# M. Tech Computer Science and Engineering

## Semester I

| S No. | Paper Code | Paper Name | Class Hours | | | Credit |
|---|---|---|---|---|---|---|
| | | **Theory** | **L** | **T** | **P** | **Cr. Pt.** |
| 1 | PGCSE101 | Advanced Engineering Mathematics [Compulsory] | 3 | 1 | 0 | 4 |
| 2 | PGCSE102 | Advanced Operating System [Compulsory] | 4 | 0 | 0 | 4 |
| 3 | PGCSE103 | Advanced Computer Architecture [Compulsory] | 4 | 0 | 0 | 4 |
| 4 | PGCSE104 | Advanced Algorithms [Compulsory] | 4 | 0 | 0 | 4 |
| 5 | PGCSE105 | Elective - I<br>A) Artificial Neural Networks<br>B) Agent Based Intelligent Systems<br>C) Advanced Soft Computing<br>D) Object Oriented Information System Design<br>E) Software Engineering & CASE tools<br>F) Computer Graphics & Multimedia | 4 | 0 | 0 | 4 |
| | | **Total** | **19** | **1** | **0** | **20** |
| | | **Practical** | **L** | **T** | **P** | **Cr. Pt.** |
| 6 | PGCSE191 | Operating System Laboratory [Compulsory] | 0 | 0 | 3 | 2 |
| 7 | PGCSE192 | A) Advanced Programming Lab | 0 | 0 | 3 | 2 |
| | | **Total** | **0** | **0** | **6** | **4** |
| | | **Seminar** | **L** | **T** | **P** | **Cr. Pt.** |
| 8 | PGCSE193 | Seminar – Based on literature survey | 0 | 2 | 0 | 1 |
| | | **Total** | **19** | **3** | **6** | **25** |

## Semester II

| S No. | Paper Code | Paper Name | Class Hours | | | Credit |
|---|---|---|---|---|---|---|
| | | **Theory** | **L** | **T** | **P** | **Cr. Pt.** |
| 1 | PGCSE201 | Advanced DBMS [Compulsory] | 4 | 0 | 0 | 4 |
| 2 | PGCSE202 | Advanced Computer Network & Security [Compulsory] | 4 | 0 | 0 | 4 |
| 3 | PGCSE203 | Theory of Computation [ Compulsory] | 4 | 0 | 0 | 4 |
| 4 | PGCSE204 | Elective - II<br>A) Cluster, Grid and Cloud Computing<br>B) Mobile Computing<br>C) Advanced Web Technology<br>D) Soft Computing<br>E) Cryptography & Computer Security | 4 | 0 | 0 | 4 |
| 5 | PGCSE205 | Elective - III<br>A) Image Processing<br>B) Pattern Recognition<br>C) Real-time Embedded Systems & Programming<br>D) Complex Systems<br>E) Distributed System Principle | 4 | 0 | 0 | 4 |
| | | **Total** | **20** | **0** | **0** | **20** |
| | | **Practical** | **L** | **T** | **P** | **Cr. Pt.** |
| 6 | PGCSE291 | Part-I – Computer Networking & DBMS Laboratory [Compulsory] | 0 | 0 | 3 | 2 |
| | | **Total** | **0** | **0** | **3** | **2** |
| | | **Seminar and Viva-voice** | **L** | **T** | **P** | **Cr. Pt.** |
| 7 | PGCSE292 | Seminar – Term paper leading to project | 0 | 2 | 0 | 1 |
| | | **Total** | **20** | **2** | **3** | **23** |

## Semester III

| S No. | Paper Code | Paper Name | Class Hours | | | Credit |
|---|---|---|---|---|---|---|
| | | **Theory** | **L** | **T** | **P** | **Cr. Pt.** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | PGCSE301 | A: Project Management & Entrepreneurship<br>B: Teaching & Research Methodologies | 4 | 0 | 0 | 4 |
| 2 | PGCSE302 | Elective - IV<br>A) Human Computer Interaction<br>B) Bioinformatics<br>C) Data Mining & Data Ware Housing<br>D) Compiler Construction<br>E) VLSI Design | 4 | 0 | 0 | 4 |
| | | **Total** | **8** | **0** | **0** | **8** |
| | | **Seminar and Viva-voice** | **L** | **T** | **P** | **Cr. Pt.** |
| 3 | PGCSE391 | Project – Part 1 (Dissertation I + Defence of Project - I) | 0 | 0 | 18 | 4+8=12 |
| | | **Total** | **8** | **0** | **18** | **20** |
| **Semester IV** | | | | | | |
| | | **Seminar and Viva-voice** | **L** | **T** | **P** | **Cr. Pt.** |
| 1 | PGCSE491 | Project – Part 2 (Dissertation II + Defence of Project - II) | 0 | 0 | 0 | 6+18=24 |
| 2 | PGCSE492 | Comprehensive Viva Voice | 0 | 0 | 0 | 4 |
| | | **Total** | **0** | **0** | **0** | **28** |

**PGCSE101: Advanced Engineering Mathematics [Compulsory]**
**Contact: 4L**
**Credit: 4**

**Module I**
Numerical Analysis: Introduction to Interpolation formulae: Stirling, Bessel"s, Spline. Solutions of system of linear and non-linear simultaneous equations: SOR algorithm, Newton"s method, (8 L)

**Module II**
*Stochastic process:* Probability: review, random variables, random processes, Random walk, brownian motion, markov process, queues: (M/M/1) : (/FIFO), (M/M/1) : (N/FIFO). (8 L)

**Module III**
Advanced linear algebra: Vector spaces, linear transformations, eigenvalues, Eigenvectors, some applications of eigenvalue problems, symmetric, skew-symmetric And orthogonal matrices, similarity of matrices, basis of Eigen vectors, diagonalisation. (8L)

**Module IV**
Advanced Graph Theory: Connectivity, Matching, Hamiltonian Cycles, Coloring Problems, Algorithms for searching an element in a data structure (DFS, BFS). (8 L)

**Module V**
Complex Variables: Review of Complex variables, Conformal mapping and transformations, Functions of complex variables, Integration with respect to complex argument, Residues and basic theorems and applications of residues. (8L)

**Module VI**
Combinatorics: Basic Combinatorial Numbers, Generating Functions and Recurrence Relations, Inclusion Exclusion Principles (8L)

**Module VII**
Optimization Technique: Calculus of several variables, Implicit function theorem, Nature of singular points, Necessary and sufficient conditions for optimization, Elements of calculus of variation, Constrained Optimization, Lagrange multipliers, Gradient method, Dynamic programming. (8L)

**Module VIII**
Fourier series and Transform: Revision of Fourier series, integrals and transforms and their properties. The 2dimensional fourier transform, convolution theorem, Parseval"s formula, discrete Fourier transform, fast Fourier transform (8L)

**Module IX**
Z-transforms Sequence, representation of sequence, basic operations on Sequences, z-transforms, properties of ztransforms, change on scale, shifting Property, inverse z-transform, solution of difference equations, region of Convergence, bilinear (s to z) transform (8L**)**

**Module X**
Walsh function and Hadamard transform:Generating walsh functions of Order n, characteristics and applications of walsh function, hadamard Matrix, properties, fast hadamard transform, applications(4L) Wavelet transform: fundamentals, the fourier transform and the short term Fourier transform, resolution problems, multi-resolution analysis, the Continuous wavelet transform, the discrete wavelet transform(4L)

**References books:**

1. Sen, M. K. and Malik, D. F.-Fundamental of Abstract Algebra, Mc. Graw Hill
2. Khanna, V. K. and Ghamdri, S. K.- Course of Abstract Algebra, Vikash Pub.
3. Halmos, T. R.-Naïve Set Theory, Van Nostrand
4. Scarborough, J. B.-Numerical Mathematical Analysis, Oxford University Press
5. Cone, S. D.-Elementary Numerical Analysis, Mc. Graw Hill.
6. Mukhopadhyay ,P.-Mathematical Statistics ,New Central Book Agency
7. Kapoor, V. K and Gupta, S.C.-Fundamental of Mathematical Statistics, Sultan Chand and Sons.

8. Uspensky, J. V.-Introduction to Mathematical Probability, Tata Mc. Graw Hill
9. Dreyfus, S. E.-The Art and Theory of Dynamic Programming –Theory and Applications, Academic Press.
10. Rao, S. S.-Optimisation Theory and Application, Wiley Eastern Ltd., New Delhi
11. Somasundaram, Discrete Mathematical structures, PHI
12. Kolman, Busby & Ross, Discrete Mathematical structures 5th ed, PHI
13. V. Krishnamurthy, Combinatorics, Theory and Applications, East-West Press, 1985.
14. N. Alon and J. Spenser, Probabilistic Methods, John Wiley and Sons, 2nd edition, 2000.
15. R. Diestel, Graph Theory, Springer-Verlag, 2nd edition, 2000
16. Kryszig, „advanced engineering mathematics"
17. Numerical Methods for Engineers & Scientists by Joe D. Hoffman

**PGCSE102: Advanced Operating System [Compulsory]**
**Contact: 4L**
**Credit: 4**

**Module I**
General overview of the UNIX system from the users perspective (6L), General outline of the UNIX kernel architecture (2L), System Buffer Cache mechanism, the foundation of the UNIX file system (4L)

**Module II**
Data Structures and Algorithms used internally by the UNIX File system (5L), System Calls used to provide user interface to the UNIX file system (6L), Process Control: Context of a process, internal kernel primitives for manipulating process context, including system call interface, interrupt handling and context switch (6L)

**Module III**
System calls for controlling process context (3L), UNIX Process Scheduling mechanism (2L)

**Module IV**
Fundamentals of UNIX memory management, including swapping and paging systems (6L),Basics of UNIX device driver interfaces (4L)

**References books:**
1.Brian Kernighan, Rob Pike, "The UNIX Programming Environment", 1st Edition, Prentice Hall, 1983
2.Michael Kerrisk, "The Linux Programming Interface: A Linux and UNIX System Programming Handbook", 1st Edition, No Starch Press, 2010
3. Robert Love, "Linux Kernel Development", 3rd Edition, Addison- Wesley Professional, 2010
4. Uresh Vahalia, "UNIX Internals: The New Frontiers", 1st Edition, Prentice Hall, 1996
5. Daniel P. Bovet, Marco Cesati, "Understanding the Linux Kernel", 3rd Edition, O"Reilly, 2005
6. Jonathan Corbet, Alessandro Runini, Greg Kroah-Hartman, "Linux Device Drivers", 3rd Edition, O"Reilly, 2005
7. Sreekrishnan Venkateswaran, "Essential Linux Device Drivers",1st Edition, Prentice Hall, 2008

**PGCSE103: Advanced Computer Architecture [Compulsory]**
**Contact: 4L**
**Credit: 4**

**Module I**
The evolution of modern Computer systems – from DEC PDP-11, IBM 360/370 family, CDC Cyber 6600, Intel X86 architecture, Performance measurement parameters – MIPS, MFLOPS, SPEC ratings, CPI etc. (4L) Introduction to high performance Computing – Overview, Flynn"s classifications – SISD, SIMD, MISD, MIMD, Examples from Vector & Array Processors, Performance comparison of algorithms for Scalar, Vector and Array Processors, Fundamentals of UMA, NUMA, NORMA architectures, Performance measurement for parallel architectures – Flynn's measure, Fang's measure, Handler"s measure, Amadahl"s law of limitation for parallel processing, Gustafson"s law. (8L)

**Module II**
Performance Enhancement of Processor by Pipelining: (12L), Basic idea to enhance the performance of a processor, Concept of Pipelining, Pipeline performance, various hazard in pipeline, methods to solve the hazards. (4L), Pipeline performence measurement parameters- speedup, effiency, throughput, classification of

pipeline processor, pipeline structure of CPU, examples from design of arithmetic pipeline- floating point adder, multiplier. (6L), Multifunction pipeline, reservation table, Dynamic pipeline, pipeline latency. (2L)

**Module III**
Vector Processing: ( 6L), Characteristics of vector processing, vector instructions, special instruction, differences between scalar and vector processing with example, architecture of typical vector processor with multiple functional pipe. (4L), Pipeline chaining and vector loops. (2L)

**Module IV**
High Performance Computing:(10L), Performance measurement parameters – MIPS, MFLOPS, SPEC rating, CPI etc., introduction to high performance computing – Overview, Flynn's classification – SISD, SIMD, MISD, MIMD. ( 2L), SIMD Array processors: SIMD computer organization, Masking and Data-Routing Mechanisms, Inter PE communication, SIMD Inter Connection Networks, SIMD Matrix Multiplication.(6L), Multiprocessor Architecture: Loosely Coupled and Tightly Coupled Multiprocessors.(2L)

**Module V**
Embedded System and its Architecture:( 6L), Why embedded system, Defination of Embedded system, Example of embedded systems, architecture of embedded systems with some example., Classification of Embedded system, Codesign of Embedded system, Embedded System Development cycle), Processor interfacing, Embedded System Design Issues: Hardware issues ( Processor, Memory, Peripherals) ,Software issues (Programming Languages, Time Criticality, RTOS)

**Module VI**
Reconfigurable Architecture and HDL(Hardware Describption Languages): (6L), Introduction to Reconfigurable architecture, FPGA (Field Programmable Gate Array):Defination, Classification, Architecture, Synthesis on FPGA, Downloading bit on FPGA.(4L), Design and testing of circuit by HDL(Hardware Describption Languages). (2L)

**Reference Books:**
1. Advanced Computer Architecture Hwang (TMH)
2. Computer Organization & design – Patterson & Hennessy (Morgan Kaufmann)
3. Computer Architecture & Organization – J P Hayes (McGraw Hill))
4. Computer organization and architecture, designing for performance – Stalling (PHI)
5. An Introduction to intel family of Microprocessors – Antonio's (Pearson)
6. Computer Architecture – Flynn (Narosa)
7. Structured Computer Organization – Tanenbaum (PHI)
8. Embedded Systems Architecture – a comprehensive guide for engineers and programmers -Tammy Noergaard ( Elsevier)

**PGCSE104: Advanced Algorithms [Compulsory]**
**Contact: 4L**
**Credit: 4**

**Module I**
Time and Space Complexity, Recurrence for divide and conquer and its solution, Methods for solving recurrences, Merge sort, Heap sort, Quick sort and Complexity analysis.(6L)

**Module II**
Dynamic Programming: Matrix-chain multiplication, All pair shortest paths, Single source shortest path, Travelling salesman problem, 0-1 knapsack problem.(6L)

**Module III**
Greedy Method: Knapsack problem, Job sequencing with deadlines, Activity – selection, Huffman codes, Minimum spanning tree by Prim's and Kruskal's algorithms.(6L)

**Module IV**
N-queen"s Problem: Constraint Satisfaction, Backtracking, Forward Checking, Look-ahead, Conflict directed backjumping.(4L)

**Module V**

Set and String Problem: Set cover, String matching, Approximate string matching, longest common subsequence.(4L)

**Module VI**

Matching Problem: Stable Marriage, Hospital Resident Problem(2L) Amortized Analysis(2L)

**Module VII**

Network Flow(2L),Complexity Classes: P, NP, NP-Hard, NP-Completeness, SAT, 3-SAT, Graph Colouring, Hamiltonian Cycle, TSP(4L),Approximation Algorithms(2L),Randomized Algorithms(2L)

**Reference Books:**


1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms".
2. A. Aho, J.Hopcroft and J.Ullman "The Design and Analysis of Algorithms"
3. D.E.Knuth "The Art of Computer Programming", Vol. 3
4. Jon Kleiberg and Eva Tardos, "Algorithm Design"
5. E.Horowitz and Shani "Fundamentals of Computer Algorithms"
6. Rajeev Motwani and P. Raghavan, "Randomized Algorithms". Cambridge University Press, New York.
7. Vazirani, Vijay V, "Approximation Algorithms". Berlin: Springer.


**Elective – I**

**PGCSE105A ARTIFICIAL NEURAL NETWORK**

**Credit: 4,**

**Module I**

**Introduction to artificial neural networks [5L]**

Biological neural networks, Pattern analysis tasks: Classification, Regression, Clustering, Computational models of neurons, Structures of neural networks, Learning principles

**Module II**

**Linear models for regression and classification [8L]**Polynomial curve fitting, Bayesian curve fitting, Linear basis function models, Bias-variance decomposition, Bayesian linear regression, Least squares for classification, Logistic regression for classification, Bayesian logistic regression for classification

**Module III**

**Feed forward neural networks [8L]**Pattern classification using Perceptron, Multilayer feed forward neural networks (MLFFNNs), Pattern classification and regression using MLFFNNs, Error back propagation learning, Fast learning methods: Conjugate gradient method, Auto associative neural networks, Bayesian neural networks.

**Module IV**

**Radial basis function networks [5L]**Regularization theory, RBF networks for function approximation, RBF networks for pattern classification,

**Module V**

**Kernel methods for pattern analysis [8L]**Statistical learning theory, Support vector machines for pattern classification, Support vector regression for function approximation, Relevance vector machines for classification and regression,

**Module VI**

**Self-organizing maps [4L]**Pattern clustering, Topological mapping, Kohonen"s self-organizing map

**Module VII**

**Feedback neural networks [5L]**Pattern storage and retrieval, Hopfield model, Boltzmann machine, Recurrent neural networks.

**Reference Books:**

1. B.Yegnanarayana, Artificial Neural Networks, Prentice Hall of India, 1999
2. Satish Kumar, Neural Networks – A Classroom Approach, Tata McGraw-Hill, 2003
3. S.Haykin, Neural Networks – A Comprehensive Foundation, Prentice Hall, 1998
4. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

**Advanced Soft Computing : PGCSE105C**
**Credit: 4**

Evolution of Computing - Soft Computing Constituents – From Conventional Artificial Intelligence to Computational Intelligence - Machine Learning Basics.

**Fuzzy Logic [8L]**
Fuzzy sets and Fuzzy logic, Fuzzy sets versus crisp sets, membership function, operations on fuzzy sets, linguistic variable, Fuzzy relations—Cartesian product, Operations on relations; Extension principle, Defuzzification methods. Applications, fuzzy controllers, fuzzy pattern recognition and image processing.

**Artificial Neural Networks [10L]**
Basic concept of neural networks, Mathematical model, Typical architectures: single layer, multilayer, Common activation functions; basic models, Perceptron, Multilayer feed forward network, Back propagation, ADALINE, MADALINE, Different issues regarding convergence of Multilayer Perceptron, Competitive learning, Self-Organizing Feature Maps.
Classification techniques : Different learning methods: Supervised, Unsupervised & reinforced; Simple Clustering algorithm, k-means & k-medoid based algorithm.
Deep learning : Why Deep Learning? Deep Convolutional Networks, Recurrent Nets, Deep Learning Use Cases.

**Genetic Algorithms [8L]**
Evolutionary and Stochastic techniques: Genetic Algorithm (GA), role of GA in optimization, Fitness function, Selection of initial population, Cross over, Mutation, Inversion, Deletion, Schema theorem and convergence of Genetic Algorithm, Simulated annealing and Stochastic models, multi objective evolutionary algorithm (***MOEA***)

**Hybrid Systems [6L]**
Neural –Network based Fuzzy Systems , Fuzzy Logic-Based Neural Networks, Fuzzy Logic controlled G.A ,Genetic Algorithm for Neural Network

**Books/References:**
1. Mitchell Melanie, “An Introduction to Genetic Algorithm”, Prentice Hall, 1998.
2. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, 1997.
3. S. Haykin, “Neural Networks”, Pearson Education, 2ed, 2001.
4. S. Rajasekaran & G. A. V. Pai , Neural Networks, Fuzzy logic, and Genetic Algorithms, PHI.
5. Klir & Yuan , Fuzzy Sets and Fuzzy Logic, Klir & Yuan, PHI, 1997
8. D. Ruan ,Intelligent Hybrid Systems, Kluwer Academic Publisher, 1997.
9 Ian Goodfellow, Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT press
10 Pravir Chawdhry, Rajkumar Roy, Raj Pant, “Soft Computing in Engineering Design and Manufacturing”, Springer.

**PGCSE105E : Software Engg & Case Tools**
**Credit: 4**

**Module I**
Introduction and over view, software development life-cycle models, software requirements analysis, identification and specification, formal requirements specification and verification - axiomatic and algebraic specifications [9L]

**Module II**
Function-oriented software design, DFD, data dictionary, structure chart, transform and transaction analysis, object-oriented design, UML diagrams, design patterns, user interface design, coding standards [11L]

**Module III**
Testing: module, sub-system and system level testing, integration testing, stub, driver, test case and test suit design, system performance testing, verification & validation, debugging [6L]

**Module IV**

Software quality : SEI CMM, ISO-9001 and Six Sigma. Software reliability and fault-tolerance, software project planning, monitoring, and control, Cost Estimation Model, Metrics, software maintenance [10L]

**Module V**

Computer-aided software engineering (CASE), software reuse, component-based software development, extreme programming [4L]

**Reference Books:**

1. Software Engineering: A Practitioner's Approach Paperback, Roger S Pressman
2. Software Engineering, Pearson Education, Ian Sommerville
3. Fundamentals of Software Engineering, Carlo Ghezzi , Mehdi Jazayeri , Dino Mandrioli
4. Software Engineering Theory and Practice, Paperback, Shari Lawrence Pfleeger

**PGCSE105F:Graphics & Multimedia**

**Contact: 4L**

**Credit: 4**

**Module I**

Introduction to computer graphics & graphics systems[6L],Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software. Scan conversion: [6L], Points & lines, Line drawing algorithms; DDA algorithm, Bresenham"s line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.[5L]

**Module II**

2D transformation & viewing [8L],Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear,Transformation of points, lines , parallel lines, intersecting lines. Viewing pipeline, Window to viewport co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse,3D transformation & viewing [7L],3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, viewport clipping, 3D viewing. [5L]

**Module III**

Curves [3L],Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves. Hidden surfaces [3L],Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Painter"s algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry, Color & shading models [2L],Light & color model; interpolative shading model; Texture. [5L]

**Module IV**

Multimedia [10L],Introduction to Multimedia: Concepts, uses of multimedia, hypertext and hypermedia; Image, video and audio, standards. Audio: digital audio, MIDI, processing sound, sampling, compression. Video: MPEG compression standards, compression through spatial and temporal redundancy, inter-frame and intra-frame compression. Animation: types, techniques, key frame animation, utility, morphing. Virtual Reality concepts. [5L]

**Reference Books:**

1. Hearn, Baker – " Computer Graphics ( C version 2nd Ed.)" – Pearson education
2. Z. Xiang, R. Plastock – " Schaum"s outlines Computer Graphics (2nd Ed.)" – TMH
3. D. F. Rogers, J. A. Adams – " Mathematical Elements for Computer Graphics (2nd Ed.)" – TMH
4. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI
5. Sanhker, Multimedia –A Practical Approach, Jaico
6. Buford J. K. – "Multimedia Systems" – Pearson Education
7. Andleigh & Thakrar, Multimedia, PHI
8. Mukherjee Arup, Introduction to Computer Graphics, Vikas Hill,
9. Computer Graphics using open GL, Pearson Education

**Practical**

**Advanced Operating System Lab**
**Code: PGCSE191**
**Contact: 3P**
**Credits: 2**

Basic shell (bash/zsh) commands and shell scripting.
Learn to use important Linux system calls related to I/O, Process Management, etc.
Learn to compile the latest Linux kernel and use it to boot the system.
Learn to use the basic tools such as: find, grep, cscope, lxr, oprofile, SystemTap, ltrace, strace, ftrace, perf, cflow etc.
Learn to modify the kernel code so that some tweaks can be made to the arguments supplied to the kernel during boot using the bootloader (eg. grub).
Learn to add a system call to the Linux kernel.
Learn to create a basic hello world type of kernel module, and be able to compile it, load and unload it.
Learn and use the various data structures and API calls that is made available by the Linux kernel.
Learn to write increasingly complicated kernel modules touching the various kernel subsystems.

**Reference Books:**
1. Brian Kernighan, Rob Pike, "The UNIX Programming Environment", 1 st Edition, Prentice Hall, 1983
2. Robert Love, "Linux System Programming: Talking Directly to the Kernel and C Library", 2 nd Edition, O"Reilly, 2013
3. Jonathan Corbet, Alessandro Rubini, Greg Kroah-Hartman, "Linux Device Drivers", 3 rd Edition, O"Reilly, 2005
4. Sreekrishnan Venkateswaran, "Essential Linux Device Drivers",1 st Edition, Prentice Hall, 2008
5. Robert Love, "Linux Kernel Development", 3 rd Edition, Addison-Wesley Professional, 2010

**Artificial Neural Networks Lab**
**Code: PGCSE192(A)**
**Credits: 2**

Program to illustrate how the choice of Activation Function (or transfer function) affects the Output of a Neuron.
Program to classify with a 2-input perceptron. iii) Program to illustrate how the Perceptron Learning Rule works for non-linearly separable problems.
Realise a Hebb Net for the AND, OR and NOT function with bipolar inputs and targets.
Develop a Matlab program for OR function with bipolar inputs and targets using ADALINE network.
Develop a Matlab program to generate XOR function for bipolar inputs and targets using MADALINE Network.
Develop a Matlab program to store the vector (-1,-1,-1,-1) and (-1,-1,1,1) in an autoassociative network. Find the weight matrix. Test the net with (1,1,1,1) as input.
Develop a Matlab program to store the letters (patterns) A,B,C,D and after training, test the noisy version of these patterns using a Hetero Associative network. Assume a matrix representation for these patterns forming the alphabets A,B,C,D and their noisy versions.
Consider a vector(1,0,1,1) to be stored in the net. Test a discrete Hopfield net with error in the 1st and 4th components (0,0,1,0) of the stored vector.
Develop a Matlab program for XOR function (binary input and output) with momentum factor using back-propagation algorithm.
Develop Matlab program for drawing feature maps (Kohonen Self Organizing Feature maps) in 1-Dimensional view.
Use Kohonen Self Organizing feature map to Cluster the vectors (assume four binary vectors) using own initial weights(to be assumed) and learning rate(to be assumed).

**Computer Graphics & Multimedia Lab**
**Code: PGCSE192**
**Credits: 2**

Learning graphics functions in C, C++.
DDA line drawing algorithm.
Bresenham"s algorithm for generation of octant of a circle.
Circle generation using Mid-point method.
Ellipse generation using Mid-point method.
Point plotting, line & regular figure algorithms.
Polygon filling algorithm (FLOODFILL / SEEDFILL) .
Cohen-Sutherland clipping algorithm.

Polygon clipping using Sutherland Hodgeman algorithm.
2D and 3D Transformations such as translation, rotation, scaling, reflection and sharing.
Curve generation using Interpolation methods.
Curve generation using B-spline and Bezier curves.
Implementation of any one of Back face removal algorithms such as Depth-Buffer algorithm, Painter's algorithm.
Creating Animation using Flash

**Software Engineering & CASE Tools Lab.**
**PGCSE192**
**Credits: 2**

Preparation of SRS document for standard application problems in standard format.(e.g Library Management System, Railway Reservation system, Hospital management System, University Admission system)
Prepare Software Design Document (ERD, DFD & structure chart)
Project Schedule preparation .
Use Case diagram, Class diagram, Sequence diagram etc. using tools like Rational Rose( For standard application problems)
Estimation of project size using Function Point(FP) calculation.
Drawing control flow graph(CFG) and determining cyclomatic complexity for some problems.
Design Test Script/Test Plan(both Black box and White Box approaches)
Designing test suites for some applications.
Estimation of product Cost by Cost Estimation models like COCOMO and its variations.
Comparative study on variations of COCOMO models.

**Semester – 2.**

**PGCSE201: Advanced DBMS [Compulsory]**
**Contact: 4L**
**Credit: 4**

**Module I**
Structure of relational Databases, Relational Algebra, Relational Calculus, Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Lossless Decomposition ,Boyce-Code Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF**[8L]**

**Module II**
Transaction processing, Concurrency control and Recovery Management, conflict and view serializability, lock base protocols, two phase locking. **[5L]**

**Module III**
Distributed DBMS features and needs. Reference architecture. Levels of distribution transparency,replication. Distributed database design - fragmentation, allocation criteria. Distributed deadlocks. Time based and quorum based protocols. Comparison. Reliability- non-blocking commitment protocols. **[9L]**

**Module IV**
Partitioned networks. Checkpoints and cold starts. Management of distributed transactions- 2 phase unit protocols. Architectural aspects. Node and link failure recoveries. Distributed data dictionary management. Distributed database administration. Heterogeneous databases-federated database, reference architecture, loosely and tightly coupled. **[6L]**

**Module V**
Introduction to Oracle RDBMS **[2L]**

**Reference Books:**
1. Leon & Leon, Essentials Of DBMS, Mc.Graw Hill
2. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
3. Saeed K. Rahimi, Frank S. Haug, Distributed Database Management Systems: A Practical Approach,Willey.

**PGCSE202:Advanced Computer Network & Security [Compulsory]**
**Contact: 4L**
**Credit: 4**

**Module I**
Overview and Introduction, Fundamental of wireless networks and security [3L]

**Module II**
Wireless LANS and PANS, Wireless WANS and MANS, AD HOC Wireless Networks, Wireless Sensor Networks, Wireless Body Area Networks [9L]

**Module III**
IEEE 802.11 MAC Layer Fundamentals: CSMA/CA, IEEE 802.11 MAC Layer, Advanced, Routing Protocols for AD HOC Wireless Networks, Routing Protocols for AD HOC Wireless Networks [6L]

**Module IV**
Energy Management in Wireless Networks, Network Lifetime Enhancement [3L]

**Module V**
Security: Introduction, Overview, Security techniques, Cryptography: Concepts & Techniques, Symmetric Key Algorithm, Asymmetric Key Algorithm, Digital Signature and RSA, Internet Security Protocols, User Authentication, Electronic Mail Security, Firewall [10L]

**Reference Book:**
1. Ad Hoc Wireless Networks, Pearson Education,C.Siva Ram Murthy, B.S. Manoj
2. Cryptography and Nerwork Security, Tata McGraw-Hill, Atul Kahate
3. Protocols and Architectures for Wireless Sensor Networks, Paperback, Holger Karl, Andreas Willig

**PGCSE203: Theory of Computation [ Compulsory]**

**Contact: 4L**
**Credit: 4**

**Module I**
Mathematical preliminaries, Models of Computation, Models of computation - classification, properties and equivalences. Finite Automata, Formal definition of a Finite Automata (FA) -Examples of FA, Designing FA, DFA and NFA, regular operations. Equivalence of NFAs and DFAs. FA with Epsilon-Transitions, Epsilon-Closures, Eliminating epsilon -Transitions. Applications of FAs. Mealy and Moore machine, Dead state, Minimization of FA, Incompletely specified machine. FA on infinite inputs.

**Module II**
Regular expression and Languages, Definition of a Regular Expressions (RE), The Operators of RE – Building RE, Conversions DFA‟s to RE. Equivalence of RE and NFA with Epsilon-moves, - Application of REs. Equivalence of regular grammar and FA.; Properties of Regular Languages (RL), Proving Languages not to be Regular, Pumping Lemma for RLs. Applications of the Pumping Lemma. Closure Properties of RLs, Decision Properties of Rls

**Module III**
Context Free Languages, Context free languages, Derivation and languages, Relationship between derivation and derivation trees, Leftmost and Rightmost Derivations. Simplification of context free grammars – Normal forms for context free grammars, CNF, and GNF. Applications of Context-Free Grammars. Non determinism vs. ambiguity in CFLs. Closure properties of CFLs. Algorithmic properties about CFLs. Pumping Lemma for CFL.

**Module IV**
Push Down Automata, Definition, Acceptance by a Push Down Automata (PDA), DPDA & NPDA, example, Equivalence of PDA‟s and CFG‟s (conversion : PDA‟s to CFG‟s and reverse). Multi stack PDA. Non- determinism adds power to PDAs.

**Module V**
Turing Machine, Unsolvable Problems. Definition, notation and Example of Turing Machine (TM). Programming techniques Computable languages and functions, Church Turing hypothesis, Universal TM, Random Access TM. Multitape TM, Equivalence of One-Tape and Multitape TM's , Nondeterministic TMs. Conversion of RE to TM. Multi-stack PDA & TM.

**Module VI**
Computability and Decidability: Church-Turing Thesis, Decision Problems, Decidability and undecidability, unsolvable problems; Halting Problem of Turing Machines; Problem reduction (Turing and mapping reduction),

Intractability (Hierarchy Theorems). Mapping reductions. More undecidable languages. Rice theorem. Reductions using controlled executions. RE Completeness. Reductions using computation histories. Linear Bounded Automata. Unrestricted grammars.

**Module VII**
Computational Complexity, Resource-constrained computation. Time Complexity- notion of complexity classes, classes P NP, NP-complete,Boolean satisfiability, NP-Completeness of CSAT and 3SAT , NP- Levin Theorem. The concept of reduction, coNP, polynomial Hierarchy. Some natural NP-complete problems. Space Complexity-Savich"s Theorem. The class PSPACE. Optimization, search, and decision problems. Approximate solutions to optimization problems.

**Module VIII**
Logic, Propositional and First-order logic and their applications to theorem proving and logic programming. Advanced/Emerging areas: Elementary introductions to DNA Computing, Quantum Computing, Cellular Automata, Circuit complexity, Structural Complexity, Parallel Complexity, Algorithmic Information.

**Module IX**
Course Guidelines, Large majority of the lectures would focus only on the core areas, with only elementary introduction to other remaining advanced areas.

**Cluster, Grid and Cloud Computing**
**Code: PGCSE204A**

**Contact: 4L**
**Credit: 4**

**Module I**
Cluster Computing [12L]A general introduction to the concept of cluster based distributed computing. Hardware technologies for cluster computing, including a survey of the possible node hardware and high-speed networking hardware and software. Software and software architectures for cluster computing, including both shared memory (OpenMP) and message passing (MPI/PVM) models. MPI-2 extension, dynamic process creation, one-sided communication, parallel I/O. Variants based on new low level protocols (MVAPICH), evaluation and tuning of system and software performance. Performance evaluation tools, HINT, netperf, netpipe, ttcp, Iperf.

**Module II**
Grid Computing [16L]. The Grid - Past, Present, Future, A New Infrastructure for 21st Century Science - The Evolution of the Grid - Grids and Grid Technologies, Programming models - A Look at a Grid Enabled Server and Parallelization Techniques – Grid applications. The concept of virtual organizations – Grid architecture – Grid architecture and relationship to other Distributed Technologies – computational and data Grids, semantic grids. Case Study: Molecular Modeling for Drug Design and Brain Activity Analysis, Resource management and scheduling, Setting up Grid, deployment of Grid software and tools, and application execution

**Module III**
Cloud Computing [16L]. Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS. Cloud computing platforms: Infrastructure as service: Amazon EC2,Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing. Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. Issues in cloud computing, Implementing real time application over cloud platform Issues in Intercloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment.

**Reference Books:**

1. Cluster Computing by Rajkumar Buyya, Clemens Szyperski
2. High Performance Cluster Computing: Architectures and systems by Rajkumar Buyya
3. Grid and Cluster Computing by C.S.R Prabhu
4. Fran Bermn, Geoffrey Fox, Anthony Hey J.G., “Grid Computing: Making the
5. Joshy Joseph, Craig Fallenstein, “Grid Computing”, Pearson Education, New Delhi, 2004,
6. Ian Foster, Carl Kesselman, “The Grid2: Blueprint for a New Computing Infrastructure”. Morgan Kaufman, New Delhi, 2004
7. Ahmar Abbas, “Grid Computing: Practical Guide to Technology and Applications”, DelmarThomson Learning, USA, 2004,
8. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper (Wiley India Edition)

9. Enterprise Cloud Computing by Gautam Shroff,Cambridge
10. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India

**PGCSE 204(B): Mobile Computing**
**Contact: 4L**
**Credit: 4**

**Module I**
Fundamentals of Cellular Communications, Introduction, First- and Second-Generation Cellular Systems, Cellular Communications from 1G to 3G, Teletraffic Engineering, Radio Propagation and Propagation Path-Loss Models, Cellular Geometry, Interference in Cellular Systems, Frequency Management and Channel Assignment Issues, Multiple Access Techniques, GSM Logical Channels and Frame Structure, Privacy and Security in GSM, Mobility Management in Cellular Networks.

**Module II**
Wireless Transmission Fundamentals,Spread Spectrum (SS) and CDMA Systems, Wireless Medium Access Control, IEEE 802.11 Architecture and Protocols, Issues in Ad Hoc Wireless Networks (Medium Access Scheme), Routing, Multicasting, Transport Layer Protocols, QoS Provisioning, Energy Management and Energy Consumption Models, Traffic Integration in Personal, Local, and Geographical Wireless Networks, Bluetooth, Technologies for High-Speed WLANs, Third-Generation Cellular Systems: UMTS.

**Module III**
Mobile Adhoc Networks, Introductory Concepts. Different models of operation, Various applications of MANET, Destination-Sequenced Distance Vector protocol - overview, Route Advertisement, Extending Base Station Coverage, Properties of DSDV protocol, Dynamic Source Routing protocol - overview and properties, DSR Route Discovery, Route Maintenance, Support for Heterogeneous Networks and Mobile IP, Multicast routing with DSR, Ad Hoc On-Demand Distance-Vector protocol - properties, Unicast Route Establishment, Multicast Route Establishment, Broadcast Optimizations and Enhancements, Link Reversal Routing - Gafni-Bertsekas Algorithm, lightweight mobile routing algorithm, Temporally Ordered Routing Algorithm, Preserving battery life of mobile nodes - Associativity Based Routing, Effects of beaconing on battery life.

**Module IV**
Wireless Sensor Networks, Sensor networks overview: introduction, applications, design issues, requirements, Sensor node architecture, Network architecture: optimization goals, evaluation metrics, network design principles, Sensor network operating systems and brief introduction to sensor network Programming, Network protocols: MAC protocols and energy efficiency, Routing protocols: data centric, hierarchical, location-based, energy efficient routing etc, Sensor deployment, scheduling and coverage issues, Self Configuration and Topology Control, Querying, data collection and processing, collaborative information processing and group connectivity, Target tracking, localization and identity management, Power management, Security and privacy.

**Module V**
Topology Control and Clustering in Adhoc Networks, Algorithms for Graphs Modeling Wireless Ad Hoc Networks, Clustering and Network Backbone, Dominating-Set-Based Routing in Ad Hoc Wireless Networks, Formation of a Connected Dominating Set, Backbone-Formation Heuristics.

**Module VI**
Mobile, Distributed and Pervasive Computing, Pervasive Computing Applications, Architecture of Pervasive Computing Software, Indoor Wireless Environments, Challenges for the Future: Nomadic Computing.

**Reference Books**

1. Gabrilovska, Prasad, “Adhoc Networking Towards Seamless Communication”, Springer.
2. Azzedine Boukerche, “Handbook of Algorithms for Wireless Networking and Mobile Computing”, Chapman and Hall/CRC, New York.
3. Wagner, Wattenhofer (Eds.), “Algorithms for Adhoc and Sensor Networks: AdvancedLectures”, Springer Lecture Notes in Computer Science.
4. Mukherjee, Bandopadhyay, Saha, “Location Management and Routing inMobile Wireless Networks”, Artech House, London.
5. Redl, S.M., Weber, M.K., Oliphant, M.W.: An Introduction to GSM. Artech House, London.
6. Mehrotra, A.: GSM System Engineering. Artech House, London.
7. Ivan Stojmenovic, “Handbook of Wireless Networking and Mobile Computing”, Wiley Inc, NewYork.
8. XiangYang Li, “Wireless Adhoc and Sensor Networks”, Cambridge University Press.


**ADVANCED WEB TECHNOLOGY**
**PGCSE204C**
**Contracts: 4L**

**Credits- 4**

**Module I**

Internet & WWW, Introduction (2L)Overview, Computer Network, Intranet, Extranet and Internet. Types of Networks (LAN, MAN, WAN), Network Topologies .Definition of Internet, Internet organization. Growth of Internet, Internet Application.

Review of TCP/IP, OSI Reference model, TCP/IP Model, IP addressing, Classful and Classless Addressing, Subnetting, Features and services of TCP/IP, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram. Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail-POP3, SMTP.

World Wide Web, Evolution of distributed computing. Core distributed computing technologies – Client/Server Architecture & its Characteristics, JAVA RMI. Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence of Web Services and Service Oriented Architecture (SOA). Introduction to Web Services – The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services. Web Server Concept and Architecture. Definition of DNS (Domain Name System). Domain and Sub domain, Address Resolution, FTP & its usage, Telnet Concepts, Remote Logging, HTTP & HTTPs.

**Module II**

Client Side Application Development, HTML & CSS, Introduction, Editors, Elements, Tags, Attributes, Heading, Paragraph. Formatting, Link, Image, Table, List, Block, Form, Frame Layout, DHTML, Basic Web Page Development, CSS- Create Class Styles, Create ID Styles ,Span, Colors.HTML5 in brief.

Extensible Markup Language (XML), Brief Over View of XML – XML Document structure, XML namespaces, Defining structure in XML documents, Reuse of XML schemes, Document navigation and transformation, Tree, Syntax, Elements, Attributes, Validation, and Viewing. XHTML in brief.

JavaScript (6L), Introduction, JavaScript in Web Pages, The Advantages of JavaScript Writing JavaScript into HTML; Building Up JavaScript Syntax; Basic Programming Techniques ; Operators and Expressions in JavaScript; JavaScript Programming Constructs; Conditional Checking Functions in JavaScript, Dialog Boxes, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array. Function, Errors, Validation. The JavaScript Document Object Model-Introduction (Instance, Hierarchy); The JavaScript Assisted Style Sheets DOM; Understanding Objects in HTML (Properties of HTML objects, Methods of HTML objects); Browser Objects, Handling Events Using JavaScript

**Module III**

Server Side Programming withPHP & MySQL,Installing and Configuring (2L),Current and Future Versions of MySQl and PHP, How to Get MySQL, Installing MySQL on Windows, Trouble Shooting your Installation, Basic Security Guidelines, Building PHP on Windows with Apache, Windows, php.ini.Basics,The Basics of PHP scripts.

The Building blocks of PHP (3L),Variables, Data Types, Operators and Expressions, Constants. Flow Control Functions in PHP: Switching Flow, Loops, Code Blocks and Browser,

**Module IV**

Functions (3L),What is function? Calling functions, Defining Functions. Variable Scope, more about arguments. Working with Arrays and Some Array-Related Functions.

Working with Objects (2L), Creating Objects, Object Instance Working with Strings, Dates and Time: Formatting strings with PHP, Investigating Strings with PHP, Manipulating Strings with PHP, Using Date and Time Functions in PHP.

Working with Forms (2L),Creating Forms, Accessing Form Input with User defined Arrays, Combining HTML and PHP code on a single Page, Using Hidden Fields to save state, Redirecting the user, Sending Mail on Form Submission, and Working with File Uploads.

Learning basic SQL Commands (2L), Learning the MySQL Data types, Learning the Table CreationSyntax, Using Insert Command, Using SELECT Command, Using WHERE in your Queries,Selecting from Multiple Tables, Using the UPDATE command to modify records, Using the DELETE Command, Frequently used string functions in MySQL, Using Date and Time Functions in MySQL.

Interacting with MySQL using PHP (2L), MySQL Versus MySQLi Functions, Connecting to MySQL with PHP, Working with MySQL Data.

**Module V**

Multimedia Application Development (4L), Pixel, Image Resolution, Image Editing using Photoshop, 2D & 3D Animation, Logo Design, Banner. Animated Component Preparation using Flash & Action script.

Multimedia Web Applications (2L),Multimedia over IP: RTP, RTCP. Streaming media, Codec and Plugins, VoIP, Text and Voice Chat.

**Reference Books:**

1. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011.

2. Web Technology & Design, C.Xavier, New Age International Publication, Delhi
3. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning,Delhi, 2013.
4. Sams Teach Yourself PHP in 24 Hours, Third Edition
5. Wrox, Beginning PHP, Apache, MySQL Web Development
6. Wrox, Beginning PHP

**Soft Computing: PGCSE 204(D)**
**Contact: 4L**
**Credit: 4**

**Module I**
Introduction to Soft Computing, Evolution of Computing, Soft Computing Constituents, From Conventional Artificial Intelligence to Computational Intelligence - Machine Learning Basics.

**Module II**
Neural Networks, Biological Neuron, Artificial Neuron, Artificial Neural Network, basic models, Hebb's learning, Adaline, Perceptron, Multilayer feed forward network, Back propagation,Different issues regarding convergence of Multilayer Perceptron, Competitive learning, Self-Organizing Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.

**Module III**
Heuristic and Meta-heuristic Search, Genetic Algorithm (GA), different operators of Genetic Algorithm, Analysis of selection operations, Hypothesis of building Blocks, Schema theorem and convergence of Genetic Algorithm, Simulated annealing and Stochastic models, Boltzmann Machine, Tabu Search, Swarm Intelligence, Particle Swarm Optimization, Applications.

**Module IV**
Fuzzy sets and Fuzzy logic, Introduction, Fuzzy sets versus crisp sets, operations on fuzzy sets, Extension principle, Fuzzy relations and relation equations, Fuzzy numbers, Linguistic variables, Fuzzy logic, Linguistic hedges, Applications, Fuzzy Decision Making, Applications.

**Module V**
Hybrid Systems, Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic and Genetic Algorithm for Optimization, Applications.

**Reference Books:**
1. Mitchell Melanie, “An Introduction to Genetic Algorithm”, Prentice Hall, 1998.
2. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, 1997.
3. S. Haykin, “Neural Networks”, Pearson Education, 2ed, 2001.
4. S. Rajasekaran & G. A. V. Pai, Neural Networks, Fuzzy logic, and Genetic Algorithms, PHI.
5. Fuzzy Sets and Fuzzy Logic, Klir & Yuan, PHI, 1997.
7. Neural Networks, Fuzzy logic, and Genetic Algorithms, S. Rajasekaran and G. A. V. Pai, PHI.
8. Intelligent Hybrid Systems, D. Ruan, Kluwer Academic Publisher, 1997.

**PGCSE204E**
**Cryptography and Computer Security**
**Contact: 4L**
**Credit: 4**

**Module I**
Introduction, Linear algebra: non linearity, echelon form of matrix, Galois Field, vector space, Modular arithmetic Coding Theory,Elementary Concepts of Coding Theory,Applications of Algebraic Coding Theory to Cryptography, Huffman coding, Hamming coding

**Module II**
Primality Testing, Primality Testing, Fermat Primality Test, Aks Primality Test,Factorization, Large prime variant, Dixon's factorization method, Quadratic-Sieve Factoring, Pollard-Rho Method

**Module III**
Eliptic curves Cryptography, Elliptic Curves, Elliptic Curves(contd.) and Finite Fields, Elliptic Curve Cryptography, ECDLP, Zero Knowledge Proof

**Module IV**
Bilinear Pairings, Basic concept, Identity based encryption, Analogous of pairing based cryptosystems

**Module V**
Communication Security, Secret Sharing Schemes,A Tutorial on Network Protocols, Kerberos, IPsec: AH and ESP, IPsec: IKE, SSL/TLS, Intruders and Viruses, Firewalls

**Module VI**
Electronic Mail Security,Distribution lists, Establishing keys, Privacy, source authentication, message integrity, nonrepudiation, proof of submission, proof of delivery, message flow confidentiality, anonymity, Pretty Good Privacy (PGP), S/MIME

**Module VII**
Secure Electronic Transaction, SET, Millicent protocol, Micropayment system,Smart-card authentication

**Reference Books:**

1. Public-key Cryptography: Theory and Practice by Abhijit Das and C E Veni Madhavan, First Edition
2. Cryptography and Network security: Principles and Practice by W. Stallings, Pearson Education
3. Cryptography & Network Security, by B. A. Forouzan and D. Mukhopadhyay, Tata Mc Graw Hill
4. Cryptography Theory and Practice, by Douglas Stinson, 2nd Edition, Chapman & Hall/CRC
5. A Course in Number Theory and Cryptography by Neal Koblitz, Springer-Verlag, New York Inc
6. Information theory, coding and cryptography by Ranjan Bose; TMH.
7. Information and Coding by N Abramson; McGraw Hill.


**Code: PGCSE205A**
**Contact: 4L**
**Credit: 4**

**Module I**
Introduction [5L]Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.

**Module II**
Digital Image Formation [6L]A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.

**Module III**
Mathematical Preliminaries [7L] Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform.

**Module IV**
Image Enhancement [8L] Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High-boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.

**Module V**
Image Restoration [7L]Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation – Spatial Transformation, Gray Level Interpolation.

**Module VI**
Image Segmentation [7L]Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection – Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.

**Reference Books:**

1. Digital Image Processing, Gonzalves,Pearson
2. Digital Image Processing, Jahne, Springer India
3. Digital Image Processing & Analysis,Chanda & Majumder,PHI
4. Fundamentals of Digital Image Processing, Jain, PHI
5. Image Processing, Analysis & Machine Vision, Sonka, VIKAS

**Paper Name: Pattern Recognition**
**Paper Code: PGCSE205B**
**Contact: 4L**
**Credit: 4**

**Module I**
Basic concepts- Definitions, data sets for Pattern Recognition, Structure of a typical pattern recognition system. Different Paradigms of Pattern Recognition. Representations of Patterns and Classes. Metric and non-metric proximity measures

**Module II**
Feature vectors - Feature spaces - Different approaches to Feature Selection-Branch and Bound Schemes. Sequential Feature Selection.

**Module III**
Principal Component Analysis (PCA), Kernel PCA

**Module IV**
Pattern classification using Statistical classifiers - Bayes" classifier - Classification performance measures – Risk and error probabilities. Linear Discriminant Function, Mahalanobis Distance, K-NN Classifier, Fisher"s LDA, Single Layer Perceptron, Multi-layer Perceptron, Training set, test set; standardization and normalization

**Module V**
Basics of Clustering; similarity / dissimilarity measures; clustering criteria. Different distance functions and similarity measures. K-means algorithm, K-medoids, DBSCAN

**Module VI**
Structural PR, SVMs, FCM, Soft-computing and Neuro-fuzzy techniques, and real life examples.

**Reference Books:**

1. Devi V.S.; Murty, M.N. (2011) Pattern Recognition: An Introduction, Universities Press, Hyderabad.
2. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001.
3. Statistical pattern Recognition; K. Fukunaga; Academic Press, 2000.
4. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.


**PGCSE205E: Distributed System Principle**
**Contact: 4L**
**Credit: 4**

**Module I**
Distributed Systems [9L],Computer architecture : CICS, RISC, Multi-core Computer networking : ISO/OSI Model Evolution of operating systems Introduction to distributed computing systems. DCS design goals, Transparencies, Fundamental issues

**Module II**
Distributed Coordination [7L],Temporal ordering of events, Lamport's logical clocks, Vector clocks; Ordering of messages, Physical clocks, Global state detection

**Module I**I
Process synchronization [6L],Distributed mutual exclusion algorithms, Performance matrix

**Module IV**
Inter-process communication [6L],Message passing communication, Remote procedure call, Transaction communication, Group communication, Broadcast atomic protocols

**Module V**
Distributed file systems [6L], Deadlocks in distributed systems and Load scheduling and balancing techniques

**Refernce Books:**

1. Distributed Systems Concepts and Design, G. Coulouris, J. Dollimore, Addison Wesley
2. Advanced Operating Systems, M. Singhal, N.G. Shivarathri, McGraw Hill
3. Distributed Operating Systems and Algorithms, Randy Chow, T. Johnson, Addison Wesley
4. Distributed Operating Systems, A.S. Tanenbaum, Prentice Hall
5. Principles of Distributed Database Systems, M. Tamer Ozsu, Patrick Valduriez, Prentice Hall International
6. Tanenbaum, A. S. Distributed Operating Systems, (ISBN 0-131-439-340), Prentice Hall 1995.
7. Tanenbaum, A. S. Modern Operating Systems, 2nd Edition (ISBN 0-13-031358-0), Prentice Hall 2001.
8. Bacon, J., Concurrent Systems, 2nd Edition, (ISBN 0-201-177-676), Addison Wesley 1998.
9. Silberschatz, A., Galvin, P. and Gagne, G., Applied Operating Systems Concepts, 1st Edition, (ISBN 0-471-36508-4), Wiley 2000.
10. Coulouris, G. et al, Distributed Systems: Concepts and Design, 3rd Edition, (ISBN 0-201-61918-0), Addison Wesley 2001.
11. Galli, D.L., Distributed Operating Systems: Concepts and Practice (ISBN 0-13-079843-6), Prentice-Hall 2000.


## Semester 3

**PGCSE301A: PROJECT MANAGEMENT & ENTREPRENEURSHIP**
**Contact: 4L**
**Credit: 4**

**Module I:**
What "Project Management" Means. About The Context Of Modern Project Management. How To Manage Projects Throughout The Five Major Process Groups. How The Triple Constraint Affects The Project Manager. How To Develop An Effective Project Plan. How To Gain Commitment To The Project Plan. How To Efficiently Execute The Project Plan. How To Minimize Or Eliminate Scope Creep. How To Organize And Develop Successful Project Teams. How To Develop An Effective Project Control System. How To Develop Realistic Project Schedules. How To Efficiently Close Out A Project.

**Module II:**
Entrepreneurship Is An Intensive Course Involving The Study Of Journals Articles, Analysis Of Cases, To Evolve Perspective On Entrepreneurship As An Academic Discipline

**Module III:**
Entrepreneurship: An Introduction, New Venture Creation, Financing Entrepreneurial Ventures And The Business Plan, Family Business Management, Managing A Growing Business, Venture Growth Strategies, Entrepreneurial Skills And Strategies, Entrepreneurial Skills And Strategies, Intrapreneurship: Entrepreneurial Ventures In A Corporate Setting, Entrepreneur As Change Agent, Sustainable Innovation And Entrepreneurship, Social Entrepreneurship

**Reference Books:**

1. M. Y. Yoshino And U. S. Rangan, Strategic Alliances: An Entrepreneurial Approach To Globalization, Hbs Press, 1995.
2. Foster, Richard N., Innovation: The Attacker's Advantage, London, Macmillan, 1986.
3. Howard H. Stevenson, Michael J. Roberts, Amar Bhide, William A. Sahlman (Editor), The Entrepreneurial Venture (The Practice Of Management Series).
4. Udayan Gupta (Editor), Done Deals: Venture Capitalists Tell Their Stories.
5. Steve Kemper, Code Name Ginger: The Story Behind Segway And Dean Kamen's Quest To Invent A New World.
6. Paul A. Gompers And Josh Lerner, The Money Of Invention: How Venture Capital Creates New Wealth.
7. Larry Bossidy, Ram Charan And Charles Burck, Execution: The Discipline Of Getting Things Done.
8. Jeffry Timmons And Stephen Spinelli, New Venture Creation: Entrepreneurship For The 21st Century With Powerweb And New Business Mentor Cd.
9. The Entrepreneur"s Guide To Business Law, Constance E. Bagley And Craig E. Dauchy, West Educational Publishing, 1998.
10. Mary Coulter, Entrepreneurship In Action, Prentice-Hall, 2001.

11. Tracy Kidder, The Soul Of A New Machine, Avon Books, 1990.
12. H. L. Morgan, A. Kallianpur, And L. M. Lodish, Entrepreneurial Marketing: Lessons From Wharton's Pioneering Mba Course, John Wiley & Sons, 2001.
13. Rita Gunther Mcgrath And Ian Macmillan, The Entrepreneurial Mindset.
14. James Collins, William C. Lazier, Beyond Entrepreneurship: Turning Your Business Into An Enduring Great Company.

**PGCSE30B: Teaching & Research Methodology**
**Contact: 4L**
**Credit: 4**

**Module I:**
Instruction: Introduction to content, Elements of instruction, Learning objectives, Roles of the teacher and the learner in instruction. [4 L]

Teaching and Learning: Application of theories of learning to teaching and learning, Sequence of learning and Strategies of learning, Teaching methods, their merits and demerits, Use of ICT in teaching & learning, Classroom management, Individual differences. [4 L]

Planning for teaching and learning: Understanding the syllabus, Preparation of a scheme of work, Lesson plan preparation, Micro teaching. [4 L]

Assessment and Evaluation: Define measurement, assessment, test, evaluation, Purpose of assessment and evaluation, Types of tests, Grading and reporting the results assessment, Evaluating teaching and learning. [4 L]

**Module II:**
Definition and explanation of research: Types and Paradigms of Research, History and Philosophy ofResearch (esp. Philosophical evolution, pathways to major discoveries & inventions), Research Process decision, planning, conducting, Classification of Research Methods; Reflective Thinking, Scientific Thinking. [8 L]

Research problem formulation: Literature review- need, objective, principles, sources, functions & its documentation, problem formulation esp. sources, considerations & steps, Criteria of a good researchproblem, Defining and evaluating the research problem, Variables esp. types & conversion of concepts to variables. Research design esp. Causality, algorithmic, quantitative and qualitative designs, Various types of designs. Characteristics of a good research design, problems and issues in research design; Hypotheses: Construction, testing, types, errors; Design of experiments
especially classification of designs and types of errors. [8 L]

Problem solving: Understanding the problem- unknowns, data & conditions, conditions - satisfiability, sufficiency, redundancy & contradiction, separation of parts of the problem and conditions, notations; devising a plan- connection between data and unknown, similar/related problems, reuse of previous solutions, rephrasing/transforming the problem, solving partial or related problem, transforming data and unknowns; carrying out the plan- esp. correctness of each step in multiple ways; evaluation of solution and method-checking correctness of solution, different derivations, utility of the
solution.[5 L]

Theoretical methods of research: Algorithmic methods including probabilistic, soft computing, and numerical methods; Modeling and Simulation; Engineering Design & Optimization (techniques); Statistical methods in research: Central tendency, Dispersions, Skewness, Moments, Kurtosis, esp. Distributions, Time series, Overview of Non-parametric tests & Multivariate analysis; Emerging techniques in discrete mathematics, algorithms, probability-statistics, internet technology and software engineering, and their application to research in computer science and information technology. [8 L]

Foundation of Hypothesis: Meaning of assumption, postulate and hypothesis, nature of hypothesis, function and importance of hypothesis, Characteristics of good hypothesis, formulating hypothesis. [2 L]

Data & Reports: Infrastructural setups for research; Methods of data collection esp. validity and reliability, Sampling; Data processing and Visualization espicially Classification; Ethical issues espicially. bias, Misuse of statistical methods, Common fallacies in reasoning. Research Funding & Intellectual Property; Research reports:

Research Proposal & Report writing esp. Study objectives, study design, problems and limitations; Prototype microproject report implementing a major part of all the above (compulsory assignment) [5L]

**Reference Books:**


1. Teaching Methodology, Caroline W. Ndirangu, African Virtual University.
2. R. Paneerselvan: Research Methodology, Prenctice-Hall India
3. G. Polya, How to Solve It, Princeton University Press
4. Fundamental of Research Methodology and Statistics, Yogesh Kumar Singh, New Age International Publishers.
5. Research Methodology Methods and Techniques (Second Revised Edition), C.R.Kothari,


**Electives - IV.**

**Bio-Informatics**
**Code: PGCSE302B**
**Contact: 4L**
**Credit: 4**

**Module I:**

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

**Module II:**

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

**Module III:**

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

**Module IV:**

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

**Module V:**

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

**Reference Books:**


1. Vavid W. Mount: Bioinformatics:Sequenc and Genome analysis
2. Arther M. Leok: Introduction to Bioinformatics, Oxford
3. Rastogi et.al.:Bioinformatics-Methods and applications-enomics, Proteomics and Drug Discovery, Prentice Hall.
4. Dan Gasfield: Algorithms on Strings, Trees and Sequences, Computer Science and Computational Biology, Cambridge University Press
5. M. S. Waterman: Introduction to Computational Biology: Maps, Sequences and Genomes, 1995.
6. Gibas, Jambeck: Developing Bio-informatics Computer Skills, SPD


**Data Mining & Data Ware Housing**

**PGCS302C**
**Contact: 4L**
**Credit: 4**

**Module I:**
Basics of Data Mining . Data Mining Functionalities, Classification of Data Mining Systems, Data Mining Issues, Data Mining Goals. Stages of the Data Mining Process

**Module II:**
Data Warehouse concepts, Data Warehouse Architecture, OLAP technology, DBMS , OLTP VS. Data Warehouse Environment, Multidimensional data model Data marts.

**Module III:**
Data Mining Techniques: Statistics, Similarity Measures, Decision Trees, Neural Networks, Genetic algorithms.

**Module IV:**
Mining Association Rules : Basic Algorithms, Parallel and Distributed algorithms, Comparative study, Incremental Rules, Advanced Association Rule Technique, Apriori Algorithm, Partition Algorithm, Dynamic Item set Counting Algorithm, FP tree growth Algorithm, Boarder Algorithm.

**Module V:**
Clustering Techniques: Partitioning Algorithms-K- means Algorithm, CLARA, CLARANS, Hierarchical Algorithms DBSCAN, ROCK.

**Module VI:**
Classification Techniques: Statistical–based, Distance-based, Decision Tree- based Decision tree.

**Module VII:**
Applications and Trends in Data Mining: Applications, Advanced Techniques - Web Mining, Web Content Mining, Structure Mining.

**References Books:**
1. Roiger & Geatz, Data Mining, Pearson Education
2. A.K.Pujari, Data Mining, University Press
3. M. H. Dunham. Data Mining: Introductory and Advanced Topics. Pearson Education.
4 J. Han and M. Kamber. Data Mining: Concepts and Techniques. Morgan Kaufman.

**VLSI Design**
**PGCSE302E**
**Contact: 3L+1T**
**Credit:4**

**Module I:**
Introduction: Overview of VLSI design Methodologies, VLSI Design flow, Design Hierarchy, Concept of Regularity, Modularity, and Locality, VLSI design styles [3L]

**Module II:**
Fabrication of MOSFETs: Fabrication Process flow: basic steps, Fabrication of NMOS Transistor, the CMOS n-Well Process, Layout Design Rules , Full- Custom mask Layout design , CMOS Inverter Layout Design [4L]

**Module III:**
MOS Transistor: The MOS Structure, Structure and operation of MOSFET, The MOS System under External Bias, The Threshold Voltage, MOSFET Current–Voltage Characteristics, Channel Length Modulation, Substrate Bias Effect, MOSFET Scaling and Small Geometry Effects, Short Channel Effects, Narrow Channel Effects, Limitation Imposed by Small Device Geometries , MOSFET Capacitances [6L]

**Module IV:**
MOS Inverters: Static Characteristics: CMOS Inverters , Circuit operation, Voltage transfer characteristics of CMOS Inverter, Calculation of VIL , Calculation of VIH , Calculation of inverter threshold voltage, Noise Margin. [5L]

**Module V:**
MOS Inverters: Switching Characteristics: Delay Time Definitions, Calculation of Delay Times, Inverter Design with delay constraints, Estimation of Interconnect Parasitic, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters[6L]

**Module VI:**
Combinational MOS Logic Circuits: CMOS Logic Circuits, Layout of simple logic gates, Complex Logic Circuits, Layout of Complex Logic Gates, AOI and OAI Gates , CMOS Transmission Gates (pass gates) , Complementary Pass,Transistor Logic[4L]

**Module VII:**
Sequential MOS Logic Circuits: Behavior of Bitable element, SR Latch Circuits, Clocked Latch and Flip flop Circuits, CMOS D-Latch and Edge Triggered Flip flop , Clocked JK Latch, Master slave Flip flop [4L]

**Module VIII:**
Semiconductor Memories: Dynamic Random Access Memory, DRAM Configuration, Historical Evaluation of DRAM Cell, DRAM Cell Types, operation of one transistor DRAM Cell, DRAM Operation Modes, Static Random Access Memory, Full custom SRAM Cell, CMOS SRAM Design Strategy, Operation of SRAM, Flash Memory NOR Flash Memory Cell, NAND Flash Memory Cell, Flash Memory Circuit [4L]

**Module IX:**
Design for Testability: Fault Types and Models, Ad Hoc Testable Design Techniques, Scan –based Techniques, Built-In Self Test Techniques.[4L]

**Reference Books**:

1. S. M. Kang and Y. Leblebici, CMOS Digital Integrated Circuits : Analysis and Design, Third Edition, MH, 2002.
2. W. Wolf, Modern VLSI Design : System on Chip, Third Edition, PH/Pearson, 2002.
3. N. Weste, K. Eshraghian and M. J. S. Smith, Principles of CMOS VLSI Design : A
4. J. M. Rabaey, A. P. Chandrakasan and B. Nikolic, Digital Integrated Circuits : A Design Perspective, Second Edition, PH/Pearson, 2003.
5. D. A. Pucknell and K. Eshraghian, Basic VLSI Design : Systems and Circuits, Third Edition, PHI, 1994.
6. J. P. Uyemura, CMOS Logic Circuit Design, Kluwer, 1999.
7. J. P. Uyemura, Introduction to VLSI Circuits and System, Wiley, 2002.
8. R. J. Baker, H. W. Li and D. E. Boyce, CMOS Circuit Design, Layout and Simulation, PH, 1997.