Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

Branch- Common to All Discipline

New Scheme Based On AICTE Flexible Curricula

BT401	**Mathematics-III**	**3L-1T-0P**	**4 Credits**

OBJECTIVES: The objective of this course is to fulfill the needs of engineers to understand applications of Numerical Analysis, Transform Calculus and Statistical techniques in order to acquire mathematical knowledge and to solving wide range of practical problems appearing in different sections of science and engineering. More precisely, the objectives are:

- To introduce effective mathematical tools for the Numerical Solutions algebraic and transcendental equations.
- To enable young technocrats to acquire mathematical knowledge to understand Laplace transformation, Inverse Laplace transformation and Fourier Transform which are used in various branches of engineering.
- To acquaint the student with mathematical tools available in Statistics needed in various field of science and engineering.

Module 1: Numerical Methods – 1: (8 hours): Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

Module 2: Numerical Methods – 2: (6 hours): Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Solution of Simultaneous Linear Algebraic Equations by Gauss's Elimination, Gauss's Jordan, Crout's methods, Jacobi's, Gauss-Seidal, and Relaxation method.,

Module 3: Numerical Methods – 3: (10 hours): Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. RungeKutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Partial differential equations: Finite difference solution two dimensional Laplace equation and Poission equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.

Module 4: Transform Calculus: (8 hours): Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace Transform method, Fourier transforms.

Module 5: Concept of Probability: (8 hours): Probability Mass function, Probability Density Function, Discrete Distribution: Binomial, Poisson's, Continuous Distribution: Normal Distribution, Exponential Distribution.

Textbooks/References:

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
7. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
8. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
9. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968. Statistics

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Information Technology, IV-Semester

IT402 - Computer Architecture

Course Objectives

The objective of course is to understand the basic structure and operation of computer system. Students will be able to know the operation of the arithmetic unit including the algorithms & implementation of fixed-point and floating-point addition, subtraction, multiplication & division. To study the different ways of communicating with I/O devices and standard I/O interfaces, hierarchical memory system including cache memories and virtual memory, concept of pipeline.

Unit-I Computer architecture and organization, computer generations, von Neumann model, CPU organization, CPU organization, Register organization, Various CPU register, Register Transfer, Bus and Memory Transfers, Arithmetic, Logic and Shift micro-operations, Arithmetic logic shift unit.

Unit–II The arithmetic and logic unit, Fixed-Point representation: integer representation, sign-magnitude, 1's and 2's complement and range, Integer arithmetic: negation, addition and subtraction, multiplication, division, Floating-Point representation, Floating-Point arithmetic, Hardwired micro-programmed control unit, Control memory, Micro-program sequence.

Unit–III Central Progressing Unit (CPU), Stack Organization, Memory Stack, Reverse Polish Notation. Instruction Formats, Zero, One, Two, Three- Address Instructions, RISC Instructions and CISC Characteristics, Addressing Modes, Modes of Transfer, Priority Interrupt, Daisy Chaining, DMA, Input-Output Processor (IOP).

Unit–IV Computer memory system, Memory hierarchy, main memory: RAM, ROM chip, auxiliary and associative memory, Cache memory: associative mapping, direct mapping, set-associative mapping, write policy, cache performance, Virtual memory: address space, memory space, address mapping, paging and segmentation, TLB, page fault, effective access time, replacement algorithm.

Unit–V Parallel Processing, Pipelining General Consideration, Arithmetic Pipeline, and Instruction Pipeline, Vector Operations, Matrix Multiplication, and Memory Interleaving, Multiprocessors, Characteristics of Multiprocessors.

Course Outcomes

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

1. Understand basic structure of computer system, arithmetic operations,
2. Understand the arithmetic operations, Study of hardwired and micro-programmed control units.
3. Develop the concepts of memory management, interleaving and mapping.
4. Analyze the arithmetic and instructional pipelines.

Reference Books:-

1. M. Morris Mano, “Computer System Architecture”, Pearson.
2. Dr. M. Usha, T.S. Srikanth, “Computer System Architecture and Organization”, Wiley India.
3. William Stallings, ”Computer Organization and Architecture”, Pearson.
4. V. Rajaraman, T. Radhakrishnan, “Computer Organization and Architecture”, PHI.

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New Scheme Based On AICTE Flexible Curricula

Information Technology, IV-Semester

IT403 - Analysis and Design of Algorithm

Course Objectives

Data structure includes analyzing various algorithms along with time and space complexities. It also helps students to design new algorithms through mathematical analysis and programming.

Unit-I Algorithms, Designing algorithms, analyzing algorithms, asymptotic notations, heap and heap sort. Introduction to divide and conquer technique, analysis, design and comparison of various algorithms based on this technique, example binary search, merge sort, quick sort, strassen's matrix multiplication.

Unit-II Study of Greedy strategy, examples of greedy method like optimal merge patterns, Huffman coding, minimum spanning trees, knapsack problem, job sequencing with deadlines, single source shortest path algorithm, etc.

Unit-III Concept of dynamic programming, problems based on this approach such as 0/1 knapsack, multistage graph, reliability design, Floyd-Warshall algorithm, etc.

Unit-IV Backtracking concept and its examples like 8 queen's problem, Hamiltonian cycle, Graph coloring problem etc. Introduction to branch & bound method, examples of branch and bound method like traveling salesman problem etc. Meaning of lower bound theory and its use in solving algebraic problem, introduction to parallel algorithms.

Unit-V Binary search trees, height balanced trees, 2-3 trees, B-trees, basic search and traversal techniques for trees and graphs (In order, preorder, postorder, DFS, BFS), NP-completeness.

Course Outcomes:

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

1. Implement sorting and searching algorithm
2. Experiment with techniques for obtaining maximum output with minnium efforts
3. Make use of dynamic programming for finding
4. Solve 8 queen's problem and others of the kind for application in real world scenarios .
5. Distinguish between NP hard and NP complete problems and develop their solutions

Reference Books:-

1. Coremen Thomas, Leiserson CE, Rivest RL; Introduction to Algorithms; PHI.
2. Horowitz & Sahani; Analysis & Design of Algorithm
3. Dasgupta; algorithms; TMH
4. Ullmann; Analysis & Design of Algorithm;
5. Michael T Goodrich, Robarto Tamassia, Algorithm Design, Wiely India

List of Experiments(expandable):

1. Write a program for Iterative and Recursive Binary Search.
2. Write a program for Merge Sort.
3. Write a program for Quick Sort.
4. Write a program for Strassen's Matrix Multiplication.
5. Write a program for optimal merge patterns.
6. Write a program for Huffman coding.
7. Write a program for minimum spanning trees using Kruskal's algorithm.
8. Write a program for minimum spanning trees using Prim's algorithm.
9. Write a program for single sources shortest path algorithm.
10. Write a program for Floye-Warshal algorithm.
11. Write a program for traveling salesman problem.
12. Write a program for Hamiltonian cycle problem.

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Information Technology, IV-Semester

IT404 - Analog & Digital Comm.

Course Objectives

The study of communication systems starts with the concept of analog communication. In this course time and frequency representation of information is given. The objective of this course is to be familiar with the basic building blocks of communication systems such as modulator and demodulator. Different types of analog modulation techniques are given in this course.

Unit-I Signals and Systems: Block diagram of a communication system, signal-definition, types of signals continuous, discrete, deterministic, non-deterministic, periodic, non-periodic, energy, power, analog and digital signals. Electromagnetic Spectra, Standard signals- DC, sinusoidal, unit step, ramp, signum, rectangular pulse, impulse(delta) signal. System definition, classification of systems, linear, nonlinear, time variant, time invariant, causal, non causal, stable and unstable systems. Fourier transforms: Time domain and frequency domain representation of signal, Fourier Transform and its properties, conditions for existence, Transform of Gate, unit step, constant, impulse, sine and cosine wave. Shifting property of delta function, convolution, time and frequency convolution theorems.

Unit-II Amplitude modulation: Modulation, need of modulation, types of modulation techniques, amplitude modulation (DSB-FC), modulation index, frequency spectrum of AM wave, linear and over modulation, power relation in AM, transmission efficiency, modulation by a complex signal, bandwidth of AM, AM modulators, square law and switching modulator, advantages and disadvantages of AM. Demodulation of AM: Suppressed carrier amplitude modulation systems, DSB-SC, SSB-SC, VSB-SC systems, comparison of various amplitude modulation systems. Demodulation of AM, square law and envelope detector, synchronous detection of AM, Low and high power AM transmitters, AM receivers, TRF and superheterodyne receivers, sensitivity, selectivity and fidelity of receivers.

Unit-III Angle modulation: Introduction and types of angle modulation, frequency modulation, frequency deviation, modulation index, deviation ratio, bandwidth requirement of FM wave, types of FM. Phase modulation, difference between FM and PM, Direct and indirect method of FM generation, FM demodulators- slope detector, Foster seeley discriminator, ratio detector. Introduction to pulse modulation systems.

Unit-IV Sampling of signal, sampling theorem for low pass and Band pass signal, Pulse amplitude modulation (PAM), Time division, multiplexing (TDM). Channel Bandwidth for PAM-TDM signal Type of sampling instantaneous, Natural and flat top, Aperture effect, Introduction to pulse position and pulse duration modulations, Digital signal, Quantization, Quantization error, Pulse code modulation, signal to noise ratio, Companding, Data rate and Baud rate, Bit rate, multiplexed PCM signal, Differential PCM (DPCM), Delta Modulation (DM) and Adaptive Delta Modulation (ADM), comparison of various systems.

Unit-V Digital modulations techniques, Generation, detection, equation and Bandwidth of amplitude shift keying (ASK) Binary Phase Shift keying (BPSK), Differential phase shift keying (DPSK), offset and non offset quadrature phase shift keying (QPSK), M-Ary PSK, Binary frequency Shift Keying (BFSK), M-Ary FSK Quadrature Amplitude modulation (QAM).

Course Outcomes:
At the end of the course student will be able to :

1. Differentiate Analog and Digital Signal and types of signals.
2. Understand the communication of information over the communication channel.
3. Understand how information signal of low frequency can be transmitted with the help of modulation techniques over a long distance.
4. Differentiate different modulation techniques such as AM, SSB, DSB and FM.
5. Explain using block diagrams, modulation and demodulation techniques for digital signal and determine bandwidth requirement.

Reference Books:

1. Singh & Sapre, “Communication Systems”, TMH.
2. Taub Schilling, “Principles of Communication Systems”, TMH.
3. W. Tomasi “Electronic Communications Systems”, Pearson Education Pvt. Ltd.
4. Taub & shilling, “Communication Systems”, TMH.
5. Abhay Gandhi, “Analog and Digital Communication”, CENGAGE Learning.

List of Experiments:

1. AM Modulation and Demodulation (Envelope Detector)
2. Frequency modulation using reactance modulator.
3. Frequency modulation using varactor modulator.
4. Pulse Amplitude Modulation and Demodulation
5. Pre-emphasis and De-emphasis
6. Analog Multiplexing.
7. Amplitude Modulation using Pspice
8. Receiver characteristics (selectivity, sensitivity, fidelity).
9. Operation of foster-seeley loop detector.
10. Operation of ratio detector.

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Information Technology, IV-Semester

IT405 - Data Base Management System

Course Objectives:

The main objectives of the course are

1. To understand fundamental knowledge of file system, database concepts and use of relational database.
2. To study of different data model and conceptual design using ER diagram.
3. Students can use SQL operations to manipulate the database and learn how to design and create a good database using functionaldependencies and normalization.
4. The course provides an overview of transaction management, concurrency control, distributed database and Big Data.

Basic Concepts: Introduction to DBMS, File system vs DBMS, Advantages of database systems, Database System architecture, Data models, Schemas and instances, Data independence, Functions of DBA and designer, Entities and attributes, Entity types, Key attributes, Relationships, Defining the E-R diagram of database.

Relational Model: Structure of relational databases, Domains, Relations, Relational algebra – fundamental operators and syntax, relational algebra queries, Entity-Relationship model :Basic concepts, Design process, constraints, Keys, Design issues, E-R diagrams, weak entity sets, extended E-R features –generalization, specialization and aggregation

SQL: Data definition in SQL, update statements and views in SQL: Data storage and definitions, Data retrieval queries and update statements, Query Processing & Query Optimization: Overview, measures of query cost, selection operation, sorting, join, evaluation of expressions, transformation of relational expressions, estimating statistics of expression results, evaluation plans. Case Study of ORACLE and DB2.

Relational Database design: Functional Dependency –definition, trivial and non-trivial FD, closure of FD set, closure of attributes, irreducible set of FD, Normalization –1NF, 2NF, 3NF, Decomposition using FD-dependency preservation, lossless join, BCNF, Multi-valued dependency, 4NF, Join dependency and 5NF

Introduction of transaction, transaction processing and recovery, Concurrency control: Lock management, specialized locking techniques, concurrency control without locking, Protection and Security Introduction to: Distributed databases, Basic concepts of object oriented data base system.

Course Outcomes:

After successful completion of this course, the students would be able to:

1. Compare file system and DBMS and explain how DBMS is better than traditional File Processing Systems.
2. Analyze the physical and logical database designs, database modeling, relational, hierarchical, and network models

3. Analyze and renovate an information model into a relational database schema and to use a DDL, DML and DCL utilities to implement the schema using a DBMS.
4. Formulate data retrieval queries in SQL and Relational Algebra.
5. Demonstrate an understanding of functional dependencies, normalization theory and apply such knowledge to the design of a database.
6. Demonstrate and explain terms like Transaction Processing, Concurrency Control, distributed database and big data.

Reference Books:

1. Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill.
2. Elmasri, Navathe, "Fundamentals of Database Systems", Pearson.
3. Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle", BPB publications.
4. S. Sharma, J. Agrawal, S. Agrawal, "Advanced Database Management System", Dreamtech Press.
5. Leon & Leon, "Fundamental of Data Base Management System", TMH

List of Experiments:

1. To perform various SQL Commands of DDL, DML, DCL.
2. Write SQL Commands such as Insertion, deletion and updation for any schema.
3. To execute Nested Queries, Join Queries, order-by, having clause and string operation.
4. To perform set operators like Union, Intersect, Minus on a set of tables.
5. To execute various commands for GROUP functions (avg, count, max, min, Sum).
6. Write a PL/SQL block for transaction application using Triggers.
7. Write a DBMS program to prepare report for an application using function.
8. Designing of various Input screens/Forms.
9. Create reports using database connectivity of Front end with back end.
10. Create database Design with normalization and implementing in any application.

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Information Technology, IV-Semester

IT406 - Introduction to MATLAB/SciLab/Web Design

Course Objective:
To familiarize students with open source academic software like Scilab or licensed software like Matlab to carryout experiments in various fields in due course like computer graphics and multimedia, soft-computing, image processing, data mining etc.
Experimental works in web design will enable students to design web pages and develop web based projects.

Introduction to MATLAB/SciLab
Installing MATLAB/SciLab Under windows/linux, Basics of MATLAB programming, Data Types, Creating variables, comments, multiline comments, Array operations in MATLAB/Scilab, Loops and execution control statements, inbuilt mathematical functions, Working with files: Scripts and Functions, Plotting and program output, overview of various toolboxes, introduction to Matlab simulink.

Introduction to Web Design
Introduction, Elements, Tags, Attributes, Paragraph, Headings, Line Breaks, Horizontal Rule, Lists, Formatting, Color Codes, Font, Text Links, Email, Images, Image Link, Forms, Table, Frames, Comments, Music Codes, Video Codes, Div, DHTML: Cascading Style Sheet Introduction, Types of CSS, Selectors (Tags), Class and Id with the Selectors, CSS Background & Color, CSS Text, CSS Font, CSS Border, CSS Padding.

Reference Books:

1. Fausett L.V. (2007) Applied Numerical Analysis Using MATLAB, 2nd Ed., Pearson Education
2. Chapra S.C. and Canale R.P. (2006) Numerical Methods for Engineers, 5th Ed., McGraw Hill
3. N.P. Gopalan, “Web Technology”, PHI.
4. Ivan Bayross, “HTML, JavaScript, DHTML and PHP”, BPB Publication.

Suggested List of Experiments/ program (Expandable):

1. Write your first Matlab/Scilab program.
2. Extract an individual element of an array
3. Write Matlab/Scilab program to illustrate loops and control statements.
4. Create a simple plot.
5. Name the title, axes title of the plot.
6. Create a webpage with HTML describing your department on following points: Use paragraph and list tags. Apply various colors to suitably distinguish key words. Also apply font styling like italics, underline and two other fonts to words you find appropriate. Also use header tags.
7. Create a web page using HTML for following: Create a table to show your class time-table. Use tables to provide layout to your HTML page describing your university infrastructure.

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Information Technology, IV-Semester

IT 407 Open Source Software Lab (Linux and R)

Course Objectives:
To develop an understanding of Linux commands and shell programming and enable students to use the Linux distributions to create, debug and run applications. Learn basic R data types, R functions, objects and class, graphs and charts.

Unit I Introduction to LINUX Operating System: Overview of popular Linux distributions, Hardware requirements for Linux, Installation of LINUX distributions
Internal And External Commands, Command Structure, general-purpose utilities: cal, date, echo, printf, bc, script, passwd, PATH, who, uname, tty, stty, pwd, cd, mkdir, rmdir

Unit II Handling files: The File System, cat, cp, rm, mv, more, file, ls, wc, pg, cmp, comm, diff, gzip, tar, zip, df, du, mount, umount, chmod, VI editor, security by file permissions commands: chmod, find, locate, Compiling C/C++ files, File processing: awk, sed, Commands: gcc, sh.

Networking commands: ping, telnet, ftp, arp, rlogin, other commands: make, apt-get, Accessing remote servers and files, Editing and manipulating files, System Administration: Configuration of Linux, Connecting to remote machines-ftp, telnet, Adding and removing users.

Unit III Programming in Linux: Bash shell scripting, Interactive scripts, shell variables, assigning values to variables, positional parameters, command line arguments, arithmetic in shell script, exit, status of a command, sleep and wait, script termination, Decision taking, -if else, nested if, file tests, string tests, case control structure, Loop control, break, continue, logical operators and executing Script, Debugging a script, executing multiple scripts, other shell script examples.

Unit IV R Introduction: Installation of R, R reserved words, Variables and Constants, R Operators, R Control Structures, R Programming: for loop, R while loop, R break & next, R repeat loop
R Functions: R Programming Function, Function Return Value, R Environment and Scope, R recursive function, R switch function

Unit V R Data Structure: R Vectors, R Matrix, R List, R Data Frame
R Object and Class: Object and Class, R S3 Class, R S4 Class, R Reference Class, R Inheritance
R Graphs and Charts: Bar plot, Histogram, Pie Chart, Box plot, Strip chart

References:

1. Forouzan, “Unix & Shell Programming”, Cengage Learning.
2. Sumitab Das,”Unix Concept & Application”,TMH.
3. Richard Peterson,”Linux Complete Reference”,TMH.
4. Michael J. Crawley, “The R Book”, Wiley
5. Roger D. Peng, “R Programming for Data Science” Lean Publishing
6. Tilman M. Davies, “The Book of R”, No Starch Press

Course Outcomes:

After the completion of this course, the students will be able to:

1. Understand the basic commands used in Linux operating system
2. Learn the important Linux/UNIX library functions and system calls
3. Write, compile and debug shell script in Linux environment
4. Learn how to program in R and write R functions
5. Read data into R, access R packages

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Information Technology, IV-Semester

BT408- 90 hrs Internship based on using various software's –Internship -II

To be completed anytime during fourth semester. Its evaluation/credit to be added in fifth semester.

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New Scheme Based On AICTE Flexible Curricula

Information Technology, IV-Semester

BT409 Cyber Security

Unit I

Introduction- Introduction of Cyber Crime, Categorizing Cybercrime, Cybercrime Theory, Criminology perception of cyber criminals: hackers, computer intrusions and Attacks, Privacy, surveillance and protection, hiding crimes in cyberspace, cryptography, hacking vs cracking, privacy and security at risk in the global information society.

Unit II

Application Security- Data Security, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control. Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail Viruses, Macro Viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce- Electronic Payment System, e- Cash, Credit/Debit Cards.

Unit III

Cryptrography concepts and Techniques

Plain text , cipher text, types – substitution ,transposition ,encryption, decryption , symmetric and asymmetric key cryptography algorithms, steganography .

Unit IV

Security Policies- Development of Policies, WWW Policies, Email Security Policies, Policy Review Process-Corporate Policies-Sample Security Policies, Publishing and Notification Requirement of the Policies.

Unit V

Information Security Standards-ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law: Copy Right Law, Software License, Semiconductor Law and Patent Law.

Case Study – Corporate Security , Cyber cases

References:

- Nina Godbole " Cyber Security: Wiley.
- Michael E.Whitman and Herbert J Mattord "Principle of Information Security" Cengage
- William stallings "Cryptography and Network Security" PEARSON
- Charles P. Pfleeger, Shari Lawerance Pfleeger, "Analysing Computer Security", Pearson Education India.
- Vinod V. Sople, "Managing Intellectual Property" PHI Learning Private Limited
- IT Act 2000 Details www.mit.gov.in
- Atul Khate, "Cryptrography and Network Security" ,TMH
- V.K.Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.
- CHANDER, HARISH," Cyber Laws And It Protection " , PHI Learning Private Limited ,Delhi

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Information Technology, VI- semester

IT 601 Computer Graphics & Multimedia

Course Objectives:

1. To introduce the principles of computer graphics and the components of a graphics system
2. To introduce basic algorithms for drawing line, circle and curves.
3. To develop understanding of the basic principles of 2D and 3D computer graphics and how to transform the shapes to fit them as per the picture definition.
4. To introduce multimedia architecture and hardware
5. To introduce multimedia file formats

Unit I

Introduction to Raster scan displays, Storage tube displays, refreshing, flickering, interlacing, colour monitors, display processors resolution, working principle of dot matrix, inkjet laser printers, working principles of keyboard, mouse scanner, digitizing camera, track ball, tablets and joysticks, graphical input techniques, positioning techniques, rubber band techniques, dragging etc.

Unit II

Scan conversion techniques, image representation, line drawing, simple DDA, Bresenham's Algorithm, Circle drawing, general method, symmetric DDA, Bresenham's Algorithm, curves, parametric function, Beizier Method, B-spline Method.

Unit III

2D & 3D Co-ordinate system, Translation, Rotation, Scaling, Reflection Inverse transformation, Composite transformation, world coordinate system, screen coordinate system, parallel and perspective projection, Representation of 3D object on 2D screen, Point Clipping, Line Clipping Algorithms, Polygon Clipping algorithms, Introduction to Hidden Surface elimination, Basic illumination model, diffuse reflection, specular reflection, phong shading, Gourand shading ray tracing, color models like RGB, YIQ, CMY, HSV.

Unit IV

Introduction to multimedia components applications, Multimedia System Architecture, Evolving technologies for Multimedia, Defining objects for Multimedia systems, Multimedia Data interface standards, Multimedia Databases, Multimedia Hardware, SCSI, IDE, MCI, Multimedia Tools, presentation tools, Authoring tools.

Unit V

Compression & Decompression, Multimedia Data & File Format standards, TIFF, MIDI, JPEG, DIB, MPEG, RTF, Multimedia I/O technologies, Digital voice and audio, Video image and animation, Full motion video, Storage and retrieval technologies.

References:-

1. Donald Hearn and M.Pauline Baker, Computer Graphics C Version, Pearson Education, 2003.
2. Prabat K Andleigh and Kiran Thakrar, Multimedia Systems and Design, PHI Learning,
3. Tay Vaughan, Multimedia making it work, Tata McGraw Hill edition.
4. Amarendra N Sinha & Arun D Udai, Computer Graphics, McGraw Hill publication.
5. Mukherjee, Fundamental of Computer Graphics and Multimedia, PHI Learning.

List of Practicals:

1.Write a program to implement DDA line drawing algorithm
2.Write a program to implement Bresenham's line drawing algorithm.
3.Write a program to implement Bresenham's circle drawing algorithm.
4.Write a program to draw an ellipse using Bresenham's algorithm.
5.Write a program to perform various transformations on line , square & rectangle.
6.Write a program to implement Cohen Sutherland line clipping algorithm.
7.Write a program to implement Liang-Bersky line clipping algorithm.
8.Write a program to implement Cohen-Sutheland polygon clipping algorithm to clip a polygon with a Pattern.
9.Write a program to convert a color given in RGB space to it's equivalent CMY color space.
10.Study of various Multimedia file formats:-RTF,MIDI,GIF,JPEG,MPEG,TIFF etc.
11.Write a program to implement JPEG compression scheme for still images.
12.Write a program to perform Packbits compression & decompression.
13.Write a short program to create a TIFF file using bitmap segments and text files as the TIFF File components.
14. Write a program to convert a BMP file into either JPEG or GIF file.
15.Study of various Multimedia Authoring Tools.

Course Outcomes:

Upon completion of this course, students will be able to-

1. Understand the core concepts of computer graphics.
2. Implement various shapes drawing algorithms.
3. Apply geometric transformations on graphic objects and also implement clipping, shading and colour models.
4. Understand multimedia systems architecture, multimedia components and use various multimedia tools.
5. Perform activities involved in design, development and testing of modeling, rendering, shading and animation.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Information Technology, VI-Semester

IT 602 Wireless and Mobile Computing

Course Objectives:

1. To provide an overview of Wireless Communication networks area and its applications in communication engineering.
2. To introduce various standards of mobile communication.
3. To explain the various terminology, principles, devices, schemes, concepts used in Wireless Communication Networks.
4. To introduce the concepts of Adhoc networks and Sensor networks and their issues
5. To introduce various security threats in wireless networks and the techniques for the prevention and detection of threats

Unit I:

Antenna , radiation pattern, antenna types, antenna gain, propagation modes, types of fading. Model for wireless digital communication, multiple access technique-SDMA, TDMA, FDMA, CDMA, DAMA, PRMA, MAC/CA, Cellular network organization, operations of cellular system, mobile radio propagation effects, handoff, power control, sectorization, traffic engineering, Infinite sources, lost calls cleared, grade of service, poison arrival process

Unit II:

GSM- Services, system architecture, radio interface, logical channels, protocols, localization and calling, handover, security, HSCSD, GPRS-architecture, Interfaces, Channels, mobility management DECT, TETRA, UMTS.

Unit III:

IEEE 802.11: LAN-architecture, 802.11 a, b and g, protocol architecture, physical layer, MAC layer , MAC management, HIPERLAN-protocol architecture, physical layer, access control sub layer, MAC sub layer. Bluetooth-user scenarios- physical layer, MAC layer.

Unit IV:

Mobile IP, DHCP, Ad hoc networks: Characteristics, performance issue, routing in mobile host. Wireless sensor network, Mobile transport layer: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission, transaction oriented TCP. Introduction to WAP.

Unit V:

Intruders, Intrusion detection, password management, viruses and related threads, worms, trojan horse defense, difference biometrics and authentication system, firewall design principle.

References:-

1 J. Schiller, “Mobile Communication”, Addision , Wiley
2 William Stalling, “Wireless Communication and Network”, Pearson Education
3 Upena Dalal,” Wireless Communication”, Oxford Higher Education
4 Dr. Kamilo Feher, “Wireless Digital communication”, PHI
5 William C.Y Lee, “Mobile Communication Design Fundamental” , John Wiley.

Suggested List of Practicals:

To implement mobile network using open source softwares like NS2 etc.
Implement Code Division Multiple Access (CDMA).
To write a programme to implement concept of frequency reuse when given size of geographical area and the set of available frequencies.
Study of OPNET tool for modeling and simulation of different cellular standards.
Study and Analysis of wired network.
Study and Analysis of wireless network.
Study and Analysis of Bluetooth.
Study of Mobile IP.
Write programs using WML (Wireless Markup Language) Rajiv Gandhi Proudyogiki Vishwavid

Course Outcomes:

Upon completion of this course, students will be able to-

1. Explain the basic concepts of wireless network and wireless generations.
2. Demonstrate the different wireless technologies such as CDMA, GSM, GPRS etc
3. Explain the design considerations for deploying the wireless network infrastructure.
4. Appraise the importance of Adhoc networks such as MANET and Wireless Sensor networks
5. Differentiate and support the security measures, standards. Services and layer wise security considerations

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Information Technology, VI-Semester

Departmental Elective IT 603(A) Compiler Design

Course Objectives:

1. To teach the students the basic concepts of Compiler, programming languages and develop an understanding of the compilation phases
2. To make students understand what is syntax analysis and various types of parsers
3. To introduce syntax trees and dependency graphs
4. To introduce intermediate code generation, memory management and the role of symbol table and its organization
5. To introduce Code generation and code optimization

UNIT-I:
Introduction to Compiler, analysis of source program, phases and passes, Bootstrapping, lexical analyzers, data structures in compilation – LEX: lexical analyzer generator, Input buffering, Specification and Recognition of tokens, YACC, The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.

UNIT-II:
Syntax Analysis: working of Parser, Top down parsing, Bottom-up parsing, Operator precedence parsing, predictive parsers, LR parsers (SLR, Canonical LR, LALR), constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator.

UNIT-III:
Syntax Directed Translation: Definitions, Inherited Attributes, L-attributed definitions, S-attributed definitions, Dependency graph, Construction of syntax trees, Top down translation, postfix notation, bottom up evaluation.

UNIT-IV:
Intermediate Code Generation: Three address code, quadruple & triples, translation of assignment statements, Boolean expression and control structures, Backpatching, Run Time Memory Management: Static and Dynamic storage allocation, stack based memory allocation schemes, Symbol Table management.

UNIT-V:
Code Optimization and Generation: organization of code optimizer, basic blocks and flow graphs, DAG representation of basic blocks, loops in flow graph, peephole optimization, Basic of block optimization.

References:-

1. A. V. Aho, R. Sethi & J. D. Ullman, Compilers: Principles, Techniques and Tools, Pearson Ed.
2. Alfred V. Aho, Jeffrey D. Ullman, Principles of Compiler Design, Narosa Publishing House.
3. Ronald Mak, Writing Compilers and Interpreters, Wiley IndiacEdition.
4. Louden, Compiler Construction, Cengage learning.

Course Outcomes:

Upon completion of this course, students will be able to-

1. Demonstrate an understanding of the compilation phases.
2. Specify and analyze the lexical, syntactic and semantic structures of advanced language features.
3. Write a scanner, parser, and semantic analyser without the aid of automatic generators.
4. Describe techniques for intermediate code and machine code optimization.
5. Design the structures and support required for compiling advanced language features.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Information Technology, VI-

Semester

Departmental Elective IT 603(B) Data Mining

Course Objectives:

1. To introduce data warehouse and its components
2. To introduce knowledge discovery process, data mining and its functionalities
3. To develop understanding of various algorithms for association rule mining and their differences
4. To introduce various classification techniques
5. To introduce various clustering algorithms.

Unit I:

Data Warehousing**:** Need for data warehousing , Basic elements of data warehousing, Data Mart, Data Warehouse Architecture, extract and load Process, Clean and Transform data, Star ,Snowflake and Galaxy Schemas for Multidimensional databases, Fact and dimension data, Partitioning Strategy-Horizontal and Vertical Partitioning, Data Warehouse and OLAP technology, Multidimensional data models and different OLAP Operations, OLAPServer: ROLAP, MOLAP, Data Warehouse implementation, Efficient Computation of Data Cubes, Processing of OLAP queries, Indexing data.

Unit II:

Data Mining**:** Data Preprocessing, Data Integration and Transformation, Data Reduction, Discretizaion and Concept Hierarchy Generation, Basics of data mining, Data mining techniques, KDP (Knowledge Discovery Process), Application and Challenges of Data Mining

Unit III:

Mining Association Rules in Large Databases**:** Association Rule Mining, Single-Dimensional Boolean Association Rules, Multi-Level Association Rule, Apriori Algorithm, Fp- Growth Algorithm, Time series mining association rules, latest trends in association rules mining.

Unit IV:

Classification and Clustering: Distance Measures, Types of Clustering Algorithms, K-Means Algorithm, Decision Tree, Bayesian Classification, Other Classification Methods, Prediction, Classifier Accuracy, Categorization of methods, Outlier Analysis.

Unit V:

Introduction of Web Mining and its types, Spatial Mining, Temporal Mining, Text Mining, Security Issue, Privacy Issue, Ethical Issue.

References:-

1. Arun k Pujari “Data Mining Technique” University Press
2. Han,Kamber, “Data Mining Concepts & Techniques”,
3. M.Kaufman., P.Ponnian, “Data Warehousing Fundamentals”, John Wiley.
4, M.H.Dunham, “Data Mining Introductory & Advanced Topics”, Pearson Education.
5. Ralph Kimball, “The Data Warehouse Lifecycle Tool Kit”, John Wiley.
6. E.G. Mallach , “The Decision Support & Data Warehouse Systems”, TMH

Course Outcomes:

Upon completion of this course, students will be able to-

1. Demonstrate an understanding of the importance of data warehousing and OLAP technology
2. Organize and Prepare the data needed for data mining using pre preprocessing techniques
3. Implement the appropriate data mining methods like classification, clustering or Frequent Pattern mining on various data sets.
4. Define and apply metrics to measure the performance of various data mining algorithms.
5. Demonstrate an understanding of data mining on various types of data like web data and spatial data

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New Scheme Based On AICTE Flexible Curricula

Information Technology, VI-Semester

Departmental Elective IT 603(C) Embedded Systems

Course Objectives:

1. To introduce students with knowledge about the basic functions and applications of embedded systems
2. To introduce the architecture of embedded systems
3. To introduce the various communication protocols
4. To enable students to have knowledge of the memory types and supporting technologies of embedded systems.
5. To enable students to have knowledge about the development of embedded software

UNIT-I Introduction to Embedded Systems: Definition of embedded system, embedded systems vs. general computing systems, history of embedded systems, classification, major application areas, purpose of embedded systems, characteristics and quality attributes of embedded systems, common design metrics, and processor technology: general purpose processor, application specific processor, single purpose processor.

UNIT-II Embedded System Architecture: Von Neumann v/s Harvard architecture, instruction set architecture, CISC and RISC instructions set architecture, basic embedded processor, microcontroller architecture, CISC & RISC examples: 8051, ARM, DSP processors.

UNIT-III Input Output and Peripheral Devices Timers and counters, watchdog timers, interrupt controllers, PWM, keyboard controller, analog to digital converters, real time clock. Introduction to communication protocols: basic terminologies, concepts, serial protocol: I2C, CAN, firewire, USB. Parallel protocols: PCI bus, IrDA, bluetooth, IEEE 802.11, wireless protocols.

UNIT-IV Memory System Architecture Caches, virtual memory, MMU, address translation, memory and interfacing, memory write ability and storage performance. Memory types, composing memory – advance RAM interfacing, microprocessor interfacing I/O addressing, interrupts, direct memory access, arbitration multilevel bus architecture.

UNIT-V Embedded System Supporting Technologies Difference between normal OS and RTOS, scheduling algorithms. Case study: Tiny OS, VxWorks, QNX. Overview of VLSI technology, introduction to device drivers. Case studies: washing machine, air-conditioning, auto focus camera.

References:

1. F Vahid, T Giogarvis, Embedded systems: A unified hardware/software approach, Wiley, 1999.

2. Raj Kamal, Embedded Systems Introduction, 2nd Ed., TMH publication, 2015.

3.David E Simons, An Embedded Software Primer, Pearson, 1999.

Course Outcomes:

Upon completion of this course, students will be able to-

1. Explain the embedded system concepts and architecture of embedded systems
2. Describe the architecture of 8051 microcontroller and write embedded program for 8051 microcontroller
3. Select elements for an embedded systems tool.
4. Understand the memory types used in embedded systems
5. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

New Scheme Based On AICTE Flexible Curricula

Information Technology, VI-Semester

Open Elective IT 604(A) Intellectual Property Rights

Course Objectives:

1. To enable Students to understand Primary forms of IPR
2. To enable Students to understand what is infringement of copyright and its consequences
3. To introduce criteria and procedure for obtaining patents
4. To enable Students to understand the registration procedures related to IPR.
5. To expose Students to contemporary issues and enforcement policies in IPR.

UNIT I Introduction

Introduction and Justifications of IPR, Nature of IP, Major forms of IP- Copyright, Patent, Trade Marks Designs, Geographic indication, layout design of Semi conductors, Plant varieties, Concept & Meaning of Intellectual Property. Major international documents relating to the protection of IP - Berne Convention, Paris Convention, TRIPS. The World Intellectual Property Organization (WIPO).

UNIT II Copyright

Meaning and historical development of copyright , Subject matter , Ownership of copyright, Term of copyright, Rights of owner, Economic Rights, Moral Rights. Assignment and licence of rights, Infringement of copyright, Exceptions of infringement, Remedies, Civil, Criminal, Administrative, Registration Procedure.

UNIT III Patents

Meaning and historical development,. Criteria for obtaining patents, Non patentable inventions, Procedure for registration, Term of patent, Rights of patentee, Compulsory licence, Revocation, Infringement of patents, Exceptions to infringement, Remedies, Patent office and Appellate Board.

UNIT IV – Trade Marks, Designs & GI

Trade Marks: Functions of marks, Procedure for registration, Rights of holder, Assignment and licensing of marks, Infringement, Trade Marks Registry and Appellate Board.

Designs: Meaning and evolution of design protection, Registration, Term of protection, Rights of holder, unregistered designs.

Geographical Indication: Meaning and evolution of GI, Difference between GI and Trade Marks, Registration, Rights, Authorised user.

UNIT V Contemporary Issues & Enforcement of IPR

IPR & sustainable development, The Impact of Internet on IPR. IPR Issues in biotechnology, E-Commerce and IPR issues, Licensing and enforcing IPR, Case studies in IPR

References:

1. P. Narayanan, Intellectual Property Law, Eastern Law House
2. . Neeraj Pandey and Khushdeep[Dharni, Intellectual Property Rights, PHI, 2014
3. N.S Gopalakrishnan and T.G. Agitha, Principles of Intellectual Property, Eastern Book Co. Lucknow, 2009.
4. Anand Padmanabhan, Enforcement of Intellectual Property, Lexis Nexis Butterworths, Nagpur, 2012.
5. Managing Intellectual Property The Strategic Imperative, Vinod V. Sople, PHI.
6. Prabuddha Ganguli, " Intellectual Property Rights" Mcgraw Hill Education, 2016.

Course Outcome:

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

1. Understand Primary forms of IPR
2. Assess and critique some basic theoretical justification for major forms of IP Protection
3. Compare and contrast the different forms of IPR in terms of key differences and similarities.
4. Uderstand the registration procedures related to IPR.
5. Have exposure to contemporary issues and enforcement policies in IPR.

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New Scheme Based On AICTE Flexible Curricula

Information Technology, VI- semester

Open Elective IT 604(B) Software Engineering

Course Objectives:

1. To introduce software development life cycle and various software process models
2. To introduce measures and metrics for software quality, reliability and software estimation techniques
3. To develop an understanding of software analysis and design phases
4. To introduce coding standards, guidelines and various software testing techniques
5. To introduce various activities for software maintenance and quality assurance

Unit I

Introduction, Software- problem and prospects Software development process: System Development Life Cycle, Waterfall Model, Spiral Model and other models, Unified process Agile development-Agile Process- Extreme Programming- Other agile Process models.

Unit II

Measures, Metrics and Indicators, Metrics in the Process and Project Domains, Software Measurement, Metrics of Software Quality, S/W reliability, Software estimation techniques, LOC and FP estimation. Empirical models like COCOMO, project tracking and scheduling, reverse engineering.

Unit III

Software requirements and specification: feasibility study, Informal/formal specifications, pre/post conditions, algebraic specification and requirement analysis models, Specification design tools. Software design and implementation: Software design objectives and techniques, User interface design, Modularity, Functional decomposition, DFD, Data Dictionary, Object oriented design, Design patterns implementation strategies like top- down, bottom-up.

Unit IV

Coding standard and guidelines, programming style, code sharing, code review, rapid prototyping, specialization, construction, class extensions, intelligent software agents, reuse performance improvement, debugging. Software Testing Strategies: Verification and Validation, Strategic Issues, test plan, white box, black-box testing, unit and integration testing, system testing test case design and acceptance testing, maintenance activities.

Unit V

Software Maintenance: Software Supportability, Reengineering, Business Process Reengineering, Reverse Engineering, Restructuring, Forward Engineering, Economics of Reengineering, project scheduling and tracking plan, project management plan, SQA and quality planning, SCM activities

and plan, CMM, Software project management standards, Introduction to component based software engineering.

References:

1 P.S. Pressman, Software Engineering. A Practitioner's Approach, TMH.
2 Rajib Mall, Fundamental of Software Engineering, PHI.
3 Hans Van Vliet, Software Engineering, Wiley India Edition.
4 James S. Peters, Software Engineering, Wiley India Edition.
5 Pankaj Jalote, Software Engineering: A Precise Approach, Wiley India.
6 Kelkar, Software Project Management, PHI Learning

Course Outcomes:

Upon completion of this course, students will be able to-

1. Define various software application domains and remember different process model used in software development.
2. Understand various measures of software and Generate project schedule.
3. Describe functional and non-functional requirements of software and develop design models of software.
4. Investigate the reason for bugs and apply the software testing techniques in commercial environment.
5. Understand various activities to be performed for improving software quality and software maintenance.

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New Scheme Based On AICTE Flexible Curricula

Information Technology, VI-Semester

Open Elective IT 604(C) Wireless Sensor Networks

Course Objectives:

1. To Understand the basic WSN technology and supporting protocols
2. Understand the medium access control protocols and address physical layer issues
3. Learn localization concepts for sensor networks
4. Learn energy efficiency and power control in sensor networks
5. Understand the security challenges in sensor networks.

Unit I

Overview of Wireless Sensor Networks: Network Characteristics, Network Applications, Network Design Objectives, Network Design Challenges, Technological Background : MEMS Technology , Wireless Communication Technology , Hardware and Software Platforms, Wireless Sensor Network Standards, Introduction, Network Architectures for Wireless Sensor Networks, Classifications of Wireless Sensor Networks, Protocol Stack for Wireless Sensor Networks.

Unit II

Fundamental MAC Protocols, MAC Design for Wireless Sensor Networks, MAC Protocols for Wireless Sensor Networks: Contention-Based Protocols, Contention-Free Protocols, Hybrid Protocols. Introduction, Fundamentals and Challenges, Taxonomy of Routing and Data Dissemination Protocols, Overview of Routing and Data Dissemination Protocols: Location-Aided Protocols, Layered and In-Network Processing-Based Protocols, Data-Centric Protocols, Multipath-Based Protocols, Mobility-Based Protocols, QoS Based Protocols, Heterogeneity-Based Protocols.

Unit III

Introduction, Query Processing in Wireless Sensor Networks, Data Aggregation in Wireless Sensor Networks, Node Localization: Concepts and Challenges of Node Localization Technologies, Ranging Techniques for Wireless Sensor Networks, Wireless Localization Algorithms, Wireless Sensor Node Localization.

Unit IV

Need for Energy Efficiency and Power Control in Wireless Sensor Networks, Passive Power Conservation Mechanisms: Physical-Layer Power Conservation Mechanisms, MAC Layer Power Conservation Mechanisms, Higher Layer Power Conservation Mechanisms, Active

Power Conservation Mechanisms: MAC Layer Mechanisms, Network Layer Mechanisms, Transport Layer Mechanisms.

Unit V

Fundamentals of Network Security, Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and ZigBee Security .

References:

1. Wireless Sensor Networks A Networking Perspective, Jun Zheng & Abbas Jamalipour, a john Wiley & sons, Inc., publication .
2. Wireless sensor networks Technology, Protocols, and Applications , kazem sohraby, daniel minoli, taieb znati , a john Wiley & sons, Inc., publication .
3. Fundamentals of wireless sensor networks theory and practice, Waltenegus Dargie, Christian Poellabauer, A John Wiley and Sons, Ltd., Publication.

Course Outcomes:

Upon completion of this course, students will be able to-

1. Have knowledge of some existing applications of wireless sensor actuator networks
2. Learn the various hardware, software platforms that exist for sensor networks
3. Have knowledge of the various protocols for sensor networks
4. Analyze modeling and simulation of sensor networks
5. Understand what research problems sensor networks pose in disciplines such as signal processing, wireless communications and even control systems

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New Scheme Based On AICTE Flexible Curricula

Information Technology, VI-

Semester

IT 605 Programming in Python

Python –Overview
Introduction, History, Features

Python –Environment Setup
Local Environment Setup, Getting Python, Installation of Python, Use of IDE

Python –Basic Syntax
Python Identifiers, Reserved Words, Lines & Indentation, Multiline Statements, Quotation in Python, Comments & other useful constructs

Python –Variables
Assigning Values to Variables, Multiple Assignment, Standard Data Types

Python Numbers
Python Strings, Python Lists, Python Tuples, Dictionary, DataType Conversion

Python –Basic Operators
Types of Operators, Arithmetic Operators, Comparison Operators, Assignment Operators, Bitwise Operators, Logical Operators, Operator Precedence.

Python –Decision Making & Loops
Flowchart, If statement Syntax

Python-Functions
Syntax for defining a function, Calling a Function, Function Arguments, Anonymous Functions
Python-Applications & Further Extensions

References:

1. Python Crash Course: A Hands-On, Project-Based Introduction to Programming, by Eric Matthes, No Starch Press
2. Learn Python the Hard Way' by Zed A. Shaw (3rd Edition), Addison Wesley
3. Head-First Python, by Paul Barry, O'Reilly
4. 'Python Programming' by John Zelle, Franklin, Beedle & Associates Inc;

Course Outcomes:
Upon completion of this course, students will be able to-

1. Install Python and have knowledge of syntax of Python
2. Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
3. Express different Decision Making statements and Functions
4. Develop code in Python using functions, loops etc.
5. Design GUI Applications in Python and evaluate different database operations

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Information Technology, VI-Semester

IT 606 Android Programming

Introduction to Android:
A little Background about mobile technologies, Overview of Android, An Open Platform for Mobile development, Open Handset Alliance, What does Android run On – Android Internals, Why to use Android for mobile development,

Developing for Android:
My First Android Application, How to setup Android Development Environment, Android development Framework - Android-SDK, Eclipse, Emulators – What is an Emulator / Android AVD, Creating & setting up custom Android emulator, Android Project Framework, My First Android Application.

Android Activities and UI Design
Understanding Intent, Activity, Activity Lifecycle and Manifest, Creating Application and new Activities, Expressions and Flow control, Android Manifest, Simple UI -Layouts and Layout properties, Fundamental Android UI Design, Introducing Layouts
Creating new Layouts, Drawable Resources, Resolution and density independence (px,dip,dp,sip,sp), XML Introduction to GUI objects viz., Push Button Text / Labels, EditText, ToggleButton, WeightSum, Padding, Layout Weight

Reference:
Head First Android Development, 2nd edition, OREILLY.
Android App Development for Dummies, 3rd edition, Michael Burton, John Wiley sons
Busy Coder's Guide to Android Development, Mark L. Murphy, Commonsware

Course Outcomes:
Upon completion of this course, students will be able to-

1. Experiment on Integrated Development Environment for Android Application Development.
2. Design and Implement User Interfaces and Layouts of Android App.
3. Use Intents for activity and broadcasting data in Android App.
4. Design and Implement Database Application and Content Providers.

5. Experiment with Camera and Location Based service and develop Android App with Security features.

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New Scheme Based On AICTE Flexible Curricula

Information Technology, VIII- semester

IT 801- Information Security

Course Objectives:

The objective of this course is to familiarize the students with the fundamentals of information security and the methods used in protecting both the information present in computer storage as well as information traveling over computer networks.

Unit I Introduction: Fundamental Principles of Information Security- Confidentiality, Availability, Integrity, Non Repudiation, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, a Model for Network Security; Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography

Unit II Block Ciphers and Data Encryption Algorithm: Block Cipher Principles, The Data Encryption Standard, The Strength of DES, Differential and linear cryptanalysis, Block Cipher Design Principles; Advanced Encryption Standard: Evaluation criteria of AES, The AES Cipher, Multiple Encryption and Triple DES, Block Cipher modes of operation, Stream Ciphers, Confidentiality using Symmetric Encryption

Unit III Public Key Encryption: Principles of Public Key Cryptosystems, The RSA algorithm, Key Management, Diffie-Hellman Key Exchange, Elliptic curve cryptography; Message Authentication and Hash Functions: Authentication requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Security of Hash Functions and MACs; Hash and MAC algorithms: Secure Hash Algorithm, HMAC; Digital Signatures and Authentication Protocols, Digital Signature Standard

Unit IV Authentication Applications, Kerberos, X.509 Authentication Service, Public key infrastructure; Electronic Mail Security: Pretty Good Privacy; IP Security: IP Security Overview, Architecture, Authentication header, encapsulating security payload, Key management; Web Security: Web security considerations, Secure Socket Layer and Transport layer Security, Secure Electronic Transaction

Unit V System Security: Intruders, Intrusion Detection, Password management; Malicious Software: Different type of malicious software, Viruses and related threats, Virus Countermeasures, Threats and attacks on Information Security, DoS and DDos Attacks; Security controls required for Information Security, Firewalls: Firewall design principles, Trusted Systems, Common criteria for information technology security evaluation

References:

1. William Stallings, "Cryptography and Network Security", Fourth edition, PHI
2. Atul Kahate, “Cryptography and Network Security”, McGraw Hill.
3. V.K. Pachghare, “Cryptography and Information Security”, PHI Learning

4. Nina Godbole, “Information System Security”, Wiley

Course Outcomes:

After the completion of this course, the students will be able to:

1. Understand key terms and concepts in information security and Cryptography and evaluate the cyber security needs of an organization.
2. Acquire knowledge to secure computer systems, protect personal data, and secure computer networks in an organization
3. Apply knowledge of various encryption algorithms and authentication mechanisms to secure information in computer systems and networks
4. Understand principles of web security to secure network by monitoring and analyzing the nature of attacks and design/develop security architecture for an organization.
5. Design operational and strategic information security strategies and policies.

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New Scheme Based On AICTE Flexible Curricula

Information Technology, VIII- semester

Departmental Elective IT 802 (A) Machine Learning

Course Objectives:
To familiarize students with the knowledge of machine learning and enable them to apply suitable machine learning techniques for data handling and to gain knowledge from it. Evaluate the performance of algorithms and to provide solution for various real-world applications.

Unit I Introduction:
Introduction, Examples of various Learning Paradigms, Perspectives and Issues, Concept Learning, Version Spaces, Finite and Infinite Hypothesis Spaces, PAC Learning, VC Dimension

Unit II Supervised Learning Algorithms:
Learning a Class from Examples, Linear, Non-linear, Multi-class and Multi-label classification, Decision Trees: ID3, Classification and Regression Trees (CART), Regression: Linear Regression, Multiple Linear Regression, Logistic Regression, Neural Networks: Introduction, Perceptron, Multilayer Perceptron, Support vector machines: Linear and NonLinear, Kernel Functions, K-Nearest Neighbors

Unit III Ensemble Learning:
Ensemble Learning Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging: Random Forest Trees, Boosting: Adaboost, Stacking

Unit IV Unsupervised Learning:
Introduction to clustering, Hierarchical: AGNES, DIANA, Partitional: K-means clustering, K-Mode Clustering, Self-Organizing Map, Expectation Maximization, Gaussian Mixture Models, Principal Component Analysis (PCA), Locally Linear Embedding (LLE), Factor Analysis

Unit V Probabilistic Learning:
Bayesian Learning, Bayes Optimal Classifier, Naïve Bayes Classifier, Bayesian Belief Networks, Mining Frequent Patterns

References:

1. EthemAlpaydin,"Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.
2. MehryarMohri, AfshinRostamizadeh, AmeetTalwalkar "Foundations of Machine Learning", MIT Press, 2012.
3. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition,1997.
4. Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2014.

5. Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, 2nd Edition, CRC Press, 2015.
6. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012
7. Jiawei Han and MichelineKambers and Jian Pei, “Data Mining –Concepts and Techniques”, 3rd Edition,Morgan Kaufman Publications, 2012.
8. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, “Mathematics for Machine Learning”, Cambridge University Press, 2019.

Course Outcomes:

After the completion of this course, the students will be able to:

1. Recognize the characteristics of machine learning strategies.
2. Apply various supervised learning methods to appropriate problems.
3. Identify and integrate more than one technique to enhance the performance of learning.
4. Create probabilistic and unsupervised learning models for handling unknown pattern.
5. Analyze the co-occurrence of data to find interesting frequent patterns and Preprocess the data before applying to any real-world problem and can evaluate its performance

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New Scheme Based On AICTE Flexible Curricula

Information Technology, VIII- semester

Departmental Elective IT 802 (B) Natural Language Processing

Course Objectives:
To provide a broad introduction to NLP with a particular emphasis on core algorithms, data structures, and machine learning for NLP.

Unit I

Introduction to various levels of natural language processing, Ambiguities and computational challenges in processing various natural languages. Introduction to Real life applications of NLP such as spell and grammar checkers, information extraction, question answering, and machine translation

Unit II

Character Encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis

Unit III

Inflectional and Derivation Morphology, Morphological Analysis and Generation using finite state transducers

Introduction to word types, POS Tagging, Maximum Entropy Models for POS tagging, Multi-word Expressions.

Unit IV

The role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models.

Introduction to phrases, clauses and sentence structure, Shallow Parsing and Chunking, Shallow Parsing with Conditional Random Fields (CRF), Lexical Semantics, Word Sense Disambiguation, WordNet, Thematic Roles, Semantic Role Labelling with CRFs.

Unit V

NL Interfaces, Text Summarization, Sentiment Analysis, Machine Translation, Question answering, Recent Trends in NLP

References:
1. J. H. Speech and Language Processing, Jurafsky, D. and Martin, Prentice Hall, 2nd Edition, 2014

2. C. D. and H. Schütze: Foundations of Statistical Natural Language Processing, Manning, The MIT Press

Course Outcomes:
After the completion of this course, the students will be able to:

1. Identify and discuss the characteristics of different NLP techniques
2. Understand the fundamental mathematical models and algorithms in the field of NLP and apply these mathematical models and algorithms in applications in software design and implementation for NLP
3. Understand the complexity of speech and the challenges facing speech engineers
4. Understand approaches to syntax and semantics in NLP
5. Understand approaches to discourse, generation, dialogue and summarization within NLP

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New Scheme Based On AICTE Flexible Curricula

Information Technology, VIII- semester

Departmental Elective IT 802 (C) Robotics

Course Objectives:
The objective of this course is to impart knowledge about industrial robots for their control and design.

Unit I Introduction to Robotics:
Types and components of a robot, Classification of robots, closed-loop and open-loop control systems;
Kinematics systems: Definition of mechanisms and manipulators, Social issues and safety

Unit II Robot Kinematics and Dynamics:
Kinematic Modelling: Translation and Rotation Representation, Coordinate transformation, DH parameters, Jacobian, Singularity, and Statics;
Dynamic Modelling: Equations of motion: Euler-Lagrange formulation

Unit III Sensors and Vision System:
Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc.
Introduction to Cameras, Camera calibration, Geometry of Image formation, Euclidean/Similarity/Affine/Projective transformations, Vision applications in robotics.

Unit IV Robot Control:
Basics of control: Transfer functions, Control laws: P, PD, PID, Non-linear and advanced controls
Robot Actuation Systems: Actuators: Electric, Hydraulic and Pneumatic; Transmission: Gears, Timing Belts and Bearings, Parameters for selection of actuators.

Unit V Control Hardware and Interfacing:
Embedded systems: Architecture and integration with sensors, actuators, components, Programming for Robot Applications

References:

1. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
2. Ghosal, A., "Robotics", Oxford, New Delhi, 2006.
3. Niku Saeed B., "Introduction to Robotics: Analysis, Systems, Applications", PHI, New Delhi.
4. Mittal R.K. and Nagrath I.J., "Robotics and Control", Tata McGraw Hill.
5. Mukherjee S., "Robotics and Automation", Khanna Publishing House, Delhi.
6. Craig, J.J., "Introduction to Robotics: Mechanics and Control", Pearson, New Delhi, 2009
7. Mark W. Spong, Seth Hutchinson, and M. Vidyasagar, "Robot Modelling and Control", John Wiley and Sons Inc, 2005
8. Steve Heath, "Embedded System Design", 2nd Edition, Newnes, Burlington, 2003

9. Merzouki R., Samantaray A.K., Phathak P.M. and Bouamama B. Ould, “Intelligent Mechatronic System: Modeling, Control and Diagnosis”, Springer.

Course Outcomes:

After the completion of this course, the students will be able to:

1. Understand robot mechanism
2. Perform kinematic and dynamic analyses with simulation
3. Design control laws for a robot
4. Integrate mechanical and electrical hardware for a real prototype of robotic device
5. Select a robotic system for given application

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Information Technology, VIII- semester

Departmental Elective IT 802 (D) Quantum Computing

Course Objectives:
The objective of this course is to impart necessary knowledge to the learner so that he/she can develop and implement algorithm and write programs using these algorithm

Unit I
Motivation for studying Quantum Computing , Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.), Origin of Quantum Computing
Overview of major concepts in Quantum Computing: Qubits and multi-qubits states, Braket notation, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement

Unit II
Math Foundation for Quantum Computing: Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors

Unit III
Building Blocks for Quantum Program: Architecture of a Quantum Computing platform,
Details of q-bit system of information representation: Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from quantum algorithmic perceptive e.g. Bell State, Operation on qubits: Measuring and transforming using gates.
Quantum Logic gates and Circuit: Pauli, Hadamard, phase shift, controlled gates, Ising, Deutsch, swap etc.

Unit IV
Programming model for a Quantum Computing Program: Steps performed on classical computer, Steps performed on Quantum Computer, Moving data between bits and qubits.
Basic techniques exploited by quantum algorithms, Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum Walks

Unit V
Major Algorithms: Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch -Jozsa Algorithm OSS Toolkits for implementing Quantum program: IBM quantum experience, Microsoft Q, Rigetti PyQuil (QPU/QVM)

References:

1. Michael A. Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quantum Computing Explained", Wiley

Course Outcomes:

After the completion of this course, the students will be able to:

1. Understand major concepts in Quantum Computing
2. Explain the working of a Quantum Computing program, its architecture and program model
3. Develop quantum logic gate circuits
4. Develop quantum algorithm
5. Program quantum algorithm on major toolkits

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Information Technology, VIII- semester

Open Elective IT 803 (A) Blockchain Technology

Course Objectives:
The objective of this course is to provide conceptual understanding of how block chain technology can be used to innovate and improve business processes. The course covers the technological underpinning of block Chain operations in both theoretical and practical implementation of solutions using block Chain technology.

Unit I Introduction: Overview of Block chain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Block chain, Transactions, Distributed Consensus, Public vs Private Block chain, Understanding Cryptocurrency to Block chain, Permissioned Model of Block chain, Overview of Security aspects of Block chain; Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency

Unit II Understanding Block chain with Crypto currency: Bitcoin and Block chain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.
Working with Consensus in Bitcoin**:** Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, HashCash PoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool

Unit III Understanding Block chain for Enterprises: Permissioned Block chain: Permissioned model and use cases, Design issues for Permissioned block chains, Execute contracts, State machine replication, Overview of Consensus models for permissioned block chain- Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm, BFT over Asynchronous systems.

Unit IV Enterprise application of Block chain: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Block chain, Block chain enabled Trade, We Trade – Trade Finance Network, Supply Chain Financing, and Identity on Block chain

Unit V Block chain application development: Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric, Writing smart contract using Ethereum, Overview of Ripple and Corda

References:
1. Melanie Swan, “Block Chain: Blueprint for a New Economy”, O’Reilly, 2015
2. Josh Thompsons, “Block Chain: The Block Chain for Beginners- Guide to Block chain Technology and Leveraging Block Chain Programming”
3. Daniel Drescher, “Block Chain Basics”, Apress; 1stedition, 2017

4. Anshul Kaushik, “Block Chain and Crypto Currencies”, Khanna Publishing House, Delhi.
5.Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing
6. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Block Chain”, Packt Publishing
7. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O’Dowd, Venkatraman Ramakrishna, “Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer”, Import, 2018

Course Outcomes:

After the completion of this course, the students will be able to:

1. Understand block chain technology
2. Acquire knowledge of crytocurrencies
3. Develop block chain based solutions and write smart contract using Hyperledger Fabric and Ethereum frameworks
4. Build and deploy block chain application for on premise and cloud based architecture
5. Integrate ideas from various domains and implement them using block chain technology in different perspectives

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Information Technology, VIII- semester

Open Elective IT 803 (B) Human Computer Interaction

Course Objectives:
To provide the basic knowledge on the levels of interaction, design models, techniques and validations focusing on the different aspects of human-computer interface and interactions

Unit I HCI Foundations:
Input–output channels, Human memory, Thinking: reasoning and problem solving, Emotion, Individual differences, Psychology and the design of interactive systems, Text entry devices, Positioning, pointing and drawing, Display devices, Devices for virtual reality and 3D interaction, Physical controls, sensors and special devices, Paper: printing and scanning

Unit II Designing Interaction:
Overview of Interaction Design Models, Discovery - Framework, Collection - Observation, Elicitation, Interpretation - Task Analysis, Storyboarding, Use Cases, Primary Stakeholder Profiles, Project Management Document

Unit III Interaction Design Models:
Model Human Processor - Working Memory, Long-Term Memory, Processor Timing, Keyboard Level Model - Operators, Encoding Methods, Heuristics for M Operator Placement, What the Keyboard Level Model Does Not Model, Application of the Keyboard Level Model, GOMS - CMN-GOMS Analysis, Modeling Structure, State Transition Networks - Three-State Model, Glimpse Model, Physical Models, Fitts' Law

Unit IV Guidelines in HCI:
Shneideman's eight golden rules, Norman's Sever principles, Norman's model of interaction, Nielsen's ten heuristics, Heuristic evaluation, contextual evaluation, Cognitive walk-through
Collaboration and Communication:
Face-to-face Communication, Conversation, Text-based Communication, Group working, Dialog design notations, Diagrammatic notations, Textual dialog notations, Dialog semantics, Dialog analysis and design

Unit V Human Factors and Security:
Groupware, Meeting and decision support systems, Shared applications and artifacts, Frameworks for groupware Implementing synchronous groupware, Mixed, Augmented and Virtual Reality
Validation: Validations - Usability testing, Interface Testing, User Acceptance Testing

References:

1. A Dix, Janet Finlay, G D Abowd, R Beale., Human-Computer Interaction, 3rd Edition, Pearson Publishers,2008
2. Shneiderman, Plaisant, Cohen and Jacobs, Designing the User Interface: Strategies for Effective Human Computer Interaction, 5th Edition, Pearson Publishers, 2010.
3. Hans-Jorg Bullinger," Human-Computer Interaction", Lawrence Erlbaum Associates, Publishers
4. Jakob Nielsen," Advances in Human-computer Interaction",Ablex Publishing Corporation

5. Thomas S. Huang," Real-Time Vision for Human-Computer Interaction", Springer
6. Preece et al, Human-Computer Interaction, Addison-Wesley, 1994

Course Outcomes:

After the completion of this course, the students will be able to:

1. Enumerate the basic concepts of human, computer interactions
2. Create the processes of human computer interaction life cycle
3. Analyze and design the various interaction design models
4. Apply the interface design standards/guidelines for evaluating the developed interactions
5. Apply product usability evaluations and testing methods

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Information Technology, VIII- semester

Open Elective IT 803 (C) Printing and Design

Course Objectives:
To impart knowledge and skills related to 3D printing technologies, selection of material and equipment and develop a product using this technique in Industry 4.0 environment

Unit I 3D Printing (Additive Manufacturing):
Introduction, Process, Classification, Advantages, Additive V/s Conventional Manufacturing processes, Applications.
CAD for Additive Manufacturing: CAD Data formats, Data translation, Data loss, STL format.

Unit II Additive Manufacturing Techniques:
Stereo- Lithography, LOM, FDM, SLS, SLM, Binder Jet technology.
Process, Process parameter, Process Selection for various applications.
Additive Manufacturing Application Domains: Aerospace, Electronics, Health Care, Defence, Automotive, Construction, Food Processing, Machine Tools

Unit III Materials:
Polymers, Metals, Non-Metals, Ceramics
Various forms of raw material- Liquid, Solid, Wire, Powder; Powder Preparation and their desired properties, Polymers and their properties, Support Materials.

Unit IV Additive Manufacturing Equipment:
Process Equipment- Design and process parameters, Governing Bonding Mechanism, Common faults and troubleshooting, Process Design

Unit V Post Processing:
Post Processing Requirement and Techniques. Product Quality: Inspection and testing, Defects and their causes

References:

1. Lan Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
2. Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing", Hanser Publisher, 2011.
3. Khanna Editorial, "3D Printing and Design", Khanna Publishing House, Delhi.
4. CK Chua, Kah Fai Leong, "3D Printing and Rapid Prototyping- Principles and Applications", World Scientific, 2017.
5. J.D. Majumdar and I. Manna, "Laser-Assisted Fabrication of Materials", Springer Series in Material Science, 2013.
6. L. Lu, J. Fuh and Y.S. Wong, "Laser-Induced Materials and Processes for Rapid Prototyping", Kulwer Academic Press, 2001.

7. Zhiqiang Fan And Frank Liou, “Numerical Modelling of the Additive Manufacturing (AM) Processes of Titanium Alloy”, InTech, 2012.

Course Outcomes:

After the completion of this course, the students will be able to:

1. Develop CAD models for 3D printing.
2. Import and Export CAD data and generate .stl file.
3. Select a specific material for the given application.
4. Select a 3D printing process for an application.
5. Produce a product using 3D Printing or Additive Manufacturing (AM).

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Information Technology, VIII- semester

Open Elective IT 803 (D) Parallel Computing

Course Objectives:

To develop an understanding of the fundamental principles and engineering trade-offs involved in designing modern parallel computers and to develop programming skills to effectively implement parallel architecture

Unit I Introduction: The need for parallelism, Forms of parallelism (SISD, SIMD, MISD, MIMD), Moore's Law and Multi-cores, Fundamentals of Parallel Computers, Communication architecture, Message passing architecture, Data parallel architecture, Dataflow architecture, Systolic architecture, Performance Issues

Unit II Large Cache Design: Shared vs. Private Caches, Centralized vs. Distributed Shared Caches, Snooping-based cache coherence protocol, directory-based cache coherence protocol, Uniform Cache Access, Non-Uniform Cache Access, D-NUCA, S-NUCA, Inclusion, Exclusion, Difference between transaction and transactional memory, STM, HTM

Unit III Graphics Processing Unit: GPUs as Parallel Computers, Architecture of a modern GPU, Evolution of Graphics Pipelines, GPGPUs, Scalable GPUs, Architectural characteristics of Future Systems, Implication of Technology and Architecture for users, Vector addition, Applications of GPU

Unit IV Introduction to Parallel Programming: Strategies, Mechanism, Performance theory, Parallel Programming Patterns: Nesting pattern, Parallel Control Pattern, Parallel Data Management, Map: Scaled Vector, Mandelbrot, Collative: Reduce, Fusing Map and Reduce, Scan, Fusing Map and Scan, Data Recognition: Gather, Scatter, Pack , Stencil and Recurrence, Fork-Join, Pipeline

Unit V Parallel Programming Languages: Distributed Memory Programming with MPI: trapezoidal rule in MPI, I/O handling, MPI derived datatype, Collective Communication, Shared Memory Programming with Pthreads: Conditional Variables, read-write locks, Cache handling, Shared memory programming with Open MP: Parallel for directives, scheduling loops, Thread Safety, CUDA: Parallel programming in CUDA C, Thread management, Constant memory and Event, Graphics Interoperability, Atomics, Streams

References:

1. D. E. Culler, J. P. Singh, and A. Gupta, “Parallel Computer Architecture”, MorganKaufmann, 2004
2. Rajeev Balasubramonian, Norman P. Jouppi, and Naveen Muralimanohar, “Multi-Core Cache Hierarchies”, Morgan & Claypool Publishers, 2011

3. Peter and Pach Eco, “An Introduction to Parallel Programming”, Elsevier, 2011
4. James R. Larus and Ravi Rajwar, “Transactional Memory”, Morgan & Claypool Publishers, 2007
5. David B. Kirk, Wen-mei W. Hwu, “Programming Massively Parallel Processors: A Hands-on Approach”, 2010
6. Barbara Chapman, F. Desprez, Gerhard R. Joubert, Alain Lichnewsky, Frans Peters “Parallel Computing: From Multicores and GPU's to Petascale”, 2010
7. Michael McCool, James Reinders, Arch Robison, “Structured Parallel Programming: Patterns for Efficient Computation”, 2012
8. Jason Sanders, Edward Kandrot, “CUDA by Example: An Introduction to GeneralPurpose GPU Programming”, 2011

Course Outcomes:

After the completion of this course, the students will be able to:

1. To develop an understanding of various basic concepts associated with parallel computing environments
2. Understand, appreciate and apply parallel and distributed algorithms in problem solving
3. Acquire skills to measure the performance of parallel and distributed programs
4. Design parallel programs to enhance machine performance in parallel hardware environment
5. Design and implement parallel programs in modern environments such as CUDA, OpenMP, etc