Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to University of Pune)

Structure & Syllabus of

B.Tech. (Computer Engineering)

Pattern 'A-14'
Effective from Academic Year 2015-16

Prepared by: - Board of Studies in Computer Engineering

Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Signed by

Chairman – BOS **Chairman – Academic Board**

Content

Program Educational Objectives (PEO)
B.Tech (Computer Engineering)

List of Programme Education Objectives [PEO] and Programme Outcomes [PO]

PEO	PEO Statement
PEO1	**Preparation:** Demonstrate application of sound engineering foundations to be a committed technology workforce
PEO2	**Core competence:** Apply mathematical and computing theory knowledge base to provide realistic computer engineering solutions
PEO3	**Breadth:** Exhibit problem solving skills and engineering practices to address problems faced by industry with innovative methods, tools and techniques
PEO4	**Professionalism:** Adopt professional and ethical practices adopting effective guidelines to acquire desired soft skills in societal and global context
PEO5	**Learning Environment:** Aim for continuing education and entrepreneurship in emerging areas of computing

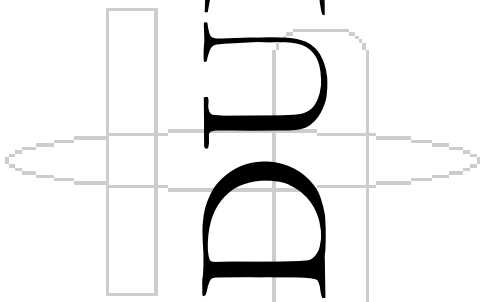
List of Programme Outcomes [PO]

Graduates will be able

PO	PO Statement
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering

	solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO	**PSO Statement**
PSO1	Select and incorporate appropriate computing theory principles, data structures and algorithms, programming paradigms to innovatively craft scientific solution addressing complex computing problems.
PSO2	Adapt to new frontiers of science, engineering and technology by getting acquainted with heterogeneous computing environments and platforms, computing hardware architectures and organizations through continuous experimentation.
PSO3	Conceive well-formed design specifications and constructs assimilating new design ideas and facts for identified real world problems using relevant development methodologies and practices, architecture styles and design patterns, modeling and simulation, and CASE tools.
PSO4	Exercise research and development aptitude focusing knowledge creation and dissemination through engineering artifacts construction, preparation and presentation of engineering evidences using procedures, techniques, guidelines, and standards considering technology migration and evolution.

MODULE VII



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B. Tech. Structure with effect from Academic Year 2015-16

Module VII

Code	Subject	Type	Teaching Scheme			Assessment Scheme				
			Theory	Project	Lab	ISA				Credits
						MSE	HA	L/P	ESE	
CS401THL	Artificial Intelligence (THL)	S_1	3		2	35	-	30	35	4
CS403THL	Compiler Design(THL)	S_2	3		2	35	-	30	35	4
CS402THL	Network Security	S_3	3		2	35	-	30	35	4
CS404THL	Data Science THL	S_4	3	-	2	35	-	30	35	4
CS405PRJ	Project-I	P	-	10	-					5
		TOTAL	12	10	8					21

FF No. : 654 A

CS401THL: Artificial Intelligence

Credits: 04 **Teaching Scheme: - Theory: 3 Hrs/Week**

Lab:2 Hrs/Week

Prerequisites:

Unit 1: Fundamentals of Artificial Intelligence (6 Hours)

Introduction, A.I. Representation, Non-AI &AI Techniques, Representation of Knowledge, Knowledge Base Systems, State Space Search, Production Systems, Problem Characteristics, types of production systems, Intelligent Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation

Unit 2: Uninformed Search Strategies (7Hours)

Formulation of real world problems, Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Depth First Search, Bidirectional Search, Comparison of Uninformed search Strategies, Searching with partial information, Sensorless problems, Contingency problems

Unit 3: Informed Search Strategies (8 Hours)

Generate & test, Hill Climbing, Best First Search, A* and AO* Algorithm, Constraint satisfaction, Game playing: Minimax Search, Alpha-Beta Cutoffs, Waiting for Quiescence

Unit 4: Knowledge Representation (7 Hours)

Knowledge based agents, Wumpus world. Propositional Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining.First order Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining.
Basics of PROLOG: Representation, Structure, Backtracking.
Expert System:Case study of Expert System in PROLOG

Unit 5: Planning (5 Hours)

Blocks world, STRIPS, Implementation using goal stack, Partial Order Planning, Hierarchical planning, and least commitment strategy. Conditional Planning, Continuous Planning

Unit 6: Uncertainty (7Hours)

Non Monotonic Reasoning, Logics for Non Monotonic Reasoning, Forward rules and Backward rules, Justification based Truth Maintenance Systems, Semantic Nets Statistical Reasoning, Probability and Bayes' theorem, Bayesian Network, Markov Networks.

List of Practical

1. Implement Non-AI and AI Techniques
2. Implement any one Technique from the following
   a. Best First Search & A* algorithm
   b. AO* algorithm
   c. Hill Climbing
3. Implement Constraint Satisfaction Algorithm
4. Implement real time applications in Prolog.
5. Expert System in Prolog
6. Implement any two Player game.
7. Simulate Blocks world problem using goal stack planning

Text Books

1. *Elaine Rich and Kevin Knight: "Artificial Intelligence." Tata McGraw Hill*
2. *Stuart Russell & Peter Norvig : "Artificial Intelligence : A Modern Approach", Pearson Education, 2nd Edition.*

Reference Books

1. *Ivan Bratko : "Prolog Programming For Artificial Intelligence" , 2nd Edition Addison Wesley, 1990.*
2. *Eugene, Charniak, Drew Mcdermott: "Introduction to Artificial Intelligence.", Addison Wesley*
3. *Patterson: "Introduction to AI and Expert Systems", PHI*
4. *Nilsson : "Principles of Artificial Intelligence", Morgan Kaufmann.*
5. *Carl Townsend, "Introduction to turbo Prolog", Paperback, 1987*

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents capable of problem formulation.
2. Evaluation of different uninformed search algorithms on well formulated problems along with stating valid conclusions that the evaluation supports.
3. Design and Analysis of informed search algorithms on well formulated problems.
4. Formulate and solve given problem using Propositional and First order logic.
5. Analyze the AI problem using different planning techniques
6. Apply various symbolic knowledge representations to specific multidisciplinary domains and reasoning tasks of a software agent.

FF No. : 654

CS403THL:Compiler Design

Credits: 4 **Teaching Scheme: 3 Hours / Week**
Lab:2 Hours / Week

Unit 1: Lexical Analysis (4 Hours)

Introduction to Compiler, Phases and Passes, Bootstrapping, Cross Compiler, Role of a Lexical Analyzer, Specification and Recognition of Tokens, Look ahead operation, Lexical Phase errors, LEX tool.

Unit 2: Syntax and Semantic Analysis (8 Hours)

Expressing Syntax: CFG, Top-Down Parsing: Recursive Descent, Predictive Parsers.
Bottom-Up Parsing: LR Parsers: Constructing SLR parsing tables, Constructing Canonical LR parsing tables, Constructing LALR parsing tables, Using ambiguous grammars, Parser generator YACC, Symbol-Table Structure, Error Detection & Recovery strategies.

Unit 3: Syntax-Directed Translation and Intermediate Code Generation (9 Hours)

Syntax-Directed Definitions, Attribute grammar, Dependency graphs, S and L attributed grammar, Bottom-Up Evaluation, Top-Down Translation,
Intermediate Representations – Need, Forms, SDT scheme for Intermediate Code Generation of assignment statement, declaration statement.
Control flow translation of Boolean expression (Back patching), if, if-else statement, while statement, array assignment.
Error Detection & Recovery: semantic errors.

Unit 4: Code Generation (6 Hours)

Issues in Code Generation, Target Language, Basic Blocks and Flow Graphs, Next-use information, Simple Code generator, DAG representation of Basic Blocks, Register allocation and Assignment, Peephole Optimization.

Unit 5: Code Optimization (8 Hours)

Introduction: Principal Sources of Optimization, Optimization of basic Blocks (local and global) Data Flow Analysis: data flow equations, reaching definitions, live variable analysis, available expressions, Loops in flow graphs: Dominators, Back edges and Reducibility.

Unit 6: Introduction to compilation for modern architectures (5 Hours)

Automatic Parallelization, Instruction Scheduling, Software Pipelining.
Introduction to advanced topics – Just-In-Time Compilation, Dynamic compilation, Interpreters (JVM/ Dalvik), Cross compilation using XMLVM, Case studies : GCC, g++, LLVM.

List of Practical

1. Assignment to understand basic syntax of LEX specifications, built-in functions and Variables.
2. Implement a Lexical Analyzer using LEX for a subset of C.
3. Implement a parser for an expression grammar using YACC and LEX. Extend to handle variables with single letter names.
4. Generate and populate appropriate Symbol Table.
5. Write a YACC specification to check the syntax of following of 'C' language statements with error detection.
   a.) if and if…else
   b.) for
   c.) switch…. case
6. Implementation of Semantic Analysis Operations (like type checking, verification of function parameters, variable declarations and coercions) possibly using an Attributed Translation Grammar.
7. Implement the front end of a compiler that generates the three address code for a simple language.
8. Generate an appropriate Target Code from the given intermediate code assuming suitable processor details.
9. Implement Common Sub-expression Elimination and Copy Propagation optimizations for an input 3-address code.
10. Implement Dead-Code Elimination, Loop optimizations for input 3-address code.

Text Books:

1. *A. V. Aho, M. S. Lam, R. Sethi, J. D. Ullman; "Compilers: Principles, Techniques and Tools"; Addison Wesley, ISBN 978-81317-2101-8, Second Edition, 2007.*
2. *K. Cooper, L. Torczon, Morgan Kaufmann; "Engineering a Compiler", ISBN 1-55860-698-X, First Edition, 2003.*

Reference Books:

1. *S. S. Muchnik, Morgan Kaufmann; "Advanced Compiler Design and Implementation", ISBN 8178672413, First Edition, 1997.*
2. *K. Muneeswaran : " Compiler Design", ISBN 978-0-19-806664-4, Oxford University Press,2013*
3. *J. R. Levine, T. Mason, D. Brown ;"Lex & Yacc", O'Reilly, ISBN 1-56592-000-7, Second Edition, 1992.*

Course Outcomes:

The student will be able to –

1. Identify and Interpret the different phases of a compiler and their functioning.
2. Design a well-structured system to ensure the syntactic correctness of a program.
3. Deploy efficient techniques for semantic analysis to generate intermediate code.
4. Propose techniques to generate machine code which conforms to the target machine specifications.
5. Apply code optimization transformations to improve the performance of target code.
6. Acquaint themselves with the knowledge of recent trends in compilation.

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CS402THL:NETWORK SECURITY

Credits: 4 **Teaching Scheme: 3 Hours / Week**
Lab:2 Hours / Week

Prerequisites: Computer Networks.

Unit 1: **(7 Hours)**

Introduction

Introduction to Security: Vulnerabilities, Threats, Threat Modeling, Risk, attack and attack types, Avoiding attacks, Security services.
Trustworthiness, Ethical issues and practices, Tradeoffs of balancing key security properties - Confidentiality, Integrity, Availability.
Protocol Vulnerabilities: DoS and DDoS, session hijacking, ARP spoofing, Pharming attack, Dictionary Attacks.
Software vulnerabilities: Phishing, buffer overflow, Cross-site scripting attack, Virus and Worm Features, Trojan horse, Social engineering attacks, ransomware, SYN-Flooding, SQL- injection, DNS poisoning, Sniffing
Bitcoin and Crypto currency system

Unit 2: **(8 Hours)**

Private key cryptography

Mathematical background for cryptography: modulo arithmetic, GCD (Euclids algorithm), algebraic structures (Groups, Rings, Fields, Polynomial Field).
Role of random numbers in security, Importance of prime numbers
Data Encryption Standard: Block cipher, Stream cipher, Feistel structure, round function, block cipher modes of operation, S-DES, Attacks on DES, S-AES, AES.
Chinese remainder theorem

Unit 3: **(7 Hours)**

Public key cryptography

RSA: RSA algorithm, Key generation in RSA, attacks on RSA.
Diffie-Hellman key exchange: Algorithm, Key exchange protocol, Attack.
Elliptic Curve Cryptography (ECC): Elliptic Curve over real numbers, Elliptic Curve over Zp, Elliptic Curve arithmetic. Diffie-Hellman key exchange using ECC.

Unit 4: **(8 Hours)**

Authentication and access control

Message authentication and Hash Function. Authentication: One-Way Authentication, Mutual Authentication, SHA-512, Centralized Authentication, The Needham-Schroeder Protocol.
Authentication Applications: Kerberos, X.509 authentication service, public key infrastructure.
Access Control in Operating Systems: Discretionary Access Control, Mandatory Access Control, Role Based Access Control.

Unit 5: **(6 Hours)**

Security application and design

Part A: Network layer security: IPSec for IPV4 and IPV6.
Transport layer security: SSL and TLS.
Application layer security: Security services, S/MIME, PGP, Https, Honey pots.
Security design: End-to-end security, Security composability, Open design, Cost and tradeoffs

Unit 6: **(5 Hours)**

Cyber Security:

Part A: Cyber Attack, Cyber Reconnaissance, Crimes in Cyber Space-Global Trends & classification, e-commerce security, Computer forensics, facebook forensic, mobile forensic, cyber forensic, digital forensic, Introduction to MQTT and CoAP for IoT.

List of Practicals:

1. Implementation of Caesar and Vigenere Cipher
2. Implementation of Playfair Cipher
3. Implementation of Hill Cipher
4. Implementation of S-RC4
5. Implementation of S-DES
6. Implementation of S-AES
7. Implementation of RSA.
8. Implementation of Diffie-Hellman key exchange
9. Implementation of ECC algorithm.
10. Study of Nessus tool

Text Books

1. *"Cryptography and Network Security-Principles and Practices" by William Stallings, Pearson Education, 2006, ISBN 81-7758-774-9, 4th Edition.*
2. *"Network Security and Cryptography", by Bernard Menezes, Cengage Learning, 2010, ISBN 81-315-1349-1, 1st Edition.*

Reference Books

1. *"Computer Security: Art and Science", by Matt Bishop, Pearson Education, 2002, ISBN 0201440997, 1st Edition.*
2. *"Network security, private communication in a public world", by Charlie Kaufman, Radia Perlman and Mike Spencer, Prentice Hall, 2002, ISBN 9780130460196, 2nd Edition.*
3. *"Cryptography and Information Security", by V.K. Pachghare, PHI, 2015, ISBN-978-81-203-5082-3, Second Edition.*

Additional Reading

1."Security architecture, design deployment and operations", by Christopher M. King, Curtis Patton and RSA press, McGraw-Hill, 2001, ISBN 0072133856, 1st Edition.
2 'Inside Network Perimeter Security" by Stephen Northcott, Leny Zeltser, et al, Pearson Education Asia, ISBN 8178087618, 1st Edition.

Course Outcomes

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

1. Analyze cryptographic techniques using a mathematical approach by examining nature of attack.
2. Establish type of attack on a given system.
3. Identify different types of attacks.
4. Justify various methods of authentication and access control for application of technologies to various sections of industry and society.
5. Design a secure system for protection from the various attacks for 7 layer model by determining the need of security from various departments of an organization.
6. Estimate future needs of security for a system by researching current environment on a continuous basis for the benefit of society.

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CS404THL: Data Science

Credits:04 **Teaching Scheme: 3 Hours / Week**
Lab:2 Hours /Week

Unit 1: Data Pre-processing (7 Hours)

Mechanisms of data collection and challenges involved therein. Typical preprocessing operations: combining values into one, handling incomplete or incorrect data, handling missing values, recoding values, sub-setting, sorting, transforming scale, determining percentiles, data manipulation, removing noise, removing inconsistencies, transformations, standardizing, normalizing - min-max normalization, zscore standardization, and rules of standardizing data.

Descriptive Statistics: role of statistics in analytics, types of data (scales of measurement - NOIR), data distributions, measures of variability (range, quartile, five number summary, variance, std dev, coeff of variation), analyzing distributions, Chebychev'sInequality, measures of shape (skewness, kurtosis), measures of association (covariance,correlation), outliers

Unit 2: Inferential Analytics (7 Hours)

Role of probability in analytics. Need for sampling, generating samples, sampling and non-sampling error. Sampling Distribution of Mean, Central Limit Theorem, Standard Error.

Estimation: Point and Interval Estimates, Confidence Intervals, level of confidence,sample size.

Hypothesis Testing: basic concepts, Errors in hypothesis testing, Power of test, Level of significance, p-value, general procedure for hypothesis testing. Parametric tests – z test, t test, chi-square test. Hypothesis testing of means: two tailed and one-tailed tests. Chi square test for independence and goodness of fit. Hypothesis testing for comparing two related samples. Limitations of hypothesis testing. Picking up the right test for a given scenario.

Unit 3: Predictive Analytics :Regression (7 Hours)

Correlation and regression, Simple Linear Regression Model, Least Squares Method. Making Data Models more flexible, making data models more selective, dealing with Categorical variables, Interpretation of regression coefficients, fine tuning data models (assessing the fit, model fitting), Coefficient of determination, Significance tests, Residual analysis, Prediction intervals. Model evaluation techniques. Assumptions of regression analysis.

Unit 4: Predictive Analytics: Supervised Method (7 Hours)

Bias-Variance Dichotomy,Model Validation Approaches,Logistic Regression Linear Discriminant Analysis,Quadratic Discriminant Analysis,Regression and Classification Trees,Support Vector Machines, Ensemble Methods: Random Forest Neural Networks,Deep learning.

Unit 5: Predictive Analytics: Unsupervised Method (6 Hours)
Similarity Measures, Design of recommender systems, user based and item based Collaborative filtering, Clustering, Associative Rule Mining

Unit 6: Prescriptive Analytics (6 Hours)
Creating data for analytics through designed experiments, creating data for analytics through Active learning, creating data for analytics through Reinforcement learning

List of Practicals

A group mini-project: take a real world data analysis problem and solve it using the above learned concepts

a. Getting Data from varied sources
b. Data massaging to prepare it for analysis
c. Generating visualizations to interpret descriptive analysis
d. Implementing sampling and estimation techniques e. Regression analysis on data
f. Hypothesis testing

Text Books:

1. "Business Analytics" by James R Evans, Pearson
2. Hastie, Trevor, et al.The elements of statistical learning.Vol. 2. No. 1. New York: springer, 2009.

Reference Books:

1.Montgomery, Douglas C., and George C. Runger.Applied statistics and probability for engineers. John Wiley & Sons, 2010
2."Data Mining: Concepts and Techniques", Jiawei Han and Micheline Kamber, Morgan Kaufman, ISBN 978-81-312-0535-8, 2nd Edition
3. "Fundamentals of Business Analytics", by R. N. Prasad, Seema Acharya,ISBN: 978-81-256-3203-2,Wiley-India
4."Business Intelligence for Dummies"

Course Outcomes:
The student will be able to –

1. Understand the process of converting data into a required format required for particular analysis.
2. Analyze data, test claims, and draw valid conclusions using appropriate statistical methodology.
3. Utilize statistical tools in deriving insights from data .
4. Apply analytic techniques and algorithms (including statistical and data mining approaches) to large data sets to extract meaningful insights.
5. Use appropriate resources to research, develop and contribute to advances and trends within the field of Data Science.
6. Interpret and present visually, orally and in written form, valid conclusions drawn from data analysis.

CS405PRJ: PROJECT -I

Credits: 05 **Teaching Scheme: -** Practical 8 Hrs/Week

Aim

This course addresses the issues associated with the successful management development project. The course emphasizes project life cycle phases requirement engineering, system analysis and system design. A further aim is for students to heighten personal awareness of the importance of developing strategies for themselves and their career. The Project Work can lead to:

a. Transform existing systems into conceptual models.
b. Transform conceptual models into determinable models.
c. Use determinable models to obtain system specifications.
d. Select optimum specifications and create physical models.
e. Apply the results from physical models to create real target systems.

Overview of the Course:

1. The Student Project Group is expected to make a survey of situation for identifying the requirements of selected Technological Problem. The Student Project Group will be monitored by Internal Guides and External Guides (if any).
2. The project requires the students to conceive, design, implement and operate a mechanism (the design problem). The mechanism may be entirely of the student's own design, or it may incorporate off-the-shelf parts. If the mechanism incorporates off-the-shelf parts, the students must perform appropriate analysis to show that the parts are suitable for their intended purpose in the mechanism.
3. The project must be open-ended – meaning that there is not a known correct answer to the design problem. Students are expected to apply their creativity (simply copying or re-creating something that already exists is not acceptable).
4. The project must have an experimental component. Students must conceive, design, implement and operate an appropriate experiment as part of the project. The experiment might be to collect data about some aspect of the design (i.e., to verify that the design will work as expected). Alternatively, the experiment could be to verify that the final mechanism performs as expected.
5. Upon receiving the approval, the Student Project Group will prepare a preliminary project report consisting Requirement Definition Document, Feasibility Study Document, System Requirement Specification, System Analysis Document, Preliminary System Design Document. All the documents indicated will have a prescribed format.
6. The Project Work will be assessed jointly by a panel of examiners having more than Five Years experience. The Project Groups will deliver the presentation of the Project Work which will be assessed by the panel.
7. The Student Project Group needs to actively participate in the presentation. The panel of examiners will evaluate the candidate's performance based on

presentation skills, questions based on the Project Work, understanding of the Project, analysis and design performed for the project.

8. The Student Project Groups are expected to work on the recommendations given by the panel of examiners. In no case any variation in Project Theme will be permitted.

Assessment Scheme

Sr. No.	Content	Marks
1	Synopsis	5
2	Feasibility Study	5
3	System Requirement Specification	5
4	System Analysis Document	20
5	Use Case Diagram	10
6	Detailed Design Plan	

Note:

The student needs to identify a technological problem in the area of Computer Engineering or Information Technology of their choice and address the problem by formulating a solution for the identified problem. The project work needs to be undertaken by a group of maximum FOUR and minimum of THREE students. The Project work will be jointly performed by the project team members.

The Project Group will prepare a synopsis of the project work which will be approved by the concerned faculty member. The project should not be a reengineering or reverse engineering project. In some cases, reverse engineering projects will be permissible based on the research component involved in it. The project work aims at solving a real world technical problem. Hence ample literature survey is required to be done by the students. Application-oriented projects will not be acceptable. Low-level custom User Interface development and its allied mapping with a particular technology will not be accepted.

Following is the list of recommended domains for Project Work:

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Model the Real World Problem
2. Identify the Design within Specification and Available Resources
3. Realise the Solution within Defined references
4. Defend his Design with Technical and Ethical reasoning
5. Adapt to changing Technological and Human resource advances
6. Use the gained knowledge for other Real World Problems

MODULE VIII

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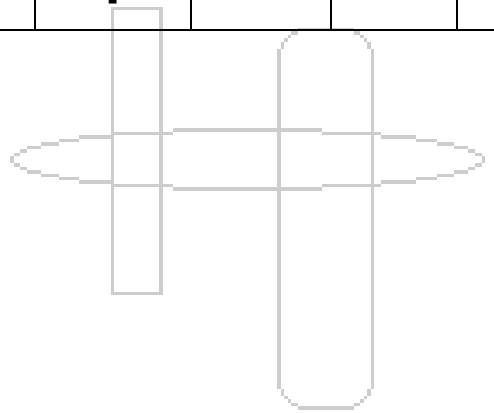
B. Tech. Structure with effect from Academic Year 2015-16

Module VIII

Code	Subject	Type	Teaching Scheme			Assessment Scheme				
			Theory	Project	Lab	ISA				Credits
						MSE	HA	L/P	ESE	
CS415INT	Internship	P	-	-	-	-	-	-	-	21
		TOTAL	-	-	-					21



CS415INT: INTERNSHIP

Credits: 21 **Teaching Scheme: -** Practical 8 Hrs/Week

Students pursuing summer internship should undergo a minimum 8 weeks training from a reputed research organization or an IT industry. Students are required to present their work upon successful completion of the internship.

Course Outcomes:
Upon completion of the course, engineering graduates will be able to

CO1	Analyse real life industry problems
CO2	Create solutions to problems with the help of latest tools
CO3	Maintain work ethics in organised sector
CO4	Cooperate with diverse teams and effectively communicate with all the stake holders
CO5	Adapt to changing work environments
CO6	Produce solutions within the technological guidelines and standards

B. Tech. Structure with effect from Academic Year 2015-16

Module VIII

Code	Subject	Type	Teaching Scheme			Assessment Scheme				
			Theory	Project	Lab	ISA				Credits
						MSE	HA	L/P	ESE	
	EL-I	S_1	3	2	-	35	-	30	35	4
	EL-II	P	3	2	-	35	-	30	35	4
	EL-III		3	2	-	35	-	30	35	4
	EL-IV		3	2	-		-	30		4
CS416PRJ	Project-II	P	-	10	-	-	-	-	-	5
		TOTAL	12	10	-					21

FF No. : 654

CS416PRJ:: PROJECT STAGE 2

Credits: 04 **Teaching Scheme: -** Practical 8 Hrs/Week

Aim

This course addresses the issues associated with the successful management development project. The course emphasizes project life cycle phases requirement engineering, system analysis and system design. A further aim is for students to heighten personal awareness of the importance of developing strategies for themselves and their career. The Project Work can lead to:

f. Transform existing systems into conceptual models.
g. Transform conceptual models into determinable models.
h. Use determinable models to obtain system specifications.
i. Select optimum specifications and create physical models.
j. Apply the results from physical models to create real target systems.

Overview of the Course:

1. The Student Project Group is expected to make a survey of situation for identifying the requirements of selected Technological Problem. The Student Project Group will be monitored by Internal Guides and External Guides (if any).
2. The project requires the students to conceive, design, implement and operate a mechanism (the design problem). The mechanism may be entirely of the student's own design, or it may incorporate off-the-shelf parts. If the mechanism incorporates off-the-shelf parts, the students must perform appropriate analysis to show that the parts are suitable for their intended purpose in the mechanism.
3. The project must be open-ended – meaning that there is not a known correct answer to the design problem. Students are expected to apply their creativity (simply copying or re-creating something that already exists is not acceptable).
4. The project must have an experimental component. Students must conceive, design, implement and operate an appropriate experiment as part of the project. The experiment might be to collect data about some aspect of the design (i.e., to verify that the design will work as expected). Alternatively, the experiment could be to verify that the final mechanism performs as expected.
5. Upon receiving the approval, the Student Project Group will prepare a preliminary project report consisting Requirement Definition Document, Feasibility Study Document, System Requirement Specification, System Analysis Document, Preliminary System Design Document. All the documents indicated will have a prescribed format.
6. The Project Work will be assessed jointly by a panel of examiners having more than Five Years experience. The Project Groups will deliver the presentation of the Project Work which will be assessed by the panel.

7. The Student Project Group needs to actively participate in the presentation. The panel of examiners will evaluate the candidate's performance based on presentation skills, questions based on the Project Work, understanding of the Project, analysis and design performed for the project.
8. The Student Project Groups are expected to work on the recommendations given by the panel of examiners. In no case any variation in Project Theme will be permitted.

Assessment Scheme

Sr. No.	Content	Marks
1	Synopsis	5
2	Feasibility Study	5
3	System Requirement Specification	5
4	System Analysis Document	10
5	System Implementation	25
6	System Testing	25
7	Project Presentation	15

Note:
The student needs to identify a technological problem in the area of Computer Engineering or Information Technology of their choice and address the problem by formulating a solution for the identified problem. The project work needs to be undertaken by a group of maximum FOUR and minimum of THREE students. The Project work will be jointly performed by the project team members.
The Project Group will prepare a synopsis of the project work which will be approved by the concerned faculty member. The project should not be a reengineering or reverse engineering project. In some cases, reverse engineering projects will be permissible based on the research component involved in it. The project work aims at solving a real world technical problem. Hence ample literature survey is required to be done by the students. Application-oriented projects will not be acceptable. Low-level custom User Interface development and its allied mapping with a particular technology will not be accepted.
Following is the list of recommended domains for Project Work:

Course Outcomes:
Upon completion of the course, graduates will be able to -

7. Model the Real World Problem
8. Identify the Design within Specification and Available Resources
9. Realise the Solution within Defined references
10. Defend his Design with Technical and Ethical reasoning

Adapt to changing Technological and Human resource advancesUse the gained knowledge for other Real World Problems

ELECTIVE List with Project

FF No. : 654

CS420THP: Cloud Computing

Credits: 3

Teaching Scheme:
Theory: 3 Hours / Week
Project Based Lab: 2 Hours/Week

Unit 1: Introduction to Cloud Computing (6 Hours)
Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud Service Models: SaaS, PaaS, IaaS, Cloud provider, benefits and limitations, Deploy application over cloud, Cloud computing vs. Cluster computing vs. Grid computing. Open Stack vs Cloud Stack, Role of Open Standards.

Unit 2: Resource Virtualization (6 Hours)
Infrastructure as a Service (IaaS): Virtualization Technology: Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine (VM). Virtualization: Server, Storage, Network. Virtual Machine (resource) provisioning and manageability, storage as a service, Data storage in cloud computing(storage as a service).
Multitenant software: Multi-entity support, Multi-schema approach, Multitenance using cloud data stores, Data access control for enterprise applications.

Unit 3: Data in the cloud (6 Hours)
Cloud file-systems: GFS and HDFS, BigTable, Features and comparisons among GFS, HDFS etc.
Databases on Cloud: NoSQL, MogoDB, HBase, Hive, Dynamo, Graph databases

Unit 4: Map Reduce (8 Hours)
Map-Reduce and extensions: Parallel computing, The map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Example/Application of Map-reduce.

Unit 5: Cloud Service Models (8 Hours)
PaaS: Introduction to PaaS - What is PaaS, Service Oriented Architecture (SOA). Cloud Platform and Management - computation, storage
SaaS: Introduction to SaaS, Web services, Web 2.0, Web OS, Case Study on SaaS

Unit 6: Cloud Management and Security (6 Hours)
Service Management in Cloud Computing: Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data - Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing
Cloud Security: Infrastructure Security - Network level security, Host level security, Application level security. Data security and Storage - Data privacy and security Issues, Jurisdictional issues raised by Data location: Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations

List of Project

1. Implement application using NoSQL
2. Implement application using Map-Reduce
3. Implement SaaS application and host it on Cloud Platform

Text Books:

1. Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, "Cloud Computing for Dummies", Wiley India.
2. Ronald Krutz and Russell Dean Vines, "Cloud Security", Wiley-India

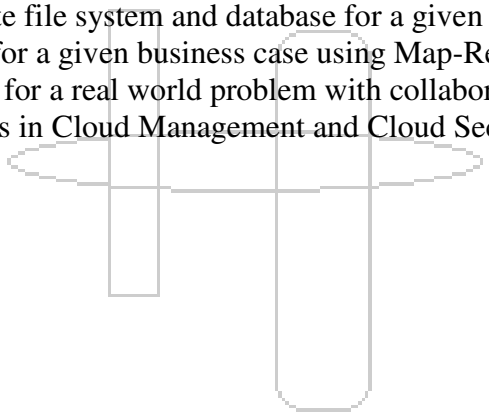
Reference Books:

1. *Barrie Sosinsky, "Cloud Computing Bible", Wiley India*
2. Antohy T Velte, et.al, "Cloud Computing : A Practical Approach", McGraw Hill.
3. McGraw Hill, "Cloud Computing", Que Publishing.

Course Outcomes:

The student will be able to –

1. Illustrate the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
2. Investigate the resource virtualization technique for a given business case
3. Choose the appropriate file system and database for a given business case
4. Develop a algorithm for a given business case using Map-Reduce model
5. Build a SaaS solution for a real world problem with collaborative efforts
6. Identify the challenges in Cloud Management and Cloud Security



FF No. : 654

CS422THP: Distributed Computing

Credits: 04

Teaching Scheme:
Theory: 3 Hours / Week
Project Based Lab: 2 Hours/Week

Unit 1: Introduction (8 Hours)

Introduction to Distributed Systems, Motivation, Examples of Distributed Systems, Design issues, Hardware and Software Concepts, Applications.
System models: Introduction, Architectural Model, Fundamental Models.
Introduction to Hadoop/MapReduce.

Unit 2: Communication (8 Hours)

Interprocess Communication: Communication primitives: Blocking/non-blocking, Synchronous/Asynchronous primitives, Message Oriented Communication, Stream Oriented Communication.
RPC: RPC Model, Transparencies in RPC, Implementation, Stub Generation, RPC Messages, Server Management, Call Semantics, Communication Protocols.
Distributed Objects: Remote Method Invocation, Java RMI

Unit 3: Synchronization (6 Hours)

Time and Global States: Clock Synchronization, Logical Clocks, Scalar time, Vector time, Global State.
Election Algorithm: Bully Algorithm, Ring Algorithm.
Mutual Exclusion: Requirements, Performance metrics, Centralized algorithm, Lamport's algorithm, Distributed algorithm, Token Ring algorithm.

Unit 4: Distributed Transaction and Deadlock (6 Hours)

Distributed Transaction: Transaction Model, Classification, Implementation, Concurrency Control: Serializability, 2 Phase Locking, Strict 2 PL, Distributed Commit: 2 Phase Commit, Recovery.
Distributed Deadlock: Avoidance, Prevention, Detection: Classification of distributed deadlock detection algorithms, Centralized Approach, Hierarchical Approach, WFG Based Fully Distributed, Deadlock Recovery

Unit 5: Fault Tolerance (7 Hours)

Introduction to Fault Tolerance, Failure Models, Failure Masking by Redundancy: Triple Modular Redundancy.
Process Resilience: Design Issues, Failure Masking and Replication, Agreement in Faulty Systems: Two Army Problem, Byzantine Generals Problem.
Reliable Client Server Communication, Reliable Group Communication.

Unit 6: Distributed Shared Memory (5 Hours)

Introduction, Advantages, Disadvantages, Architecture of DSM Systems, Design and Implementation issues of DSM: Granularity, Structure of Shared Memory Space, Memory Consistency Models, Replacement Strategies, Thrashing.
Case study: Google File System

List of Project areas:

1. Design client-server application using Java RMI/RPC.
2. Develop solution for Clock Synchronization, Election Algorithm and Mutual Exclusion in Distributed system.
3. Implementation of different deadlock detection algorithms in Distributed system.

Text Books:

1. *Andrew S. Tanenbaum & Maarten Van Steen; "Distributed Systems Principles and Paradigms"; 5th Edition, Prentice Hall India.*
2. *Ajay Kshemkalyani, Mukesh Singhal; "Distributed Computing: Principles, Algorithms, and Systems"; 2008, Cambridge University Press.*

Reference Books:

1. *Pradeep K. Sinha; "Distributed Operating Systems Concepts and Design;1997, Prentice Hall India.*
2. *George Coulouris, Jean Dollimore & Tim Kindberg; "Distributed Systems – Concepts and Design"; 5th Edition, Addison-Wesley.*
3. *Mukesh Singhal, Niranjan G. Shivaratri; "Advanced Concepts In Operating Systems",2001, McGrawHill.*
4. *M. L. Liu ;"Distributed Computing: Principles and Applications";2004, Addison-Wesley.*

Course Outcomes:

The student will be able to –
1. Identify the basic principles, design issues and architectural aspects of distributed systems.
2. Analyze the different techniques used for Communication in distributed system.
3. Develop the solutions for Clock synchronization, Mutual exclusion in distributed system.
4. Construct an optimal and cost-effective solution for Distributed transaction and Deadlock.
5. Use and apply important methods in distributed systems to support Scalability and Fault tolerance.
6. Gain knowledge on Distributed File System and design issues of Distributed Shared Memory.

FF No. : 654

CS423THP: Ubiquitous Computing

Credits: 4

Teaching Scheme:
Theory: 3 Hours / Week
Project Based Lab: 2 Hours/Week

Unit 1: Introduction to Ubiquitous Computing (7 Hours)
Concept of Distributed Computing, Mobile Computing, Pervasive Computing, Wearable Computing, Modeling the Key Ubiquitous/Pervasive Computing Properties, Mobile Adaptive Computing , Mobility Management and Caching.

Unit 2: Pervasive Computing Devices (7 Hours)
Smart Environment: CPI and CCI Smart Devices: Application and Requirements, Device Technology and Connectivity, Human Computer Interaction.

Unit 3: Human Computer Interaction (6 Hours)
Explicit HCI, Implicit HCI, User Interface and Interaction for four hand-held widely used devices, Hidden UI via basic smart devices, Hidden UI via wearable and Implanted devices, Human centered design, user models.

Unit 4: Middleware for Pervasive Computing (6 Hours)
Adaptive middleware, Context aware middleware, Mobile middleware, Service Discovery, Mobile Agents.

Unit 5: Security in Pervasive Computing (7 Hours)
Security and Privacy in Pervasive Networks, Experimental Comparison of Collaborative Defense Strategies for Network Security.

Unit 6: Challenges and Outlook (7 Hours)
Overview of challenges, smart devices, Smart Interaction, Smart physical environment device interaction, Smart human-device interaction, Human Intelligence versus machine intelligence, social issues.
Case Study- Wearable Computing/ Cyber Physical System.

List of Project areas:

1. Context-aware computing
2. Proactive computing
3. Mobile and real-time data/media management
4. Multimedia data and sensing dissemination
5. Mobility management
6. Location-dependent query processing, and positioning.

Text Books:

1. *Stefan Poslad, "Ubiquitous Computing, Smart devices, environment and interaction," Wiley.*
2. *Frank Adelstein, Sandeep Gupta, Golden Richard III, Loren Schwiebert, "Fundamentals of Mobile and Pervasive Computing," Tata McGraw Hills.*

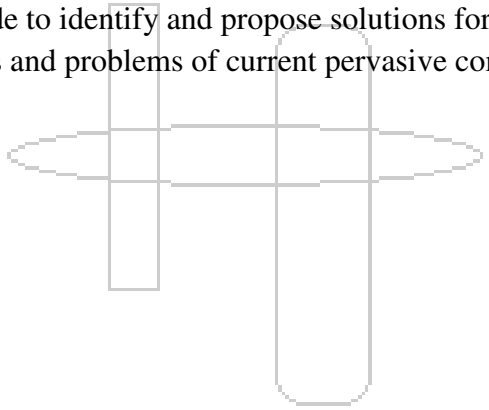
Reference Books: ***(As per IEEE format)***

1. *Jochen Burkhardt, Horst Henn, Stefan Hepper, Klaus Rindtor, Thomas Schaeck, "Pervasive Computing," Pearson, Eighteenth Impression, 2014.*

Course Outcomes:

The student will be able to –

1. Describe the characteristics of pervasive computing applications including the basic computing application problems, performance objectives and quality of services, major system components and architectures of the systems.
2. Analyze the strengths, problems and limitations of the current tools, devices and communications for pervasive computing systems.
3. Recognize the different ways that humans will interact with systems in a ubiquitous environment and account for these accordingly
4. List and exemplify the key technologies involved in the development Ubicomp systems
5. Develop an attitude to identify and propose solutions for security and privacy issues.
6. Explore the trends and problems of current pervasive computing systems using examples.



FF No. : 654

CS425THP: GEOGRAPHICAL INFORMATION SYSTEMS

Credits: 4

Teaching Scheme:
Theory: 3 Hours / Week
Project Based Lab: 2 Hours/Week

Unit 1: GIS and Maps (6 Hours)

Fundamentals of GIS: Roots of GIS, Overview of Information System, Four Ms, GIS Definition and Terminology, GIS Queries, GIS Architecture, Models of GIS, Framework for GIS, GIS Categories, Levels/Scales of Measurement. Map Language: Map as a Model, Classification of Maps, Spatial Referencing System, Map Projections, Commonly Used Map Projections, Grid Systems, Computer in Map Production, Digital Database in a GIS, Linkage of GIS to Remote Sensing

Unit 2: Remote Sensing Fundamentals (7 Hours)

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

Unit 3: Image Processing (7 Hours)

Digital Image Processing: Basic Character of Digital Images, Preprocessing, Registration, Enhancement, Spatial Filtering, Transformations, Classification, Image Classification and GIS. Visual Image Interpretation: Types of Pictorial Data Products, Image Interpretation Strategy, Image Interpretation Process, Overview of Image Interpretation Equipments.

Unit 4: Spatial Data Modeling and Management (7 Hours)

Spatial Data Modeling: Stages of GIS Data Modeling, Graphic Representation of Spatial Data, Raster GIS Models, Vector GIS Models, GIS Data Management: Database Management Systems, GIS Data File Management, Database Models, Storage of GIS Data Object based Data Models, Temporal Topology, Organizational Strategy of DBMS in GIS.

Unit 5: Data Input, Quality and Analysis (7 Hours)

Data Input and Editing: The Data Stream, Data Input Models, Data Input Methods, GPS for GIS Data Capture, Data Editing. Data Quality Issues: Components of Data Quality, Accuracy, Precision and Resolution, Consistency, Completeness, Sources of Error in GIS, GIS Output, Modeling Errors and Error Evaluation. Data Analysis and Modeling: Format Conversion, Data Medium Conversion, Spatial Measurement Methods, Buffering Techniques, Overlay Analysis, Modeling Surfaces.

Unit 6: GIS Applications (6 Hours)

Urbanization, Defense, Weather-forecasting, Agriculture, Transportation, Forestry, Natural disasters, Tourism, Energy management, Water resource management, Animal welfare, Healthcare etc.

List of Project areas:

1. Prepare a map for the selected geographical area as per topological survey

2. Design a spatial database for the entities related with a geographical area specified in above map.

3. Study the connectivity of maps with spatial databases.

4. Analyze a case study of any GIS application of your choice.

5. Prepare a presentation on any latest GIS technology / technique / software / hardware.

Text Books:

1. *"Remote Sensing and Geographical Information Systems", M. Anji Reddy B S Publications, Second Edition, 2006*
2. *"Introduction to Geographic information systems", Kang-Tsung Chang, Tata-McGraw-Hill Publications, Third edition, 2006. ISBN: 978-0073101712.*

Reference Books:

1. *"Principles of Geographical Information Systems", Peter A Burroughs and McDonnell, Oxford University Press, 1998. ISBN 978-0198233657.*
2. *"The GIS Book", George B Korte, Onward press (Thomson Learning), 5th Edition, 2001. ISBN 81-7800-112-8.*

Course Outcomes:

The student will be able to –

1. Differentiate among map projections for geographical areas
2. Design spatial data model for geographical area encompassing related entities
3. Create database for geographical area encompassing related entities using GIS software
4. Propose effective remote sensing based solutions addressing requirements in domains such as urban planning, weather forecasting, defense and land management
5. Display the impact of data processes such as data input, quality, analysis and output in GIS applications
6. Build skill set required for responsible positions such as GIS Analyst, GIS Technician and GIS Specialist

FF No. : 654

CS427THP: Enterprise Systems(TPL)

Credits: 04

Teaching Scheme:
Theory: 3 Hours / Week
Project Based Lab: 2 Hours/Week

Unit 1: Business Process Management (7Hrs)

Business Process Modeling Foundation: Conceptual Model and Terminology, Abstraction Concepts, From Business Functions to Business Processes, Activity Models and Activity Instances , Process Models and Process Instances , Process Interactions, Modeling Process Data /Organization / Operation, Business Process Flexibility

Process Orchestrations: Control Flow Patterns, Workflow Nets, Business Process Modeling Notation

Process Choreographies: Motivation and Terminology, Development Phases, Process Choreography Design and Implementation, Service Interaction Patterns

Properties of Business Processes: Data Dependencies, Structural Soundness, Soundness, Relaxed Soundness, Weak Soundness, Lazy Soundness, Soundness Criteria Overview

Petri Nets, Event-driven Process Chains, Yet Another Workflow Language (YAWL), Graph-Based Workflow Language

Unit 2: SOA Fundamentals (7Hrs)

Service-Oriented Computing and SOA , Introduction to Service-Oriented Computing, The Evolution of SOA, Principles of Service-Orientation, Goals and Benefits of Service-Oriented Computing, Service-Orientation, Problems Solved by Service-Orientation, Challenges Introduced by Service-Orientation, Effects of Service-Orientation on the Enterprise, Origins and Influences of Service-Orientation, Understanding Design Principles, Principle Profiles, Design Pattern References, Principles and Design Granularity

Service Contracts (Standardization and Design): Contracts principles, Types of Service Contract Standardization, Contracts and Service Design, Versioning, Technology / Development Tool Dependencies

Service Coupling (Intra-Service and Consumer Dependencies): Coupling principles, Service Contract Coupling Types, Service Consumer Coupling Types, Service Loose Coupling and Service Design, Enterprise Service Bus, Web Services and Primitive SOA, Web Services and Contemporary SOA, Service Layers

Unit 3: SOA Design Principles (7Hrs)

Service Abstraction (Information Hiding and Meta Abstraction Types): Abstraction principles, Types of Meta Abstraction, Measuring Service Abstraction, Service Abstraction and Service Design, Risks Associated with Service Abstraction

Service Reusability (Commercial and Agnostic Design): Reuse Principle, Service Reuse in SOA, Service Reusability and Service Design

Service Autonomy (Processing Boundaries and Control): Autonomy Principle, Types of Service Autonomy, Measuring Service Autonomy, Service Contract Autonomy (services with normalized contracts) Autonomy and Service Design
Service Statelessness (State Management Deferral and Stateless Design): State Management, Measuring Service Statelessness, Statelessness and Service Design
SOA Delivery Strategies, Service-Oriented Analysis: Introduction, Service Modeling, Service-Oriented Design: Introduction, SOA Composition Guidelines), Service Design, Importance of WSDL, SOAP, The use of registries via UDDI

Unit 4: SOA Technology and Implementation (7Hrs)
Service Discoverability (Interpretability and Communication): Discoverability, Types of Discovery and Discoverability, Measuring Service Discoverability, Discoverability and Service
Service Composability (Composition Member Design and Complex Compositions): Composition, Composition Concepts and Terminology, Complex Service Composition, Measuring Service Composability and Composition Effectiveness Potential, Composition and Service Design, Service-Orientation and Object-Orientation, Mapping Service-Orientation Principles to Strategic Goals, SOA Platforms, SOA support in .NET and J2EE platforms

Unit 5: Enterprise Architecture (7Hrs)
Introduction to Enterprise Architecture, State of the Art and Foundations of Enterprise Architecture, Communication of Enterprise Architecture, Language for Enterprise Modeling, Viewpoints and Visualization, Architecture Analysis, Architecture Alignment, Tool Support, Domain-Driven Architecture, Resource-Oriented Architecture, Defining EAI, The EAI Process, Data-Level EAI, Application Interface-Level EAI, Method-Level EAI, User Interface-Level EAI, EAI Inrteroperability

Unit 6: Enterprise Architecture Frameworks (7Hrs)
The Open Group Architecture Framework (TOGAF), Zachman Enterprise Architecture Framework, Extended Enterprise Architecture Framework (E2AF), Enterprise Architecture Planning (EAP), Federal Enterprise Architecture Framework (FEAF), Treasury Enterprise Architecture Framework (TEAF), Capgemini's Integrated Architecture Framework (IAF), Joint Technical Architecture (JTA), Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance, (C4ISR) and DoDAF, Department of Defense Technical Reference Model (DoD TRM), Technical Architecture Framework for Information Management (TAFIM), Computer Integrated Manufacturing Open System Architecture (CIMOSA), Purdue Enterprise Reference Architecture (PERA), Standards and Architecture for eGovernment Applications (SAGA), IEEE Std 1471-2000 IEEE Recommended Practice for Architectural Description

List of Practical:

1. To narrate concise Requirement Definition Document and System Requirements Specification Document for target system with reference to the IEEE 610.12.1990 Standard guidelines clearly indicating the requirements considerations.
2. To decompose and organize the problem domain area into broad subject areas and identify the boundaries of problem/system along with identification of Business Processes and develop full detail Business Process diagrams.
3. To develop Domain-driven vocabulary of the target system indicating domain lexicon and context-based terminologies.
4. To identify and categorize the target system services with detailed service specifications modeled with component diagram incorporating appropriate architectural style and coupling.
5. To design the service layers and tiers modeled with deployment diagram accommodating abstraction, autonomy, statelessness and reuse.
6. To map the service levels and primitives to appropriate Strategies for data processing using XML / XQuery/ JSON / JAXB.
7. To produce, invoke, compose Web Services using SOAP, WSDL and UDDI.
8. To implement and integrate the components of the target system using .NET / J2EE platforms adhering to Service specifications.
9. To create the balanced scorecard for the target system indicating the standards and principles applied.

Text Books:

1. *Mathias Weske, Business Process Management, Concepts, Languages, Architectures, ISBN 978-3-540-73521-2 Springer Berlin Heidelberg New York, 2007*
2. *Thomas Erl, Service-Oriented Architecture: Concepts, Technology, and Design. ISBN: 0-13-185858*-0, Publisher: Prentice Hall PTR, 2005

Reference Books :

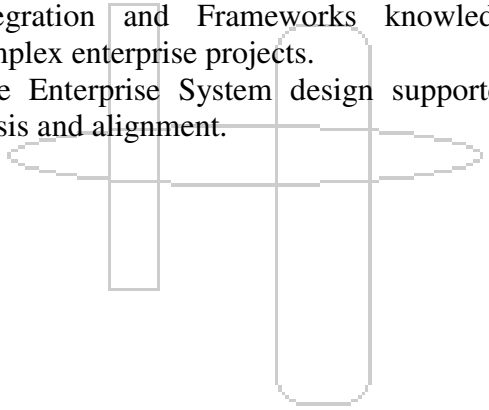
1. *Thomas Erl, SOA Principles of Service Design, Pearson Education, Inc., ISBN 0-13-234482-3, 2007*
2. *Eric A. Marks, Michael Bell., Executive's guide to service-oriented architecture, John Wiley & Sons, Inc.ISBN-13: 978-0-471-76894-4, 2006*
3. *Daniel Minoli, Enterprise Architecture A to Z, Frameworks, Business Process Modeling, SOA, and Infrastructure Technology, Auerbach Publications, Taylor & Francis Group, ISBN 978-0-8493-8517-9, 2008*
4. *SetragKhoshafian, Service Oriented Enterprises, Auerbach Publications, Taylor & Francis Group, ISBN 0-8493-5360-2, 2007*
5. *Mike Rosen, Boris Lublinsky, Kevin T. Smith, Marc J. Balcer, Applied SOA: Service-Oriented Architecture and Design Strategies, Wiley Publishing, Inc., ISBN: 978-0-470-22365-9, 2008*

6. *Marc Lankhorst et al., Enterprise Architecture at Work, Modelling, Communication and Analysis, Second Edition, ISBN 978-3-642-01309-6, Springer-Verlag Berlin Heidelberg 2009*
7. *David S. Linthicum,Enterprise Application Integration, Addison-Wesley Professional 2003, ISBN-10: 1402052626*

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Model business requirements and business processes using BPMN 2.0 standard encompassing Process Orchestrations and Choreographies.
2. Discover the set of services with composite services creation and designing services to facilitate integration and understand interrelationships among SOA, Web Services, OOD and IT infrastructure.
3. Explore the concepts, guidelines and technology for service orchestration to integrate a Business Process Management Solution in an Enterprise SOA in societal context.
4. Prepare well-formed specifications and reports for service composition and delivery to the stakeholders.
5. Understand case studies and lessons learned with utilization of Enterprise Architecture Integration and Frameworks knowledge towards planning and implementing complex enterprise projects.
6. Create sustainable Enterprise System design supported by enterprise modelling, architecture analysis and alignment.



FF No. : 654

CS428THP: Machine Vision and Pattern Recognition.

Credits: 4

Teaching Scheme:
Theory: 3 Hours / Week
Project Based Lab: 2 Hours/Week

Unit 1: Digital Image Formation and low-level processing (7 Hours)
Overview and State-of-the-art, Fundamentals of Image Formation, Image Acquisition, Sampling, Quantization, Difference in Monochrome and Multichrome imaging, concept of color spaces Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Histogram Processing.

Unit 2: Feature Extraction and Image Segmentation (7 Hours)
Edges - Canny, Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT,Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.
Region Growing, Edge Based approaches to segmentation, Segmentation by Graph-Theoretic Clustering, Mean-Shift mode finding, Texture Segmentation; Active contours.

Unit 3: 3D vision. Geometry (6 Hours)
3D vision tasks, Basics of projective geometry, A single perspective camera, Scene reconstruction from multiple views, Two cameras, stereopsis, Three cameras and trifocal tensor, Shape from X, Full 3D objects, 3D model-based vision, 2D view-based representations of a 3D scene.

Unit 4: Motion analysis (6 Hours)
Differential motion analysis methods, Optical flow: Optical flow computation, Global and local optical flow estimation, Combined local-global optical flow estimation, Optical flow in motion analysis, Analysis based on correspondence of interest points, Detection of specific motion patterns, Video tracking: Background modeling, Kernel-based tracking, Object path analysis, Motion models to aid tracking, Kalman filters, Particle filters.
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Unit 5: Probability and Bayesian decision theory (7 Hours)
Basics of probability and Distribution, Pattern recognition systems, design cycle, learning and adaptation. Case studies of Pattern recognition ,Statistical and syntactic pattern recognition, Classification problem, classification error, Bayes minimum error classifier, Bayes minimum risk classifier, discriminent functions and decision surfaces. multidimensional case for distributions

Unit 6: Parametric estimation and unsupervised learning (7 Hours)
Parametric estimation of probability density functions, non parametric estimation of probability density functions, Parzen windows, k-nearest neighbor classifier .Properties of linear classifiers, linearly separable training samples, perceptron criterion and algorithm, minimum squared error criterion, Fisher‟s linear discriminant function, Unsupervised learning & Clustering, Stages in clustering.

List of Project areas:

1. Object recognition
2. Object Tracking
3. Video Analytics
4. Image Enhancement
5. 3D object modeling

Text Books:

1. Gonzalez, Woods ,"Digital Image Processing,", 2nd edition, PHI.
2. D. A. Forsyth, J. Ponce,"Computer Vision: A Modern Approach," Pearson Education, 2003.
3. Milan Sonka ,"Image Processing, Analysis & Machine Vision,"Thomson Publication.
4. Theodoridis, Koutrombas ,"Introduction to Pattern Recognition," 3 rd Edition Academic Press.

Reference Books: ***(As per IEEE format)***

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2. R.O.Duda, P.E. Hart, G.G.Stork ,"Pattern Classification," John Wiley and sons, 2004

Course Outcomes:

The student will be able to –

1. Perform low level image processing operations
2. Identify feature vectors for object detection purpose.
3. Apply the principles of projective geometry for 3D scene construction
4. Analyze the frame sequence to track the region of interest or event.
5. Apply probability theory to estimate classifier performance.
6. Describe the principles of parametric and non parametric classification methods.

FF No. : 654

CS429THP: Information Retrieval

Credits: 04

Teaching Scheme:
Theory: 3 Hours / Week
Project Based Lab: 2 Hours/Week

Unit 1: Introduction (5 Hours)

Introduction, Definition, Objectives, Search and Browse Capabilities; A Formal Document Representation, Characterization of IR Models Text operations, Pre- processing, Porter's Stemming Algorithm, term weighting techniques, Zipf's law, Heap's law

Unit 2: Information Retrieval Models (7 Hours)

Boolean Retrieval, Extended Boolean Models, Vector Space Model, Probabilistic Model, Naive Bayes, Text Classification, Document and Term Clustering, Flat and Hierarchical Clustering, Matrix Decomposition, Latent Semantic Indexing, Bayesian Model, Models for Browsing.

Unit 3: Query Processing and Retrieval Evaluation (7 Hours)

Digital libraries, Morphological, Lexical Analysis, Thesaurus Construction, Ontology. Retrieval Performance, Evaluation Measures for Ranked and Unranked Results Query Languages, Structural Queries, Relevance Feedback, Query Expansion

Unit 4: Indexing and Searching (7 Hours)

Automatic Indexing, Inverted Files, Fast Inversion (FAST-INV) Algorithm, Signature Files, Partitioning, Tries, Suffix Trees and Suffix Arrays, PAT Tree, Distributed Indexing, Index Compression.

Unit 5: Parallel, Distributed IR and Web Searching (7 Hours)

Parallel IR, Distributed IR, Index Construction. Search Engines, Browsing, Metasearchers, Searching using Hyperlinks, Crawling, Link Analysis, Architectures(Agents, Buses, Wrappers/Mediators) , PageRank Algorithm, HillTop Algorithm

Unit 6: Multimedia IR (7 Hours)

Multimedia Data Modeling, Query Languages, A Generic Multimedia Indexing (GEMINI) Approach, One Dimensional Time Series, Two Dimensional Color Images, Automatic Feature Extraction, Operations on images, Motion detection, Object recognition, Automatic image annotation and retrieval, Audio, Graph, Video Retrieval Hashing Algorithms, Image Features and Similarity Functions

List of Project areas: (For THP, TLP courses)

1. Text preprocessing

2. Building index structures
3 Query processing
4 Text search & ranking score

Text Books:

1. Ricardo Baeza-Yates, Berthier Ribeiro-Neto, "Modern Information Retrieval: the concepts and technology behind search", Second Edition, Pearson Education India
2. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, "Introduction to Information Retrieval", Cambridge University Press

Reference Books:

1. Gerald Kowalski, Mark Maybury, "Information Storage and Retrieval Systems: Theory and Implementation", Springer Pvt. Ltd., 2006
2. William Frakes, Ricardo Baeza-Yates, "Information Retrieval: Data Structures & Algorithms", Pearson Education, 2008
3. C. J. Van Rijsbergen, "Information Retrieval", Information Retrieval Group, University of Glasgow

Course Outcomes:

The student will be able to –
1. Apply text operations for formal document representation
2. Describe various information retrieval system architectures and models
3. Validate retrieval performance of an information retrieval system
4. Construct indexes using suitable techniques
5. Apply sequential search and pattern matching techniques
6. Illustrate working of parallel, distributed and multimedia information retrieval system

FF No. : 654

CS433THP:: Internet of Things

Credits: 04

Teaching Scheme:
Theory: 3 Hours / Week
Project Based Lab: 2 Hours/Week

Unit 1: Introduction of Internet of Things (7 Hours)

Things in IoT, Characteristics of IoT, IoT Enabling technologies: WSN, Cloud Computing, Big Data Analytics, Communication protocols , Embedded systems, IoT vs M2M. IoT Smart-X applications: Home Automataion, Cities, Environment, Energy, Logistics, Agriculture, Industry, Health & Lifestyle,

Unit 2: Embedded suite for IoT (7 Hours)

Physical device – Raspberry Pi Interfaces, Hardware requirement of Pi, Connecting remotely to the Raspberry Pi over the network using VNC, Image processing using Raspberry Pi, GPIO Basics, Controlling GPIO Outputs Using a Web Interface,– Programming , APIs / Packages, Arduino Interfaces, Beagle bone Interfaces,

Unit 3: Wireless Technologies For Iot (7 Hours)

Protocol Standardization for IoT , M2M and WSN Protocols, RFID Protocols & NFC protocols, Issues with IoT Standardization ,Unified Data Standards ,Protocols – IEEE 802.15.4, Zigbee, IPv6 technologies for the IoT, IPv6 over low-power WPAN (6LoWPAN)

Unit 4: Cloud Analytics (6 Hours)

Introduction to cloud computing, Role of Cloud Computing in IoT, Cloud-to-Device Connectivity, View of IoT– Ubiquitous IoT Applications, Introduction to Cloud Storage models and communication APIs Web server – Web server for IoT, Python web application framework , Designing a RESTful web API

Unit 5: Resource Management In The Internet Of Things (7 Hours)

Clustering, Software Agents, Clustering Principles in an Internet of Things Architecture, Design Guidelines, and Software Agents for Object Representation, Data Synchronization.

Identity portrayal, Identity management, various identity management models: Local, Network, Federated and global web identity, user-centric identity management, device centric identity management and hybrid-identity management

Unit 6: Internet of things Challenges (6 Hours)

Vulnerabilities of IoT, Security, Privacy & Trust for IoT, Security requirements, Threat analysis, Use cases and misuse cases,

IoT Challenges: Mobility, Reliability, Scalability, Management, Availability, Interoperability, Resource Optimization & cost efficiency, Infrastructure Configuration & reconfiguration, IoT Overarching Challenges, Cloud data management, cloud data monitoring, Cloud data Exchange,

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.
2. Dr. Ovidiu Vermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, ISBN-10: 8792982735

Reference Books:

1. Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014.
2. Daniel Minoli John Wiley & Sons ,Building the internet of things with ipv6 and mipv6, The Evolving World of M2M Communications, ISBN: 978-1-118-47347-4
3. Cassimally, Hakim, "Designing the Internet of Things", Wiley Publications, ISBN 10: 111843062X

Course Outcomes:

The student will be able to –
1. Learn the terminology, technology and its applications of IoT
2. Analyze Embedded suite widely used in IoT.
3 . Describe the concept of M2M with necessary protocols
4. Uunderstand the cloud storage for IoT applications.
5. Optimize resources for different IoT applications
6. Understand Real world IoT Design constraint
.

FF No. : 654

CS434THP: Randomized and Approximation Algorithms

Credits: 04

Teaching Scheme:
Theory: 3 Hours / Week
Project Based Lab: 2 Hours/Week

Unit 1 **(8 Hrs)**

Basic probability theory

Introduction to randomization in computation and some simple randomized algorithms. **Basic discrete probability theory:** basic counting, definition of probability, examples, independence of events, conditional probability, union bound, inclusion exclusion, Bayes' rule, discrete random variables, expectation, variance, linearity of expectation, sum of independent random variables, standard distributions (Bernoulli, Binomial, Geometric), coupon collector problem, birthday paradox, probabilistic recurrences.
Uniform generation of combinatorial structures. Indicator random variables and their role in algorithm analysis.

Unit 2 **(5 Hrs)**

Tail Inequalities and applications

Moments and deviation, occupancy problem, Markov and Chebyshev inequalities and some applications, randomized selection, weak law of large numbers, stable marriage problem and principle of deferred decision, coupon collector problem and sharp threshold, Chernoff's bound and some applications, set balancing.

Unit 3 **(6 Hrs)**

Randomized Algorithms and Randomized Complexity Classes.

Las Vegas and Monte-Carlo algorithms (with examples: randomized quick sort, Karger's min-cut algorithm). Basic complexity classes P, NP, RP, Co-RP, ZPP, BPP and their interrelations, probability amplification in RP and BPP, randomness and nonuniformity, Adleman's theorem. Yao's min-max principle and lower bound for randomized computations.

Unit 4 Algebraic techniques **(7 Hrs)**

Polynomial identity testing, Schwartz-Zippel lemma and applications (with examples verifying matrix multiplication, testing equality of strings, perfect matching problem for bipartite graphs), Mulmuley-Vazirani-Vazirani isolation lemma and application to matching problem. Number theoretic algorithms (finding quadratic non-residues, primality testing), introduction to probabilistic methods.

Unit 5 Markov Chains and Random Walks **(7 Hrs)**

Markov chains: definition, representations, randomized algorithm for 2-SAT and 3-SAT, classifying states of Markov chains, Gambler's ruin, stationary distributions. Random walks on undirected graphs, cover time, hitting time, commute time, graph connectivity, electrical networks, introduction to expander graphs. Expanders and rapidly mixing random walks.

Unit 6 Approximation Algorithms (7 Hrs)

Introduction to approximation algorithms, NP-hard optimization problems, lower bounding OPT, Review of approximation algorithm for vertex cover, TSP. Example of set-cover (O(log n) factor approx-algorithm based on greedy strategy, layering), Shortest super-string problem, Knapsack and FPTAS algorithms.

Linear programming based algorithms, LP relaxation, LP duality. LP rounding strategy and primal-dual schema, set-cover and some other examples using LP based techniques, maximum satisfiability.

Text Books: ***(As per IEEE format)***

1. Motwani*, Raghavan "Randomized Algorithms" ,*Cambridge University Press, 2010, ISBN: 9780521613903

2. Mitzenmatcher, Upfal "Probability and Computing", Cambridge University Press*, 2005,* ISBN: 9780521835404

3.Vazirani "Approximation Algorithms", Springer-verlag*, 2004,* ISBN: 9783540653677

Reference Books: ***(As per IEEE format)***

1. Kai Lai Chung *"A course in probability theory." ,*Acp, 2008, ISBN: 9788181477156

2. William Feller *"An introduction to probability theory and its applications." ,*Wiley India Pvt Ltd ISBN: 9788126518050

Course Outcomes:

The student will be able to –

1. Solve problems based on the basic discrete probability and combinatorics
2. Design Las-Vegas, Monte-Carlo randomized algorithms for various computational problems
3. Analyze time complexity and success probability of randomized algorithms using random variables.
4. Illustrate application of tail inequalities in tight estimation of the success probability and the time complexity of randomized algorithms
5. Explain role of advanced algebraic techniques such as Schwartz-Zippel Lemma, Isolation Lemma, Markov chains and random walks on graphs in randomized algorithms design
6. Design approximation algorithms for NP-complete problems using suitable paradigm

FF No. : 654

CS435THP: MANAGEMENT INFORMATION SYSTEMS

Credits: 04

Teaching Scheme:
Theory: 3 Hours / Week
Project Based Lab: 2 Hours/Week

Unit 1: Foundations of Information Systems (6 Hours)

Introduction, Why Information Systems (IS)? IS Framework, System Concepts, Components of IS, Major Roles of IS, Trends in IS, Major Types of IS– Transaction Processing Systems (TPS), MIS, Decision Support Systems (DSS), etc. Organization Basic, Features of Organizations, Models of Organizations, Competitive Strategy Concepts, Strategic Uses of Information Technology, The Value Chain.

Unit 2: Manufacturing and Service Systems (7 Hours)

Functional Levels in Manufacturing Systems, Personnel Management, Financial Management, Production Management, Material Management, Marketing Management, MIS for Manufacturing Sector, Service Sector, Distinctive Services, Service Vs. Product, Service Process Cycle and Analysis, Customer Service Design, MIS for Service Sector, Insurance and Airline

Unit 3: e-Business (7 Hours)

Enterprise Resource Planning (ERP), Benefits and Challenges of ERP, Trends in ERP, Supply Chain Management (SCM), The Role of SCM, Benefits and Challenges of SCM, Trends in SCM, Customer Relationship Management (CRM), The Three Phases of CRM, Benefits and Challenges of CRM, Trends in CRM, Electronic Commerce (e-Commerce), Scope of e-Commerce, Essential e-Commerce Processes, Electronic Payment Processes, B2C e-Commerce, B2B e-Commerce, Business Standards.

Unit 4: Information Systems for Decision Support (7 Hours)

Business and Decision Support, Decision Making Process, Components of DSS, MIS, Difference between DSS and MIS, Online Analytical Processing, Types of DSS, Using DSS, What-if analysis, Sensitivity analysis, Goal-seeking analysis, Optimization analysis, Data Mining for Decision Support, Executive Information Systems, Knowledge Management Systems, Group Decision Support Systems (GDSS), Components of GDSS, Overview of a GDSS Meeting, Expert Systems.

Unit 5: Challenges Ahead (7 Hours)

Introduction to Security and Ethical Challenges, Ethical Responsibility of Business Professionals, Computer Crime, Hacking, Cyber Theft, Unauthorized Use at Work Software Piracy, Piracy of Intellectual Property, Computer Viruses and Worms, Security Management, Tools, Encryption, Firewalls, e-Mail Monitoring, Biometric Security, Disaster Recovery, Fault Tolerant Systems, etc, Global Management of Information Technology, Cultural, Political and Geo-economic Challenges, Global Business/IT Strategies.

Unit 6: MIS Applications (6 Hours)

Financial accounting, Customer Relationship Management (CRM), Enterprise Resource Planning (ERP) Systems, Electronic Medical Record (EMR) Systems, Geographical Information Systems (GIS), Expert Systems.

List of Project areas:

1. Consider any organization from any sector. Study its organizational structure and comment about it.

2. By giving examples, differentiate between operational, strategic and tactical level of management process and its effect on design information system.

3. Identify and evaluate the design considerations for the given information system.

4. Study testing and quality assurance strategies.

5. Identify cases of computer crime, hacking, and cyber theft with respect to given information system. Plan about how to avoid and deal with such kind of security threats.

Text Books:

1. *"Management Information Systems: Managing Information Technology in the Business Enterprise", James O'Brien, Tata McGraw-Hill Publishing Company Limited, 10th Edition, ISBN 0-07-058739-6.*
2. *"Management Information Systems", Jawadekar Waman S, Tata McGraw-Hill Publishing Company Limited, ISBN 0-07-044575-3, 2nd Edition.*

Reference Books:

1. *"Management Information Systems", Shajahan S, Priyadharshini R, New Age International, ISBN 81-224-1549-0.*
2. *"Management Information Systems", Arora Ashok, Bhatia Akshaya, Excel Pub, ISBN 81-7446-188-4.*
3. *"Information Systems A management Perspective", Alter Steven, Addison Wilsey, ISBN 0-201-35109-9, 3rd Edition.*
4. *"Information Systems For Modern Management", Murdick R G, Ross J E, Claggett J R, Prentice Hall Of India, ISBN 81-203-0397-0, 3rd Edition.*

Course Outcomes:

The student will be able to –

1. Estimate the functional complexities in manufacturing and/or service sectors for implementation of Management Information Systems.
2. Design solutions differentiating management information systems based on their features and applicability.
3. Initiate ethically responsible behaviour as a professional.
4. Build a set of professional skills required for responsible positions such as System Analyst, Business Consultant and Information System Manager.

5. Respond positively to cultural, political, economical and organizational challenges during process of project management.
6. Follow required domain specific processes and standards for management information systems.

FF No. : 654

CS439THP:Modeling and Simulations

Credits:4

Teaching Scheme:
Theory: 3 Hours / Week
Project Based Lab: 2 Hours/Week

Unit 1: Process of Modeling and Simulation (6 hours)

What is M&S, Need for Abstraction, Relationship between modeling and simulation Process of modeling: Problem identification and formulation, Real system data collection, Model development, Validation, Experiment design, Simulation runs and Results interpretation.

Unit 2: Formal models and modeling techniques (7 hours)

Monte Carlo methods, Stochastic processes, Queuing theory: Little's Theoremand applications, M/M/1 Queuing System, Petri nets, Game theory, State spaces and transitions, Graph structures: directed graphs, trees, networks.

Unit 3: Discrete Event Simulation (7 hours)

Deterministic vs. stochastic simulation, Static vs. Dynamic Simulation,
Constructing dynamic stochastic simulation models, Time keeping, Event Scheduling, State transition, Time driven and event driven models, Pseudo-random number generation.

Unit 4: Agent-based simulation (7 hours)

Modeling Complex Systems, Agents, environments, ABMS: When and Why,
Agent based model design, Autonomous Agents, Agent Interaction, Topologies and Neighborhoods, Tools for ABMS: Repast, Swarm, NetLogo.

Unit 5 : M&S Applications and Awareness (7 hours)

Application areas: optimization, decision making support, forecasting, safety considerations, training and education.
ABMS Applications: Social networks, Organizations, Markets, Flows, Epidemiology, Diffusion.

Unit 6: Advanced Topics (6 hours)

Model scalability, Virtual Reality, Virtual Worlds, Intro to Rare Event Simulation,
Intro to Parallel Discrete Event Simulation, PDES Challenges.

Text Books:

Structure and syllabus of S.Y. B.Tech Computer Engineering. Pattern A-16, A.Y. 2017-18

1. Discrete Event Simulation: A First Course, L. Leemis and S. Park, 2006, Prentice-Hall.
2. Agent-Based Models, Nigel Gilbert, 2008, SAGE Publications.
3. System Simulation and Modeling, Sankar Sengupta, 2013, Pearson Education.

Reference Books:

1. Handbook of Simulation: Principles, Methodology, Advances, Applications, and Practice, J. Banks, 1998, John Wiley & Sons.
2. Parallel and Distributed Simulation Systems, Fujimoto R.M., 2000, John Wiley & Sons.

List of Projects:

1. Develop a simple deterministic simulation to determine the loan tenure for Rs.X principal amount when the customer pays Rs.Y per month. Assume the fixed interest rate of 10% per year.

2. Develop a Monte Carlo simulation model for profit estimation before introducing a new product in the market. Consider the uncertainty in terms of sales, production costs, competitive pricing and other market dynamics.

3. Develop a discrete event simulation of a typical fast-food restaurant. Restaurant configuration, business factors and customer behavior factors should be tunable parameters. (SimPy)

4. Agent based simulation : Marketing/Diffusion: Word of Mouth publicity, Epidemiology: spread of disease. (NetLogo)

5. Develop a parallel discrete event simulation for a network of routers using conservative event processing.

Course Outcomes:

Upon completion of the course, graduates will be able to –

1. Demonstrate the effectiveness of modeling and simulation at predicting behavior/performance/problems of systems under development.
2. Develop a model for a given problem using appropriate modeling and simulation technique/formalism.
3. Implement discrete event simulation models using general-purpose programming languages or DES frameworks
4. Design an agent-based simulation model for a complex system.
5. Contribute towards increased utilization of modeling and simulation as a problem solving approach for issues in governance and industry where it could be applied
6. Adapt to the changing needs of the organizations and individuals during the development process.

FF No. : 654

CS440THP::Data Acquisition System

Credits: 04

Teaching Scheme:
Theory: 3 Hours / Week
Project Based Lab: 2 Hours/Week

Unit 1 : Systems and Measurements (6 Hours)

Part A:Introduction to data acquisition system(DAS), Block Diagram of DAS, Multichannel DAS, Generalized measurement system, Characteristics of measuring devices, accuracy, precision, errors, linearity, hysteresis, threshold, repeatability, reliability calibration., Basic concepts of feedback control system:- open loop and closed loop.

Unit 2 : Sensors and Signal Conditioning circuits (7 Hours)

Part AIntroduction to the sensors, Types of sensors: Temperature sensor (LM35,RTD, Thermocouple), Light sensor(photodiode, optocoupler), Distance and range sensor (IR,LVDT), Accelerometer sensor, Touch screen sensor. Signal conditioning circuits: Analog and Digital, Opamp in signal conditioning circuits as amplifier.

Unit 3 : ARM Microcontroller (7 Hours)

Part A:Family Architecture, Block diagram, Features, Data / Programme Memory, Reg set, Reg Bank, Special Function Registers, Data Memory, Programme Memory, Interrupt Structure , Timer Prog ,Serial Port Prog , Misc Features.

Unit 4 : I/O interfacing & Bus Systems (6 Hours)

PartA: Introduction to the BUS System, Bus design issues, Synchronous Bus, Asynchronous Bus, Bus Allocation, Bus Priority. Interfacing Buses:I2C, SPI ,CAN , SCADA and RS 232C .

Unit 5 : Relay Sequencer and Ladder diagrams (7Hours)

Introduction to the relay sequencer. Elements of Ladder Diagrams (limit, pressure, level, thermal, mechanical switch) and examples based on ladder diagrams. Data Loggers.

Unit 6: Programmable Logic Controls (7 Hrs)

PartA:PLC : PLC block diagram and its function, PLC Operation: I/O scan mode, execution mode, PLC Software Functions: Timer, accumulated timer, counters. Advantages of PLC over Relay sequencer.

Project Domains:

1. Project based on signal conditioning circuit for sensors.

2. Project based on temperature controller using LM35
3. Project based on IR sensor.
4. Project based on ARM controller and any sensor
5. Case study on PLC systems

Text Books:

1. *"Process control instrumentation", C.D. Johnson, Pearson education, ISBN-81-7758-410-3, seventh edition.*
2. *"Opamp and linear integrated circuits", Ramakant Gaikwad, PHI publication, ISBN-9780132808682, 4th edition.*

Reference Books :

1. *"Instrumentation Devices and System", Rangan, G .R. Sarma, V.S.V. Mani, Tata McGraw-Hill, ISBN-0-07-463350-3, 2nd Edition.*
2. *Microcontroller Handbook*

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Define the characteristics of measuring devices for an instrument.
2. Identify the functioning of measuring devices in an industrial process.
3. Design elements of signal conditioning circuit that are necessary for sensors.
4. Describe the structural units of Microcontroller.
5. Interconnect devices using communication buses.
6. Develop programs for the process control systems using sensors.

FF No. : 654

CS442THP: HUMAN COMPUTER INTERACTION

Credits: 04

Teaching Scheme:
Theory: 3 Hours / Week
Project Based Lab: 2 Hours/Week

Unit 1: Introduction (6 Hours)

Human, Definition of Human Computer Interaction, Interdisciplinary Nature, Goals, Human Factors, Measurable Factors – Learn ability, Speed, Efficiency, Satisfaction. Early Focus on Users, Ergonomics, Usability, Types of Usability, User Interface (UI), Contexts - Web, Business, Mobile, Gaming Applications, Categorization of Applications based on Human Factors, Accessibility and Security.

Unit 2: Principles and Models (7 Hours)

Eight Golden Rules of Interface Design, Principles of Good Design, Faulty Designs, Miller's Principle, Norman's Action Model, Gulf of Execution and Evaluation, Errors – Mistakes, Slips, Lapses and Violations, Guidelines for Data Display, Guidelines for Data Entry, Conceptual, Semantic, Syntactic and Lexical Model, Task Analysis, GOMS, Keystroke-Level Model, User Persona, UI Standards and GUI Libraries.

Unit 3: Design Process and Interaction Styles (7 Hours)

Design, Three Pillars of Design, Process of Design, Ethnographic Observations, Contextual Inquiry, Iterative Design, Participatory Design, Navigation Design, Visual Design, - Layout, Color, Fonts, Labeling, LUCID, Scenarios, Interaction Styles - Direct Manipulation, Menu Selection, Form-Filling, Commands, Natural Language, Internationalization, Interaction Design Patterns.

Unit 4: Evaluation Techniques and Interface Categories (7 Hours)

Expert-based Evaluation, User-based Evaluation, Heuristic Evaluation, Cognitive Walkthrough, Semiotic Analysis, Expert Reviews, Usability Testing, User Surveys, Interviews, Think Aloud, Acceptance Tests, Statistical Methods, Touch Interfaces, Public Place Interfaces, Wearable Interfaces, Tangible Interfaces, Intelligent Interfaces, Ubiquitous and Context-Aware Interaction.

Unit 5: Documentation and Groupware (7 Hours)

Classification of Documents, Printed Manuals, Reading from Displays, Online Help, Tutorial, Error / Warning Messages, Groupware, Goals / Dimensions of Cooperation, Asynchronous Interactions, Synchronous Interactions, Online Communities, Communityware

Unit 6:Miscellaneous (6 Hours)

Case Studies: Web Usability, Mobile Usability, Embedded Systems, Social Networking Sites, Messengers, E-Governance Sites, Security Tools, e-Health applications

List of Project areas:

1. Identify specialized users and related facilities for a selected product / system and make necessary suggestions for its improved accessibility design.

2. Design user persona for the users of selected product / system.

3. Conduct a contextual inquiry for selected product / system.

4. Design an interface prototype for selected product / system.

5. Evaluate an interface using usability evaluation technique.

Text Books:

1. *"Human-Computer Interaction", Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, Pearson Education, ISBN 81- 297-0409-9, 3rd Edition.*
2. *"Designing the User Interface", Ben Shneiderman, Pearson Education, ISBN 81-7808-262-4, 3rd Edition*

Reference Books:

1. *"The Design of Everyday Things", Donald Norman, Basic Books, ISBN 100-465-06710-7, 2002 Edition*
2. *"The Essential Guide to User Interface Design", Wilbert O. Galitz, Wiley-dreamtech India (P) Ltd., ISBN 81-265-0280-0, 2nd Edition.*
3. *"Human-Computer Interaction in the New Millennium", John M. Carroll, Pearson Education, ISBN 81-7808-549-6.*

Course Outcomes:

The student will be able to –

1. Identify human factors and usability issues related with computing applications
2. Differentiate computing applications into categories based on human factors
3. Design a user interface by applying suitable design principles, models and usability guidelines
4. Integrate ethno-cultural and accessibility computing aspects into the user interface design
5. Display the impact of usability evaluation and testing in computing applications
6. Follow required processes and standards while designing user interfaces

FF No. : 654

CS436THP:: ADVANCED COMPUTER ARCHITECTURE

Credits: 04

Teaching Scheme:
Theory: 3 Hours / Week
Project Based Lab: 2 Hours/Week

Unit I **(6Hours)**

Overview of Parallel Processing

Parallelism in Uniprocessor system, Evolution of parallel processors, Architectural Classification, Flynn's, Fengs, handlers classification. Pipeline, Vector, Array, Bernstein's' condition for parallelism, dependence graphs. Multicore architecture- GPU processor and programming model.

Unit II **(8Hours)**

Pipeline Architecture

Principles and implementation of Pipelining, Classification of pipelining processors, Arithmetic and Instruction pipelining, Instruction level parallelism (ILP) Pipelining hazards and resolving techniques, Data forwarding. register renaming pipeline reservation table, sequencing and collision, Branch problem, branch penalty .prediction. Delayed branching Branch target buffer Advanced pipelining techniques, loop unrolling techniques, Superscalar pipelining, speedup, in order, out of order execution, VLIW processor software scheduling, Software pipelining

Unit III **(6 Hours)**

Vector and Array Processor

Basic vector architecture, Issues in Vector Processing, Vector Instructions Register to Register and Memory to Memory Architectures Vector performance, Vector Chaining ,Vector loops and recurrence vectorizers and optimizers, Cray I Cray Y-MP
SIMD Computer Organization **:** Distributed & shared memory model Processing Element (PE) Masking and Data Routing Inter PE Communication
Interconnection networks of SIMD, Static Vs Dynamic network, Permutations, Shuffle exchange, Bit reversal hyper cube ,mesh network, Iliac, omega, blocking, non blocking networks.Compute Unified Device Architecture (CUDA) Hardware , Memory, Thread model Parallel Algorithms For Array Processors**:** Matrix Multiplication. Sorting on mesh, hypercube and CUDA Vectorization and Parallelization methods

Unit IV

Multiprocessor Architecture

UMA, NUMA, COMA MPP Processor. Loosely and Tightly coupled multiprocessors, characteristics of multiprocessors & multiprocessing, Inter Processor communication network, Time shared bus, Crossbar switch, Interleaved memories S access, C access.
Cache coherency and bus snooping and directory based protocols. Massively Parallel Processors (MPP), Inter Processor Communication and Synchronization.

Unit V (6Hours)
Multithreaded Architecture

Latency hiding techniques, Principles of multithreading, Issues and solutions. Multithreaded processors model, context switching policies. Blocked multithreading, Interleaved multithreading, simultaneous multithreading.
Software multithreading, thread concept, lightweight process (LWP), bounded, unbounded threads, thread management: thread scheduling & control by thread library & kernel (State transition diagram).

Unit VI (6 Hours)
Parallel Software Issues

Operating systems for multiprocessors systems, software issues for multiprocessors Message Passing Interface (MPI) Principles of Parallel Algorithm design: Decomposition, tasks and Dependency graphs. Parallel language constructs. Programming using message passing and shared memory paradigms (Sorting, searching, matrix problems)

List of Project Areas-
Solving computational intensive problems using following technologies (At least Two)
OPEN MP
MPI
Using Thread libraries
NVIDIA GPU

Text Books

1. *Kai Hwang, "Advanced Computer Architecture," Tata McGraw-Hill ISBN 0-07-113342-9*
2. *Kai Hwang, Faye A. Briggs, "Computer Architecture and Parallel Processing," McGraw-Hill international Edition ISBN 007-066354-8.*
3. *V. Raja Raman, L Siva ram Murthy, "Parallel Computers Architecture and Programming," PHI ISBN 81-203-1621-5.*

Reference Books:

1. *DezsoSima, Fountain, Kacsuk, "Advanced Computer Architecture," Pearson Education Asia ISBN 981-4053-74-0.*
2. *Culler, Jasvinder Pal Singh , Gupta, "Parallel Computer Architecture," Morgan Kaufman (ELSVIER) ISBN 81-8147-189-X*

3. *3.Grama ,Gupta , Karypis, Vipin Kumar : "Introduction to Parallel Computing ," Pearson learning ISBN 978-81-317-0807-1*

Course Outcomes:

Students will be able to :

1. Understand the architecture of parallel processing
2. Describe the concept of Pipeline Architecture.
3. Acquaint the knowledge of Vector Architecture.
4. Explore the characteristics of multiprocessors & multiprocessing.
5. Study the basic techniques of multithreading.
6. Identify the software issues for multiprocessors.

FF No. : 654

CS431THP: Machine Learning

Credits: 4

Teaching Scheme:
Theory: 3 Hours / Week
Project Based Lab: 2 Hours/Week

Unit 1: Introduction to Machine Learning (8 Hours)
Types of Learning: Supervised, Unsupervised, Reinforcement.
Learning System: Well posed learning problem, Designing a learning system, Issues in machine learning.
Concept Learning: Concept Learning, General-to-Specific Ordering: Task, search, Find S algorithm, Version space and the candidate elimination algorithm, List-then-eliminate algorithm, inductive bias.

Unit 2: Decision Trees (5 Hours)
Decision Tree Learning: representation, Basic decision tree learning algorithm, Hypothesis space, Issues in decision tree learning.

Unit 3: Machine Learning Algorithms (8 Hours)
SVM: Kernel functions, Linear SVM, Nonlinear SVM.
Hidden Markov model, Genetic algorithm, Regression analysis, Multivariable regression.

Unit 4: Clustering Algorithm and recurrent Networks (8 Hours)
k-means algorithm, k-nearest neighbor learning, weighted majority algorithm, Hopefield Net, Hamming net, Maxnet, Kohonen self organizing map, Principal component Analysis (PCA).

Unit 5: Bayesian Learning (6 Hours)
Bayes theorem, Maximum likelihood hypothesis, minimum description length principle, Gibbs algorithm, Bayesian belief networks, Expectation maximization algorithm.

Unit 6: Evaluating and Validating Hypothesis (5 Hours)
Evaluating hypothesis accuracy, Sampling theory, Central limit theorem, hypothesis testing, comparing learning algorithms.
Validation: Cross validation, Confusion matrix.

List of Project areas:

1. Implement following learning algorithms on a Concept learning task.
   a. Find-S algorithm
   b. List-then-eliminate algorithm
   c. Candidate Elimination algorithm

2. Apply the following machine learning algorithms on a dataset obtained from UCI ML repository.
   a. Support Vector Machine
   b. Genetic algorithm

3. Apply the following clustering algorithms on a dataset obtained from UCI ML repository.
   a. K-means
   b. PCA

Text Books

1. T. Mitchell, " Machine Learning", McGraw-Hill, 1997.
2. Anup Kumar Srivastava, Soft Computing, Alpha Science International limited. 2009.

Reference Books

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT press, 2004.
2. Jacek M. Zurada, "Introduction to Artificial neural System", JAICO publishing house,2002,.

Course Outcomes:

Upon completion of the course, graduates will be able to –

1. Demonstrate knowledge learning algorithms and concept learning through implementation for sustainable solutions of applications.
2. Evaluate decision tree learning algorithms.
3. Analyze research based problems using Machine learning techniques.
4. Apply different clustering algorithms used in machine learning to generic datasets and specific multidisciplinary domains.
5. Formulate a given problem within the Bayesian learning framework with focus on building lifelong learning ability.
6. Evaluation of different algorithms on well formulated problems along with stating valid conclusions that the evaluation support.