UNIVERSITY OF ENGINEERING AND MANAGEMENT, JAIPUR

Course Description

Title of Course: Teaching & Research Methodology
Course Code: MCSE301
L-T-P Scheme: 4-0-0 **Course Credits: 4**

Introduction:

The study of conducting research is Research Methodology. Research: The word research is composed of two syllables "Re" and "Search"."Re" is the prefix meaning 'Again or over again or a new' and "Search" is the latter meaning 'to examine closely and carefully' or 'to test and try'.Together they form, a careful, systematic, patient study and investigation in some field of knowledge undertaken to establish principles / policies.

Objective: Data mining is a class of analytical techniques that examine a large amount of data to discover new and valuable information. This course is designed to introduce the core concepts of data mining, its techniques, implementation, benefits, and outcome expectations from this new technology. It will also identify industry branches which most benefit from DM (such as retail, target marketing, fraud protection, health care and science, web and ecommerce). The course will focus on business solutions and results by presenting detailed case studies from the real world and finish with implementing leading mining tools on real (public domain) data.

Learning Outcomes:

1. Understand data mining principles and techniques: Introduce DM as a cutting edge business intelligence method and acquaint the students with the DM techniques for building competitive advantage through proactive analysis, predictive modeling, and identifying new trends and behaviors. Learning objectives include:

a. Building basic terminology.

b. Learning how to gather and analyze large sets of data to gain useful business understanding.

c. Learning how to produce a quantitative analysis report/memo with the necessary information to make decisions.

d. Describing and demonstrating basic data mining algorithms, methods, and tools

e. Identifying business applications of data mining

f. Overview of the developing areas - web mining, text mining, and ethical aspects of data mining.

2. Develop and apply critical thinking, problem-solving, and decision-making skills.

3. Develop and apply enthusiasm for learning. Class participation is encouraged in this course. Enriching classroom discussions and learning by communicating interest, suggestions for improvements, additional readings and Internet resources, is a major goal. Express

diligence, enthusiasm, patience, and thoroughness in dealing with complicated analysis and procedures and less-than-perfect-constantly-evolving technology.

Course Contents:

Unit –I: Instruction

Introduction to content, Elements of instruction, Learning objectives, Roles of the teacher and the learner in instruction

Unit –II: Teaching and Learning

Application of theories of learning to teaching and learning, Sequence of learning and Strategies of learning, Teaching methods, their merits and demerits, Use of ICT in teaching & learning, Classroom management, Individual differences.

Unit –III: Planning for teaching and learning

Understanding the syllabus, Preparation of a scheme of work, Lesson plan preparation, Micro teaching.

Unit –IV: Assessment and Evaluation

Define measurement, assessment, test, evaluation, Purpose of assessment and evaluation, Types of tests, Grading and reporting the results assessment. Evaluating teaching and learning

Unit –V: Definition and explanation of research

Types and Paradigms of Research, History and Philosophy of Research (esp. Philosophical evolution, pathways to major discoveries & inventions), Research Process decision, planning, conducting, Classification of Research Methods; Reflective Thinking, Scientific Thinking.

Unit –VI: Research problem formulation:

Literature review- need, objective, principles, sources, functions & its documentation, Problem formulation esp. sources, considerations & steps, Criteria of a good research problem, Defining and evaluating the research problem, Variables esp. types & conversion of concepts to variables. Research design esp. Causality, algorithmic, quantitative and qualitative designs, and various types of designs. Characteristics of a good research design, problems and issues in research design; Hypotheses: Construction, testing, types, errors; Design of experiments especially classification of designs and types of errors.

Unit –VII: Problem solving:

Understanding the problem- unknowns, data & conditions, conditions - satisfiability, sufficiency, redundancy & contradiction, Separation of parts of the problem and conditions, notations; devising a plan- connection between data and unknown, similar/related problems, reuse of previous solutions, rephrasing/transforming the problem, solving partial or related problem, Transforming data and unknowns; carrying out the plan- esp. correctness of each step in multiple ways; Evaluation of solution and method- checking correctness of solution, different derivations, utility of the solution

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Unit –VIII: Data & Reports:

Infrastructural setups for research; Methods of data collection esp. validity and reliability, Sampling; Data processing and Visualization especially Classification; Ethical issues especially. bias, Misuse of statistical methods, Common fallacies in reasoning. Research Funding & Intellectual Property; Research reports: Research Proposal & Report writing esp. Study objectives, study design, problems and limitations; Prototype micro- project report implementing a major part of all the above (compulsory assignment

Text Book:

1. Kotahri C.R., Research Methodology: Methods and Trends.
2. Stuart Melville and Wayne Goddard - Research Methodology: An Introduction for Science & Engineering Students.

Reference Books:

1. Brian W. Kernighan and Rob Pike, The Practice of Programming, Addison-Wesley, 1999.

Faculty In-Charge HOD, CSE Dept.

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Course Description

Title of Course: Data Mining & Data Warehousing
Course Code: MCSE302C
L-T-P Scheme: 4-0-0 **Course Credits: 4**

Introduction:

The recent years have generated explosive expansion of digital data stored in computer databases as well as increased pressure on companies to keep competitive advantage. This has put Data Mining (DM) as a key method for extracting meaningful information from the flood of digital data collected by businesses, government, and scientific agencies.

Objective: Data mining is a class of analytical techniques that examine a large amount of data to discover new and valuable information. This course is designed to introduce the core concepts of data mining, its techniques, implementation, benefits, and outcome expectations from this new technology. It will also identify industry branches which most benefit from DM (such as retail, target marketing, fraud protection, health care and science, web and ecommerce). The course will focus on business solutions and results by presenting detailed case studies from the real world and finish with implementing leading mining tools on real (public domain) data.

Learning Outcomes:

Knowledge:

1. Understand data mining principles and techniques: Introduce DM as a cutting edge business intelligence method and acquaint the students with the DM techniques for building competitive advantage through proactive analysis, predictive modeling, and identifying new trends and behaviors. Learning objectives include:

a. Building basic terminology.

b. Learning how to gather and analyze large sets of data to gain useful business understanding.

c. Learning how to produce a quantitative analysis report/memo with the necessary information to make decisions.

d. Describing and demonstrating basic data mining algorithms, methods, and tools

e. Identifying business applications of data mining

f. Overview of the developing areas - web mining, text mining, and ethical aspects of data mining.

2. Develop and apply critical thinking, problem-solving, and decision-making skills.

3. Develop and apply enthusiasm for learning. Class participation is encouraged in this course. Enriching classroom discussions and learning by communicating interest, suggestions for

improvements, additional readings and Internet resources, is a major goal. Express diligence, enthusiasm, patience, and thoroughness in dealing with complicated analysis and procedures and less-than-perfect-constantly-evolving technology.

Application:

- Business Management
- Market Analysis and Management
- Corporate Analysis & Risk Management
- Customer credit policy analysis
- Loan payment prediction
- Classification and clustering of customers for targeted marketing.

Course Contents:

Unit –I: Overview of data mining process

Data Mining, Data Warehouse, KDD

Unit –II: Data Mining Processes and Knowledge Discovery

Data Cleaning Unit, Data Integration Unit, Mining

Unit –III: Database Support to Data Mining

Real life application on data set

Unit –IV: Data Mining Techniques and Functions

Knowledge grow and prediction

Unit –V: Cluster Analysis

K-mean, K-Median, DBSCAN, CLARA, CLARANS, ROCK etc

Unit –VI: Regression Algorithms in Data Mining

Regression is a data mining technique used to predict a range of numeric values, given a particular dataset

Unit –VII: Neural Networks in Data Mining

GA Algorithm

Unit –VIII: Decision Tree Algorithms

F-P Tree, Decision Tree

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Unit –IX: Data Mining for Customer Relationship Management Fraud detection, and risk management applications

Customer Relationship Management, Risk Management

Unit –X: Link Analysis in Text Mining, Web Mining Taxonomy, Mining the Web User Behavior, Web Analytics

Web Mining, Text Mining etc

Text Book:

1. Arun K.Pujari, "Data Mining Techniques", Universities Press.
2. Alex Berson, Stephen J. Smith, "Data Warehousing Data Mining & OLAP", Tata McGrow-Hill

References:

1. Gajendra Sharma, "Data Mining Data Warehousing and OLAP", S.K.KATARIA & SONS.
2. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World", PEARSON

UNIVERSITY OF ENGINEERING AND MANAGEMENT, JAIPUR

Course Description

Title of Course: Artificial Intelligence
Course Code: MCSE302A
L-T Scheme: 4-0 **Course Credits: 4**

Objectives: In this course we will study the basic components of an intelligent system, their functions, mechanisms, policies and techniques used in their implementation and examples.

Learning Outcomes: The students will have a detailed knowledge of the concepts of artificial intelligence, various applications of AI in different fields, Aware of a variety of approaches to AI techniques

Course Contents:

Unit-1 (Introduction to AI): Definitions, Goals of AI, AI Approaches, AI Techniques, Branches of AI, Applications of AI. Introduction of Intelligent Systems: Agents and Environments, Good Behavior: the concept of Rationality, The Nature of Environments, The structure of Agents, How the components of agent programs work.

Unit-2 (Problems Solving, Search and Control Strategies)

Solving Problems by Searching, Study and analysis of various searching algorithms. Implementation of Depth-first search, Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bi-directional search Informed (Heuristic) Search Strategies: Greedy best-first search A* search: Minimizing the total estimated solution cost, Conditions for optimality: Admissibility and consistency, Optimality of A*, Memory-bounded heuristic search, Heuristic Functions, Generating admissible heuristics from sub problems: Pattern databases, Learning heuristics from experience. Beyond Classical Search: Local Search Algorithms and Optimization Problems: Hillclimbing search Simulated annealing, Local beam search, Genetic algorithms, Local Search in Continuous Spaces, Searching with Non-deterministic Actions: AND-OR search trees, Searching with Partial Observations. Adversarial Search and Constraint Satisfaction Problems, Study of min-max algorithm Adversarial Search: Games, Optimal Decisions in Games, The mini-max algorithm, Optimal decisions in multiplayer games, Alpha--Beta Pruning, Move ordering , Imperfect Real-Time Decisions, Evaluation functions, Cutting off search, Forward pruning, Search versus lookup, Stochastic Games, Evaluation functions for games of chance, Partially Observable Games Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Variations on the CSP formalism, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs, Alpha-beta pruning and CSP, Implementation aspects of minimax algorithm and CSP.

Unit- 3 (Knowledge Representations Issues, Predicate Logic, Rules)

Knowledge representation, KR using predicate logic, KR using rules. Reasoning System - Symbolic, Statistical: Reasoning, Symbolic reasoning, Statistical reasoning.

Unit-4 (Quantifying Uncertainty, Learning Systems)

Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Bayes' Rule and Its Use, Representing Knowledge in an Uncertain Domain, Other Approaches to Uncertain Reasoning, Rule-based methods for uncertain reasoning, Representing vagueness: Fuzzy sets and fuzzy logic, Study of fuzzy logic and Decision trees, Implementation aspects of Decision trees. Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees, The decision tree representation, Expressiveness of decision trees, inducing decision trees from examples.

Unit-5 (Expert Systems)
Introduction, Knowledge acquisition, Knowledge base, working memory, Inference engine, Expert system shells, Explanation, Application of expert systems. Fundamentals of Neural Networks: Introduction and research history, Model of artificial neuron, Characteristics of neural networks, learning methods in neural networks, Singlelayer neural network system, Applications of neural networks. Fundamentals of Genetic Algorithms: Introduction, Encoding, Operators of genetic algorithm, Basic genetic algorithm.

Text Books
1. Rich, Elaine Knight, Kevin, Artificial Intelligence, Tata McGraw Hill.
2. Luger, George F, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education.

References
1. Nilsson, Nils J, Artificial Intelligence, Morgan Kaufmann.
2. Russell, Stuart J. Norvig, Peter, AI: A Modern Approach, Pearson Education.

UNIVERSITY OF ENGINEERING AND MANAGEMENT, JAIPUR

Course Description

Title of Course: Bioinformatics **Course Code: MCSE302B**
L-T Scheme: 4-0 **Course Credits: 4**

Introduction:

For nearly 20 years, the three leading public repositories for DNA and RNA sequence data have collaborated to provide access to the ever increasing amount of genetic data produced by institutions around the world. The three repositories have now reached a significant milestone by collecting and disseminating 100 giga bases of sequence data. For a frame of reference, one hundred billion bases is about equal to the number of nerve cells in a human brain and a bit less than the number of stars in the Milky Way. These 100,000,000,000 bases, or "letters" of the genetic code, represent both individual genes and partial and complete genomes of over 165,000 organisms. While a single gene from organisms as diverse as humans, elephants, earthworms, fruitflies, apple trees, and bacteria can range from less than one hundred to over several thousand bases long, an organism's genome can be longer than one billion bases. The free access to this information allows scientists to study and compare the same data as their colleagues nearly anywhere in the world, and makes possible collaborative research that will lead ultimately to cures for diseases and improved health.

Objectives:

The course is designed to introduce the most important and basic concepts, methods, and tools used in Bioinformatics. Topics include (but not limited to) bioinformatics databases, sequence and structure alignment, protein structure prediction, protein folding, protein - protein interaction, Monte Carlo simulation, and molecular dynamics. Emphasis will be put on the understanding and utilization of these concepts and algorithms. The objective is to help the students to reach rapidly the frontier of bioinformatics and be able to use the bioinformatics tools to solve the problems on their own research.

Learning Outcomes:

1. Describe how the bioinformatics/public health information infrastructure is used to collect, process, maintain, and disseminate data.
2. Describe how societal, organizational, and individual factors influence and are influenced by bioinformatics/public health communications.
3. Discuss the influences of social, organizational and individual factors on the use of information technology by end users.
4. Collaborate with communication and informatics specialists in the process of design,
5. implementation, and evaluation of bioinformatics/public health programs.
6. Use information technology to access, evaluate, and interpret bioinformatics/public health data.

Course Contents:

Unit 1: Concepts of Cell, tissue, types of cell, components of cell, organelle. Functions of different organelles. Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept. Concepts of RNA : Basic structure, Difference between RNA and DNA. Types of RNA. Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Tranlation, Introduction to Metabolic Pathways.

Unit 2: Introduction to Bioinformatics. Recent challenges in Bioinformatics. Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed

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Unit 3: DNA Mapping and Assembly : Size of Human DNA ,Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Short DNA Molecules, Mapping Long DNA Molecules. DeBruijn Graph. Sequence Alignment: Introduction, local and global alignment, pair wise and multiple alignment, Dynamic Programming Concept. Alignment algorithms: Needleman and Wunsch algorithm, Smith-Waterman.

Unit 4: Probabilistic Models; Hidden Markov Model : Concepts, Architecture, Transition matrix, estimation matrix. Application of HMM in Bioinformatics : Genefinding, profile searches, multiple sequence alignment and regulatory site identification. Bayesian networks Model :Architecture, Principle ,Application in Bioinformatics.

Unit 5: Assigning protein function and predicting splice sites: Decision Tree Gene Expression Clustering. K Means Algorithm.

Text Books

1. Vavid W. Mount: Bioinformatics Sequenc and Genome analysis
2. Arther M. Leok: Introduction to Bioinformatics, Oxford
3. Rastogi et.al.:Bioinformatics-Methods and applications-enomics, Proteomics and Drug Discovery, Prentice Hall.

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Course Description

Title of Course: Compiler Design
Course Code: MCSE302D
L-T Scheme: 3-1 **Course Credits: 4**

Introduction:

This course examines compiler design concepts, phases of compiler in detail and cousins of compiler. The Topics to be covered (tentatively) include:

- Introduction to Compiler
- Lexical Analysis
- Syntax Analysis
- Type Checking
- Intermediate Code Generation
- Code Generation
- Code Optimization

Objectives:

In this course the students will study the introduction to the major concept areas of language translation and compiler design. To enrich the knowledge in various phases of compiler ant it's use, code optimization techniques, machine code generation, and use of symbol table. To extend the knowledge of parser by parsing LL parser and LR parser. To provide practical programming skills necessary for constructing a compiler. To provide practical programming skills necessary for constructing a compiler.

Learning Outcomes:
Knowledge:

1. To apply the knowledge of lex tool & yacc tool to devleop a scanner & parser.
2. To design & conduct experiments for Intermediate Code Generation in compiler.
3. To design & implement a software system for backend of the compiler.
4. To deal with different translators.
5. To develop program to solve complex problems in compiler
6. To learn the new code optimization techniques to improve the performance of a program in terms of speed & space.
7. To acquire the knowledge of modern compiler & its features.
8. To learn & use the new tools and technologies used for designing a compiler
9. To use the knowledge of patterns, tokens & regular expressions for solving a problem in the field of data mining.

Application:

1. To apply compiler design techniques.
2. To relate theory of compiler design to practice
3. To learn to build domain specific generators
4. The students shall acquire the generic skills to design and implement a compiler along with analysis of practical aspects.

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Course Description

Unit 1: **Introduction to Compiling**
Compilers, Analysis-synthesis model , The phases of the compiler, Cousins of the compiler.
Lexical Analysis
The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).

Unit 2: Syntax Analysis
The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.
Syntax directed translation
Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.

Unit 3: Type checking
Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions
Run time environments
Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision
of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy
restore, call by name), Symbol tables, dynamic storage allocation techniques.

Unit 4: Intermediate code generation
Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).
Code optimization
Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization.
Code generations
Issues in the design of code generator, a simple code generator, Register allocation & assignment.

Text Books
1. Aho, Sethi, Ullman - “Compiler Principles, Techniques and Tools” - Pearson Education.
2. Holub - “Compiler Design in C” – PHI
3.Tremblay and Sorenson Compiler Writing-McgrawHill International .
4. Chattopadhyay , S- Compiler Design (PHI)

References
1. J. Archer Harris, Operating systems – Schuam’s outlines, Tata Mc Graw Hill.
2. Gary Nutt, Operating Systems – A modern perspective, Pearson Education.

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Course Description

Title of Course: Microelectronics & VLSI Design
Course Code: CS705B
L-T Scheme: 3-0 **Course Credits: 3**

Introduction:

This course examines microelectronics & VLSI design concepts, and MOS fabrication basics. The topics to be covered (tentatively) include:

- Introduction to VLSI Design
- Micro-electronic Processes for VLSI Fabrication
- CMOS for Digital VLSI Circuits
- VHDL

Objectives:

The Course Educational Objectives are:

1. To acquire knowledge on basics of microelectronics & VLSI design.
2. To get acquainted with IC fabrication process and layout design rules.
3. To gain knowledge on design concept of CMOS digital circuits.
4. To gain knowledge on VHDL.

Learning Outcomes:

Knowledge:

Once the student has successfully completed this course, he/she will be able to answer the following questions or perform following activities:

1. Able to explain the basic concepts of Microelectronics & VLSI design.
2. Able to describe VLSI design steps.
3. Able to describe the IC fabrication steps and different layout design rules.
4. Able to design various CMOS based digital circuits.
5. Able to describe various digital circuits using VHDL.

Application:

1. To design and implement CMOS based circuits.
2. To fabricate NMOS, PMOS, and CMOS.
3. To design VHDL based digital circuits.

Course Contents:

Pre-requisite: Knowledge of Basic Electronics Engineering of first year and Analog Electronics of second year.

Unit 1: Introduction to VLSI Design: VLSI Design Concepts, Moor's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, ASIC, PLA, FPGA), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structural, Physical).

Unit 2: MOS structure: E-MOS & D-MOS, Charge inversion in E-MOS, Threshold voltage, Flat-Band voltage, Potential balance & Charge balance, Inversion, MOS capacitances, three-terminal MOS structure with Body-effect, four-terminal MOS transistor: Drain current, I-V characteristics, Current-voltage equations (simple derivation), scaling in MOSFET: General scaling, Constant voltage scaling & Constant field scaling, Short channel effects. CMOS inverter, Simple Combinational Gates-NAND gate and NOR gate using CMOS.

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Unit 3: Micro-electronic Processes for VLSI Fabrication: Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photo-lithography – Positive & Negative photo-resist ; Basic CMOS Technology – (Steps in fabricating CMOS), Basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator; Layout Design Rule: Stick diagram with examples, Layout rules.

Unit 4: Hardware Description Language: VHDL or Verilog Combinational & Sequential Logic circuit Design.

Text Books

1. Wayne Wolf; Modern VLSI Design, Pearson Education. [For unit-I]
2. S.M.Kang & Y.Leblebici; CMOS Digital Integrated Circuit, Tata McGraw Hill. [For unit-II and unit-III]
3. J. Bhaskar; A VHDL primer, third edition, Prentice hall [For unit-IV]

References

1. Digital Integrated Circuits, Demassa & Ciccone, John Willey & Sons.
2. CMOS Circuit Design, Layout & Simulation, R. J. Baker, H. W. Lee, D. E. Boyee, PHI.
3. Advance Digital Design Using Verilog, Michel D. Celliti, PHI