

# COURSE STRUCTURE & SYLLABUS FOR INFORMATION TECHNOLOGY

*(Applicable for batches admitted from 2019 - 2020)*



UNIVERSITY COLLEGE OF ENGINEERING VIZIANAGARAM  
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA  
KAKINADA - 533 003, Andhra Pradesh, India

University College of Engineering Vizianagaram (A)  
 Jawaharlal Nehru Technological University Kakinada  
 Department of Information Technology- R19 Course Structure  
 Program: B.Tech (Information Technology)

I YEAR I SEMESTER						
S.No	Course Code	Courses	L	T	P	C
1	HS1101	Communicative English	3	0	0	3
2	BS1102	Calculus	3	0	0	3
3	BS1103	Applied Physics	3	0	0	3
4	ES1104	Essentials of Electronics Engineering	3	0	0	3
5	ES1105	Fundamentals of Computer Science	3	0	0	3
6	HS1106	English Communication Skills lab	0	0	3	1.5
7	BS1107	Applied Physics Lab	0	0	3	1.5
8	BS1108	Applied Physics Virtual Lab	0	0	2	0
9	ES1109	IT Workshop	0	0	3	1
10	ES1110	Essentials of Electronics Engineering lab	0	0	3	1.5
Mandatory courses						
11	MC1111	Professional Ethics & Human Values	3	0	0	0
Total			18	0	14	20.5

I YEAR II SEMESTER						
S.No	Course Code	Courses	L	T	P	C
1	BS1201	Linear algebra and Numerical Methods	3	0	0	3
2	ES1202	Digital Logic Design	3	0	0	3
3	BS1203	Applied Chemistry	3	0	0	3
4	ES1204	Problem solving and Programming using C	3	0	0	3
5	ES1205	Engineering Drawing	1	0	3	2.5
6	HS1206	Advanced English Communication Skills lab	0	0	3	1.5
7	BS1207	Applied Chemistry Lab	0	0	3	1.5
8	ES1208	Problem solving and Programming using C-Lab	0	0	3	1.5
9	PR1209	Engineering Exploration Project - Design Thinking (15 Hrs per Sem.)	0	0	0	0.5
Mandatory Courses						
10	MC1210	Constitution of India	3	0	0	0
11	MC1211	Physical Fitness Activities/Yoga	2	0	0	0
Total			18	0	12	19.5

**II YEAR –I SEMESTER**

S.No	Course Code	Courses	L	T	P	C
1	BS2101	Discrete Mathematical Structures	3	0	0	3
2	IT2102	Principles of Software Engineering	3	0	0	3
3	ES2103	Python Programming	3	0	0	3
4	IT2104	Data Structures	3	0	0	3
5	IT2105	Computer Organization	3	0	0	3
6	IT2106	Principles of Programming Languages	3	0	0	3
7	ES2107	Python Programming Lab	0	0	3	1.5
8	IT2108	Data Structures through C++ Lab*	0	0	3	1.5
9	MC2109	Essence of Indian Traditional Knowledge	3	0	0	0
10	MC2110	Employability Skills – I	3	0	0	0
Total			24	0	6	21
*Relevant theory to be taught in the lab						

**II YEAR –II SEMESTER**

S.No	Course Code	Courses	L	T	P	C
1	BS2201	Probability and Statistics	3	0	0	3
2	IT2202	Object Oriented Programming through Java	2	1	0	3
3	IT2203	Operating Systems	3	0	0	3
4	IT2204	Data Base Management Systems	3	0	0	3
5	IT1205	Theory of Computation	3	0	0	3
6	IT2206	Java Programming Lab	0	0	3	1.5
7	IT2207	Unix and Operating Systems Lab	1	0	3	2
8	IT2208	Data Base Management Systems Lab	0	0	3	1.5
9	MC2209	IPR & Patents	3	0	0	0
Total			18	1	9	20

III YEAR I SEMESTER						
S.No	Course Code	Courses	L	T	P	C
1	IT3101	Advanced Data Structures	3	1	0	4
2	IT3102	Computer Networks	3	0	0	3
3	IT3103	Compiler Design	3	0	0	3
4	IT3104	Artificial Intelligence	3	0	0	3
5	PE3105	Professional Elective -I 1. Software Testing Methodologies 2. NO SQL Databases 3. Scripting Languages 4. Computer Graphics 5. Design Patterns	3	0	0	3
6	IT3106	Design and Analysis of Algorithms	3	1	0	4
7	IT3107	Unified Modeling Language (UML) Lab **	0	0	3	1.5
8	IT3108	AI Tools & Techniques Lab	0	0	3	1.5
9	MC3109	Employability Skills - II	3	0	0	0
Total			21	2	6	23
**Relevant theory to be taught in the lab						

III YEAR II SEMESTER						
S.No	Course Code	Courses	L	T	P	C
1	IT3201	Data Warehousing and Data Mining	3	0	0	3
2	OE3202	Open Elective- I (Inter Disciplinary)	3	0	0	3
3	IT3203	Cryptography and Network Security	3	0	0	3
4	PE3204	Professional Elective II (MOOCS/NPTEL/SWAYAM) Duration: 12 Weeks Minimum	3	0	0	3
5	IT3205	M-Commerce	3	0	0	3
6	IT3206	Computer Networks and Security lab	0	0	3	1.5
7	IT3207	Data Mining Lab	0	0	3	1.5
8	PR3208	Industrial Training/ Internship/ Research Projects in National Laboratories/Academic Institutions	0	0	0	2
Total			15	0	6	20

IV YEAR I SEMESTER						
S.No	Course Code	Courses	L	T	P	C
1	IT4101	Web Technologies	3	0	0	3
2	IT4102	Machine Learning	3	1	0	4
3	OE4103	Open Elective II (Inter Disciplinary)	3	0	0	3
4	PE4104	Professional Elective III 1. Big Data Technologies 2. Social Media Analytics 3. Ad-hoc and Sensor Networks 4. Cloud Computing 5. R-Programming	3	0	0	3
5	PE4105	Professional Elective IV 1. Distributed Systems 2. Internet of Things 3. Parallel Computing 4. Data Science 5. Pattern Recognition & Biometrics	3	0	0	3
6	IT4106	Web Technologies Lab	0	0	3	1.5
7	PR4107	Project –I	0	0	0	2.5
8	MC4108	Environmental Sciences	3	0	0	0
Total			19	1	3	20

IV YEAR II SEMESTER						
S.No	Course Code	Courses	L	T	P	C
1	HS4201	Management and Organizational Behavior	3	0	0	3
2	OE4202	Open Elective- III (Inter Disciplinary)	3	0	0	3
3	PE4203	Professional Elective- V 1. Deep Learning 2. Natural Language Processing 3. Block Chain Technologies 4. Software Project Management 5. Network Programming	3	0	0	3
4	PR4204	Project- II	0	0	0	7
Total			9	0	0	16

Open Electives Offered:

III Year – II Semester:

Open Elective-I(Inter Disciplinary):

- 1.Java Programming
- 2.Database Management Systems
- 3.Computer Graphics
- 4.Principles of Software Engineering
- 5.Web Technologies

IV Year – I Semester:

Open Elective-II(Inter Disciplinary):

- 1.Soft Computing
- 2.Machine Learning
- 3.AI Tools & Techniques
- 4.Pattern Recognition
- 5.Mobile Application Development

IV Year – II Semester:

Open Elective- III (Inter Disciplinary):

- 1.Data Science
- 2.Internet of Everything
- 3.Wireless Sensor Networks
- 4.R-Programming
- 5.Digital Marketing & Multimedia

## ADVANCED DATA STRUCTURES

### Course Objectives:

- Describe and implement a variety of advanced data structures (hash tables, priority queues, balanced and digital search trees).
- Analyze the space and time complexity of the algorithms studied in the course.
- Identify different solutions for a given problem; analyze advantages and disadvantages to different solutions.
- Demonstrate an understanding of external sorting and string matching algorithms.

### UNIT-I: Algorithm Analysis and Hashing

Introduction to Algorithm Analysis, Step Counts, Asymptotic Notations, Amortized Analysis (Text Book 2)

Dictionaries, Hashing, Hash Functions, Open Hashing, Closed Hashing, Extendible Hashing (Text Book 1 & Reference 1)

### UNIT-II: Priority Queues and Tournament Trees

Introduction to Priority Queues and ADT, implementation with Lists, Binary Heaps: Operations, Build Heap, Performance Analysis, Binomial Queues: Operations, Amortized Analysis, Lazy Binomial Queues (Text Book 2 & Reference 5)

Tournament Trees: Winner Trees and Loser Trees (Text Book 2)

### UNIT-III: Efficient Binary Search Trees (Text Book 1)

AVL Trees, Red-Black Trees and Splay Trees: Introduction, Operations, Maximum Height, Performance Analysis

### UNIT-IV: Multiway and Digital Search Trees and External Sorting

(Text Book 1) Multiway Search Trees: B-Trees and B<sup>+</sup>-Trees

Digital Search Trees: Digital Search Trees, Binary Tries, PARTRICA and Multiway Tries introduction, k-way merging, buffer handling, run generation, optimal merging of runs

### UNIT-V: String Matching (Text Book 3)

Exact String Matching: Straightforward Algorithms, The Knuth-Morris-Pratt Algorithm, The Boyer-Moore Algorithm, Multiple Searches, Bit-Oriented Approach, Matching Sets of Words, Regular Expression Matching, Suffix Tries and Trees, Suffix Arrays

#### Course Outcomes:

- Be able to understand and apply asymptotic analysis on data structures, including search trees, heaps, and dictionaries.
- Understand the implementation and complexity analysis of external sorting and string matching algorithms.
- Have an idea of applications of data structures and algorithms in a variety of areas, including linear programming and duality, string matching, game -theory.

#### TEXT BOOKS:

1. Fundamentals of Data Structures in C: Second Edition, Horowitz, Sahani, Anderson Freed, Universities Press.
2. Data Structures, Algorithms and Applications in C++, Second Edition, Sartaj Sahani, Universities Press.

#### REFERENCE BOOKS:

1. Data structures and Algorithm Analysis in C, 2nd edition, Mark Allen Weiss, Pearson
2. “Introduction to Algorithms”, T. Cormen, R.Rivest, C. Stein, C. Leiserson, PHI publication, Second Edition, 2004, ISBN 81-203-2141-3.
3. Data Structures, a Pseudo code Approach, Richard F Gilberg, Behrouz A Forouzan, Cengage.

#### e-Resources:

- 1) <http://lcm.csa.iisc.ernet.in/dsa/dsa.html>
- 2) [http://utubersity.com/?page\\_id=878](http://utubersity.com/?page_id=878)
- 3) <http://freevidelectures.com/Course/2519/C-Programming-and-Data-Structures>
- 4) <http://freevidelectures.com/Course/2279/Data-Structures-And-Algorithms>



## COMPUTER NETWORKS

### Course Objectives:

The main objectives are

- Study the basic taxonomy and terminology of the computer networking and enumerate the layers of OSI model and TCP/IP model
- Study data link layer concepts, design issues, and protocols
- Gain core knowledge of Network layer routing protocols and IP addressing
- Study Session layer design issues, Transport layer services, and protocols
- Acquire knowledge of Application layer and Presentation layer paradigms and protocols

### UNIT I

Introduction: History and development of computer networks, Basic Network Architectures: OSI reference model, TCP/IP reference model, and Networks topologies, types of networks (LAN, MAN, WAN, circuit switched, packet switched, message switched, extranet, intranet, Internet, wired, wireless).

### UNIT II

Physical layer: Line encoding, block encoding, scrambling, modulation demodulation (both analog and digital), errors in transmission, multiplexing (FDM, TDM, WDM, OFDM, DSSS), Different types of transmission media. Data Link Layer services: framing, error control, flow control, medium access control. Error & Flow control mechanisms: stop and wait, Go back N and selective repeat. MAC protocols: Aloha, slotted aloha, CSMA, CSMA/CD, CSMA/CA, polling, token passing, scheduling.

### UNIT III

Local Area Network Technology:Token Ring. Error detection (Parity, CRC), Ethernet, Fast Ethernet, Gigabit Ethernet, Personal Area Network: Bluetooth and Wireless Communications Standard: Wi-Fi (802.11) and Wi-MAX.

### UNIT IV

Network layer: Internet Protocol, IPv6, ARP, DHCP, ICMP, Routing algorithms: Distance vector, Link state, Metrics, Inter-domain routing. Sub netting, Super netting, Classless addressing, Network Address Translation.

### UNIT V

Transport layer: UDP, TCP. Connection establishment and termination, sliding window, flow and congestion control, timers, retransmission, TCP extensions, Queuing theory, Single and multiple server queuing models, Little's formula. Application Layer. Network Application services and protocols including e-mail, www, DNS, SMTP, IMAP, FTP, TFTP, Telnet, BOOTP, HTTP, IPSec, Firewalls.

### Course Outcomes:

At the end of the course, the students will be able to:

- Illustrate the OSI and TCP/IP reference model
- Analyze MAC layer protocols and LAN technologies
- Design applications using internet protocols
- Implement routing and congestion control algorithms
- Develop application layer protocols

### Text Books:

- 1) Computer Networks , Andrew S. Tanenbaum, David J. Wetherall, Pearson Education India; 5 edition, 2013
- 2) Data Communication and Networking , Behrouz A. Forouzan, McGraw Hill, 5th Edition, 2012

### Reference Books:

- 1) Computer Networks: A Systems Approach, LL Peterson, BS Davie, Morgan-Kauffman , 5th Edition, 2011.
  - 2) Computer Networking: A Top-Down Approach JF Kurose, KW Ross, Addison-Wesley, 5th Edition, 2009
  - 3) Data and Computer Communications , William Stallings , Pearson , 8th Edition, 2007 e-Resources:
- 1) <https://nptel.ac.in/courses/106/105/106105183/>

III Year – I Semester

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## COMPILER DESIGN

### Course Objectives:

- To make the student to understand the process involved in a compiler.
- Create an overall view of various types of translators, linkers, loaders, and phases of a compiler.
- Understand what is syntax analysis, various types of parsers especially the top down approach, awareness among students the various types of bottom up parsers.
- Understand the syntax analysis and intermediate code generation, type checking, the role of symbol table and its organization.
- Understand Code generation, machine independent code optimization and instruction scheduling.

### UNIT-I:

Overview of language processing – pre-processors – compiler – assembler – interpreters, pre-processors, – linkers & loaders – structure of a compiler – phases of a compiler Lexical Analysis – Role of Lexical Analysis – Lexical Analysis Vs. Parsing – Token, patterns and Lexemes – Lexical Errors – Regular Expressions – Regular definitions for the language constructs – Strings, Sequences, Comments – Transition diagram for recognition of tokens, Reserved words and identifiers, Examples.

### UNIT-II:

Syntax Analysis – discussion on CFG, LMD,RMD, parse trees, Role of a parser – classification of parsing techniques – Brute force approach, left recursion, left factoring,.Top down parsing – First and Follow- LL(1) Grammars, Non- Recursive predictive parsing – Error recovery in predictive parsing.

### UNIT-III:

Bottom-Up Parsing: Bottom-Up Parsing, Shift-Reduce Parsing, Shift-Reduce Conflicts, LR Parsers-SLR, CLR, LALR; Error Recovery in Parsing, Handling Ambiguous Grammars. Syntax Directed Translation: Syntax Directed Definition, Evaluation Orders for SDDs, Attribute Grammars, S-attributed and L-attributed Definitions, Syntax Directed Translation Schemes.

### UNIT-IV:

Intermediate Code Generation: Different Types of Intermediate Forms- Abstract Syntax Trees, Polish Notation and Three Address Code, Types of Three Address Statements, Types and Decelerations, Translation of Expressions, Type Checking, Type Expressions, Type Systems, Equivalence of Type Expressions, Control Flow, Back Patching.

#### UNIT-V:

Code Optimization: Principal Sources of Optimization, Machine Dependent and Independent Optimization, Organization of Code Optimizer, Basic Graphs and Flow Graphs, DAG Representation of Basic Blocks, Loop Optimization, Peephole Optimization, Global Dataflow Analysis.

Code Generation: Issues in the Design of Code Generation, Object Code Forms, Target Machine, Simple Code generator, Register Allocation and Assignment.

#### Course Outcomes:

- To introduce the major concept areas of language translation and compiler design
- To develop an awareness of the function and complexity of compilers.
- To provide practical, hands on experience in compiler design
- Identify the similarities and differences among various parsing techniques and grammar transformation techniques.

#### TEXT BOOKS:

1. Compilers, Principles Techniques and Tools- Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D. Ullman, 2nd ed, Pearson, 2007.
2. Compiler Design, K. Muneeswaran, Oxford.

#### REFERENCE BOOKS:

1. Engineering a compiler, 2nd edition, Keith D. Cooper & Linda Torczon, Morgan Kaufman. <http://www.nptel.iitm.ac.in/downloads/106108052/>
2. Principles of compiler design, V. Raghavan, 2nd ed, TMH, 2011.
3. Compiler construction, Principles and Practice, Kenneth C Loudon, CENGAGE
4. Implementations of Compiler, A new approach to Compilers including the algebraic methods, Yunlinsu, SPRINGER

## ARTIFICIAL INTELLIGENCE

### Course Objectives:

- To have a basic proficiency in a traditional AI language including an ability to write simple to intermediate programs and an ability to understand code written in that language.
- To have an understanding of the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minmax, resolution, etc. that play an important role in AI programs.
- To have a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, agents and robotics, expert systems, and planning.

### UNIT-I:

Introduction to artificial intelligence: Introduction ,history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of ai languages, current trends in AI

### UNIT-II:

Problem solving: state: space search and control strategies : Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening a\*, constraint satisfaction Problem reduction and game playing: Introduction, problem reduction, game playing, alphabeta pruning, two-player perfect information games

### UNIT-III:

Logic concepts: Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in propositional logic, resolution refutation in propositional logic, predicate logic

### UNIT-IV:

Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web

## UNIT-V:

Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools

### Course Outcomes:

- Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
- Formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).
- Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).
- Design and carry out an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.

### TEXT BOOKS:

1. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
2. Artificial intelligence, A modern Approach , 2nd ed, Stuart Russel, Peter Norvig, PEA
3. Artificial Intelligence- Rich, Kevin Knight, Shiv Shankar B Nair, 3rd ed, TMH
4. Introduction to Artificial Intelligence, Patterson, PHI

### REFERNCE BOOKS:

1. Artificial intelligence, structures and Strategies for Complex problem solving, - George F Lugar, 5th ed, PEA
2. Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
3. Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier

## SOFTWARE TESTING METHODOLOGIES

(Professional Elective-I)

## Course Objectives:

- To study fundamental concepts in software testing, including software testing Course Objectives:, process, criteria, strategies, and methods and To discuss various software testing issues and solutions in software unit test; integration, regression, and system testing.
- To learn how to planning a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report.
- To expose the advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions.
- To gain software testing experience by applying software testing knowledge and methods to practice-oriented software testing projects.
- To understand software test automation problems and solutions, To learn how to write software testing documents, and communicate with engineers in various forms and To gain the techniques and skills on how to use modern software testing tools to support software testing projects.

UNIT-I: Software Testing: Introduction, Evolution, Myths & Facts, Goals, Psychology, Definition, Model for testing, Effective Vs Exhaustive Software Testing. Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, relating test life cycle to development life cycle, Software Testing Methodology.

UNIT-II: Verification and Validation: Verification & Validation Activities, Verification, Verification of Requirements, High level and low level designs, How to verify code, Validation

Dynamic Testing I: Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table based testing, Cause-Effect Graphing based testing, Error guessing

UNIT-III: Dynamic Testing II: White-Box Testing: need, Logic coverage criteria, Basis path testing, Graph matrices, Loop testing, data flow testing, mutation testing  
 Static Testing: inspections, Structured Walkthroughs, Technical reviews  
 Validation activities: Unit testing, Integration Testing, Function testing, system testing, acceptance testing Regression testing: Progressives Vs regressive testing, Regression testability, Course Objectives: of regression testing, when regression testing done, Regression testing types, Regression testing techniques.

UNIT-IV: Efficient Test Suite Management: Test case design. Why does a test suite grow, Minimizing the test suite and its benefits, test suite prioritization, Types of test case prioritization, prioritization techniques, measuring the effectiveness of a prioritized test suite.

UNIT-V: Automation and Testing Tools: need for automation, categorization of testing tools, selection of open source testing tools, Cost incurred. Testing Object Oriented Software: basics, Object oriented testing. Testing Web based Systems: Challenges in testing for web-based software, quality aspects, web engineering, testing of web-based systems, Testing mobile systems

Course Outcomes:

By the end of the course, the student should have the ability to:

- Identify and understand various software testing problems, apply software testing knowledge and engineering methods and solve these problems by designing and selecting software test models, criteria, strategies, and methods.
- Design and conduct a software test process for a software project.
- Analyze the needs of software test automation.
- Use various communication methods and skills to communicate with their teammates to conduct their practice-oriented software testing projects.
- Basic understanding and knowledge of contemporary issues in software testing, such as component-based, web based and object oriented software testing problems
- Write test cases for given software to test it before delivery to the customer and write test scripts for both desktop and web based applications

TEXT BOOKS:

1. Software Testing, Principles and Practices, Naresh Chauhan, Oxford
2. Foundations of Software testing, Aditya P Mathur, 2ed, Pearson
3. Art of Software Testing, Myers Glenford

REFERENCE BOOKS:

1. Software Testing, 4th edition, P.C. Jorgensen, Aurbach Publications  
(Dist.by SPD).
2. Software testing techniques - Baris Beizer, International Thomson  
computer press, second edition.
3. Introduction to Software Testing, P.Ammann&J.Offutt, Cambridge Univ.Press
4. Software Testing, Principles, techniques and Tools, M G Limaye, TMH
5. Effective Methods for Software testing, William E Perry, 3ed, Wiley Software  
Testing- Yogesh Singh, CAMBRIDGE.



## NO SQL DATABASES

Code: PE3101

(Professional Elective-I)

### Course Objectives:

From the course the student will

- To understand the basic concepts and the applications of database systems. To master the basics of SQL and construct queries using SQL.
- To understand the relational database design principles.
- To become familiar with the basic issues of transaction processing and concurrency control.
- To become familiar with database storage structures and access techniques.

### UNIT I

Introduction to NoSQL: Definition And Introduction, Sorted Ordered Column-Oriented Stores, Key/Value Stores, Document Databases, Graph Databases, Examining Two Simple Examples, Location Preferences Store, Car Make And Model Database, Working With Language Bindings.

### UNIT II

Interacting with NoSQL: If NoSql Then What, Language Bindings For NoSQL Data Stores, Performing Crud Operations, Creating Records, Accessing Data, Updating And Deleting Data

### UNIT III

NoSQL Storage Architecture : Working With Column-Oriented Databases, Hbase Distributed Storage Architecture, Document Store Internals, Understanding Key/Value Stores In Memcached And Redis, Eventually Consistent Non-Relational Databases.

### UNIT IV

NoSQL Stores : Similarities Between Sql And MongoDB Query Features, Accessing Data From Column-Oriented Databases Like Hbase, Querying Redis Data Stores, Changing Document Databases, Schema Evolution In Column-Oriented Databases, Hbase Data Import And Export, Data Evolution In Key/Value Stores.

### UNIT V

Indexing and Ordering Data Sets : Essential Concepts Behind A Database Index, Indexing And Ordering In MongoDB, Creating and Using Indexes In MongoDB, Indexing And Ordering In Couchdb, Indexing In Apache Cassandra.

### Course Outcomes:

After the completion of the course, student will be able to do the following.

- Define, compare and use the four types of NoSQL Databases (Document-oriented, Key Value Pairs, Column oriented and Graph).
- Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
- Explain the detailed architecture, define objects, load data, query data and performance tune Document oriented NoSQL databases.
- Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data

### Text Books:

- 1) Pramod Sadalage and Martin Fowler, NoSQL Distilled, Addison-Wesley Professional, 2012.
- 2) Dan McCreary and Ann Kelly, Making Sense of NoSQL, Manning Publications, 2013.

### Reference Books:

- 1) Shashank Tiwari, Professional NoSQL, Wrox Press, Wiley, 2011, ISBN: 978-0-470-94224-6
- 2) Gaurav Vaish, Getting Started with NoSQL, Packt Publishing, 2013.

## SCRIPTING LANGUAGES

Code: PE3101

(Professional Elective-I)

## Course Objectives:

From the course the student will

- Understand the concepts of scripting languages for developing web based projects.
- Illustrates object oriented concepts like PHP, PYTHON, PERL.
- Create database connections using PHP and build the website for the world.
- Demonstrate IP address for connecting the web servers.
- Analyze the internet ware application, security issues and frame works for application.

## UNIT I

Introduction to PERL and Scripting: Scripts and Programs, Origin of Scripting , Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

## UNIT II

Advanced PERL: Finer points of looping, pack and unpack, file system, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues.

PHP Basics: PHP Basics- Features, Embedding PHP Code in your Web pages, Outputting the data to the browser, Data types, Variables, Constants, expressions, string interpolation, control structures, Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions.

## UNIT III

Advanced PHP Programming: PHP and Web Forms, Files, PHP Authentication and Methodologies-Hard Coded, File Based, Database Based, IP Based, Login Administration, Uploading Files with PHP, Sending Email using PHP, PHP Encryption Functions, the Crypt package, Building Web sites for the World.

## UNIT IV

TCL: TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures ,input/output, procedures , strings , patterns, files, Advance TCL- eval, source, exec and up level commands, Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, C Interface. Tk-Visual Tool Kits, Fundamental Concepts of Tk, Tk by example, Events and Binding , Perl-Tk.

## UNIT V

Python: Introduction to Python language, python-syntax, statements, functions, Built-in-functions and Methods, Modules in python, Exception Handling. Integrated Web Applications in Python – Building Small, Efficient Python Web Systems, Web Application Framework.

#### Course Outcomes:

After the completion of the course, student will be able to do the following.

- Ability to understand the differences between scripting languages.
- Create PHP authentication Methodology for security issues.
- Identify PHP encryption functions and Mcrypt Package.
- Explain syntax and variables in TCL.
- Able to gain some fluency programming in Ruby, JavaScript, Perl, Python, and related languages.
- Master an understanding of python especially the object oriented concepts.

#### Text Books:

- 1) The World of Scripting Languages, David Barron, Wiley Publications.
- 2) Python Web Programming, Steve Holden and David Beazley, New Riders Publications.
- 3) Beginning PHP and MySQL, 3<sup>rd</sup> Edition, Jason Gilmore, Apress Publications (Dream tech).

#### References Books:

- 1) Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP, J.Lee and B.Ware (Addison Wesley) Pearson Education. Programming Python,M.Lutz,SPD.
- 2) PHP 6 Fast and Easy Web Development, Julie Meloni and Matt Telles, Cengage Learning Publications.
- 3) Tcl and the Tk Tool kit, Ousterhout, Pearson Education.
- 4) PHP and MySQL by Example, E.Quigley, Prentice Hall (Pearson).
- 5) Perl Power, J.P.Flynt, Cengage Learning.

COMPUTER GRAPHICS  
(Professional Elective-I)

Course Objectives:

- To develop, design and implement two and three dimensional graphical structures
- To enable students to acquire knowledge Multimedia compression and animations
- To learn Creation, Management and Transmission of Multimedia objects.

UNIT-I:

2D Primitives: Output primitives – Line, Circle and Ellipse drawing algorithms - Attributes of output primitives – Two dimensional Geometric transformations - Two dimensional viewing – Line, Polygon, Curve and Text clipping algorithms

UNIT-II:

3D Concepts: Parallel and Perspective projections - Three dimensional object representation – Polygons, Curved lines, Splines, Quadric Surfaces, - Visualization of data sets - 3Dtransformations – Viewing -Visible surface identification.

UNIT-III:

Graphics Programming: Color Models – RGB, YIQ, CMY, HSV – Animations – General Computer Animation, Raster, Keyframe - Graphics programming using OPENGL – Basic graphics primitives – Drawing three dimensional objects - Drawing three dimensional scenes

UNIT- IV:

Rendering: Introduction to Shading models – Flat and Smooth shading – Adding texture to faces – Adding shadows of objects – Building a camera in a program – Creating shaded objects– Rendering texture – Drawing Shadows.

UNIT- V:

Fractals: Fractals and Self similarity – Peano curves – Creating image by iterated functions – Mandelbrot sets – Julia Sets – Random Fractals.

Overview of Ray Tracing: Intersecting rays with other primitives – Adding Surface texture – Reflections and Transparency – Boolean operations on Objects.

Course Outcomes:

- Know and be able to describe the general software architecture of programs that use 3D computer graphics.
- Know and be able to discuss hardware system architecture for computer graphics. This Includes, but is not limited to: graphics pipeline, frame buffers, and graphic accelerators/co-processors.

- Know and be able to select among models for lighting/shading: Colour, ambient light; distant and light with sources; Phong reflection model; and shading (flat, smooth, Gourmand, Phong).

#### TEXT BOOKS:

1. Donald Hearn, Pauline Baker, Computer Graphics – C Version, second edition, Pearson Education,2004.
2. F.S. Hill, Computer Graphics using OpenGL, Second edition, Pearson Education,2003.

#### REFERENCE BOOKS:

1. James D. Foley, Andries Van Dam, Steven K. Feiner, John F. Hughes, Computer Graphics- Principles and practice, Second Edition in C, Pearson Education, 2007.
2. Schaum's Outline of Computer Graphics Second Edition, Zhigang Xiang, Roy A. Plastock.

#### e-Resources:

- 1) <http://math.hws.edu/eck/cs424/downloads/graphicsbook-linked.pdf>
- 2) <https://nptel.ac.in/courses/106/106/106106090/>

DESIGN PATTERNS  
Code: PE4101  
(Professional Elective-I)

Course Objectives:

- Demonstration of patterns related to object oriented design.
- Describe the design patterns that are common in software applications.
- Analyze a software development problem and express it.
- Design a module structure to solve a problem, and evaluate alternatives.
- Implement a module so that it executes efficiently and correctly

UNIT I

Introduction: Design Pattern, Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern.

A Case Study: Designing a Document Editor : Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation, Summary .

UNIT II

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

UNIT III

Structural Pattern: Adapter, Bridge, Composite, Decorator, façade, Flyweight, Proxy.

UNIT IV

Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer,

UNIT V

Behavioral Patterns: State, Strategy, Template Method , Visitor, Discussion of Behavioral Patterns. What to Expect from Design Patterns, A Brief History, The Pattern Community An Invitation, A Parting Thought.

Course Outcomes:

- Construct a design consisting of a collection of modules
- Exploit well-known design patterns (such as Iterator, Observer, Factory and Visitor).
- Distinguish between different categories of design patterns.
- Ability to understand and apply common design patterns to incremental/iterative development.
- Ability to identify appropriate patterns for design of given problem.
- Design the software using Pattern Oriented Architectures.

**Text Books:**

- 1) Design Patterns By Erich Gamma, Pearson Education.

**Reference Books:**

- 1) Head First Design patterns, Eric Freeman & Elisabeth Freeman, O'REILLY, 2007.
- 2) Design Patterns in Java, Steven John Metsker & William C. Wake, Pearson education, 2006
- 3) J2EE Patterns, Deepak Alur, John Crupi & Dan Malks, Pearson education, 2003.
- 4) Design Patterns in C#, Steven John metsker, Pearson education, 2004.
- 5) Pattern Oriented Software Architecture, F.Buschmann & others, John Wiley & Sons.



## DESIGN AND ANALYSIS OF ALGORITHMS

## Course Objectives:

- Upon completion of this course, students will be able to do the following:
- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis and synthesize efficient algorithms in common engineering design situations.

UNIT-I: Introduction: Algorithm, Pseudo code for expressing algorithms, performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation and Little oh notation, probabilistic analysis, Amortized analysis.

UNIT-II: Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication, Performance Measurement, Randomized Sorting Algorithms

UNIT-III: Greedy method: General method, applications-Job sequencing with deadlines, knapsack problem, spanning trees, Minimum cost spanning trees, Single source shortest path problem.

UNIT-IV: Dynamic Programming: General method, applications-Matrix chain multiplication, Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem, Reliability design.

Backtracking: General method, applications-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles.

UNIT-V: Branch and Bound: General method, applications - Travelling sales person problem, 0/1 knapsack problem- LC Branch and Bound solution, FIFO Branch and Bound solution.

NP-Hard and NP-Complete problems: Basic concepts, non deterministic algorithms, NP - Hard and NP Complete classes, Cook's theorem.

## Course Outcomes:

Students who complete the course will have demonstrated the ability to do the following:

- Analyze worst-case running times of algorithms using asymptotic analysis.
- Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
- Describe the greedy paradigm and explain when an algorithmic design situation calls for it.
- Explain the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate.
- Synthesize new graph algorithms and algorithms that employ graph

## TEXT BOOKS:

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Universities Press.
2. Introduction to Algorithms, second edition, T.H.Cormen, C.E.Leiserson, R.L.Rivest and C.Stein, PHI Pvt.Ltd.
3. Introduction to the Design and Analysis of Algorithms, Anany Levitin, PEA

## REFERENCE BOOKS:

1. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.
2. Algorithm Design, Foundation, Analysis and internet Examples, Michel T Goodrich, Roberto Tamassia, Wiley
3. Design and Analysis of Algorithms , S Sridhar, Oxford
4. Design and Analysis of Algorithms, Parag Himanshu Dave, Himansu BAlachandra Dave, 2ed, Pearson Education.

## UNIFIED MODELLING LANGUAGES LAB

### Course Objectives

- Construct UML diagrams for static view and dynamic view of the system.
- Generate creational patterns by applicable patterns for given context.
- Create refined model for given Scenario using structural patterns.
- Construct behavioural patterns for given applications.

Take any real-time case studies and work on the following weeks

Week 1: Familiarization with Rational Rose or Umbrello

Week 2, 3 & 4:

For each case study:

- a) Identify and analyze events
- b) Identify Use cases
- c) Develop event table
- d) Identify & analyze domain classes
- e) Represent use cases and a domain class diagram using Rational Rose
- f) Develop CRUD matrix to represent relationships between use cases and problem domain classes

Week 5 & 6:

For each case study:

- a) Develop Use case diagrams
- b) Develop elaborate Use case descriptions & scenarios
- c) Develop prototypes (without functionality)
- d) Develop system sequence diagrams

Week 7, 8, 9 & 10:

For each case study:

- a) Develop high-level sequence diagrams for each use case
- b) Identify MVC classes / objects for each use case
- c) Develop Detailed Sequence Diagrams / Communication diagrams for each use case showing interactions among all the three-layer objects
- d) Develop detailed design class model (use GRASP patterns for responsibility assignment)
- e) Develop three-layer package diagrams for each case study

Week 11 & 12:

For each case study:

- a) Develop Use case Packages
- b) Develop component diagrams
- c) Identify relationships between use cases and represent them
- d) Refine domain class model by showing all the associations among classes

Week 13 onwards:

For each case study:

- a) Develop sample diagrams for other UML diagrams
- b) State chart diagrams
- c) Activity diagrams
- d) Deployment diagrams

Course Outcomes

Students successfully completing this course will be able to:

- Understand the Case studies and design the Model.
- Understand how design patterns solve design problems.
- Develop design solutions using creational patterns.

Construct design solutions by using structural and behavioral patterns

**AI TOOLS & TECHNIQUES LAB**  
Code: IT3107

**Course Objectives:**

- Study the concepts of Artificial Intelligence.
- Learn the methods of solving problems using Artificial Intelligence.
- Introduce the concepts of machine learning.

**List of Experiments:**

1. Study of Prolog.
2. Write simple fact for the statements using PROLOG.
3. Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing
4. Write a program to solve the Monkey Banana problem.
5. Write a program in turbo prolog for medical diagnosis and show the advantage and disadvantage of green and red cuts
6. Write a program to implement factorial, Fibonacci of a given number
7. Write a program to solve 4-Queen and 8-puzzle problem using LISP/PROLOG/PYTHON. .
8. Write a program to solve traveling salesman problem using LISP/PROLOG/PYTHON.
9. Write a program to solve water jug problem using LISP/PROLOG/PYTHON.
10. Implementation of A\* Algorithm using LISP /PROLOG/PYTHON
11. Implementation of Hill Climbing Algorithm using LISP /PROLOG/PYTHON
12. Implementation of DFS and BFS for water jug problem using LISP /PROLOG/PYTHON
13. Implementation of Towers of Hanoi Problem using LISP /PROLOG/PYTHON

**Course Outcomes:**

At the end of the course, the students will be able to:

- Identify problems that are amenable to solution by AI methods.
- Identify appropriate AI methods to solve a given problem.
- Formalize a given problem in the language/framework of different AI methods.
- Implement basic AI algorithms.
- Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.

Employability Skills -II  
Code: MC3101

A list of vital employability skills from the standpoint of engineering students with discussion how to potentially develop such skills through campus life.

- 1) Interview Skills: Interviewer and Interviewee – in-depth perspectives. Before, During and After the Interview. Tips for Success.
- 2) Presentation Skills: Types, Content, Audience Analysis, Essential Tips – Before, During and After, Overcoming Nervousness.
- 3) Etiquette and Manners – Social and Business.
- 4) Time Management – Concept, Essentials, Tips.
- 5) Personality Development – Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills.
- 6) Decision-Making and Problem-Solving Skills: Meaning, Types and Models, Group and Ethical Decision-Making, Problems and Dilemmas in application of these skills.
- 7) Conflict Management: Conflict - Definition, Nature, Types and Causes; Methods of Conflict Resolution.
- 8) Stress Management: Stress - Definition, Nature, Types, Symptoms and Causes; Stress Analysis Models and Impact of Stress; Measurement and Management of Stress
- 9) Leadership and Assertiveness Skills: A Good Leader; Leaders and Managers; Leadership Theories; Types of Leaders; Leadership Behaviour; Assertiveness Skills.
- 10) Emotional Intelligence: Meaning, History, Features, Components, Intrapersonal and Management Excellence; Strategies to enhance Emotional Intelligence.

References:

- 1) Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
- 2) S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.
- 3) R.S. Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand & Company Ltd., 2018.
- 4) Raman, Meenakshi & Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.

## DATA WAREHOUSING AND DATA MINING

## Course Objectives

- Students will be enabled to understand and implement classical models and algorithms in data mining.
- They will learn how to analyse the data, identify the problems, and choose the relevant models and algorithms to apply.
- They will further be able to assess the strengths and weaknesses of various methods and algorithms and to analyse their behaviour.

UNIT–I: Introduction: Why Data Mining? What Is Data Mining. What Kinds of Data Can Be Mined, What Kinds of Patterns Can Be Mined? Which Technologies Are Used? Which Kinds of Applications Are Targeted? Major Issues in Data Mining. Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity

UNIT–II: Data Pre-processing: Data Preprocessing: An Overview, Data Exploration and Visualization techniques, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization. Data Warehouse and OLAP Technology - An Overview: What Is a Data Warehouse? A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, From Data Warehousing to Data Mining.

UNIT–III: Classification: Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Working of Decision Tree, building a decision tree, methods for expressing an attribute test conditions, measures for selecting the best split, Algorithm for decision tree induction. Alternative Techniques, Bayes' Theorem, Naïve Bayesian Classification, Bayesian Belief Networks

UNIT–IV: Association Analysis: Basic Concepts and Algorithms: Problem Defecation, Frequent Item Set generation, Rule generation, compact representation of frequent item sets, FP-Growth Algorithm.

UNIT–V: Cluster Analysis: Basic Concepts and Algorithms: Overview: What Is Cluster Analysis? Different Types of Clustering, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bisecting K-means, Strengths and Weaknesses; Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center- Based Approach, DBSCAN Algorithm, Strengths and Weaknesses.

Course Outcomes:

- Understand stages in building a Data Warehouse
- Understand the need and importance of pre-processing techniques
- Understand the need and importance of Similarity and dissimilarity techniques
- Analyse and evaluate performance of algorithms for Association Rules.
- Analyse Classification and Clustering algorithms

TEXT BOOKS:

1. Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson.
2. Data Mining concepts and Techniques, 3/e, Jiawei Han, Michel Kamber, Elsevier.

REFERENCE BOOKS:

1. Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning.
2. Data Mining : VikramPudi and P. Radha Krishna, Oxford.
3. Data Mining and Analysis-Fundamental Concepts and Algorithms; Mohammed J. Zaki, Wagner Meira, Jr, Oxford
4. Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH.



JAVA PROGRAMMING  
(Open Elective- I)

COURSE OBJECTIVES:

- To learn why Java is useful for the design of desktop and web applications.
- To learn how to implement object-oriented designs with Java.
- To identify Java language components and how they work together in applications.
- To design and program stand-alone Java applications.
- To learn how to design a graphical user interface (GUI) with Java Swing.
- To understand how to use Java APIs for program development.

UNIT I:

Introduction to OOP: Introduction, Need of Object Oriented Programming, principles of Object Oriented Languages, Procedural languages Vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features, Program structures, Installation of JDK1.6

UNIT II:

Variables , Primitive Datatypes, Identifiers- Naming Conventions, Keywords, Literals, Operators-Binary, Unary and ternary, Expressions, Precedence rules and Associativity, Primitive Type Conversion and Casting, Flow of control Branching, Conditional, loops. Classes and Objects- classes, Objects, Creating Objects, Methods, constructors-Constructor overloading, cleaning up unused objects-Garbage collector, Class variable and Methods-Static keyword, this keyword, Arrays, Command line arguments

UNIT III:

Inheritance, Types of Inheritance, Deriving classes using extends keyword, Method overloading, super keyword, final keyword, Abstract class Interfaces, Packages and Enumeration: Interface-Extending interface, Interface Vs Abstract classes, Packages-Creating packages , using Packages, Access protection, javalang package. Exceptions & Assertions - Introduction, Exception handling techniques-try...catch, throw, throws, finally block, user defined exception, Exception Encapsulation and Enrichment, Assertions.

UNIT IV:

MultiThreading: java.lang.Thread, The main Thread, Creation of new threads, Thread priority, Multithreading Using is Alive() and join(), Synchronization, suspending and Resuming threads, Communication between Threads, Input/Output: reading and writing data, java.io package

#### UNIT V:

Applets: Applet class, Applet structure, An Example Applet Program, Applet Life Cycle, paint(),update() and repaint(). Event Handling - Introduction, Event Delegation Model, java.awt. event Description, Sources of Events, Event Listeners, Adapter classes, Inner classes.

Why AWT?, java.awt package, Components and Containers, Button, Label, Checkbox, Radio buttons, List boxes, Choice boxes, Text field and Text area, container classes, Layouts, Menu, Scroll bar. Bean: Introduction , JFrame, JApplet, JPanel, Components in swings, Layout Managers, JList and JScroll Pane, Split Pane, JTabbedPane, Dialog Box Pluggable Look and Feel

#### TEXT BOOKS:

1. The Complete Reference Java, 8ed, Herbert Schildt, TMH
2. Introduction to Java programming, 7 th ed, Y Daniel Liang, Pearson
3. Programming in JAVA, Sachin Malhotra, Saurabh choudhary, Oxford.
4. JAVA for Beginners, 4e, Joyce Farrell, Ankit R. Bhavsar, Cengage Learning.
5. Object oriented programming with JAVA, Essentials and Applications, Raj Kumar Bhuyya, Selvi, Chu TMH

#### REFERENCE BOOKS:

1. JAVA Programming, K.Rajkumar.Pearson
2. Core JAVA, Black Book, Nageswara Rao, Wiley, Dream Tech
3. Core JAVA for Beginners, Rashmi Kanta Das, Vikas.
4. Object Oriented Programming Through Java, P. Radha Krishna, Universities Press

DATABASE MANGEMENT SYSTEMS  
(Open Elective-I)

## COURSE OBJECTIVES:

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
- To understand and use data manipulation language to query, update, and manage a database
- To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency,
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

## UNIT-I:

An Overview of Database Management, Introduction- What is Database System. What is Database-Why Database- Data Independence- Relation Systems and Others- Summary, Database system architecture, Introduction- The Three Levels of Architecture-The External Level- the Conceptual Level- the Internal Level- Mapping- the Database Administrator-The Database Management Systems- Client/Server Architecture. The E/R Models, The Relational Model, Relational Calculus, Introduction to Database Design, Database Design and ER Diagrams-Entities Attributes, and Entity Sets-Relationship and Relationship Sets-Conceptual Design With the ER Models, The Relational Model Integrity Constraints

## UNIT-II:

Overview Relations- Key Constraints –Foreign Key Constraints-General Constraints, Relational Algebra and Calculus, Relational Algebra- Selection and Projection- Set Operation, Renaming – Joins- Division- More Examples of Queries, Relational Calculus, Tuple Relational Calculus- Domain Relational Calculus.

## UNIT-III:

Queries, Constraints, Triggers: The Form of Basic SQL Query, Union, Intersect, and Except, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Database.

## UNIT-IV:

Schema Refinement (Normalization) : Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), concept of surrogate key, Boyce-codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF).

#### UNIT-V:

Transaction Management and Concurrency Control: Transaction, properties of transactions, transaction log, and transaction management with SQL using commit rollback and save point. Concurrency control for lost updates, uncommitted data, inconsistent retrievals and the Scheduler. Concurrency control with locking methods : lock granularity, lock types, two phase locking for ensuring serializability, deadlocks, Concurrency control with time stamp ordering : Wait/Die and Wound/Wait Schemes, Database Recovery management : Transaction recovery.

#### COURSE OUTCOMES:

- Describe a relational database and object-oriented database.
- Create, maintain and manipulate a relational database using SQL
- Describe ER model and normalization for database design. Examine issues in data storage and query processing and can
- formulate appropriate solutions.
- Understand the role and issues in management of data such as efficiency, privacy, security, ethical responsibility, and strategic advantage.
- Design and build database system for a given real world problem

#### TEXT BOOKS:

1. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGraw Hill 3rd Edition
2. Data base Management Systems by Korth

#### REFERENCES BOOKS:

1. Data base Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate Pearson Education
3. Database Systems - The Complete Book, H G Molina, J D Ullman, J Widom Pearson

COMPUTER GRAPHICS  
(Open Elective-I)

Course Objectives:

- To develop, design and implement two and three dimensional graphical structures
- To enable students to acquire knowledge Multimedia compression and animations
- To learn Creation, Management and Transmission of Multimedia objects.

UNIT-I:

2D Primitives: Output primitives – Line, Circle and Ellipse drawing algorithms - Attributes of output primitives – Two dimensional Geometric transformations - Two dimensional viewing – Line, Polygon, Curve and Text clipping algorithms

UNIT-II:

3D Concepts: Parallel and Perspective projections - Three dimensional object representation – Polygons, Curved lines, Splines, Quadric Surfaces, - Visualization of data sets - 3D transformations – Viewing -Visible surface identification.

UNIT-III:

Graphics Programming: Color Models – RGB, YIQ, CMY, HSV – Animations – General Computer Animation, Raster, Keyframe - Graphics programming using OPENGL – Basic graphics primitives – Drawing three dimensional objects - Drawing three dimensional scenes

UNIT- IV:

Rendering: Introduction to Shading models – Flat and Smooth shading – Adding texture to faces – Adding shadows of objects – Building a camera in a program – Creating shaded objects– Rendering texture – Drawing Shadows.

UNIT- V:

Fractals: Fractals and Self similarity – Peano curves – Creating image by iterated functions – Mandelbrot sets – Julia Sets – Random Fractals.

Overview of Ray Tracing: Intersecting rays with other primitives – Adding Surface texture – Reflections and Transparency – Boolean operations on Objects.

Course Outcomes:

- Know and be able to describe the general software architecture of programs that use 3D computer graphics.
- Know and be able to discuss hardware system architecture for computer graphics. This Includes, but is not limited to: graphics pipeline, frame buffers, and graphic accelerators/co-processors.

- Know and be able to select among models for lighting/shading: Color, ambient light; distant and light with sources; Phong reflection model; and shading (flat, smooth, Gourand, Phong).

#### TEXT BOOKS:

3. Donald Hearn, Pauline Baker, Computer Graphics – C Version, second edition, Pearson Education, 2004.
4. F.S. Hill, Computer Graphics using OPENGL, Second edition, Pearson Education, 2003.

#### REFERENCE BOOKS:

1. James D. Foley, Andries Van Dam, Steven K. Feiner, John F. Hughes, Computer Graphics- Principles and practice, Second Edition in C, Pearson Education, 2007.

III Year - II Semester

L	T	P	C
3	0	0	3

## PRINCIPLES OF SOFTWARE ENGINEERING

Course Objectives:

- Graduates are effective team members, aware of cultural diversity, who conduct themselves ethically and professionally.
- Graduates use effective communication skills and technical skills to assure production of quality software, on time and within budget.
- Graduates build upon and adapt knowledge of science, mathematics, and engineering to take on more expansive tasks that require an increased level of self-reliance, technical expertise, and leadership.

UNIT-I: Introduction to Software Engineering

Evolution, Software Crisis, Software Development Projects, Exploring Style of Software Development, Emergencies Of Software Engineering, Software Life Cycle Models: Waterfall model and its extensions, Agile Development Model-Essential Idea Behind Agile Models, Agile Verses Other Models, Extreme Programming Model, Scrum Model. Spiral Model-Phases Of The Spiral Models. A Comparisons Of Different Models-Selecting An Appropriate Life Cycle Model For A Project.

UNIT-II: Software requirement analysis and specification

Value of good SRS, requirement process, requirement specification, functional specifications with use-cases, other approaches for analysis, validation.

Planning a software project: Effort estimation, project schedule and staffing, quality planning, risk management planning, project monitoring plan, detailed scheduling.

*UNIT- III: Software Design*

Overview of design process, Cohesion and coupling, Layered arrangement of modules, Approaches to software design.

Function-Oriented Software Design: Overview of SA/SD Methodology, Structured Analysis, Developing the DFD Model of a System, Structured Design, Detailed Design, Design Review, overview of Object Oriented design.

User Interface Design: Characteristics of Good User Interface, Basic Concepts, Types of User Interfaces, Fundamentals of Component-based GUI Development, A User

## Interface Design Methodology.

### UNIT– IV: Coding and testing

Coding, Code Review, Software Documentation, Testing, Unit Testing, Black-Box Testing, White-Box Testing, Debugging, Program Analysis Tool, Integration Testing, Testing Object-Oriented Programs, System Testing, Some General Issues Associated with Testing

### UNIT VI: Software Maintenance

Software maintenance, Maintenance Process Models, Maintenance Cost, Software Configuration Management. Software Reuse: what can be Reused? Why almost No Reuse So Far? Basic Issues in Reuse Approach, Reuse at Organization Level.

### Course Outcomes:

- Foundation: Graduates shall have strong foundation in science, mathematics, and engineering, and can apply this fundamental knowledge to software engineering tasks. Graduates know classical and evolving software engineering methods.
- Graduate can analyze and create specification for a particular project
- Graduate can build software architecture and user interface.
- Graduate could be able to apply fundamental testing techniques.
- Graduate could be able to learn the process of maintenance and importance of reuse.

### TEXTBOOKS:

1. Fundamentals of Software Engineering, Rajib Mall, Fifth Edition, PHI.
2. Software Engineering, Ian Sommerville, 10th edition, Pearson education.
3. Software Engineering, 9e Roger S. Pressman, TMH.

### REFERENCEBOOKS:

1. Software Engineering by Vileet, Latest Edition
2. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India, 2010. (2)
3. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
4. Software Engineering: Abstraction and modeling, Diner Bjorner, Springer International edition, 2006.
5. Software Engineering: A Primer, Waman S Jawadkar, Tata McGraw-Hill, 2008



III Year – II Semester

L	T	P	C
3	0	0	3

WEB TECHNOLOGIES  
(Open Elective- I)

Course Objectives:

- This course is designed to introduce students with no programming experience to the programming languages and techniques associated with the World Wide Web.
- The course will introduce web-based media-rich programming tools for creating interactive web pages.
- The student will be able to create web pages and can work efficiently on web.

UNIT-I:

HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, HTML5

CSS: Levels of Style Sheets, Style Specification Formats, Selector Forms, The Box Model, Conflict Resolution

UNIT-II:

JavaScript: The Basic of JavaScript: Objects, Primitives Operations and Expressions, Screen Output and Keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions

XML: Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX Approaches,

UNIT-III:

PHP Programming: Introducing PHP: Creating PHP script, Running PHP script. Working with variables and constants: Using variables, Using constants, Data types, Operators .Controlling program flow: Conditional statements, Control s statements, Arrays, functions.

UNIT-IV:

PERL: Introduction to PERL, Operators and if statements, Program design and control structures, Arrays, Hashes and File handling, Regular expressions, Subroutines, retrieving documents from the web with Perl.

#### UNIT-V:

Ruby: Introduction to Ruby, Variables, types, simple I/O, Control, Arrays, Hashes, Methods, Classes, Iterators, Pattern Matching.

#### Course Outcomes

- Analyze a web page and identify its elements and attributes.
- Create web pages using XHTML and Cascading Styles sheets.
- Build dynamic web pages.
- Build web applications using PHP.
- Programming through PERL and Ruby
- Write simple client-side scripts using AJAX

#### TEXT BOOKS:

1. Programming the World Wide Web, Robert W Sebesta, 7ed, Pearson.
2. Web Technologies, Uttam K Roy, Oxford
3. The Web Warrior Guide to Web Programming, Bai, Ekedahl, Farrell, Gosselin, Zak, Karparhi, MacIntyre, Morrissey, Cengage

#### REFERENCE BOOKS:

1. Ruby on Rails Up and Running, Lightning fast Web development, Bruce Tate, Curt Hibbs, O'Reilly (2006)
2. Programming Perl, 4ed, Tom Christiansen, Jonathan Orwant, O'Reilly (2012)
3. Web Technologies, HTML < JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
4. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning
5. <http://www.upriss.org.uk/perl/PerlCourse.html>

## CRYPTOGRAPHY AND NETWORK SECURITY

### Course Objectives

In this course the following principles and practice of cryptography and network security are covered:

- Classical systems, symmetric block ciphers (DES, AES, other contemporary symmetric ciphers)
- Public-key cryptosystems (RSA, El Gamal and ECC),
- Algorithms for factoring and discrete logarithms, cryptographic protocols, hash functions, authentication, key management, key exchange, signature schemes.
- Email and web security, viruses, firewalls, cyber laws, and other topics.

### UNIT-I: Introduction and Mathematical Background

Security Goals, Attacks, Services and Mechanisms, Model for Network Security, Cryptography and Cryptanalysis, Symmetric vs Asymmetric Ciphers, Substitution vs Transposition Ciphers, Stream vs Block ciphers. Number Theory: Primes, Coprime, Primality Test, GCD (Euclid's algorithm), Groups and Fields, Discrete Logarithmic Problem. Modular Arithmetic: Basics, Congruence, Fermat's little theorem, Euler's theorem, Computing Inverse, Chinese Remainder Theorem

### UNIT-II: Symmetric Ciphers

Classic Ciphers, Confusion and Diffusion, Fiestel Structure, DES, Modes of operation, Triple DES, IDEA, Blow fish, AES

### UNIT-III: Public Key Cryptography

RSA(algorithm, performance and attacks), Diffie Hellman Key Exchange, El Gamal (encryption and signatures), Elliptic Curve Cryptography (Elliptic Curves, encryption, key exchange and signatures)

### UNIT-IV: Key Management and Authentication

Cryptographic Hash, Message Authentication Codes, Digital Signatures, X.509 certificates, PKI, One Way Authentication, Mutual Authentication, Centralized Authentication, Kerberos

### UNIT-V: Network Security and Malware

IPsec (Transport vs Tunnel, AH, ESP, Security Associations, IKE), SSL, Firewalls and Intrusion Detection Systems, DoS and DDoS, Buffer Overflow, Format Sting

## Vulnerabilities, The IT Act 2000: Aim and Objectives, Scope, Offences and Punishments

### Course Outcomes

- To be familiar with information security awareness and a clear understanding of its importance.
- To master fundamentals of secret-key and public-key cryptographic systems.
- To master protocols that provide security and authentication services.
- To be familiar with network security threats and countermeasures.
- To be familiar with different types of cyber crimes and cyber laws.

### TEXT BOOKS:

1. Cryptography and Network Security: Principles and Practice, Sixth Edition, William Stallings, Pearson, 7<sup>th</sup> edition.
2. Cryptography and Network Security, Third Edition, Behrouz A Forouzan, Debdeep Mukhopadhyay, Mc Graw Hill.
3. Cryptography, Network Security and Cyber Laws, Bernard L. Menezes, Ravinder Kumar, Cengage.

### REFERENCES BOOKS:

1. Introduction to Computer Networks & Cyber Security, Chwan Hwa Wu, J. David Irwin, CRC press.
2. Hack Proofing your Network, Russell, Kaminsky, Forest Puppy, Wiley Dreamtech.
3. Everyday Cryptography, Fundamental Principles & Applications, Keith Martin, Oxford.

III Year – II Semester

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## MOBILE COMMERCE

### Course Objectives:

- To describe e-commerce system concepts
- To critically analyze examples and cases of e-commerce systems
- To describe systems and technology in m-commerce
- To examine some of the applications in m-commerce

### UNIT I

#### ELECTRONIC COMMERCE

Traditional commerce and E-commerce – Internet and WWW – Role of WWW – Value Chains – Strategic Business And Industry Value Chains – Role of E-commerce. Packet Switched Networks – TCP/IP Protocol Script – Internet Utility Programs – SGML, HTML And XML – Web Client And Servers – Web Client/Server Architecture – Intranet And Extranets – Web Based Tools For E-commerce – Security.

### UNIT II

#### MOBILE COMMERCE

Introduction – Infrastructure of M-Commerce – Types Of Mobile Commerce Services – Technologies Of Wireless Business – Benefits And Limitations, Support, Mobile Marketing & Advertisement, Non- Internet Applications In M-Commerce – Wireless/Wired Commerce Comparisons.

### UNIT III

#### MOBILE COMMERCE- TECHNOLOGY

A Framework For The Study Of Mobile Commerce – NTT Docomo's I-Mode – Wireless Devices For Mobile Commerce – Towards A Classification Framework For Mobile Location Based Services – Wireless Personal And Local Area Networks –The Impact Of Technology Advances On Strategy Formulation In Mobile Communications Networks.

### UNIT IV

#### MOBILE COMMERCE: THEORY AND APPLICATIONS

The Ecology Of Mobile Commerce – The Wireless Application Protocol – Mobile Business Services – Mobile Portal – Factors Influencing The Adoption of Mobile Gaming Services – Mobile Data Technologies And Small Business Adoption And Diffusion – E-commerce in The Automotive Industry – Location- Based Services: Criteria For Adoption And Solution Deployment – The Role of Mobile Advertising In Building A Brand – M-commerce Business Models

## UNIT V

### BUSINESS– TO– BUSINESS MOBILE E– COMMERCE

Enterprise Enablement – Email and Messaging – Field Force Automation (Insurance, Real Estate, Maintenance, Healthcare) – Field Sales Support (Content Access, Inventory) – Asset Tracking and Maintenance/Management – Remote IT Support – Customer Retention (B2C Services, Financial, Special Deals) – Warehouse Automation – Security.

#### Course Outcomes:

- Impart the students with higher level knowledge and understanding of contemporary trends in e-commerce and business finance.
- To provide adequate knowledge and understanding about M-Com practices to the students.
- Learners will be able to recognize features and roles of businessmen, entrepreneur, managers, consultant, which will help learners to possess knowledge and other soft skills and to react aptly when confronted with critical decision making.

#### TEXT BOOKS

- 1.E.BrianMennecke, J.TroyStrader, “Mobile Commerce: Technology, Theory and Applications”, Idea Group Inc., IRM press, 2003.
- 2.Ravi Kalakota, B.AndrewWhinston, “Frontiers of Electronic Commerce”, Pearson Education, 2003.

#### REFERENCES

- 1.P. J. Louis, “M-Commerce Crash Course”, McGraw- Hill Companies February 2001.
- 2.Paul May, “Mobile Commerce: Opportunities, Applications, and Technologies Of Wireless Business” Cambridge University Press March 2001.

## CRYPTOGRAPHY AND NETWORKING SECURITY LAB

## Week-1:

- i. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should XOR each character in this string with 0 and displays the result.
- ii. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should AND or and XOR each character in this string with 127 and display the result.

## Week-2:

- i. Encrypt the message "PAY" using hill cipher with the following key matrix and show the decryption to formulate original plaintext  $K = \begin{bmatrix} 17 & 17 & 5 \\ 21 & 18 & 21 \\ 2 & 2 & 19 \end{bmatrix}$

## Week-3:

- i. Write a Java program to perform encryption and decryption using the following algorithms
  - a. Ceaser cipher b. Substitution cipher c. Hill Cipher
- ii. Write a C/JAVA program to implement Ceaser Cipher
- iii. Write a C/JAVA program to Affine Cipher with equation  $c=3x+12$
- iv. Write a C/JAVA program to implement Playfair Cipher with keyldrp
- v. Write a C/JAVA program to implement polyalphabetic Cipher
- vi. Write a C/JAVA program to implement AutoKey Cipher
- vii. Write a C/JAVA program to implement Hill Cipher. (Use any matrix but find the inverse yourself)
- viii. Write a C/JAVA program to implement Rail fence technique
- ix. Write a C/JAVA program to implement Simple Columner Transposition technique
- x. Write a C/JAVA program to implement Advanced Columner Transposition technique

## Week-4:

- i. Write a C/JAVA program to implement the DES algorithm logic.
- ii. Write a C/JAVA program to implement the Blowfish algorithm logic. generation sub key and S Box from the given 32-bit key by Blowfish.

Week-5:

- i. Write a C/JAVA program to implement the Rijndael algorithm logic.
- ii. Write the RC4 logic in Java Using Java cryptography; encrypt the text “Hello world” using Blowfish. Create your own key using Java key tool.

Week-6:

- i. Write a C/JAVA program to implement Euclidean Algorithm
- ii. Write a C/JAVA program to implement Advanced Euclidean Algorithm
- iii. Write a C/JAVA program to implement Simple RSA Algorithm with small numbers
- iv. Write a Java program to implement RSA algorithm. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.

Week-7:

- i. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
- ii. Calculate the message digest of a text using the MD5 algorithm in JAVA.



III Year – II Semester

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## DATA MINING LAB

### Course Objectives

- Practical exposure on implementation of well known data mining tasks.
- Exposure to real life data sets for analysis and prediction.
- Learning performance evaluation of data mining algorithms in a supervised and an unsupervised setting.
- Handling a small data mining project for a given practical domain.

### System/Software Requirements:

- Intel based desktop PC
- WEKA TOOL AND R TOOL

Week-1: Demonstration of preprocessing on datasets student. arff and labor .arff

Week-2: Demonstration of Association rule process on dataset contactlenses .arff using apriori algorithm

Week-3: Demonstration of Association rule process on dataset supermarket. arff using apriori algorithm

Week-4: Demonstration of classification rule process on dataset student. arff and employee.arff using j48 algorithm

Week-5: Demonstration of classification rule process on dataset employee. arff using id3 Algorithm

Week-6: Demonstration of classification rule process on dataset employee. arff using naïve bayes algorithm

Week-7: Demonstration of clustering rule process on datasets iris. arff and student. arff using simple k- means

Week-8: Implement Statistical analysis and Inferential statistics and Hypothesis Testing for Kaggle competition and Data.Gov data sets using R(Perform Batch wise with case studies).

Week-9: Perform Classification task whether the loan applicant will repay the loan Or not on Bank loan dataset using R

III Year – II Semester

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Industrial Training/ Internship/  
Research Projects in National Laboratories/  
Academic Institutions

IV Year – I Semester

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## WEB TECHNOLOGIES

### Course Objectives:

- This course is designed to introduce students with no programming experience to the programming languages and techniques associated with the World Wide Web.
- The course will introduce web-based media-rich programming tools for creating interactive web pages.
- The student will be able to create web pages and can work efficiently on web.

### UNIT-I:

HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, HTML5

CSS: Levels of Style Sheets, Style Specification Formats, Selector Forms, The Box Model, Conflict Resolution

### UNIT-II:

Java script: The Basic of Java script: Objects, Primitives Operations and Expressions, Screen Output and Keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions

XML: Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX Approaches,

### UNIT-III:

PHP: Introduction to PHP, Creating PHP script, Running PHP script. Working with variables and constants: Using variables, Using constants, Data types, Operators. Controlling program flow: Conditional statements, Control s statements, Arrays, functions.

#### UNIT-IV:

Perl: Introduction to PERL, Operators and if statements, Program design and control structures, Arrays, Hashes and File handling, Regular expressions, Subroutines, retrieving documents from the web with Perl.

#### UNIT-V:

Ruby: Introduction to Ruby, Variables, types, simple I/O, Control, Arrays, Hashes, Methods, Classes, Iterators, Pattern Matching.

#### Course Outcomes

- Analyse a web page and identify its elements and attributes.
- Create web pages using XHTML and Cascading Styles sheets.
- Build dynamic web pages.
- Build web applications using PHP.
- Programming through PERL and Ruby
- Write simple client-side scripts using AJAX

#### TEXT BOOKS:

4. Programming the World Wide Web, Robert W Sebesta, 7ed, Pearson.
5. Web Technologies, Uttam K Roy, Oxford
6. The Web Warrior Guide to Web Programming, Bai, Ekedahl, Farrell, Gosselin, Zak, Karparhi, MacIntyre, Morrissey, Cengage

#### REFERENCE BOOKS:

6. Ruby on Rails Up and Running, Lightning fast Web development, Bruce Tate, Curt Hibbs, Oreilly ( 2006)
7. Programming Perl, 4ed, Tom Christiansen, Jonathan Orwant, Oreilly (2012)
8. Web Technologies, HTML < JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
9. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning
10. <http://www.upriss.org.uk/perl/PerlCourse.html>

## MACHINE LEARNING

### Course Objectives:

The course is introduced for students to

- Gain knowledge about basic concepts of Machine Learning
- Study about different learning algorithms
- Learn about of evaluation of learning algorithms
- Learn about Dimensionality reduction

### UNIT I

Introduction: Definition of learning systems, Goals and applications of machine learning, Aspects of developing a learning system: training data, concept representation, function approximation.

Inductive Classification: The concept learning task, Concept learning as search through a hypothesis space, General-to-specific ordering of hypotheses, Finding maximally specific hypotheses, Version spaces and the candidate elimination algorithm, Learning conjunctive concepts, The importance of inductive bias.

### UNIT II

Decision Tree Learning: Representing concepts as decision trees, Recursive induction of decision trees, Picking the best splitting attribute: entropy and information gain, Searching for simple trees and computational complexity, Occam's razor, Overfitting, noisy data, and pruning. Experimental Evaluation of Learning Algorithms: Measuring the accuracy of learned hypotheses. Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing.

### UNIT III

Computational Learning Theory: Models of learnability: learning in the limit; probably approximately correct (PAC) learning. Sample complexity for infinite hypothesis spaces, Vapnik-Chervonenkis dimension. Rule Learning: Propositional and First-Order, Translating decision trees into rules, Heuristic rule induction using separate and conquer and information gain, First-order Horn-clause induction (Inductive Logic Programming) and Foil, Learning recursive rules, Inverse resolution, Golem, and Progol.

### UNIT IV

Artificial Neural Networks: Neurons and biological motivation, Linear threshold units. Perceptron's: representational limitation and gradient descent training, Multilayer networks and backpropagation, Hidden layers and constructing intermediate, distributed representations. Overfitting, learning network structure, recurrent networks. Support Vector Machines: Maximum margin linear separators. Quadratic programming solution to finding maximum

margin separators. Kernels for learning non-linear functions.

#### UNIT V

Bayesian Learning: Probability theory and Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Logistic regression. Bayes nets and Markov nets for representing dependencies. Instance-Based Learning: Constructing explicit generalizations versus comparing to past specific examples. k-Nearest-neighbor algorithm. Case-based learning.

#### Course Outcomes:

- Identify machine learning techniques suitable for a given problem
- Solve the problems using various machine learning techniques
- Apply Dimensionality reduction techniques
- Design application using machine learning techniques

#### Text Books:

- 1) T.M. Mitchell, “Machine Learning”, McGraw-Hill, 1997.
- 2) Ethern Alpaydin, “Introduction to Machine Learning”, MIT Press, 2004.
- 3) Machine Learning, Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

#### Reference Books:

- 1) Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Book by Peter Flach
- 2) Stephen Marsland, “Machine Learning -An Algorithmic Perspective”, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
- 3) Andreas C. Müller and Sarah Guido “Introduction to Machine Learning with Python: A Guide for Data Scientists”, Oreilly.

#### e-Resources:

- 1) Andrew Ng, “Machine Learning Yearning” <https://www.deeplearning.ai/machine-learning-yearning/>
- 2) Shai Shalev-Shwartz , Shai Ben-David, “Understanding Machine Learning: From Theory to Algorithms” , Cambridge University Press  
<https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html>

IV Year – I Semester

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Soft Computing  
(Open Elective-II)

Course Objectives:

- The main objective of the Soft Computing Techniques to Improve Data Analysis Solutions is to strengthen the dialogue between the statistics and soft computing research communities in order to cross-pollinate both fields and generate mutual improvement activities.
- Soft Computing is a consortia of methodologies which collectively provide a body of concepts and techniques for designing intelligent systems.

UNIT-I

Soft Computing : Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.

UNIT-II

Artificial Intelligence : Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A\* algorithm, AO\* Algorithms and various types of control strategies. Knowledge representation issues, Propositional and predicate logic, monotonic and non monotonic reasoning, forward Reasoning, backward reasoning, Weak & Strong Slot & filler structures, NLP.

UNIT-III

Genetic algorithm : Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional method.

UNIT-IV

Genetic Algorithms-1: Motivation, Genetic Algorithms, An Illustrative Example, Hypothesis Space Search (Chapter-9 from Machine Learning, Tom M. Mitchell, MGH).

UNIT-V

Genetic Algorithms-2: Genetic Programming, Models of Evolution and Learning, Parallelizing Genetic Algorithms (Chapter-9 from Machine Learning, Tom M. Mitchell, MGH)

Course Outcomes:

- Learn about soft computing techniques and their applications
- Analyze various neural network architectures
- Understand perceptrons and counter propagation networks.
- Define the fuzzy systems
- Analyze the genetic algorithms and their applications.

Text Books:

1. Machine Learning ,Tom M. Mitchell, MGH
2. E. Goldberg,Genetic Algorithms: Search and Optimization, Addison-Wesley
3. 1. S.N. Sivanandam& S.N. Deepa, Principles of Soft Computing, Wiley Publications, 2nd Edition, 2011.
4. 2. S. Rajasekaran& G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications, PHI Publication, 1st Edition, 2009.

Reference Books:

1. N.K.Bose, Ping Liang, Neural Network fundamental with Graph, Algorithms & Applications, TMH, 1st Edition, 1998.
2. Bart Kosko, Neural Network & Fuzzy System, PHI Publication, 1st Edition, 2009.
3. Rich E, Knight K, Artificial Intelligence, TMH, 3rd Edition, 2012.
4. George J Klir, Bo Yuan, Fuzzy sets & Fuzzy Logic,Theory& Applications, PHI Publication, 1st Edition, 2009.
5. Martin T Hagen, Neural Network Design, Nelson Candad, 2nd Edition, 2008.



MACHINE LEARNING  
(Open Elective-II)

COURSE OBJECTIVES:

- To learn well-known machine learning algorithms
- To evaluate and compare the performance of various machine learning algorithms
- Able to differentiate regression models and distance based models and ANNS.

UNIT I: Introduction: Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning. Concept learning and the general to specific ordering – Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias.

UNIT II: Linear Regression & Logistic Regression: Predicting Numeric Values: Regression - Finding the best fit lines with linear regression, locally weighted linear regression, Shrinking Coefficients, The bias / Variance tradeoff. LOGISTIC REGRESSION: Classification with logistic regression and the sigmoid function, Using optimization to find the best regression coefficients.

UNIT III: Artificial Neural Networks: Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition, Advanced topics in artificial neural networks

UNIT IV: Evaluation Hypotheses: Motivation, Estimation hypothesis accuracy, Basics of sampling theory, A general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms. Evolutionary Learning: Genetic Algorithms, Genetic Operators. Genetic Programming Ensemble learning: Boosting, Bagging, swarm intelligence, PSO.

UNIT V: Support Vector Machines: Separating data with the maximum margin, finding the maximum margin, efficient optimization with SMO algorithm, speeding up optimization with full Platt SMO, Using Kernels for more Complex data. Dimensionality Reduction Techniques: Principal Component analysis, Example. Instance-Based Learning- Introduction, k -Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning.

#### COURSE OUTCOMES:

- Recognize the characteristics of machine learning algorithms and their applications to real world problems
- Able to differentiate linear and logistic regressions.
- Able to write and evaluate hypothesis
- Understand the concepts of Artificial neural networks
- Can apply kernel methods to solve real world problems.
- Learn eager and lazy learners.

#### TEXT BOOKS:

1. Machine Learning ,Tom M. Mitchell, MGH.
2. Machine Learning in Action, Peter Harington, 2012, Cengage.`

#### REFERENCE BOOKS:

1. Introduction to Machine Learning, Ethem Alpaydin, PHI, 2004.
2. A course in Machine Learning , Hal Daum'e III

ARTIFICIAL INTELLIGENCE  
(Open Elective-II)

Course Objectives:

- To have a basic proficiency in a traditional AI language including an ability to write simple to intermediate programs and an ability to understand code written in that language.
- To have an understanding of the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minmax, resolution, etc. that play an important role in AI programs.
- To have a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, agents and robotics, expert systems, and planning.

UNIT-I:

Introduction to artificial intelligence: Introduction ,history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of ai languages, current trends in AI

UNIT-II:

Problem solving: state space search and control strategies : Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening a\*, constraint satisfaction Problem reduction and game playing: Introduction, problem reduction, game playing, alpha beta pruning, two-player perfect information games

UNIT-III:

Logic concepts: Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in pr operational logic, resolution refutation in propositional logic, predicate logic

UNIT-IV:

Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure, Cyc theory, case grammars, semantic web

#### UNIT-V:

Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools

#### Course Outcomes:

- Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
- Formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).
- Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).
- Design and carry out an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.

#### TEXT BOOKS:

5. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
6. Artificial intelligence, A modern Approach , 2nd ed, Stuart Russel, Peter Norvig, PEA
7. Artificial Intelligence- Rich, Kevin Knight, Shiv Shankar B Nair, 3rd ed, TMH
8. Introduction to Artificial Intelligence, Patterson, PHI

#### REFERNCE BOOKS:

4. Artificial intelligence, structures and Strategies for Complex problem solving,  
- George F Lugar, 5th ed, PEA
5. Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
6. Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier

IV Year – I Semester

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PATTERN RECOGNITION  
(Open Elective-II)

Course Objectives:

The course is designed to introduce students to theoretical concepts and practical

- Issues associated with pattern recognition
- To equip students with basic mathematical and statistical techniques commonly used in pattern recognition.
- To introduce students to a variety of pattern recognition algorithms.
- Enable students to apply machine learning concepts in real life problems.

UNIT-I: Introduction: Machine perception, pattern recognition example, pattern recognition systems, the Design cycle, Learning and adaptation

Bayesian Decision Theory: Introduction, continuous features – two categories classifications, minimum error-rate classification-zero-one loss function, classifiers, discriminant functions, and decision surfaces

UNIT-II: Normal density: Univariate and multivariate density, discriminant functions for the normal Density different cases, Bayes decision theory – discrete features, compound Bayesian decision theory and context

UNIT-III: Maximum likelihood and Bayesian parameter estimation: Introduction, maximum likelihood Estimation, Bayesian estimation, Bayesian parameter estimation– Gaussian case

UNIT-IV: Un-supervised learning and clustering: Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K - means clustering. Data description and clustering – similarity measures, criteria function for clustering.

UNIT-V: Pattern recognition using discrete hidden Markov models: Discrete-time Markov process, Extensions to hidden Markov models, three basic problems of HMMs, types of HMMs. Continuous hidden Markov models: Continuous observation densities, multiple mixtures per state, speech recognition applications.

## Course Outcomes

At the end of this course, students will be able to:

- Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.
- Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.
- Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.
- Apply pattern recognition techniques to real-world problems such as document analysis and recognition.
- Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.

## TEXT BOOKS:

1. Pattern classifications, Richard O. Duda, Peter E. Hart, David G. Stroke. Wiley student edition, Second Edition.
2. Pattern Recognition, An Introduction, V Susheela Devi, M Narsimha Murthy, University Press

## REFERENCE BOOKS:

1. R.C Gonzalez and R.E. Woods, "Digital Image Processing", Addison Wesley, 1992.
2. Pattern Recognition and Image Analysis – Earl Gose, Richard John baugh, Steve Jost PHI 2004
3. Fundamentals of speech Recognition, Lawrence Rabiner, Bing – Hwang Pearson education.
4. Pattern Recognition, Sergios Theodoridis, Konstantinos Koutroumbas, Academic Press, Elsevier, 4ed,

## MOBILE APPLICATION DEVELOPMENT

(Open Elective- II)

### Course Objectives:

- To demonstrate the introduction and characteristics of mobile applications
- Application models of mobile application frameworks. Managing application data and User-interface design for mobile applications
- Integrating networking, the OS and hardware into mobile-applications
- Addressing enterprise requirements in mobile applications – performance, scalability, modifiability, availability and security
- Testing methodologies for mobile applications– Publishing, deployment, maintenance and management. To demonstrate their skills of using Android software development tools
- To demonstrate their ability to deploy software to mobile devices

### UNIT I

Introduction to mobile devices: Introduction to Mobile Computing, Introduction to Android Development Environment, Mobile devices vs. desktop devices, ARM and Intel architectures, Screen resolution, Touch interfaces, Application deployment, App Store, Google Play, Windows Store.

Development environments: XCode, Eclipse, VS2012, PhoneGAP, etc.; Native vs. web applications.

Factors in Developing Mobile Applications: Mobile Software Engineering, Frameworks and Tools, Generic UI Development, Android User.

### UNIT II

Android User Interface: Measurements – Device and pixel density independent measuring units User Interface (UI) Components – Editable and non editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities.

### UNIT III

Back Ground Running Process, Networking And Telephony Services: Services: Introduction to services – local service, remote service and binding the service, the communication between service and activity, Intent Service.

Multithreading: Handlers, Sanctus.

Android network programming: Http Url Connection, Connecting to REST-based and SOAP based Web services.

Broad cast receivers: Local Broadcast Manager, Dynamic broadcast receiver, System Broadcast. Pending Intent, Notifications.

#### UNIT IV

Android: Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

#### UNIT V

Advanced Topics: Power Management: Wake locks and assertions, Low-level OS support, Writing power-smart applications.

Augmented Reality via GPS and other sensors: GPS, Accelerometer, Camera.

Mobile device security in depth: Mobile malware, Device protections, iOS “Jailbreaking”, Android “rooting” and Windows’ “defenestration”; Security and Hacking: Active Transactions, More on Security, Hacking Android.

#### Course Outcomes:

Upon completion of the course students should be able to:

- Install and configure Android application development tools.
- Design and develop user Interfaces for the Android platform.
- Save state information across important operating system events.
- Apply Java programming concepts to Android application development.

#### Text Books:

- 1) Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, Android Programming: The Big Nerd
- 2) Ranch Guide, Big Nerd Ranch LLC, 2nd edition, 2015.
- 3) Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design and Development, Prentice Hall, 2004.
- 4) Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox) , 2012
- 5) Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013
- 6) Dawn Griffiths, David Griffiths, “*Head First: Android Development*” ,OReilly2015,ISBN: 9781449362188
- 7) <http://developer.android.com/develop/index.html>
- 8) Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012

#### Reference Books:

- 1) Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013
- 2) Tomasz Nurkiewicz and Ben Christensen, Reactive Programming with RxJava, O’Reilly Media, 2016.
- 3) Brian Fling, Mobile Design and Development, O’Reilly Media, Inc., 2009.
- 4) Maximiliano Firtman, Programming the Mobile Web, O’Reilly Media, Inc., 2nd ed., 2013.
- 5) Cristian Crumlish and Erin Malone, Designing Social Interfaces, 2nd ed., O’Reilly Media, Inc., 2014.
- 6) Suzanne Ginsburg, Designing the iPhone User Experience: A User-Centered Approach to Sketching and Prototyping iPhone Apps, Addison-Wesley Professional, 2010.



IV Year – I Semester

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## BIG DATA TECHNOLOGIES

(Professional Elective-III)

### COURSE OBJECTIVES:

- Optimize business decisions and create competitive advantage with Big Data analytics
- Introducing Java concepts required for developing map reduce programs
- Derive business benefit from unstructured data
- Imparting the architectural concepts of Hadoop and introducing map reduce paradigm
- To introduce programming tools PIG & HIVE in Hadoop ecosystem.

UNIT-I: Working with Big Data: Google File System, Hadoop Distributed File System (HDFS) – Building blocks of Hadoop (Namenode, Datanode, Secondary Namenode, Job Tracker, Task Tracker), Introducing and Configuring Hadoop cluster (Local, Pseudo- distributed mode, Fully Distributed mode), Configuring XML files.

UNIT-II: Writing MapReduce Programs: A Weather Dataset, Understanding Hadoop API for MapReduce Framework (Old and New), Basic programs of Hadoop MapReduce: Driver code, Mapper code, Reducer code, Record Reader, Combiner, Partitioner

UNIT-III: Hadoop I/O: The Writable Interface, Writable Comparable and comparators, Writable Classes: Writable wrappers for Java primitives, Text, Bytes Writable, Null Writable, Object Writable and Generic Writable, Writable collections, Implementing a Custom Writable: Implementing a Raw Comparator for speed, Custom comparators

UNIT-IV: Pig: Hadoop Programming Made Easier Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin

UNIT-V: Applying Structure to Hadoop Data with Hive: Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive, Examining the Hive Clients, Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analyzing Data

## COURSE OUTCOMES:

- Preparing for data summarization, query, and analysis.
- Applying data modeling techniques to large data sets
- Creating applications for Big Data analytics
- Building a complete business data analytic solution

## TEXT BOOKS:

1. Big Java 4th Edition, Cay Horstmann, Wiley John Wiley & Sons, INC
2. Hadoop: The Definitive Guide by Tom White, 3<sup>rd</sup> Edition, O'reilly
3. Hadoop in Action by Chuck Lam, MANNING Publ.
4. Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk, Bruce Brown, Rafael Coss

## REFERENCE BOOKS:

1. Hadoop in Practice by Alex Holmes, MANNING Publ.
2. Hadoop MapReduce Cookbook, Srinath Perera, Thilina Gunarathne
3. "Map Reduce: Simplified Data Processing on Large Clusters", Jeffrey Deon and Sanjay ghemawat

## SOFTWARE LINKS:

1. Hadoop: <http://hadoop.apache.org/>
2. Hive: <https://cwiki.apache.org/confluence/display/Hive/Home>  
Piglatin: <http://pig.apache.org/docs/r0.7.0/tutorial.html>

**SOCIAL MEDIA ANALYTICS**  
(Professional Elective - III)

Course Objectives:

By the end of this course, students will be able to:

1. Understand and apply key concepts in social media metrics.
2. Understand and apply social media analytics tools.
3. Collect social media data.
4. Monitor consumers and competitors and glean deeper consumer insights based on advanced social media data modeling.
5. Develop social media strategy and measure social media campaign effectiveness.
6. Make better business decisions by leveraging social media data.

Unit-I

Introduction to Social Media Analytics (SMA): Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas  
Network Fundamentals and Models: The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization.

Unit-II

Making Connections: Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity.  
Web Analytics Tools: Clickstream analysis, A/B testing, online surveys, Web crawling and Indexing.  
Natural Language Processing Techniques for Micro-text Analysis

Unit-III

Facebook Analytics: Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on FB. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. (LinkedIn, Instagram, YouTube, Twitter etc.

Unit-IV

Google Analytics: Introduction. (Websites) Processing and Visualizing Data, Influence Maximization, Link Prediction, Collective Classification, Applications in Advertising and Game Analytics Introduction to Python Programming, Collecting and analyzing social media data; visualization and exploration

Unit-V

Practical: Students should analyze the social media of any ongoing campaigns and present the findings.

#### Course Outcomes:

- Familiarize the learners with the concept of social media analytics and understand its significance.
- Familiarize the learners with the tools of social media analytics.
- Enable the learners to develop skills required for analyzing the effectiveness of social media for business purposes.

#### TextBooks:

1. Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media, Matthew Ganis, Avinash Kohirkar, Pearson-2016 edition.
2. Social Media Metrics: How to Measure and Optimize Your Marketing Investment, Jim Sterne, Wiley publisher, Latest edition.

#### Reference Books:

1. Social Media ROI: Managing and Measuring Social Media Efforts in Your Organization (Que Biz-Tech), Oliver Blanchard, Que Publishing, Latest edition.
2. Social Media Analytics, Marshall Sponder, McGraw Hill, Latest edition.
3. Social Media Marketing, Tracy L. Tuten, Michael R. Solomon, Sage, Latest edition.

IV Year –I Semester

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ADHOC & SENSOR NETWORKS  
(Professional Elective - III)

Course Objectives:

From the course the student will learn

- Architect sensor networks for various application setups
- Devise appropriate data dissemination protocols and model links cost
- Understanding of the fundamental concepts of wireless sensor networks and has a basic knowledge of the various protocols at various layers
- Evaluate the performance of sensor networks and identify bottlenecks

UNIT I

Introduction to Ad Hoc Wireless Networks-Cellular and Ad Hoc Wireless Networks, Characteristics of MANETs, Applications of MANETs, Issues and Challenges of MANETs, Ad Hoc Wireless Internet, MAC protocols for Ad hoc Wireless Networks-Issues, Design Goals and Classifications of the MAC Protocols.

UNIT II

Routing Protocols for Ad Hoc Wireless Networks-Issues in Designing a Routing Protocol, Classifications of Routing Protocols, Topology-based versus Position-based Approaches, Issues and design goals of a Transport layer protocol, Classification of Transport layer solutions, TCP over Ad hoc Wireless Networks, Solutions for TCP over Ad Hoc Wireless Networks, Other Transport layer protocols.

UNIT III

Security protocols for Ad hoc Wireless Networks-Security in Ad hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad hoc Wireless Networks, Cooperation in MANETs, Intrusion Detection Systems.

UNIT IV

Basics of Wireless Sensors and Applications-The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption, Clustering of Sensors, Applications, Data Retrieval in Sensor Networks- Classification of WSNs, MAC layer, Routing layer, Transport layer, Highlevel application layer support, Adapting to the inherent dynamic nature of WSNs.

UNIT V

Security in WSNs-Security in WSNs, Key Management in WSNs, Secure Data Aggregation in WSNs, Sensor Network Hardware-Components of Sensor Mote, Sensor Network Operating Systems- TinyOS, LA-TinyOS, SOS, RETOS, Imperative Language-nesC, Dataflow Style Language- TinyGALS, Node-Level Simulators, NS-2 and its sensor network extension, TOSSIM.

Course Outcomes:

- Evaluate the principles and characteristics of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks
- Determine the principles and characteristics of wireless sensor networks
- Discuss the challenges in designing MAC, routing and transport protocols for wireless ad-hoc sensor networks
- Illustrate the various sensor network Platforms, tools and applications

Demonstrate the issues and challenges in security provisioning and also familiar with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs

Text Books:

- 1) Ad Hoc Wireless Networks – Architectures and Protocols, C. Siva Ram Murthy, B. S. Murthy, Pearson Education, 2004.
- 2) Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P. Aggarwal, World Scientific Publications / Cambridge University Press, March 2006.
- 3) Wireless Sensor Networks – Principles and Practice, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010.

Reference Books:

- 1) Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp2009.
- 2) Wireless Ad hoc Mobile Wireless Networks – Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008.
- 3) Ad hoc Networking, Charles E. Perkins, Pearson Education, 2001.
- 4) Wireless Ad hoc Networking, Shih-Lin Wu, Yu-Chee Tseng, Auerbach Publications, Taylor & Francis Group, 2007.

IV Year – I Semester

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**CLOUD COMPUTING**  
(Professional Elective- III)

Course Objectives:

- To provide students with the fundamentals and essentials of Cloud Computing.
- To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios.
- To enable students exploring some important cloud computing driven commercial systems and applications.
- To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

UNIT I:

Introduction: Network centric computing, Network centric content, peer-to –peer systems, cloud computing delivery models and services, Ethical issues, Vulnerabilities, Major challenges for cloud computing

Parallel and Distributed Systems: introduction, architecture, distributed systems, communication protocols, logical clocks, message delivery rules, concurrency, and model concurrency with Petri Nets.

UNIT II:

Cloud Infrastructure: At Amazon, The Google Perspective, Microsoft Windows Azure, Open Source Software Platforms, Cloud storage diversity, Inter cloud, energy use and ecological impact, responsibility sharing, user experience, Software licensing

Cloud Computing : Applications and Paradigms: Challenges for cloud, existing cloud applications and new opportunities, architectural styles, workflows, The Zookeeper, The Map Reduce Program model, HPC on cloud, biological research

UNIT III:

Cloud Resource virtualization: Virtualization, layering and virtualization, virtual machine monitors, virtual machines, virtualization- full and para, performance and security isolation, hardware support for virtualization, Case Study: Xen, vBlades

Cloud Resource Management and Scheduling: Policies and Mechanisms, Applications of control theory to task scheduling, Stability of a two-level resource allocation architecture, feed back control based on dynamic thresholds, coordination, resource bundling, scheduling algorithms, fair queuing, start time fair queuing, cloud scheduling subject to

deadlines, Scheduling Map Reduce applications, Resource management and dynamic application scaling

#### UNIT IV:

Storage Systems: Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system., Apache Hadoop, Big Table, Megastore ( text book 1), Amazon Simple Storage Service(S3) (Text book 2)

Cloud Security: Cloud security risks, security – atop concern for cloud users, privacy and privacy impact assessment, trust, OS security, Virtual machine security, Security risks

#### UNIT V:

Cloud Application Development: Amazon Web Services : EC2 – instances, connecting clients, security rules, launching, usage of S3 in Java, Installing Simple Notification Service on Ubuntu 10.04, Installing Hadoop on Eclipse, Cloud based simulation of a Distributed trust algorithm, Cloud service for adaptive data streaming ( Text Book 1)

Google: Google App Engine, Google Web Toolkit (Text Book 2)

Microsoft: Azure Services Platform, Windows live, Exchange Online, Share Point Services, Microsoft Dynamics CRM (Text Book 2)

#### Course Outcomes:

After successful completion of this course, student will be able to

- Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.
- Apply the fundamental concepts in datacenters to understand the tradeoffs in power, efficiency and cost.
- Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.
- Analyze various cloud programming models and apply them to solve problems on the cloud.

#### TEXT BOOKS:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier
2. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH



**REFERNCE BOOK:**

1. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammara selvi, TMH

R-PROGRAMMING  
(Professional Elective-III)

COURSE OBJECTIVES:

- Use R for statistical programming, computation, graphics, and modeling,
- Write functions and use R in an efficient way,
- Fit some basic types of statistical models
- Use R in their own research,
- Be able to expand their knowledge of R on their own.

UNIT-I:

Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

UNIT-II:

R Programming Structures, Control Statements, Loops, - Looping Over Nonvector Sets,- If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary Search Tree.

UNIT-III:

Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and Maxima- Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product- Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /out put, Accessing the Keyboard and Monitor, Reading and writer Files,

UNIT-IV:

Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files.

UNIT-V:

Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,-ANOVA.

Linear Models, Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, - Poisson Regression- other Generalized Linear Models-Survival Analysis,

Nonlinear Models, Splines- Decision- Random Forests,

#### COURSE OUTCOMES:

At the end of this course, students will be able to:

- List motivation for learning a programming language
- Access online resources for R and import new function packages into the R workspace
- Import, review, manipulate and summarize data-sets in R
- Explore data-sets to create testable hypotheses and identify appropriate statistical tests
- Perform appropriate statistical tests using R Create and edit visualizations with

#### TEXT BOOKS:

- 1) The Art of R Programming, Norman Matloff, Cengage Learning
- 2) R for Everyone, Lander, Pearson

#### REFERENCE BOOKS:

- 1) R Cookbook, Paul Teetor, Oreilly.
- 2) R in Action, Rob Kabacoff, Manning

**DISTRIBUTED SYSTEMS**  
(Professional Elective- IV)

**COURSE OBJECTIVES**

- Provides an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission, IPC mechanisms in distributed systems, Remote procedure calls.
- Expose students to current technology used to build architectures to enhance distributed Computing infrastructures with various computing principles

**UNIT-I:**

Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges.

System Models: Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model.

**UNIT-II:**

Interposes Communication: Introduction, The API for the Internet Protocols- The Characteristics of Interposes communication, Sockets, UDP Datagram Communication, TCP Stream Communication; External Data Representation and Marshalling; Client Server Communication; Group Communication- IP Multicast- an implementation of group communication, Reliability and Ordering of Multicast.

**UNIT-III:**

Distributed Objects and Remote Invocation: Introduction, Communication between Distributed Objects- Object Model, Distributed Object Modal, Design Issues for RMI, Implementation of RMI, Distributed Garbage Collection; Remote Procedure Call, Events and Notifications, Case Study: JAVA RMI

**UNIT-IV:**

Operating System Support: Introduction, The Operating System Layer, Protection, Processes and Threads –Address Space, Creation of a New Process, Threads.

**UNIT-V:**

Distributed File Systems: Introduction, File Service Architecture; Peer-to-Peer Systems: Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays. Coordination and Agreement: Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication. Transactions & Replications: Introduction, System Model and Group Communication, Concurrency Control in Distributed Transactions, Distributed Dead Locks, Transaction Recovery; Replication-Introduction, Passive (Primary) Replication, Active Replication.

#### COURSE OUTCOMES:

- Develop a familiarity with distributed file systems.
- Describe important characteristics of distributed systems and the salient architectural features of such systems.
- Describe the features and applications of important standard protocols which are used in distributed systems.
- Gaining practical experience of inter-process communication in a distributed environment

#### TEXT BOOKS:

1. Ajay D Kshemkalyani, Mukesh Sigal, “Distributed Computing, Principles, Algorithms and Systems”, Cambridge
2. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems- Concepts and Design”, Fourth Edition, Pearson Publication

#### REFERENCE BOOKS

Distributed-Systems-Principles-Paradigms-Tanenbaum PHI

IV Year – I Semester

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PARALLEL COMPUTING  
(Professional Elective-IV)

Course Objectives:

- To study the scalability and clustering issues and the technology necessary for them.
- To understand the technologies enabling parallel computing.
- To study the different types of interconnection networks.
- To study the different parallel programming models.
- To study the software support needed for shared memory programming.

UNIT I: SCALABILITY AND CLUSTERING

Evolution of Computer Architecture – Dimensions of Scalability – Parallel Computer Models – Basic Concepts Of Clustering – Scalable Design Principles – Parallel Programming Overview – Processes, Tasks and Threads – Parallelism Issues – Interaction / Communication Issues – Semantic Issues In Parallel Programs.

UNIT II: ENABLING TECHNOLOGIES

System Development Trends – Principles of Processor Design – Microprocessor Architecture Families – Hierarchical Memory Technology – Cache Coherence Protocols – Shared Memory Consistency – Distributed Cache Memory Architecture – Latency Tolerance Techniques – Multithreaded Latency Hiding.

UNIT III: SYSTEM INTERCONNECTS

Basics of Interconnection Networks – Network Topologies and Properties – Buses, Crossbar and Multistage Switches, Software Multithreading – Synchronization Mechanisms.

UNIT IV: PARALLEL PROGRAMMING

Paradigms And Programmability – Parallel Programming Models – Shared Memory Programming.

UNIT V: MESSAGE PASSING PROGRAMMING

Message Passing Paradigm – Message Passing Interface – Parallel Virtual Machine.

Course Outcomes:

On completion of the course the student should have the following outcomes defined in terms of knowledge, skills and general competence:

- The basic construction and use of parallel computers.
- The content and use of the terminology for how one measures the performance of parallel algorithms and parallel computers.
- How to develop computer programs for different types of parallel computers.
- Optimize sequential code for fastest possible execution.
- Analyze sequential programs and determine if they are worthwhile to parallelize.

- Develop, analyze and implement algorithms for parallel computers.
- Can analyze and perform development work related to the use of parallel computers.

**TEXT BOOKS:**

1. Kai Hwang and Zhi. Wei Xu, “Scalable Parallel Computing”, Tata McGraw-Hill, New Delhi, 2003.

**REFERENCES:**

1. David E. Culler & Jaswinder Pal Singh, “Parallel Computing Architecture: A Hardware/Software Approach”, Morgan Kaufman Publishers, 1999.
2. Michael J. Quinn, “Parallel Programming in C with MPI & OpenMP”, Tata McGraw-Hill, New Delhi, 2003.
3. Kai Hwang, “Advanced Computer Architecture” Tata McGraw-Hill, New Delhi, 2003.

INTERNET OF THINGS  
(Professional Elective-IV)

COURSE OBJECTIVES

- Learns about various types of sensors, actuators and different network protocols.
- Construction of wireless sensor networks and communication using different connectivity technologies
- To Know about how m2M communication performs and communication between user and the device
- To Know about programming platforms to implement IOT
- Learns about how data is handled generated by IOT application
- how IoT is used for industrial purpose , able to builds viors IoT applications

UNIT- I: Introduction to IOT: Sensing: Sensors, Transducers, Sensor Classes and sensor types. Actuation: Actuator, Actuator Types: Hydraulic Actuators, Pneumatic Actuators, Electric Actuators, Thermal or Magnetic Actuators, Mechanical Actuators, Soft Actuators.

Basic of Networking: IoT Components, IoT Categories, N/w Protocols: MQTT(Message Queue Telemetry Transport), CoAP(Constrained Application Protocol), XMPP( Extensible Messaging and Presence Protocol), AMQP(Advanced Message Queuing Protocol).

UNIT- II: Communication protocols: Zigbee, 6LoWPAN, Z-Wave, NFC, RFID, IEEE 802.15.4.

Sensor Networks: Wireless Sensor Networks (WSNs), Sensor Nodes, Basic Components of a Sensor Node, Challenges, Node Behavior in WSNs, Applications of WSNs, Types of sensor networks: Static WSN's and Dynamic WSN's.

UNIT- III: Machine to Machine communication: Introduction, M2M Overview, M2M Applications, M2M Features, M2M Node Types

Interoperability in IOT: Definition, Types of Interoperability: User Interoperability, Device Interoperability

IoT Platforms: Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.



#### UNIT- IV:

Introduction to Python programming, Introduction to Raspberry Pi: Specifications, Basic Architecture, Raspberry Pi OS Setup, Implementation of IoT with Raspberry Pi.

Software-Defined Networking: Overview of Current Network, Current Network to SDN, SDN Architecture, Basic Concepts of SDN, Components/Attributes of SDN, Challenges

Platforms for data collection and storage:

Cloud Computing: Characteristics, Components of Cloud Computing, Service Models, Deployment Models and sensor clouds: Introduction, Actors in Sensor-cloud, Architecture, and Work Flow of Sensor-Cloud. Introduction to fog computing.

#### UNIT-V:

Introduction to IOE: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II, Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories.

#### COURSE OUTCOMES:

- Aware about how sensors and actuators are connected by using different network protocols
- node behavior in wireless sensor networks and known about which connectivity technology was used according to the application.
- Knows about Arduino boards and their connection with sensors and actuators
- Learns about how Pi os is installed and how code is embedded into the board
- Came to know about how data is stored using cloud computing and knows about sensor clouds.
- Construction various IOT applications using various sensors and Actuators

#### TEXT BOOKS:

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by PethuruRaj and Anupama C. Raman (CRC Press)
2. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
3. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press, 2015

#### REFERENCE BOOKS:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley
2. Getting Started with the Internet of Things CunoPfister , Oreilly
3. Industry 4.0: The Industrial Internet of Things”, by Alasdair Gilchrist (Apress)
4. “Industrial Internet of Things: Cybermanufacturing Systems “by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer).

IV Year – I Semester

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DATA SCIENCE  
Code: PE4102  
(Professional Elective-IV)

Course Objectives:

From the course the student will learn

- Provide you with the knowledge and expertise to become a proficient data scientist.
- Demonstrate an understanding of statistics and machine learning concepts that are vital for data science;
- Learn to statistically analyze a dataset;
- Explain the significance of exploratory data analysis (EDA) in data science.
- Critically evaluate data visualizations based on their design and use for communicating stories from data

UNIT I

Introduction, The Ascendance of Data, Motivating Hypothetical: Data Scenester, Finding Key Connectors, The Zen of Python, Getting Python, Virtual Environments, Whitespace Formatting, Modules, Functions, Strings, Exceptions, Lists, Tuples, Dictionaries defaultdict, Counters, Sets, Control Flow, Truthiness, Sorting, List Comprehensions, Automated Testing and assert, Object-Oriented Programming, Iterables and Generators, Randomness, Regular Expressions, Functional Programming, zip and Argument Unpacking, args and kwargs, Type Annotations, How to Write Type Annotations.

UNIT II

Visualizing Data: matplotlib, Bar Charts, Line Charts, Scatterplots. Linear Algebra: Vectors, Matrices, Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Some Other Correlational Caveats, Correlation and Causation.

Gradient Descent: The Idea Behind Gradient Descent, Estimating the Gradient, Using the Gradient, Choosing the Right Step Size, Using Gradient Descent to Fit Models, Minibatch and Stochastic Gradient Descent.

UNIT III

Getting Data: stdin and stdout, Reading Files, Scraping the Web, Using APIs,

Working with Data: Exploring Your Data Using NamedTuples

Dataclasses, Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction.

Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem

UNIT IV

Machine Learning: Modeling, Overfitting and Underfitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, k-Nearest Neighbors, Naive Bayes, Simple Linear Regression, Multiple Regression, Digression, Logistic Regression

## UNIT V

Support Vector Machines, Decision Trees, Neural Networks: Perceptrons, Feed-Forward Neural Networks, Backpropagation. Clustering: The Idea, The Model, Choosing k, Bottom-Up Hierarchical Clustering. Recommender Systems: Manual Curation, Recommending What's Popular, User-Based Collaborative Filtering, Item-Based Collaborative Filtering, Matrix Factorization Data Ethics, Building Bad Data Products, Trading Off Accuracy and Fairness, Collaboration, Interpretability, Recommendations, Biased Data, Data Protection IPython, Mathematics, NumPy, pandas, scikit-learn, Visualization, R

### Course Outcomes:

At the end of the course, student will be able to

- Describe what Data Science is and the skill sets needed to be a data scientist.
- Explain in basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data.
- Use R to carry out basic statistical modeling and analysis.
- Apply basic tools (plots, graphs, summary statistics) to carry out EDA.
- Describe the Data Science Process and how its components interact.
- Use APIs and other tools to scrap the Web and collect data.
- Apply EDA and the Data Science process in a case study.

### Textbooks:

- 1) Joel Grus, "Data Science From Scratch", O'Reilly.
- 2) Allen B.Downey, "Think Stats", O'Reilly.

### Reference Books:

- 1) Doing Data Science: Straight Talk From The Frontline, 1<sup>st</sup> Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013
- 2) Mining of Massive Datasets, 2<sup>nd</sup> Edition, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, v2.1, Cambridge University Press, 2014
- 3) "The Art of Data Science", 1<sup>st</sup> Edition, Roger D. Peng and Elizabeth matsui, Lean Publications, 2015
- 4) "Algorithms for Data Science", 1<sup>st</sup> Edition, Steele, Brian, Chandler, John, Reddy, Swarna, springers Publications, 2016

### e-Resources:

- 1) <https://github.com/joelgrus/data-science-from-scratch>

IV Year – I Semester

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PATTERN RECOGNITION & BIOMETRICS  
(Professional Elective -IV)

Course Objectives:

- The course is designed to introduce students to theoretical concepts and practical Issues associated with pattern recognition
- Describe the principles of the three core biometric modalities (face, fingerprint and iris), and know how to deploy them in authentication scenarios
- Organize and conduct biometric data collections, and apply biometric databases in system evaluation
- Calculate distributions of within- and between-class matching scores, and calculate various error estimates based on these distributions

UNIT I:

Pattern Recognition: machine perception, pattern recognition example, pattern recognition systems, the design cycle, learning and adaptation.

Bayesian Decision Theory: Introduction, continuous features-two categories classifications, minimum error rate classification-zero-one loss function, classifiers, discriminate functions, and decision surfaces.

UNIT II:

Normal density: Univariate and multivariate density, discriminate functions for the normal density-different cases, Bayes decision theory – discrete features, compound Bayesian decision theory and context.

Component analyses: Principal component analysis, non-linear component analysis, Low dimensional representations, and multi dimensional scaling.

UNIT III:

Digitized Image and its properties: Basic concepts, Image Functions, the dirac distribution and convolution, the Fourier transform, Images as a Stochastic process, Images as linear systems.

Image Digitization: Sampling, Quantization, Colour Images.

Digital Image Properties: Metric and topological properties of Digital Images, Histograms, Visual perception of the Image, Image quality, Noise in Images.

UNIT IV:

Biometrics: Introduction, benefits of biometrics over traditional authentication systems, benefits of

biometrics in identification systems, selecting a biometric for a system, Applications, Key biometric terms and processes, biometric matching methods, Accuracy in biometric systems

#### UNIT V:

Physiological Biometric Technologies: Fingerprints, Technical description, characteristics, Competing technologies, strengths, weaknesses, deployment, Facial scan, Technical description, characteristics, weaknesses, deployment, Iris scan, Technical description, characteristics, strength, weaknesses, deployment  
Hand Biometric: Palm Print, Vein Pattern, Signature and Hand Writing Technology-Technical description, characteristics, strengths, weaknesses and deployment.

#### Course Outcomes:

At the end of the course, student will be able to

- Understand theoretical concepts and practical Issues associated with pattern recognition.
- Demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems
- Analyze biometric systems at the component level and be able to analyze and design basic biometric system applications

#### Text Books:

1. pattern classification ,Richard o.Duda, peter E.Hart, David G.Stroke, Wiley student edition, 2<sup>nd</sup> edition.
2. Digital Image processing , Rafeal C.Gonzalez, Richard E.Woods, 2<sup>nd</sup> edition, Pearson Education/PHI.
3. Privacy Enhancing Biometric, Chuck Wilson, Vein pattern recognition, CRC press, 2010
4. Biometrics: Identity Verification in a Network, 1<sup>st</sup> Edition, Samir Nanavathi, Michel Thieme, and Raj Nanavathi, Wiley Eastern, 2002
5. Implementing Biometric Security, 1<sup>st</sup> Edition, John Chirillo and Scott Blaul Wiley Eastern Publication, 2005
6. Image Processing, Analysis and Machine Vision – Milan Sonka, Vaclav Hlavac, Roger Boyle, Second Edition – Vikas Publishing House.

Reference Books:

- 1) Digital Image Processing And Analysis – Chanda & Majumder
- 2) Security, Risk and the Biometric State: Governing Borders and Bodies, 1<sup>st</sup> Edition, Benjamin Muller, Routledge, 2010
- 3) Handbook of Biometrics, Jain, Anil K.; Flynn, Patrick; Ross, Arun A. (Eds.), Springer, 2008
- 4) Handbook of Biometrics, Anil K. Jain, Patrick Flynn, Arun A. Ross, Springer, 2007(T4)
- 5) Biometrics for Network Security, 1<sup>st</sup> Edition, John Berger, Prentice Hall, 2004

IV Year –I Semester

L T P C  
0 0 3 1.5

## WEB TECHNOLOGIES LAB

### COURSE OBJECTIVES

- To acquire knowledge of XHTML, Java Script and XML to develop web applications
- Ability to develop dynamic web content using Java Servlets and JSP
- To understand JDBC connections and Java Mail API
- To understand the design and development process of a complete web application

1. Design the following static web pages required for an online book store web site.

#### 1) HOME PAGE:

The static home page must contain three frames.

Top frame: Logo and the college name and links to Home page, Login page, Registration page, Catalogue page and Cart page (the description of these pages will be given below).

Left frame: At least four links for navigation, which will display the catalogue of respective links.

For e.g.: When you click the link “mba”, the catalogue for ‘mba’ Books should be displayed in the Right frame.

Right frame: The *pages to the links in the left frame must be loaded here*. Initially this page contains description of the web site.

Logo	Web Site Name			
Home	Login	Registration	Catalogue	Cart
mca mba BCA	Description of the Web Site			





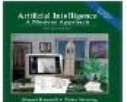







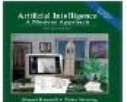







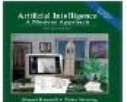





## 2) LOGIN PAGE

Logo	Web Site Name			
Home	Login	Registration	Catalogue	Cart
MCA MBA BCA	<p>           Login : <input type="text" value="11a51f0003"/>            Password: <input type="password" value="*****"/>  <input type="button" value="Submit"/> <input type="button" value="Reset"/> </p>			

## 3) CATALOGUE PAGE:

The catalogue page should contain the details of all the books available in the web site in a table. The details should contain the following:

1. Snap shot of Cover Page.
2. Author Name.
3. Publisher.
4. Price.
5. Add to cart button.

Logo	Web Site Name																			
Home	Login	Registration	Catalogue	Cart																
MCA MBA BCA	<table border="1"> <tbody> <tr> <td></td> <td>Book : XML Bible Author : Winston Publication : Wiley</td> <td>\$ 40.5</td> <td></td> </tr> <tr> <td></td> <td>Book : AI Author : S.Russel Publication : Princeton hall</td> <td>\$ 63</td> <td></td> </tr> <tr> <td></td> <td>Book : Java 2 Author : Watson Publication : BPB publications</td> <td>\$ 35.5</td> <td></td> </tr> <tr> <td></td> <td>Book : HTML in 24 hours Author : Sam Peter Publication : Sam</td> <td>\$ 50</td> <td></td> </tr> </tbody> </table>					Book : XML Bible Author : Winston Publication : Wiley	\$ 40.5			Book : AI Author : S.Russel Publication : Princeton hall	\$ 63			Book : Java 2 Author : Watson Publication : BPB publications	\$ 35.5			Book : HTML in 24 hours Author : Sam Peter Publication : Sam	\$ 50	
	Book : XML Bible Author : Winston Publication : Wiley	\$ 40.5																		
	Book : AI Author : S.Russel Publication : Princeton hall	\$ 63																		
	Book : Java 2 Author : Watson Publication : BPB publications	\$ 35.5																		
	Book : HTML in 24 hours Author : Sam Peter Publication : Sam	\$ 50																		

**4. REGISTRATION PAGE:**

Create a “*registration form* “with the following fields

- 1) Name (Text field)
- 2) Password (password field)
- 3) E-mail id (text field)
- 4) Phone number (text field)
- 5) Sex (radio button)
- 6) Date of birth (3 select boxes)
- 7) Languages known (check boxes – English, Telugu, Hindi, Tamil)
- 8) Address (text area)

**5. DESIGN A WEB PAGE USING CSS (Cascading Style Sheets) which includes the following:**

- 1) Use different font, styles:

In the style definition you define how each selector should work (font, color etc.).

Then, in the body of your pages, you refer to these selectors to activate the styles

**6. WRITE AN XML file which will display the Book information which includes the following:**

- 1) Title of the book
- 2) Author Name
- 3) ISBN number
- 4) Publisher name
- 5) Edition
- 6) Price

Write a Document Type Definition (DTD) to validate the above XML file.

**7. Write Ruby program reads a number and calculates the factorial value of it and prints the Same.**

**8. Write a Ruby program which counts number of lines in a text files using its regular Expressions facility.**

**9. Write a Ruby program that uses iterator to find out the length of a string.**

**10. Write simple Ruby programs that uses arrays in Ruby.**

**11. Write programs which uses associative arrays concept of Ruby.**

**12. Write Ruby program which uses Math module to find area of a triangle.**

**13. Write Ruby program which uses tk module to display a window**

**14. Define complex class in Ruby and do write methods to carry operations on complex objects.**

**15. Write a program which illustrates the use of associative arrays in perl.**

**16. Write perl program takes set names along the command line and prints whether they are regular files or special files**

**COURSE OUTCOMES:**

- Students will be able to develop static web sites using XHTML and Java Scripts
- To implement XML and XSLT for web applications
- Develop Dynamic web content using Java Servlets and JSP
- To develop and implement a complete Dynamic web Application

IV Year – I Semester

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PROJECT-I

IV Year – I Semester

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ENVIRONMENTAL SCIENCES

IV Year – I Semester

L T P C  
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DATA SCIENCE  
Code: PE4102  
(Open Elective-III)

Course Objectives:

From the course the student will learn

- Provide you with the knowledge and expertise to become a proficient data scientist.
- Demonstrate an understanding of statistics and machine learning concepts that are vital for data science;
- Learn to statistically analyze a dataset;
- Explain the significance of exploratory data analysis (EDA) in data science.
- Critically evaluate data visualizations based on their design and use for communicating stories from data

UNIT I

Introduction, The Ascendance of Data, Motivating Hypothetical: Data Science, Finding Key Connectors, The Zen of Python, Getting Python, Virtual Environments, Whitespace Formatting, Modules, Functions, Strings, Exceptions, Lists, Tuples, Dictionaries defaultdict, Counters, Sets, Control Flow, Truthiness, Sorting, List Comprehensions, Automated Testing and assert, Object-Oriented Programming, Iterables and Generators, Randomness, Regular Expressions, Functional Programming, zip and Argument Unpacking, args and kwargs, Type Annotations, How to Write Type Annotations.

UNIT II

Visualizing Data: matplotlib, Bar Charts, Line Charts, Scatterplots. Linear Algebra: Vectors, Matrices, Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Some Other Correlational Caveats, Correlation and Causation.

Gradient Descent: The Idea Behind Gradient Descent, Estimating the Gradient, Using the Gradient, Choosing the Right Step Size, Using Gradient Descent to Fit Models, Minibatch and Stochastic Gradient Descent.

UNIT III

Getting Data: stdin and stdout, Reading Files, Scraping the Web, Using APIs,

Working with Data: Exploring Your Data Using NamedTuples

Dataclasses, Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction.

Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem

UNIT IV

Machine Learning: Modeling, Overfitting and Underfitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, k-Nearest Neighbors, Naive Bayes, Simple Linear Regression, Multiple Regression, Digression, Logistic Regression

UNIT V

Support Vector Machines, Decision Trees, Neural Networks: Perceptrons, Feed-Forward Neural Networks, Backpropagation. Clustering: The Idea, The Model, Choosing k, Bottom-Up Hierarchical Clustering.

Recommender Systems: Manual Curation, Recommending What's Popular, User-Based Collaborative Filtering, Item-Based Collaborative Filtering, Matrix Factorization

Data Ethics, Building Bad Data Products, Trading Off Accuracy and Fairness, Collaboration, Interpretability, Recommendations, Biased Data, Data Protection

IPython, Mathematics, NumPy, pandas, scikit-learn, Visualization, R

#### Course Outcomes:

At the end of the course, student will be able to

- Describe what Data Science is and the skill sets needed to be a data scientist.
- Explain in basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data.
- Use R to carry out basic statistical modeling and analysis.
- Apply basic tools (plots, graphs, summary statistics) to carry out EDA.
- Describe the Data Science Process and how its components interact.
- Use APIs and other tools to scrap the Web and collect data.
- Apply EDA and the Data Science process in a case study.

#### Textbooks:

- 1) Joel Grus, "Data Science From Scratch", O'Reilly.
- 2) Allen B.Downey, "Think Stats", O'Reilly.
- 3) The Data Science Design Manual, Skinea Steven.
- 4) Managing Global Software Projects, Ramesh Gopaldaswamy.

#### Reference Books:

- 5) Doing Data Science: Straight Talk From The Frontline, 1<sup>st</sup> Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013
- 6) Mining of Massive Datasets, 2<sup>nd</sup> Edition, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, v2.1, Cambridge University Press, 2014
- 7) "The Art of Data Science", 1<sup>st</sup> Edition, Roger D. Peng and Elizabeth matsui, Lean Publications, 2015
- 8) "Algorithms for Data Science", 1<sup>st</sup> Edition, Steele, Brian, Chandler, John, Reddy, Swarna, springers Publications, 2016

#### e-Resources:

- 2) <https://github.com/joelgrus/data-science-from-scratch>

IV Year – I Semester

L T P C  
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INTERNET OF EVERYTHING  
(Open Elective-III)

Course Objectives:

- Learns about various types of sensors, actuators and different network protocols.
- Construction of wireless sensor networks and communication using different connectivity technologies
- To Know about how m2M communication performs and communication between user and the device
- To Know about programming platforms to implement IOT
- Learns about how data is handled generated by IOT application
- how IoT is used for industrial purpose , able to build IoT applications

UNIT I:

Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II, Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories.

UNIT II:

Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis

UNIT III:

Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems. IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models, IIoT Reference Architecture

UNIT IV:

Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking, Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics – Introduction

UNIT V: Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management. Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries.

Course Outcomes:



- Aware about how sensors and actuators are connected by using different network protocols
- Node behavior in wireless sensor networks and known about which connectivity technology was used according to the application.
- Knows about Arduino boards and their connection with sensors and actuators
- Learns about how Pi OS is installed and how code is embedded into the board
- Came to know about how data is stored using cloud computing and knows about sensor clouds.
- Construction various IOT applications using various sensors and Actuators

#### TEXT BOOKS:

1. .Industry 4.0: The Industrial Internet of Things”, by Alasdair Gilchrist (Apress)
2. “Industrial Internet of Things: Cybermanufacturing Systems “by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer).
3. Internet of Things: Architecture, Design Principles And Applications, Raj kamal, McGraw Hill Higher Education
4. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press, 2015.

#### REFERENCE BOOKS:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley, 2013
2. Getting Started with the Internet of Things (Make: Projects), CunoPfister , Oreilly, 2011

WIRELESS SENSOR NETWORKS  
(Open Elective-III)

Course Objectives

- Understand the state-of-the-art in network protocols, architectures and applications.
- Analyze existing network simulator to working environment.
- Understand the medium access control protocols and Markov chain properties.
- Learn key routing protocols for sensor networks and main design issues
- Understand the routing protocols for wireless sensor networks and advanced protocols.

Unit I

Introduction to Wireless Sensor Networks: Course Information, Motivations, Applications, Performance metrics, History and Design factors.

Network Architecture: Traditional layered stack, Cross-layer designs, Sensor Network Architecture

Hardware Platforms: Motes, Hardware parameters

Unit II

Introduction to ns-3: Introduction to Network Simulator 3 (ns-3), Description of the ns-3 core Unit and simulation example.

Unit III

Medium Access Control Protocol design: Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled

Introduction to Markov Chain: Discrete time Markov Chain definition, properties, classification and analysis

MAC Protocol Analysis: Asynchronous duty-cycled X-MAC Analysis (Markov Chain)

Unit IV

Security: Possible attacks, countermeasures, SPINS, Static and dynamic key distribution

Unit V

Routing protocols: Introduction, MANET protocols

Routing protocols for WSN: Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast

Opportunistic Routing Analysis: Analysis of opportunistic routing (Markov

Chain)Advanced topics in wireless sensor networks.

Advanced Topics: Recent development in WSN standards, software applications.

Course Outcomes:

After completion of this course, the student will be able to

- explain the basics concepts of wireless sensor networks.understand of network simulator 3 to implement protocols of wsn .
- use of medium access control protocol design issues.
- knowledge of different security concepts and attacks.
- gain working of different routing protocols.
- learnt advanced topics and make use of real time environment

Text Book(s):

1. W. Dargie and C. Poellabauer, “Fundamentals of Wireless Sensor Networks – Theory and Practice”, Wiley 2010.
2. KazemSohraby, Daniel Minoli and TaiebZnati, “wireless sensor networks - Technology, Protocols,and Applications”, Wiley Interscience 2007.

Reference Book:

1. Takahiro Hara, Vladimir I. Zadorozhny, and Erik Buchmann, “Wireless SensorNetwork Technologies for the Information Explosion Era”, springer 2010.

R-PROGRAMMING  
(Open Elective-III)

COURSE OBJECTIVES:

- Use R for statistical programming, computation, graphics, and modelling,
- Write functions and use R in an efficient way,
- Fit some basic types of statistical models
- Use R in their own research,
- Be able to expand their knowledge of R on their own.

UNIT-I:

Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

UNIT-II:

R Programming Structures, Control Statements, Loops, - Looping Over Non vector Sets,- If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return-Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary Search Tree.

UNIT-III:

Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and Maxima- Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product- Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /out put, Accessing the Keyboard and Monitor, Reading and writer Files,

UNIT-IV:

Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files.

#### UNIT-V:

Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,-ANOVA.

Linear Models, Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, - Poisson Regression- other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision- Random Forests,

#### COURSE OUTCOMES:

At the end of this course, students will be able to:

- List motivation for learning a programming language
- Access online resources for R and import new function packages into the R workspace
- Import, review, manipulate and summarize data-sets in R
- Explore data-sets to create testable hypotheses and identify appropriate statistical tests
- Perform appropriate statistical tests using R Create and edit visualizations with

#### TEXT BOOKS:

- 3) The Art of R Programming, Norman Matloff, Cengage Learning
- 4) R for Everyone, Lander, Pearson

#### REFERENCE BOOKS:

- 3) R Cookbook, Paul Teetor, Oreilly.
- 4) R in Action, Rob Kabacoff, Manning

IV Year – I Semester

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DIGITAL MARKETING & MULTIMEDIA  
(Open Elective-III)

Course Objectives:

Identify impact of digital space and digital marketing in reaching out to customers.

- Find out the opportunities for marketers on digital platform.
- Use digital media for the creation of products and services.
- Differentiate factors that influence the consumer

How and What are the different elements that make the consumer so unique?

UNIT I:

HTML: Introduction, HTML5, Audio Elements, Video Elements, Organizing Elements. Scripting Documents: Dynamic Document content, Document properties, Legacy DOM, Document Collections, Overview of the W3C DOM, Traversing a Document, Finding Elements in a Document, Modifying a Document, Adding Content to a Document Example

UNIT II:

Cascading Style Sheets and Dynamic HTML: Overview of CSS, CSS for DHTML Scripting inline Styles, Scripting computed styles, Scripting CSS Classes, Scripting Style Sheets. Java Script and XML: Obtaining XML Documents, Manipulating XML with the DOM API, Transforming XML with XSLT querying XML with X path, Serializing XML, Example, XML and Web services.

UNIT III:

Search Engine Optimization (SEO): Searching Engine Marketing, Search Engine Optimization, Measuring SEO Success, Mapping with SEO Journey. Search Advertising: Online Advertising Payment Models, Search Advertising (Desktop & Mobile Devices), Planning & Executing a search Advertising Campaign, Strategic Implications of Advertising on the search Network.

UNIT IV:

Search Media Marketing: What is Social Media? Social Media Marketing, Social Media Marketing Strategy, Adopting Social Media in Organizations: Internal Learning, Paid-Owned-Earned Media, Social CRM. Mobile Marketing: Mobile Internet in India, What is Mobile Marketing? Email Marketing Strategy, Forms of Mobile Marketing, Mobile Advertising, M-Commerce.

UNIT V:

E-Mail Marketing: E-Mail Marketing in India, What is E-Mail Marketing? E-Mail Marketing Strategy, Executing E-Mail Marketing. Internet Marketing: Internet Marketing Strategy, Content Marketing, Content Marketing in India.

Course Outcomes:

At the end of the course, student will be able to

- Explain about web pages with basic HTML5, DHTML tags using CSS and XML, the overview of W3C DOM.
- Discuss the key elements of a digital Java Scripts.
- Apply search engine optimization techniques to a website.
- Illustrate how the effectiveness of a digital marketing campaign can be measured
- Demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs

Text Books:

1. The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns, Ian Dodson, Wiley, 2016
2. Programming the World Wide Web, Robert W Sebesta, Pearson, 8<sup>th</sup> edition, 2015

Reference Books:

1. Fundamentals of Digital Marketing, Second Edition, Pearson Paperback, 2019
2. Internet Marketing- A Practical approach in the India Context by Moutusy Maity, Oxford
3. Java Script: The Definite Guide David Flanagan, O' Reilly Publisher

IV Year – II Semester

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### DEEP LEARNING (Professional Elective-V)

Course Objectives:

- To acquire knowledge on the basics of neural networks.
- To implement neural networks using computational tools for variety of problems.
- To explore various deep learning algorithms.

Unit1: Introduction to Deep Learning, Bayesian Learning, Decision Surfaces  
Linear Classifiers, Linear Machines with Hinge Loss, Optimization Techniques, Gradient  
Descent, Batch Optimization

Unit2: Introduction to Neural Network, Multilayer Perceptron, Back Propagation  
Learning Unsupervised Learning with Deep Network, Autoencoders, Convolutional Neural  
Network, Building blocks of CNN, Transfer Learning

Unit 3: Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam  
Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance  
Normalization, Group Normalization

Unit 4: Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection  
Network, Fully Connected CNN etc. Classical Supervised Tasks with Deep Learning, Image  
Denoising, Semantic Segmentation, Object Detection etc.

Unit 5: LSTM Networks, Generative Modelling with DL, Variational Autoencoder, Generative  
Adversarial Network Revisiting Gradient Descent

Course Outcomes:

Students will be able to:

- Develop algorithms simulating human brain.
- Implement Neural Networks in Tensor Flow for solving problems.
- Explore the essentials of Deep Learning and Deep Network architectures.
- Define, train and use a Deep Neural Network for solving real world problems that require artificial Intelligence based solutions.

Text Books:

- 1) "Deep Learning (Adaptive Computation and Machine Learning series", Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 2017.



- 2) Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.
- 3) “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, Nikhil Buduma, Nicholas Locascio, O'Reilly Media, 2017.

Reference Books:

- 1) Deep learning from first principle, 2<sup>nd</sup> edition, tinniam v Ganesh, 2018
- 2) Introduction to Deep Learning , 1<sup>st</sup> edition, by Eugene charniak, The MIT Press, 2019

NATURAL LANGUAGE PROCESSING  
(Professional Elective-V)

Course Objectives:

- Acquaintance with natural language processing and learn how to apply basic algorithms in this field.
- To recognize the significance of pragmatics for natural language understanding.
- Capable of describing the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

UNIT – I:

Regular Expressions, Text Normalization, Edit Distance: Regular Expressions, Words, Corpora, Text Normalization, Minimum Edit Distance. N-Gram Language Models: N-grams, Evaluating Language Models, Generalization and Zeros, Smoothing, Kneser-Ney Smoothing, The web and stupid Backoff, Advanced Perplexity's Relation to Entropy.

UNIT – II:

Parts of Speech Tagging: English Word Classes, The Penn Tree bank part of speech Tagset, Part of Speech tagging, HMM part of speech tagging, Maximum Entropy Markov Models, Bi-directionality, Part of Speech tagging for other languages.

UNIT – III:

Formal Grammars of English: Constituency, Context Free Grammars, Some Grammar Rules for English, Treebanks, Grammar Equivalence and Normal Form, Lexicalized Grammars. Syntactic Parsing: Ambiguity, CYK Parsing, Partial parsing.

UNIT – IV:

Dependency Parsing: Dependency Relations, Formalisms, Treebank, Transition Based Dependency Parsing, Graph based dependency parsing, Evaluation. Representation of Sentence Meaning: Computational Desiderata for Representations, Model - Theoretic Semantics, First Order Logic, Event and State Representations, Description Logics.

UNIT – V:

Semantic Parsing : Information Extraction: Named Entity Recognition, Relation Extraction, Extracting Times, Events and their times, Template Filling. Lexicons for Sentiment, Affect and Connotation: Defining Emotion, Available Sentiment and Affect Lexicons, Creating affect lexicons by human labeling, semi supervised induction of affect

lexicons, supervised learning of word sentiment, Using lexicons for Sentiment Recognition.

Course Outcomes:

Upon completion of this course, student will be able to:

- Understand the theoretical underpinnings of natural language processing in linguistics and formal language theory.
- Learn Manipulating large corpus, exploring linguistic models and testing empirical claims.
- Able to build robust systems to perform linguistic tasks.

Text Book:

1. Speech and Language Processing- Daniel Jurafsky, James H Martin, 2<sup>nd</sup> edition, PHI, 2008.

Reference Book:

1. Natural Language Processing using Python by Steven Bird, Ewan Klein, Edward Loper, 1<sup>st</sup> edition, O'Reilly Publications, 2009.

IV Year - II Semester

L T P C  
3 0 0 3

ETHICAL HACKING WITH BLOCK CHAIN TECHNOLOGIES  
(Professional Elective-V)

Course Objectives:

- To understand issues relating to ethical hacking
- To understand and analyse Information security threats & counter measures To perform security auditing & testing
- Understand how blockchain systems work
- To securely interact with them,
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from blockchain technology into their own projects.

UNIT I: Ethical hacking overview & vulnerabilities

Understanding the importance of security, Concept of ethical hacking and essential Terminologies- Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking

UNIT II: Foot printing & port scanning

Foot printing - Introduction to foot printing, Understanding the information gathering methodology of the hackers, Tools used for the reconnaissance phase. Port Scanning - Introduction, using port scanning tools, ping sweeps, Scripting Enumeration-Introduction, Enumerating windows OS & Linux OS

UNIT III: System hacking:

Aspect of remote password guessing, Role of eavesdropping ,Various methods of password cracking, Keystroke Loggers, Understanding Sniffers ,Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.

Unit IV: Introduction to Blockchain

What is Blockchain?, Why Blockchain is crucial?, History of Blockchain, Distinction between databases and blockchain, Explaining Distributed Ledger, Blockchain ecosystem, Blockchain structure, Working of blockchain technology, Permissioned and permission-less blockchain origins, Blockchain objectives, Blockchain users and adoption, Blockchain challenges, New developments in blockchain, Cryptocurrency , Digital Tokens, Smart Contracts, DAOs and DACs

Unit V: Introduction to Crypto currency and Networking Concepts

What is Crypto Currency?, What is Crypto currency used for?, Different types Of Cryptocurrencies, Bitcoin, Ethereum, Litecoin, Monero, Ripple, What Is A Crypto Wallet, What Is A Crypto Exchange, Crypto and Cryptocurrencies, Cryptographic Hash Functions,Hash Pointers and Data Structures, Digital Signatures ,Public Keys as Identities ,A Simple Cryptocurrency, Decentralization, Centralization vs. Decentralization, Distributed Consensus, Consensus without Identity: the Block Chain, Incentives and Proof of Work

#### Course Outcomes:

- understand vulnerabilities, mechanisms to identify vulnerabilities/threats/attacks
- perform penetration & security testing become a professional ethical hacker
- Able to understand design principles of Bitcoin and Ethereum.
- Able to learn about Nakamoto consensus.
- Learns about Simplified Payment Verification protocol.
- Learns about differences between proof-of-work and proof-of-stake consensus.
- Learns about Interaction with a blockchain system by sending and reading transactions.
- Learns about Design, build, and deploy a distributed application.
- Learns about Evaluate security, privacy, and efficiency of a given blockchain system.

#### Text Books:

1. Kimberly Graves, "Certified Ethical Hacker", Wiley India Pvt Ltd, 2010
2. Michael T. Simpson, "Hands-on Ethical Hacking & Network Defense", Course Technology, 2010
3. Rajat Khare, "Network Security and Ethical Hacking", Luniver Press, 2006
4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

#### Reference Books:

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
1. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
2. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger," Yellow paper. 2014.
3. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts.
4. Blockchain-The untold story by Srinivas Mahankali
5. Blockchain From Concept to Execution, Debajani Mohanty
6. The Definitive Guide to Blockchain for Accounting and Business by Saurav Dutta
7. Ramachandran V, BackTrack 5 Wireless Penetration Testing Beginner's Guide (3rd ed.). Packt Publishing, 2011
8. Thomas Mathew, "Ethical Hacking", OSB publishers, 2003

IV Year – II Semester

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SOFTWARE PROJECT MANAGEMENT & QUALITY ASSURANCE  
(Professional Elective-V)

COURSE OBJECTIVES

- To study how to plan and manage projects at each stage of the software development life cycle (SDLC)
- To train software project managers and other individuals involved in software project planning and tracking and oversight in the implementation of the software project management process.
- To understand successful software projects that support organization's strategic goals

UNIT -I:

Introduction Project, Management, Software Project Management activities, Challenges in software projects, Stakeholders, Objectives & goals Project Planning: Step-wise planning, Project Scope, Project Products & deliverables, Project activities, Effort estimation, Infrastructure

UNIT -II:

Project Approach Lifecycle models, Choosing Technology, Prototyping Iterative & incremental Process Framework: Lifecycle phases, Process Artifacts, Process workflows (Book 2)

UNIT -III:

Effort estimation & activity Planning Estimation techniques, Function Point analysis, SLOC, COCOMO, Use case-based estimation, Activity Identification Approaches, Network planning models, Critical path analysis Risk Management Risk categories, Identification, Assessment, Planning and management, PERT technique, Monte Carlo approach

UNIT -IV:

Project Monitoring & Control, Resource Allocation Creating a framework for monitoring & control, Progress monitoring, Cost monitoring, Earned value Analysis, Defects Tracking, Issues Tracking, Status reports, Types of Resources, Identifying resource requirements, Resource scheduling

UNIT -V:

Software Quality Planning Quality, Defining Quality - ISO 9016, Quality Measures, Quantitative Quality Management Planning, Product Quality & Process Quality Metrics, Statistical Process Control Capability Maturity Model, Enhancing software Quality (Book3)

TEXT BOOKS:

1. Software Project Management, Bob Hughes & Mike Cotterell, TATA McGraw-Hill
2. Software Project Management, Walker Royce: Pearson Education, 2005.
3. Software Project Management in practice, Pankaj Jalote, Pearson.

REFERENCE BOOKS:

Software Project Management, Joel Henry, Pearson Education.

NETWORK PROGRAMMING  
(Professional Elective –V)

Course Objectives:

Having successfully completed this course, the student will be able to:

- Demonstrate mastery of main protocols comprising the Internet.
- Develop skills in network programming techniques.
- Implement network services that communicate through the Internet.
- Apply the client-server model in networking applications.
- Practice networking commands available through the operating systems

UNIT-I: Introduction to Network Programming: OSI model, Unix standards, TCP and UDP & TCP connection establishment and Format, Buffer sizes and limitation, standard internet services, Protocol usage by common internet application.

UNIT-II: TCP client server: Introduction, TCP Echo server functions, Normal startup, terminate and signal handling server process termination, Crashing and Rebooting of server host shutdown of server host.

UNIT-III: Sockets: Address structures, value – result arguments, Byte ordering and manipulation function and related functions Elementary TCP sockets – Socket, connect, bind, listen, accept, fork and exec function, concurrent servers. Close function and related function. I/O Multiplexing and socket options: I/O Models, select function, Batch input, shutdown function, poll function, TCP Echo server, getsockopt and setsockopt functions. Socket states, Generic socket option IPV6 socket option ICMPV6 socket option IPV6 socket option and TCP socket options.

UNIT-IV: Elementary UDP sockets: Introduction UDP Echo server function, lost datagram, summary of UDP example, Lack of flow control with UDP, determining outgoing interface with UDP. Elementary name and Address conversions: DNS, gethost by Name function, Resolver option, Function and IPV6 support, uname function, other networking information.

UNIT-V: IPC : Introduction, File and record locking, Pipes, FIFOs streams and messages, Name spaces, system IPC, Message queues, Semaphores. Remote Login: Terminal line disciplines, Pseudo Terminals, Terminal modes, Control Terminals, rlogin Overview, RPC Transparency Issues.



Course Outcomes:

- Be able to create sockets and analyze different (client/server) models.
- Be able to create processes, threads, semaphores and Bluetooth programming.
- Be able to analyze different protocols.

TEXTBOOKS:

1. UNIX Network Programming, Vol. I, Sockets API, 2nd Edition. - W.Richard Stevens, Pearson Edn. Asia.
2. UNIX Network Programming, 1st Edition, - W.Richard Stevens. PHI.

REFERENCES:

1. UNIX Systems Programming using C++ T CHAN, PHI.
2. UNIX for Programmers and Users, 3rd Edition Graham GLASS, King abls, Pearson Education
3. Advanced UNIX Programming 2nd Edition M. J. ROCHKIND, Pearson Education