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

Fourth Year -Semester VII										
Scheme of Instructions					Scheme of Examinations					
Sr. No	Subjects	Lect/ Week	Pract/ Week	Tuto/ Week	Theory		T/W	Practical	Oral	Total
					Hours	Marks	Marks	Marks	Marks	Marks
1	Data Warehousing, Mining & Business Intelligence	4	2	--	3	100	25	--	25	150
2	Digital Signal & Image processing	4	2	--	3	100	25	--	25	150
3	Simulation and Modeling	4	2	--	3	100	25	25	--	150
4	Software testing & Quality Assurance	4	2	--	3	100	25	--	25	150
5	Elective – I	4	2	--	3	100	25	--	25	150
6	Project - I	--	4	--	--	--	25	--	25	50
	TOTAL	**20**	**14**	**2**	**3**	**500**	**150**	**25**	**125**	**800**

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
HOURS PER WEEK	LECTURES	:	04	
	TUTORIALS	:	--	
	PRACTICALS	:	02	
			HOURS	**MARKS**
EVALUATION SYSTEM:	THEORY		3	100
	PRACTICAL		--	--
	ORAL		--	25
	TERM WORK		--	25
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.

6. **Cluster Analysis**: What is it? Types of Data in cluster analysis, Categories of clustering methods, Partitioning methods – K-Means, K-Mediods. Hierarchical Clustering- Agglomerative and Divisive Clustering, BIRCH and ROCK methods, DBSCAN, Outlier Analysis

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.

9. **Web Mining:** Web mining introduction, Web Content Mining, Web Structure Mining, Web Usage mining, Automatic Classification of web Documents.

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:

1. MacLennan Jamie, Tang ZhaoHui and Crivat Bogdan, “Data Mining with Microsoft SQL Server 2008”, Wiley India Edition.
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.
3. Michael Berry and Gordon Linoff “Data Mining Techniques”, 2nd Edition Wiley Publications.
4. Alex Berson and Smith, “Data Mining and Data Warehousing and OLAP”, McGraw Hill Publication.
5. E. G. Mallach, “Decision Support and Data Warehouse Systems", Tata McGraw Hill.

6. Michael Berry and Gordon Linoff "Mastering Data Mining- Art & science of CRM", Wiley Student Edition
7. Arijay Chaudhry & P. S. Deshpande, "Multidimensional Data Analysis and Data Mining Dreamtech Press
8. Vikram Pudi & Radha Krishna, "Data Mining", Oxford Higher Education.
9. Chakrabarti, S., "Mining the Web: Discovering knowledge from hypertext data",
10. M. Jarke, M. Lenzerini, Y. Vassiliou, P. Vassiliadis (ed.), "Fundamentals of Data Warehouses", Springer-Verlag, 1999.

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**.**

DIGITAL SIGNAL AND IMAGE PROCESSING			
CLASS: B.E. (INFORMATION TECHNOLOGY)		SEMESTER – VII	
HOURS PER WEEK	LECTURES	04	
	TUTORIALS	--	
	PRACTICALS	02	
		Hours	Marks
EVALUATION SYSTEM	THEORY	03	100
	PRACTICAL		
	ORAL	-	25
	TERM WORK	-	25

1. **Introduction to Discrete Time Signals & System:** Discrete–Time Signals representation and Manipulation, Discrete–Time IIR and FIR Systems, Impulse Response, Transfer Function, Difference Equation, Frequency Domain and Time Domain Analysis of IIR filter and FIR filter, Correlation, Linear and Circular and Covolution Algortithm,
2. **Discrete Fourier Transform:** DTFT**,** Frequency Domain Sampling, Properties of DFT, DIT-FFT algorithm, Spectral Analysis using FFT, Linear FIR filtering using FFT based Overlap Save and Overlap Add Method,
3. **Image Transforms :** Introduction to Unitary Transform, DFT, Properties of 2-D DFT, FFT, IFFT, Walsh transform, Hadamard Transform, Discrete Cosine Transform, Discrete Wavelet Transform,
4. **Image Enhancement :** Gray Level Transformations, Histogram Processing, Spatial Filtering: Introduction, Smoothing and Sharpening Filters. Colour Image Enhancement.
5. **Image Segmentation and Reprsentation :** Detection of Discontinuities, Laplacian of Gaussian, Derivative of Gaussain, 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
2. *R.C.Gonsales R.E.Woods,* **"**Digital Image Processing*", Second Edition, Pearson Education*
3. Anil K.Jain, "*Fundamentals of Image Processing*", PHI

Reference Books :

1. S Sallivahanan, *"Digital Signal Processing*", TMH.
2. Milan Sonka, Vaclav Hlavac, Roger Boyle,"Image Processing Analysis and Machine Vision" Second Edition, Thomson Learning Inc,
3. William Pratt, " Digital Image Processing",John Wiley.

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				
CLASS B.E. (INFORMATION TECHNOLOGY)				SEMESTER VII
HOURS PER WEEK	LECTURES	:	04	
	TUTORIALS	:	--	
	PRACTICALS	:	02	
			HOURS	**MARKS**
EVALUATION SYSTEM:	THEORY		3	100
	PRACTICAL		--	25
	ORAL		--	--
	TERM WORK		--	25
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 super market, Cobweb model, and any service sectors.

Text Book:

Banks J., Carson J. S., Nelson B. L., and Nicol D. M., "Discrete Event System Simulation", 3rd edition, Pearson Education, 2001.

Reference Books:

1. Gordon Geoffrey, "System Simulation", 2nd edition, PHI, 1978.
2. Law A. M., and Kelton, W. D., "Simulation Modeling and Analysis", 3rd edition, McGraw-Hill, 2000.
3. Narsing Deo, "System Simulation with Digital Computer", PHI.
4. Frank L. Severance, "System Modeling and Simulation"
5. Trivedi K. S., "Probability and Statistics with Reliability, Queueing, and Computer Science Applications", PHI, 1982.
6. Wadsworth G. P., and Bryan, J. G., "Introduction to Probability and Random Variables", McGraw-Hill, 1960.
7. Donald W. Body, "System Analysis and Modeling", Academic Press Harcourt India.
8. Bernard, "Theory Of Modeling and Simulation"
9. Levin & Ruben, "Statistics for Management".
10. Aczel & Sounderpandian, "Business Statistics".

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
HOURS PER WEEK	LECTURES	:	04	
	TUTORIALS	:	--	
	PRACTICALS	:	02	
			HOURS	**MARKS**
EVALUATION SYSTEM:	THEORY		3	100
	PRACTICAL		--	
	ORAL		--	25
	TERM WORK		--	25
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 **,** 3.4 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.

4. **Data Flow Testing:** Data Flow Anomaly,. Overview of Dynamic Data Flow Testing, Data Flow Graph, Data Flow Terms, Data Flow Testing Criteria, Comparison of Data Flow Test Selection Criteria, Feasible Paths and Test Selection Criteria, Comparison of Testing Techniques.

5. **System Integration Testing:** Concept of Integration Testing, Different Types of Interfaces and Interface Errors, Granularity of System Integration Testing, System Integration Techniques, Software and Hardware Integration, Test Plan for System Integration, Off-the-Shelf Component Integration, Off-the-Shelf Component Testing, Built-in Testing

6. **System Test Categories:** Basic Tests, Functionality Tests, Robustness Tests, Interoperability Tests, Performance Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Documentation Tests.

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

9. **System Test Planning And Automation:** Structure of a System Test Plan, Introduction and Feature Description, Assumptions, Test Approach, Test Suite Structure, Test Environment, Test Execution Strategy, Test Effort Estimation, Scheduling and Test Milestones, System Test Automation, Evaluation and Selection of Test Automation Tools, Test Selection Guidelines for Automation, Characteristics of Automated Test Cases, Structure of an Automated Test Case, Test Automation Infrastructure

10. **System Test Execution:** Preparedness to Start System Testing, Metrics for Tracking System Test, Metrics for Monitoring Test Execution, Beta Testing, First Customer Shipment, System Test Report, Product Sustaining, Measuring Test Effectiveness.

11. **Acceptance Testing:** Types of Acceptance Testing, Acceptance Criteria, Selection of Acceptance Criteria, Acceptance Test Plan, Acceptance Test Execution, Acceptance Test Report, Acceptance Testing in eXtreme Programming.

12. **Software Quality:** Five Views of Software Quality, McCall's Quality Factors and Criteria, Quality Factors Quality Criteria, Relationship between Quality Factors and Criteria, Quality Metrics, ISO 9126 Quality Characteristics, ISO 9000:2000 Software Quality Standard ISO 9000:2000 Fundamentals, ISO 9001:2000 Requirements

Text Book

1. "Software Testing and Quality Assurance: Theory and Practice", Sagar Naik, University of Waterloo, Piyu Tripathy, Wiley , 2008

References:

1. "Effective methods for Software Testing "William Perry, Wiley.
2. "Software Testing - A Craftsman's Approach", Paul C. Jorgensen, CRC Press, 1995.
3. "The Art of Creative Destruction", Rajnikant Puranik, SPD.
4. "Software Testing", Srinivasan Desikan and Gopalaswamy Ramesh - Pearson Education 2006.
5. "Introducing to Software Testing", Louis Tamres, Addison Wesley Publications, First Edition.
6. "Software Testing", Ron Patton, SAMS Techmedia Indian Edition, Pearson Education 2001.

7. “The Art of Software Testing”, Glenford J. Myers, John Wiley & Sons, 1979.
8. “Testing Object-Oriented Systems: Models Patterns and Tools”, Robert V. Binder, Addison Wesley, 2000.
9. “Software Testing Techniques”, Boris Beizer, 2nd Edition, Van Nostrand Reinhold, 1990.
10. “Software Quality Assurance”, Daniel Galin, Pearson Education.

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				
CLASS B.E. (INFORMATION TECHNOLOGY)				SEMESTER VII
HOURS PER WEEK	LECTURES	:	04	
	TUTORIALS	:	--	
	PRACTICALS	:	02	
			HOURS	**MARKS**
EVALUATION SYSTEM:	THEORY		3	100
	PRACTICAL		--	--
	ORAL		--	25
	TERM WORK		--	25
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.

2. **Wireless Communications Principles and Fundamentals:** Introduction, The Electromagnetic Spectrum, The Cellular Concept, The Ad Hoc and Semi Ad Hoc Concepts, Wireless Services, Data Delivery Approaches, Overview of Basic Techniques and Interactions Between the Different Network Layers

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).

5. **Third Generation (3G) Cellular Systems:** Introduction, 3G Spectrum Allocation, Third Generation Service Classes and Applications, Third Generation Standards.

6. **Fourth Generation (4G):** Introduction, Design Goals for 4G and Beyond and Related Research Issues, 4G Services and Applications, Challenges.

7. **Satellite Networks:** Introduction, Satellite Systems, VSAT Systems, Examples of Satellite-based Mobile Telephony Systems, Satellite based Internet Access.

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.

9. **Wireless Local Area Networks:** Introduction, Wireless LAN Topologies, Wireless LAN Requirements, The Physical Layer, The Medium Access Control (MAC) Layer, Latest Developments.
10. **Wireless ATM and Ad Hoc Routing:** Introduction, Wireless ATM Architecture, HIPERLAN 2: An ATM Compatible WLAN, Routing in Wireless Ad Hoc Networks.

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

12. **Security Issues in Wireless Systems:** The Need for Wireless Network Security, Attacks on Wireless Networks, Security Services, Wired Equivalent Privacy (WEP) Protocol, Mobile IP, Weaknesses in the WEP Scheme, Virtual Private Network (VPN).

13. **Economics of Wireless Networks:** Introduction, Economic Benefits of Wireless Networks, The Changing Economics of the Wireless Industry, Wireless Data Forecast, Charging Issues.

14. **Case Studies on Simulation of Wireless Network Systems:** Performance Evaluation of IEEE 802.11 WLAN Configurations Using Simulation, Simulation Analysis of the QoS in IEEE 802.11 WLAN System, Simulation Comparison of the TRAP and RAP Wireless LANs Protocols, Simulation Modeling of Topology Broadcast Based on Reverse-Path Forwarding (TBRPF) Protocol Using an 802.11 WLAN-based MONET Model.

Text Book:

"Wireless Networks", P. Nicopolitidis, M. S. Obaidat, G. I. Papadimitriou, A. S. Pomportsis, John Wiley & Sons, Ltd.

References:

1. "Wireless Communications Principles and Practices", T. S. Rappaport, Pearson Education.
2. "Wireless Communications and Networks", William Stallings, Pearson Education.
3. "Wireless and Mobile Network Architectures", Yi-BaNG Lin and Imrich Chlamtac, Wiley.
4. "Wireless and Mobile Communication", Sanjeev Kumar, New Age International Publications.
5. "Wireless Network Evoving :2G to 3G", Garg, Pearson Education.
6. "Mobile Communication System", Y. C. Lee.
7. "Guide to Wireless Network Security", John R. Vacca, Springer.
8. "The Wireless Application Protocol", Steve Mann, Scott Sbihli, Wiley.
9. "Mobile Communications", Jochen Schiller, Pearson, Second Edition.
10. "Mobile Computing- Technology, Applications and Service Creation", A. K. Talukder, R.R. Yavagal, TMH.

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**
EVALUATION SYSTEM:	THEORY		3	100
	PRACTICAL		--	--
	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).				

1. **Multimedia Basics, Multimedia Authoring and Tools:** What is Multimedia?, Multimedia and Hypermedia, World Wide Web, Overview of Multimedia Software Tools, Further Exploration, Multimedia Authoring, Some Useful Editing and Authoring Tools, VRML.

2. **Graphics and Image Data Representation:** Graphics/Image Data Types 60, Popular File Formats.

3. **Concepts in Video and Digital Audio:** Color Science, Color Models in Images, Color Models in Video. Types of Video Signals, Analog Video, Digital Video, Digitization of Sound, MIDI: Musical Instrument Digital Interface, Quantization and Transmission of Audio.

4. **Lossless & Lossy Compression Algorithms:** Introduction, Basics of Information Theory, Run-Length Coding, Variable-Length Coding, Dictionary-Based Coding, Arithmetic Coding, Lossless Image Compression. Distortion Measures, The Rate-Distortion Theory, Quantization, Transform Coding, Wavelet-Based Coding, Wavelet Packets, Embedded Zerotree of Wavelet Coefficients, Set Partitioning in Hierarchical Trees (SPIHT).

5. **Image Compression Standards:** The JPEG Standard, The JPEG2000 Standard, The JPEG-LS Standard, Bilevel Image Compression Standards.

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

7. **MPEG Video Coding:** Overview, MPEG-1, MPEG-2, Object-Based Visual Coding in MPEG-4, Synthetic Object Coding in MPEG, MPEG-4 Object types, Profiles and Levels, MPEG-4 Part10/H.264, MPEG-7.

8. **Basic Audio & MPEG Audio Compression Techniques:** ADPCM in Speech Coding, G.726 ADPCM, Vocoders, Psychoacoustics, MPEG Audio, Other Commercial Audio Codecs, future: MPEG-7 and MPEG-2.

9. **Computer and Multimedia Networks:** Basics of Computer and Multimedia Networks, Multiplexing Technologies, LAN and WAN, Access Networks, Common Peripheral Interfaces.

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.

12. **Image Databases:** Raw Images, Compress Image Presentations, Image Processing Segmentation, Similarity- Based Retrieval, Alternating Image DB Paradigms, Representing Image DBs with Relations and R Trees, Retrieving Images by Special Layout, Implementations, Selected Commercial Systems.

13. **Text/Document Databases:** Precision and Recall, Stop Lists, Word Stems and Frequency tables, Latent Semantic Indexing, TV-Trees, Other Retrieval Techniques, Selected Commercial Systems.

14. **Video & Audio Databases:** Organizing content of a Single video, Querying content of Video Libraries, Video Segmentation, Video Standard and Selected Commercial Systems. A general Model of Audio Data, Capturing Audio Content through Discrete Transformation, Indexing Audio Data and Selected Commercial Systems.

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:

1. Ze-Nian Li and M. S. Drew, “Fundamental of Multimedia”, Pearson Education.
2. V. S. Subrahmanian, “Principles of Multimedia Database Systems”, Morgan Kaufmann Punlication.

Reference Books:

1. K. R. Rao, Zoran S. Bojkovic, D. A. Milovanovic, “Introduction to Multimedia Communications”, Wiley.
2. R. Steinmetz and K. Nahrstedt “Multimedia: Computing, Communication & Applications, Pearson Education.
3. Buford, “Multimedia Systems”, Pearson Education.
4. C. T. Bhunia, “Multimedia and multimedia Communications”, New Age International Publishers.
5. Prabhat K. Andheigh, Kiran Thakrar, “Multimedia Systems design’, PHI.
6. Koegel Buford, “Multimedia Systems”, Pearson Eduaction.
7. J. D. Gibson, ‘Multimedia Communications: Directions and Innovations’, Academic Press, Hard-court India.
8. Free Halshal, ‘Multimedia Communications’, PEA.

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 compression and decompression.
12. Design a game/application in flash.
13. Convert BMP file to JPG file using any programming language.

Elective – I : EVOLUTIONARY ALGORITHMS				
CLASS B.E. (INFORMATION TECHNOLOGY)				SEMESTER VII
HOURS PER WEEK	LECTURES	:	04	
	TUTORIALS	:	--	
	PRACTICALS	:	02	
			HOURS	**MARKS**
EVALUATION SYSTEM:	THEORY		3	100
	PRACTICAL		--	--
	ORAL		--	25
	TERM WORK		--	25
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**.**				

1. **Evolutionary Computation (EC):** The Historical Development of EC, Principles of Darwinian natural selection, Overview of Genetic Algorithms (GA), Genetic Programming (GP), Evolutionary Strategies (ES), Evolutionary Programming (EP), Features of Evolutionary Computation, Genes and Population Genetics, The Genotype/Phenotype Dichotomy, Broad Applicability, Hybridization with Other Methods, Parallelism, Applications of Evolutionary Computation.

2. **Genetic Algorithms (GA):** Overview of Conventional Optimization and Search Techniques, Simple Genetic Algorithm, Comparison with Other Optimization Techniques, Application of GA (Data analysis and prediction, Genetic algorithms in financial markets, GA in search, optimization, and machine learning), GA Terminologies: Individual, Genes, Fitness, Population, Encoding, Breeding, Termination Implicit Parallism, Case Study of Traveling Salesman Problem.

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.

4. **Genetic Programming (GP):** Introduction, Comparison with GA, Primitives of GP, Attributes, Terminals, Function set, Operators in GP, Steps in GP, Improving genetic programming with statistics, Genetic programming with tree genomes, linear genomes, and graph genomes, Implementation of genetic programming , GP Applications. Case study of Santa-Fe-trial, Case study of John Muir Trail.

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.

6. **Evolutionary Strategies (ES)**: Introduction, Comparison with GA & GP, Operators, Gaussian Mutation Operator, Intermediate Recombination Operator, Application of ES for Image Enhancement.

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.

9. **Application of Genetic Algorithm to Image Processing:** Designing Texture Filters with Genetic Algorithms, Genetic Algorithm Based Knowledge Acquisition on Image Processing, Object Localization in Images Using Genetic Algorithm, Problem Description, Image Preprocessing, The Proposed Genetic Algorithm Approach.

Text Book:

1. Sivanandam, Deepa "Introduction to Genetic Algorithm", Springer.
2. Melanie Mitchell: "An Introduction to Genetic Algorithm**"**, PHI.

Reference Books:

1. D. E. Goldberg, "Genetic Algorithms in Search, Optimisation and Machine Learning", Addison-Wesley.
2. Zbigniew Michalewics, "Genetic Algorithms + Data Structures = Evolution Programs", Springer Verlag, 1997.
3. Goldberg, "Genetic Algorithms", Pearson Eduction.
4. T. Back, D. B. Fogel and Michalewicz, "Evolutionary Computation1: Basic Algorithms and Operators", 2000.
5. A. E. Eiben and J.E. Smith, "Introduction to Evolutionary Computing", Springer, 2003.
6. W. Banzhaf et al. Morgan Kaufmann, "Genetic Programming: An Introduction", 1999.
7. J. R. Koza, "Genetic Programming: On the Programming of Computers by Means of Natural Selection", 1992
8. Vose Michael D, "The Simple Genetic Algorithm — Foundations And Theory", Phi.
9. Rajasekaran S., Pai G.A. Vijayalakshmi, "Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications", Phi.
10. Reeves, C. R. and Rowe, J. E., "Genetic Algorithms - Principles and Perspectives: A Guide to GA Theory", 2003.
11. Falkenauer. E., "Genetic Algorithms and Grouping Problems", 1998.

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.
- Finite Automata Construction Using Genetic Algorithm.
- Russian Roulette

Elective I - NANOTECHNOLOGY				
CLASS B.E. (INFORMATION TECHNOLOGY)				SEMESTER VII
HOURS PER WEEK	LECTURES	:	04	
	TUTORIALS	:	--	
	PRACTICALS	:	02	
			HOURS	**MARKS**
EVALUATION SYSTEM:	THEORY		3	100
	PRACTICAL		--	--
	ORAL		--	25
	TERM WORK		--	25
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 synthesi.

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, Mossbauer 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.

9. **Microelectronics:** Introduction, nano manufacturing product strategy, considering future impacts, identifying potential synergies, existing technologies, future nano electronic device technologies, photonics.

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 Medicens:** Developing of Nanomedicens, Nanosytems 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:

1. "Introduction to Nanotechnology", C. P. Poole and F. J. Owens, Wiley.
2. "Nano Materials", A. K. Bandyopadhyay, New Age International Publishers.
3. "Nano Essentials", T. Pradeep, TMH.
4. "Nanotechnology: A Gentle Introduction to the Next Big Idea", M. Ratner and D. Ratner, Pearson Education.
5. "Nanotechnology – Science, Innovation, and Opportunity", L. E. Foster, Pearson Eduction.
6. "Nanotechnology – the fun and easy way to explore the science of mater's smallest particles", Richard Booker and Earl Boysen, Wiley.
7. Nanotechnology: Content and Context, Christopher Kelty and Kristen Kulinowski.

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
HOURS PER WEEK	LECTURES	:	04	
	TUTORIALS	:	--	
	PRACTICALS	:	02	
			HOURS	**MARKS**
EVALUATION SYSTEM:	THEORY		3	100
	PRACTICAL		--	--
	ORAL		--	25
	TERM WORK		--	25
Prerequisite: Computer Graphics				
Objective: To understand fundamental concepts and principles of Geographical Information Systems.				

1. **Fundamentals of GIS:** Introduction, Definition of GIS, Evolution of GIS, Roots of GIS, Four M's, Definition, GIS Architecture, Models of GIS, Framework for GIS, GIS Categories, Map as a Model, Spatial Referencing System, Map Projections, Commonly Used Map Projections, Grid Systems, Cartographic Symbolization, Types of Maps, Typography, Map Design, Map Productions, Map Applications.

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.

3. **GIS Data Processing, Analysis and Visualization:** Raster based GIS data processing, Vector based GIS data processing, Human computer interaction and GIS, Visualization of geographic information, principles of cartographic design in GIS, Generation of information product, Image Classification and GIS, Visual Image Interpretation, Types of Pictorial Data Products, Image Interpretation Strategy, Image Interpretation Process, Overview of Image Interpretation Equipments.

4. **Terrain Mapping, Geocoding and Segmentation:** Interpolation, Visualization of Continuous Surfaces, Data Sources for Interpolations, Methods for Interpolations, Global Interpolation, Local Deterministic Methods, Comparison of Global and Local Method, Optimal Interpolation Using Geo Statistics – Kriging, Variogram, Geocoding, Applications of Geocoding, Dynamic Segmentation, Applications of Dynamic Segmentation.

5. **Remote Sensing Fundamentals:** Remote Sensing - Basic Principles, Electromagnetic Remote Sensing, Energy Sources, Energy Interactions with Earth's Surface Materials, Microwave Remote Sensing, The Radar Principle, Factors Affecting Microwave Measurements, Radar Wavebands, SLAR Systems, Sar, Interpreting Sar Images, Geometrical Characteristics, Remote Sensing, Platform and Sensors, Satellite System Parameters, Sensor Parameters, Imaging Sensor Systems, Earth Resources Satellites, Meteorological Satellites.

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:

1. Peter A Burrough and McDonell, "Principles of Geographical Information Systems", Oxford University Press, 1998.
2. M. N. DeMers, "Fundamentals of Geographic Information Systems", 3rd edition, Wiley.
3. M. Anji Reddi, "Remote Sensing and Geographical Information Systems", B. S. Publications, Second Edition, 2001.
4. George B Korte, "The GIS Book", Onword press, Thomson Learning, 5th Edition, 2003.
5. Kang-tsung Chang, "Introduction to Geographical Information Systems", Tata McGraw Hill, Third Edition, 2003.
6. Tor Bernhardsen, "Geographic Information Systems – An Introduction", 3rd edition, Wiley.
7. Ian Heywood, Sarah Cornelius & etal., "An Introduction to Geographical Information Systems", 2nd Edition, Pearson Education.

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	
HOURS PER WEEK	LECTURES	:	04	
	TUTORIALS	:	--	
	PRACTICALS	:	02	
			HOURS	**MARKS**
EVALUATION SYSTEM:	THEORY		3	100
	PRACTICAL		--	--
	ORAL		--	25
	TERM WORK		--	25
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.

3. **Problem Solving**: Solving problems by searching, Problem Formulation, Uninformed Search Techniques- DFS, BFS, Iterative Deepening, Comparing Different Techniques, Informed search methods – heuristic Functions, Hill Climbing, Simulated Annealing, A*, Performance Evaluation.

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.

8. **Planning:** Planning problem, Planning with State Space Search, Partial Order Planning, Hierarchical Planning, Conditional Planning.
9. **Uncertain Knowledge and Reasoning**: Uncertainty, Representing knowledge in an Uncertain Domain, Overview of Probability Concepts, Belief Networks, Simple Inference in Belief Networks

10. **Learning:** Learning from Observations, General Model of Learning Agents, Inductive learning, learning Decision Trees, Introduction to neural networks, Perceptrons, Multilayer feed forward network, Application of ANN, Reinforcement learning: Passive & Active Reinforcement learning.

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

Text Book:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 2nd Edition, Pearson Publication.

Reference Books:

1. George Lugar, "AI-Structures and Strategies for Complex Problem Solving", 4/e, 2002, Pearson Educations
2. Robert J. Schalkolf, Artificial Inteilligence: an Engineering approach, McGraw Hill, 1990.
3. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson.
4. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.
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.
7. M. Tim Jones, Artificial Intelligence – A System Approach, Infinity Science Press - Firewall Media.
8. Christopher Thornton and Benedict du Boulay, "Artificial Intelligence – Strategies, Applications, and Models through Search, 2nd Edition, New Age International Publications.
9. Elaine Rich, Kevin Knight, Artificial Intelligence, Tata McGraw Hill, 1999.
10. David W. Rolston, Principles of Artificial Intelligence and Expert System Development, McGraw Hill, 1988.

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				
CLASS B.E. (INFORMATION TECHNOLOGY)				SEMESTER VII
HOURS PER WEEK	LECTURES	:	--	
	TUTORIALS	:	--	
	PRACTICALS	:	04	
			HOURS	**MARKS**
EVALUATION SYSTEM:	THEORY		--	--
	PRACTICAL		--	--
	ORAL		--	25
	TERM WORK		--	25

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