Guru Nanak Dev Engineering College, Ludhiana

Department of Computer Science & Engineering

Scheme & Syllabus
M. Tech. Computer Science & Engineering
(2014 Batch Onwards)
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Department of Computer Science and Engineering  
Guru Nanak Dev Engineering College, Ludhiana
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Software Engineering Methodologies (MTCS501)

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Testing and Quality Assurance: Verification and validation, Automated static analysis, system testing, Component testing, Test case design, Test automation, Quality assurance and standards, Quality planning and control.

Agile Software Development: The Genesis of Agile, Introduction and background, Agile Manifesto and principles, Overview of Scrum, Extreme programming, Feature driven development, Lean software development, Agile project management, Design and development practices in Agile projects, Test driven development, Continuous integration, Refactoring, Pair programming, Simple design, User stories, Agile testing.

Software Reuse and Component Based Software Engineering: The Reuse landscape, design patterns, Application frameworks, Application system reuse, Commercial–off-the-shelf component reuse, Components and component models, Component based software engineering process, Component composition, Component adaptation techniques.

Recommended Books:

Databases and Data Mining (MTCS502)

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Distributed Database Management System (DDBMS): Introduction to distributed database, Advantages and disadvantages of distributed database, Homogenous and Heterogeneous distributed databases, Functions and architecture of DDBMS, Data fragmentation, Data allocation, Distributed transactions, Distributed concurrency control, Distributed deadlock management and Distributed database recovery.

Object Oriented Database Management System (OODBMS): Concepts of OODBMS, Storing objects in relational database, Object oriented data models and DBMS, Issues in OODBMS, Advantages and disadvantages of OODBMS.

Spatial and Temporal Data and Mobility: Motivations, Terms in databases, Spatial and geographic data, Multimedia database, Mobility and personal databases.

Data Warehousing and OLAP: Introduction to data warehousing, Data ware architecture, Data flows, warehousing tools, Data marts, Data warehouse design, Online Analytical Processing (OLAP benchmarks, benefits, representation of multi-dimensional data applications of OLAP, OLAP tools, categories of OLAP tools).

Data Mining: Introduction, Process of data mining, Data mining goals, Tasks and techniques (Prediction modeling, Database segmentation, Link analysis, Deviation detection), Applications of data mining.


Classification: Introduction, Applications of clustering, Classification technique: Decision trees.

Recommended Books:
Advanced Data Structure (MTCS503)

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Introduction to Data Structures: Algorithm design strategies - Greedy, Divide and Conquer backtracking, Branch and bound, Heuristic. Complexity of algorithms - Algorithm analysis techniques, Amortized analysis, Basic data structures - Abstract Data Types (ADTs), stacks, queue and linked lists and their applications.


Graphs: Graph ADT, Graph traversals/search methods - DFS and BFS. Applications of Graphs-Minimum cost spanning tree using Prim and Kruskal’s algorithm, Dijkstra’s algorithm for single source shortest path problem.

Recommended Books:
Distributed Computing Architecture (MTCS504)

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Introduction to Distributed Systems: Distributed systems – Scheduling and resource sharing, Web challenges. System models - Architectural models, Fundamental models, Characterization of distributed systems. Interprocess communication – Client/server communication, Distributed objects and remote invocation, Communication between distributed objects, Remote procedure call.

Distributed Computing Architecture: Client–server architecture, 3-tier architecture, n-tier architecture, Distributed objects, Loose coupling, Tight coupling, Client/server computing- building blocks, Infrastructure, Choice of client operating system or server operating system.

Distributed Operating Systems and File Systems: Operating system layer, Design issues, Protection, Processes and threads, Architecture of operating system, Distributed file systems, File service architecture, Name services, Domain name system, Case study of the global name service, X.500 Directory service, SUN network file systems, Andrewfile systems.

Distributed Shared Memory: Design and implementation issues, Sequential consistency and Release consistency and other consistency Models, Munin case study, Ivy case study.

Distributed Computing Paradigms: Overview of existing distributed computing paradigms, Cluster computing, Grid computing, Utility computing, Autonomic computing and Cloud computing, Essential characteristics of various computing paradigms and their comparison.

Recommended Books:
Digital Image Processing (MTCS505) 

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Introduction: Fundamental steps in Digital Image Processing, Components of an image processing system, Image sampling and quantization, Color models


Image Enhancement in Frequency Domain: Basics of filtering in the frequency domain, Image smoothing and sharpening using frequency domain filters.


Multiresolution Analysis: Wavelet analysis, Continuous wavelet transform, Discrete wavelet transform, Wavelet decomposition and reconstruction in two dimensions, Wavelet packet analysis, Wavelet based image denoising.

Image Compression: Image compression model, Compression measures, Compression algorithm and its types (Entropy, Predictive, Transform and layered coding), Types of redundancy (Coding, Inter-pixel, Psycho-visual and Chromatic), Lossless compression algorithms – Run-length, Huffman, Bit-plane, Arithmetic, Predictive coding. Lossy compression algorithms – Lossy predictive, Block transform coding.

Morphological Image Processing: Structuring element, Erosion, Dilation, Opening, Closing, Hit-or-Miss transform, Boundary detection, Hole filling, Connected components, Convex hull, Thinning, Thickening, Skeletons, Pruning, Reconstruction by dilation and erosion.

Image Segmentation: Classification of image segmentation algorithms, Point, Line and Edge detection, Hough transforms, Corner detection, Global thresholding, Otsu’s method, Multivariable thresholding, Region-based segmentation, Watershed segmentation.
**Image Features Representation:** Characteristics of good features, Boundary representation (Chain code, Polygonal approximations, Signatures, Bending energy, Statistical moments, Region Representation)

**Applications of image processing.**

**Recommended Books:**
Information Retrieval (MTCS506)

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Prerequisites: Basic knowledge of web search and web metadata.

Syllabus:

Introduction: Information retrieval, Retrieval process, Retrieval models - Set theoretic, Algebraic and probabilistic models, Key word based querying, Structured queries, Query optimization.

Text Encoding: Tokenisation, Stemming, Lemmatisation, Stop words, Phrases, Optimizing indices with skip lists, Proximity and phrase queries, Positional indices.


Scoring and Search System: Scoring, Term weighting and vector space model, Cosine measure, Scoring documents. Computing scores in complete search system - Components of an IR system. Efficient vector space scoring, Nearest neighbor techniques, Reduced dimensionality approximations, Random projection.


Recommended Books:
Lab-I (MTCS507)

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Software Engineering Methodologies Lab:

1. Study and usage of ERP based system.
4. Case study of Six Sigma in any engineering application.
5. Case study for highlighting any applications using UML.

Advanced Data Structures Lab:

Students are required to implement following programs:

1. To implement the Stack ADT and Queue ADT using an array and singly Linked List.
2. To perform various operations on a binary search tree.
3. To traverse the given binary tree in Preorder, Inorder and Postorder.
4. To implement BFS and DFS for a given graph.
5. To implement various sorting methods.
6. To perform various operations on a B-Tree.
7. To perform various operations on an AVL tree.
8. To generate a minimum cost spanning tree using Prim/Kruskal algorithm.
9. To implement Dijkstra algorithm to find the shortest path.
10. To implement various hashing techniques.
Lab-II (MTCS508)

Digital Image Processing Lab:

- Familiarity with MATLAB image processing commands.
- Implementation of various algorithms related to following topics:
  - Generation of lines, array, matrix and image.
  - Application of image processing operations.
  - Enhancement of images in spatial domain and frequency domain.
  - Image restoration techniques.
  - Color image processing.
  - Wavelet transforms.
  - Segmentation of 2-D images.
  - Image compression techniques.
  - Morphological image processing.
  - Texture features
  - A minor project based on above taught image processing techniques.

Information Retrieval Lab:

1. Analysis of textual and semi-structured data sets.
2. Write code for text indexing and retrieval.
4. Comparative analysis of posting algorithms.
5. Computing similarity between two documents.
6. Ranking and scoring documents in a repository based on certain search criteria.
8. Study of existing tools of information retrieval.
Network Security (MTCS601)

Introduction: Overview of computer networks (OSI reference model, TCP/IP protocol suite), MAC protocols for high speed LANs, MANs and Wireless LANs (FDDI, DQDB, HIPPI, Gigabit Ethernet, Wireless Ethernet), Fast access technologies.


Data Integrity: Hash Functions, Digital signatures, Digital certificates.


Recommended Books:

Ad-hoc MAC: MAC Protocols - Design issues, Goals and classification. Multi-channel MAC and Power control MAC protocol. IEEE Standards: 802.11a, 802.11b, 802.11g, 802.15, HIPERLAN.


Cross Layer Design and Integration of Ad-hoc for 4G: Cross layer Design - Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary perspective, Integration of Ad-hoc with Mobile IP networks.

Sensor Networks: Sensor network architecture, Data dissemination, Data gathering, MAC protocols for sensor networks, Location discovery, Quality of Sensor Networks, Evolving standards and other issues, Recent trends in infrastructure less networks.

Recommended Books:

Wireless Networks (MTCS603)

Prerequisites: The understanding of computer networks and security.

Syllabus:


Wireless LAN: Infrared and radio transmission, Ad-hoc networks, Wireless local loop, Wi-Fi and Wi-Max. IEEE 802.11 - System architecture, Services, Medium access control, Standards. Wi-Fi security and protected access, HIPERLAN. IEEE 802.15 – Architecture and services. IEEE 802.16 – Architecture and services.

Mobile Networks and Transport Layer: Mobile IP, Dynamic host configuration protocol, Mobile Ad-hoc routing protocols, Multicast routing, TCP over wireless networks, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmission and recovery, Transmission timeout, Freezing, Selective retransmission, Transaction oriented TCP.


Recommended Books:
Parallel Computing (MTCS604)

Introduction: Basic uniprocessor architecture, Multiprogramming and time sharing, Pipeline computers, Multiprocessor systems, Serial versus parallel processing. Parallelism approaches – Data parallelism, Control parallelism. Hardware taxonomy – Flynn’s classifications, Handler’s classifications, Parallel processing applications.


Pipelining and Superscalar Techniques: Linear pipeline processors - Asynchronous and synchronous models, Clocking and timing control, Nonlinear pipeline processors, Reservation and latency analysis, Collision-Free scheduling, Pipeline schedule optimization. Instruction pipeline design - Instruction execution phases, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch handling techniques, Pipeline hazards.

Basic Parallel Algorithmic Techniques and Programming: Pointer jumping, Divide-and-Conquer, Partitioning, Pipelining, Accelerated cascading, Symmetry breaking, Synchronization (Locked, Lock-free) parallel algorithms. Programming systems - Pthreads, OpenMP, MPI and global address space languages.

Recommended Books:
Cloud Computing (MTCS605)

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Cloud Computing Architecture: The cloud reference model architecture, Cloud based services, Infrastructure as a service (IaaS), Platform as a service (PaaS), Software as a service (SaaS), Cloud deployment scenarios, Public cloud, Private cloud, Hybrid cloud and Community cloud.


Mobile Cloud Computing: Overview of mobile cloud computing, Advantages, Challenges, using smartphones with the cloud. Offloading techniques - their pros and cons, Mobile cloud security.

Cloud Computing Platforms: Study of recent emerging cloud computing platforms and their comparison.

Recommended Books:

Big Data Analytics (MTCS606)  

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**Prerequisites:** Basic quantitative skills, including elementary statistics, as well as basic programming skills in SQL.

**Syllabus:**

**Introduction:** Big Data overview, State of the practice in analytics, When to consider Big Data Solutions, The Data scientist, Big Data Analytics in industry. Verticals - Big Data for web analytics, Big Data in crowd sourcing analytics, Big Data in mobile business intelligence and Big Data in healthcare.

**Statistical Modeling for Big Data using R:** Introduction to R, Analyzing and exploring the data, Statistics for model building and evaluation. Introduction to Rstudio.

**Advanced Analytics:** Analytics for unstructured data, Understanding distributed systems and Hadoop, Components and architecture of Hadoop, Hadoop management, Setting up a Hadoop cluster, Difference of HDFS from other DFS, Working with files in HDFS, Anatomy of a mapreduce program.

**Big Data Management:** In-database Analytics – Introduction to NoSQL- aggregate data models, Graph databases, Graphless databases, Distribution models, Introduction to Hbase, Pig, Hive, MongoDB, Casadenra.

**Machine Learning:** Introduction to Clustering, Classification, Association rules, Linear regression, Logistic regression, Naïve Bayes, Decision trees.

**Case Studies:** Social media data management, Anomaly detection, Web search recommendation systems.

**Recommended Books:**

Advanced Operating Systems (MTCS607)

Prerequisites: Basic knowledge of the Operating Systems and Computer Architecture.

Syllabus:


Distributed Operating Systems: Distributed system goals, Types and architecture of Distributed Systems, Threads, Virtualization, Client/server model, Communication and synchronization in distributed systems, Limitations of distributed operating systems.

Real Time Operating Systems: Characteristics, Task operations, Task states and scheduling, Inter task communication and resource sharing, Analysis of real time systems requirement, Hardware and Software tradeoffs, Timer interrupt service routines.

Deadlocks: Deadlock handling strategies, Issues in deadlock detection and revaluation, Distributed deadlock detection. Control organization – Centralized, distributed and hierarchical detection algorithms.


Case Study: Overview of UNIX, LINUX, WINDOWS NT, Android and IOS Operating systems.

Recommended books:
5. A. C. Shaw, “Logic Design Of operating systems”, PHI.
Object Oriented Analysis and Design Using UML (MTCS608)

Prerequisites: Basic knowledge of Object Oriented programming principles and software engineering fundamentals.

Syllabus:

Introduction: Object Oriented analysis and design fundamentals, Principles of modeling, Conceptual model of UML, Software development life cycle, Iterative and evolutionary analysis and design, Agile modeling.

Structural Modeling: Classes, Relationships, Access specification (visibility of attributes and operations) class diagrams, Advanced classes, Advanced relationships, Interfaces types and roles, Packages, Instances and object, Object diagrams.


Advanced Behavioral Modeling: Events and signals, State machines, Process and threads, Transition and condition, Time and space, State chart diagrams.

Architectural Modeling: Components- Terms and concepts, Component diagrams, Nodes and connections, Deployment diagrams, Modeling a client/server system.

Case Studies: NextGen POS system, Railway reservation, Booking ticket, Library management system, Online mobile recharge.

Recommended Books:

Testing Fundamentals: Principles of testing, Software development life cycle models, Significance and potential of testing. Types of testing - White box testing, Black box testing, Integration testing, System and acceptance testing, Performance testing, Regression testing, Ticking Box testing, Static analysis, Symbolic testing, Program mutation testing, Input space, partitioning, Functional program testing, Data flow guided testing, Internalization testing, Ad-hoc testing, Object Oriented testing strategies and issues, Interface testing and test case design.


Software Quality Metrics: Measurement theory, Software quality metrics, Product quality metrics, Software maintenance metrics, Collecting software engineering data.

Software Quality Assurance: Importance and essence, FTR, Structured walk through technique, Software reliability, Validation, Safety and hazards analysis, Features affecting quality of software, Software quality assurance plan. Software quality in business context, Planning for software quality assurance, Product quality and process quality, Quality standards and control.

Software Quality Models: ISO - Capability Maturity Model, CMMI, People CMM, Test maturity model.

Recommended Books:
Compiler Design (MTCS610)

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Introduction to Compiler: Compilers, Analysis of the source program. Analysis - Synthesis model of compilation, Phases of compilation, Grouping of phases, Phases of translation, Interpretation, Bootstrapping.

Lexical Analysis: Regular grammar and regular expression for common programming language features, Interface with input, Parser and symbol table, Token, Lexeme and patterns, Problems in lexical analysis, Error reporting, Implementation, Transition diagrams, Study of LEX tool.

Syntax Analysis: Role of the parser. Writing grammars - Context-free grammar, Top down parsing - Backtracking, LL(1), Recursive descent parsing, Predictive parsing, Bottom-up parsing - Shift reduce parsing, Operator precedent parsing, LR parsers, SLR parser, Canonical LR parser, LALR parser, Study of YACC tool.

Symbol Table: Symbol table format, Block structure languages, Hashing, Tree structure representation of scope information. Block structures and non-block structure storage allocation - Static, Runtime stack and heap storage allocation, Storage allocation for arrays, Strings and records.

Semantic Analysis: Abstract syntax tree, Polish notation and three address codes, Attributed grammars, Syntax directed translation. Type checking - Type system, Type expressions, Structural and name equivalence of types, Type conversion, Type checker.


Code Generation: Issues in the design of code generator, Basic blocks and Flow graphs, DAG representation of Basic blocks, Peephole optimization.

Code Optimization: Principal sources of optimization, Optimization of basic blocks, Global data flow analysis.

Recommended Books:

Pattern Recognition (MTCS611)

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Introduction: Definitions, Data sets for pattern recognition, Different paradigms of pattern recognition, Clustering vs Classification, Supervised vs Un-supervised learning, Representations of patterns and classes, Linearly separable patterns and Non-linearly separable patterns, Applications and examples.

Clustering: Basics of clustering, Sequential algorithm, Similarity and dissimilarity measures, Clustering criteria, Hierarchical algorithms, Functional optimization-based clustering, Graph clustering, Learning clustering, Clustering high dimensional data, Subspace clustering, Cluster validity measures.


Classifiers: Role of classifier in pattern recognition, Decision tree, Linear classifier, Quadratic classifier, K-nearest neighbor, Bayesian classifier. Support vector machines (SVMs) – Non-linear SVM classifier, Different kernel functions (Radial Basis function, polynomial). Artificial neural networks (ANNs) for classification and regression, Single layer perceptron, Multi-layer Perceptron, Backpropagation ANN. training set, Test set, Standardization and normalization.

Case Study: Digit recognition, Character recognition, Pattern recognition applications in bioinformatics and medical imaging.

Recommended Books:
Machine Learning (MTCS 612) L T P
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**Prerequisites:** Knowledge of basic computer science principles and skills, Familiarity with the basis of probability theory and linear algebra.

**Syllabus:**


**Clustering:** Introduction, Mixture densities, K-means clustering, Expectation-maximization algorithm, Hierarchical clustering, Choosing the number of clusters.

**Decision Trees:** Introduction, Univariate trees - Classification and regression. Pruning, Rule extraction from Trees, Learning rules from data, Multivariate trees, Basic decision tree learning algorithm, Issues in decision tree learning.

**Artificial Neural Networks:** Neurons and biological motivation, Linear threshold units, Perceptrons, Training a perceptron. Multilayer networks and back propagation, Training procedures, Tuning the network size, Bayesian view of learning, Dimensionality reduction, Learning time.

**Support Vector Machines:** Maximum margin linear separators, Quadratic programming solution to finding maximum margin separators, Kernels for learning non-linear functions.

**Bayesian Learning and Instance Based Learning:** Probability theory and bayes rule, Naive Bayes learning algorithm, Parameter smoothing, Generative vs. discriminative training, Bayes nets and markov nets for representing dependencies, K-Nearest neighbor algorithm, Case-based learning.

**Hidden Markov Model:** Introduction, Discrete Markov Processes, Three basic problems of HMM, Learning model parameters, Continues observations, The HMM with input, Model selection in HMM.

**Recommended Books:**
Introduction: Living parts - Tissues, Cells, Compartments and organelles, Molecular biology, Concept of DNA, RNA, Protein and metabolic pathway. Bioinformatics, Role of bioinformatics in biological sciences, Scope and challenges in bioinformatics.


Proteomics: Classification of proteomics, Proteomic analysis, Protein identification methods, Protein structure prediction, Applications of proteomics.

Genomics: Genomics, its classification, DNA structure prediction, DNA sequencing, genome analysis, applications of genomics, Whole genome comparison.

Sequence Analysis: File formats for biomolecular sequences. Sequence alignment - pairwise alignment, Multiple sequence alignment, Sequence similarity, BLAST and FASTA algorithms.

Applications of Bioinformatics: Phylogenetic analysis, Microarrays, DNA and protein microarrays. Bioinformatics in pharmaceutical industry - Informatics, Drug discovery and designing.

Recommended Books:
Soft Computing (MTCS614)  

Introduction: Introduction to soft computing: Definitions, Goals and importance, applications of soft computing.


Recommended Books:
Natural Language Processing (MTCS615)

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Introduction: Need for processing of natural languages, Language processing levels, Applications of NLP, Introduction to Finite State Automata and Regular expressions, Introduction to Formal languages and Context-free grammars.

Morphological Processing: Inflectional and Derivational morphology, Morphological parsing, Finite state transducers, N-gram language models.


Parsing: Basic parsing strategies, Parsing with context-free grammars, Earley algorithm, Finite-state parsing methods, Unification of feature structures.


Recommended Book:

Introduction: Mechanism of speech production, Acoustic phonetics, Digital models for speech signals, Sampling of speech signals, Quantization, Delta modulation, Differential PCM.

Speech Processing in Time Domain: Time domain parameters of Speech signal, Methods for extracting the parameters, Energy, Average magnitude, Zero crossing rate. Silence discrimination using energy and Zero crossings, Short time auto correlation function, Pitch period estimation using auto correlation function.


Recommended Books:
Research Methodology (MTCS617)

Introduction: Meaning of research, Objectives of research, Motivation in research, Types of research, Research approaches, Significance of research, Research methods versus Methodology, Research and scientific method, Importance of knowing how research is done, Research process, Criteria of good research.

Defining the Research Problem: Define research problem, Selecting the problem, Necessity of defining the problem, Technique involved in defining a problem.

Research Design: Meaning of research design, Need for research design, Features of a good design, Important concepts relating to research design, Different research designs, Basic principles of experimental designs, Developing a research plan.

Sampling Design: Census and sample survey, Implications of a sample design, Steps in sampling design, Criteria of selecting a sampling procedure, Characteristics of a good sample design, Different types of sample designs, Selecting a random sample, Random sample from an infinite universe, Complex random sampling designs.

Measurement and Scaling Techniques: Measurement in research, Measurement scales, Sources of error in measurement, Tests of sound measurement, Technique of developing measurement tools, Scaling, Meaning of scaling, Scale classification bases, Scaling techniques, Scale construction techniques.

Methods of Data Collection: Collection of primary data, Observation method, Interview method, Collection of data through questionnaires, Collection of data through schedules, Difference between questionnaires and schedules, Collection of secondary data, Selection of appropriate method for data collection, Guidelines for constructing questionnaire/schedule, Guidelines for successful interviewing, Difference between survey and Experiment.

Processing and Analysis of Data: Processing operations, Problems in processing, Elements/Types of analysis, Statistics in research, Measures of central tendency, Measures of Dispersion, Measures of asymmetry (Skewness), Measures of relationship, Simple regression analysis, Multiple correlation and regression, Partial correlation, Association in case of attributes.

Sampling Fundamentals: Need for sampling, Important sampling distributions, Central limit theorem, Sampling theory, Sandler’s A-test, Concept of standard Error, Estimation, Estimating the population mean, Estimating population proportion, Sample size and its determination, Determination of sample size through the approach based on precision rate and confidence level, Determination of sample size through the approach based on Bayesian Statistics.

Recommended Books:
Optimization Techniques (MTCS618)


Constrained Optimization Methods: Kuhn-Tucker conditions, Penalty function method, Multiplier method, Variable elimination method, Complex search method, Random search method

Advanced Optimization Methods: Linear programming, Geometric programming, Genetic algorithms, Particle swarm optimization, Ant colony optimization, Bee colony optimization.

Recommended Books:
Modeling and Simulation (MTCS619)

Introduction: Modeling concepts and definitions, System models and role of simulation, Types of models, Discrete-event simulation, Steps in a simulation study, Simulation examples.

Statistical Models in Simulation: Basics of statistical model, Discrete and continuous distribution, Poisson processes and empirical distribution, Elementary queuing theory, Queuing models involving non-exponential distribution, Queuing models involving hyper-exponential distribution, Queuing models without a poisson input, Priority discipline queuing model, Queuing networks, Application of queuing models.

Random Number Generation: Properties of random numbers, Generation of pseudo random numbers, Random variate generation, Techniques for generation of pseudo random numbers - Mid-square random number generator, Residue method, Arithmetic congruential generator, Hypothesis testing and tests for random numbers.

Input Modeling and Output analysis: Data collection, Identifying the distribution of data- histograms and Quantile-Quantile plots, Parameter estimation, Goodness of fit tests applied to simulation inputs, Output analysis and measures of performance and estimation.

Simulation Tools: Basic introduction to simulation tools - Scilab, Tortuga and Extend. Introduction to network simulators - NS2, CloudSim, Wireshark.

Recommended Books:
Neural Networks and Fuzzy Logic (MTCS620)

Introduction of Neural Networks: Basic concepts of neural networks, Human brain, Biological neuron, Model of an artificial neuron, Analogy between real and artificial neurons, Comparison between artificial neural network and biological neural network, Characteristics of neural networks, Neural network architectures, Learning methods, Activation functions, Application of ANNs.

Perception and Backpropagation: Rosenblatt’s perceptron, Perceptron learning rule, Perceptron training algorithm, ADALINE, Delta rule, MADALINE, Concept of backpropagation, Architecture of backpropagation, Method of steepest descent, Backpropagation training algorithm, Learning rate, Selection of learning rate, Momentum factor, Merits and demerits of backpropagation, Applications of backpropagation.


Recommended Books:


Project Appraisal: Technical appraisal, Environmental appraisal, Economic and market appraisal, Including market survey for forecasting future demand and sales, Managerial appraisal.

Financial Appraisal: Project cost estimation and working capital requirements, Sources of funds, Appropriate composition of funds (capital budgeting).


Need and Techniques for Comparison of Investment Proposals: Payback method, Accounting rate of return, Internal rate of return, Net present value method, Net terminal value method, Multiple internal rate of return.


Social Cost Benefit Analysis (SCBA): Meaning, Rationale, Approaches to SCBA - UNIDO approach, L-M approach, Social appraisal of projects in developing countries with special reference to India.

Implementation of Projects: Project scheduling and control, Problems of project implementation, Role of project manager, Project audit.

Case studies relevant to the course should be discussed in the class.

Recommended Books:
Human Resources Development and Training Methods (MTCS622)

Prerequisites: Basics of Human Resource management.

Syllabus:

**Human Resource Management**: Definition, Objectives, Functions, Scope, Importance of HRM in India, Human resource planning, Job analysis, Job description and Job specification, Performance appraisal methods, Compensation management, Training and development- Concepts and rationale, Need, Requisites of effective training, Policies, Its linkage to company’s strategy, Role of external agencies in training and development. Training Needs Assessment (TNA) - Meaning and purpose, TNA at different levels, Approaches, Output and methods used in TNA.

**Overview of Training Methodologies**: Logic and process of Learning, On the job training, Off the job training, lecture, Field trips, Panel discussion, Behavior modeling, Interactive demonstrations, Brain storming, Case studies, Action mazes, Incident process, Jig saws, In-baskets, Team tasks, Buzz-groups and syndicates, Agenda setting, Use of audio-visual aids in training, Computer aided instructions- Distance learning, Open learning, E-Learning- Choosing optimum training method, Technologies convergence and multimedia environment.

**Development Techniques**: Need for development - Differences between training and development, Development techniques for enhancing decision-making and interpersonal skills, Case-study, In-basket exercise; Special projects, Role plays, Finding metaphors, Simulations, Business games, Clinics, Critical incidents, Fish bowls, T-groups, Hot role plays, Data gathering, Grouping methods, Transactional analysis, Expectation analysis, Multiple management, Programme learning, Syndicate work, Games, Demonstration and practice monitoring, Coaching, Self diagnostic skills, Experience learning, Discovery learning, Brain storming, Counselling, Position rotation, Team building, and sensitivity training.

**Designing Training and Development Programs**: Organization of training and development programs, Training design, Kinds of training and development programs- Competence based and role based training, Diversity training, Choice of training and development methods, Preparation of trainers, Developing training materials, E-learning environment, Flexible learning modules, Self-development, Training process outsourcing.

**Evaluation of Training and Development**: Reasons for evaluating training and development programs, Problems in evaluation, Evaluation planning and data collection, Different evaluation frameworks, Problems of measurement and evaluation, Costing of training, Measuring costs and benefits of training program, Obtaining feedback of trainees, Methods of evaluating effectiveness of training Efforts, Kirkpatrick model of training effectiveness, Training issues resulting from the external environment and
internal needs of the company employee appraisal methods, Competency mapping, Bench marking, Entrepreneurial development, Entrepreneurial development program, Training and development of entrepreneurs.

**Emerging Trends in Training and Development:** Gamification, Team training and six sigma training, Electronic Enabled Training Systems (EETS)-Concept and types, benefits and challenges in using EETS, Concerns in implementation— Availability, Incorporation, Extension, and Learning renewals for EETS, Use of EETS and its up scalability, Follow up activities, Training and development initiatives of some selected companies from private and public sectors and MNCs, Employee counselling, Competency mapping, PCMM, Balanced score card, Appreciative inquiry, Integrating HRD with technology.

Relevant case studies to be discussed.

**Recommended Books:**