domain which is not part of your curriculum
     - Fabrication of devices preferably those devices energized from converging technologies
     - Creation of experimental setup and experimentation based on technological literature in the public domain
   - Project can be undertaken on any subject taught through semester I to Semester VIII
   - Students can certainly take ideas from anywhere, but be sure that they should evolve them in the unique way to suit their project requirements.
   - Head of department and senior staff in the department will take decision regarding projects.

**Project Report Format may consist of some of the following**
• Introduction of the title
• Aims and objectives
• Literature Surveyed
• Existing system (if any)
• Problem Statement
• Scope
• Proposed System
• Methodology (your approach to solve the problem)
• Analysis
• Details of Hardware & Software
• Design details
• Implementation Plan for next semester