INVERTIS
UNIVERSITY BAREILLY
Established by Govt. of U.P. u/s 2F of UGC Act, 1956 vide U.P. Act 22 of 2010.

Scheme of Instruction & Syllabi of Bachelor of Technology (Computer Science and Engineering)

(With effect from academic session 2023-24)

(Dr. Gaurav Agarwal)
HOD CSE

(Dr. R.K. Shukla)
Dean Engineering & Technology

(Dr. Y D S Arya)
Vice-Chancellor

Invertis Institute of Engineering &Technology
INVERTIS UNIVERSITY

Invertis Village, Bareilly-Lucknow NH-24, Bareilly

W.e.f session 2023-2024

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STUDY AND EVALUATION SCHEME
(With effect from academic session 2023-2024)
B.Tech. in Computer Science and Engineering
YEAR IV, SEMESTER VII

S. No.	Category	Course Code	Course Title / Subjects	Hours Per Week			Evaluation Scheme		Total	Credits
				L	T	P	CA	EE		
1	Professional Elective Course	BCS- 071-075	Elective- IV	3	0	0	25	50	75	3
2	Professional Elective Course	BCS- 076-080	Elective- V	3	0	0	25	50	75	3
3	Open Elective Course	BOE- 701-705	Open Elective-II	3	0	0	25	50	75	3
PRACTICALS AND PROJECTS										
5	Project	BCS- 753	Project - II	0	0	12	50	100	150	6
6	Seminar	BCS-754	Industrial Training Viva	0	0	2	25	0	25	1
			TOTAL	9	0	14	150	250	400	16

L-Lecture, **T-** Tutorial, **P-** Practical, **CT –** Cumulative Test, **TA –**Teacher Assessment,

AT – Attendance, **E-Sem –** End Semester Marks

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STUDY AND EVALUATION SCHEME
(With effect from academic session 2023-2024)
B.Tech. in Computer Science and Engineering
YEAR IV, SEMESTER VIII

S. No.	Category	Course Code	Course Title / Subjects	Hours Per Week			Evaluation Scheme		Total	Credits
				L	T	P	CA	EE		
1	Professional Elective Course	BCS- 081-085	Elective- VI	3	0	0	25	50	75	3
2	Professional Elective Course	BCS- 086-090	Elective-VII	3	0	0	25	50	75	3
3	Professional Elective Course	BCS- 091-095	Elective- VIII	3	0	0	25	50	75	3
PRACTICALS AND PROJECTS										
4	Project	BCS- 854	Project - III	0	0	12	50	100	150	6
			TOTAL	9	0	12	125	250	375	15

L-Lecture, **T-** Tutorial, **P-** Practical, **CT –** Cumulative Test, **TA –**Teacher Assessment,

AT – Attendance, **E-Sem –** End Semester Marks

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CSE ELECTIVES

CSE ELECTIVE-IV
BCS-071 Embedded and Real Time Systems
BCS-072 Data Compression
BCS-073 Neural Networks
BCS-074 OS for Smart Devices (Android)
BCS-075 Client Server Computing

CSE ELECTIVE –V
BCS-076 Distributed Database
BCS-077 Software Quality Management
BCS-078 Simulation and Modeling
BCS-079 UNIX and Shell Programming
BCS-080 Digital Image Processing

CSE ELECTIVE –VI
BCS-081 Computational Geometry
BCS-082 Computational Complexity
BCS-083 IT in Forensics Science
BCS-084 Advanced Computer Network
BCS-085 Big Data Analysis

CSE ELECTIVE- VII
BCS-086 Advanced Computer Architecture
BCS-087 Artificial Intelligence and Expert System
BCS-088 Data Warehouse and Mining
BCS-089 Distributed System
BCS-090 IT Workshop (Sci Lab/ MATLAB)

CSE ELECTIVE-VIII
BCS-091 Cryptography and Network Security
BCS-092 .NET Framework
BCS-093 Mobile Computing
BCS-094 Machine Learning
BCS-095 Speech and Natural Language Processing

OPEN ELECTIVES

OPEN ELECTIVE-II
BOE-701 Soft Skills and Interpersonal Communication
BOE-702 Cyber Laws and Ethics
BOE-703 Human Resource Development and Organizational Behavior
BOE-704 Product Development
BOE-705 Queuing Theory and Modeling

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BCS-071	Embedded and Real Time Systems	L T P 3 0 0	3 Credits

Pre-requisites: None

Course Objectives:

CO1	Syllabus deals with issues in real time operating systems
CO2	Importance of deadlines and concept of task scheduling
CO3	Student will be able to understand and design real time operating systems which are backbone of embedded industry
CO4	Student will be able to understand Common Approaches to Real Time Scheduling
CO5	To learn about RAC

Detailed Syllabus

MODULE-I

Introduction: Embedded Systems and general purpose computer systems, history, classifications, applications and purpose of embedded systems. Core of Embedded Systems: Microprocessors and microcontrollers, RISC and CISC controllers, Big endian and Little endian processors, Application specific ICs, Programmable logic devices, COTS, sensors and actuators, communication interface, embedded firmware, other system components, PCB and passive components.

MODULE-II

Introduction: Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

MODULE-III

Real Time Scheduling: Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

Resources Sharing: Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol.

Course Outcomes: After the completion of the course the student will be able to:

CO1	To present the mathematical model of the system.
CO2	To develop real-time algorithm for task scheduling.
CO3	To understand the working of real-time operating systems and real-time database
CO4	To work on design and development of protocols related to real-time communication.
CO5	Able to implement RAC

Text Books:-

1. Real Time Systems by Jane W. S. Liu, Pearson Education Publication.
2. Embedded Systems, Rajkamal, TataMcGraw-Hill

Reference Books:

1. Mall Rajib, "Real Time Systems", Pearson Education
2. Albert M. K. Cheng , "Real-Time Systems: Scheduling, Analysis, and Verification",Wiley.

BCS-072	Data Compression	L T P 3 0 0	3 Credits

Pre-requisites: Students should have the knowledge of computer graphics

Course Objectives:

CO1	To introduce students to basic applications, concepts, and techniques of Data Compression
CO2	To develop skills for using recent data compression software to solve practical problems in a variety of disciplines.
CO3	To gain experience doing independent study and research
CO4	Student will be able to understand different types of coding

Detailed Syllabus

MODULE-I

Compression Techniques: Loss less compression, Lossy Compression, Measures of prefonnance,Modeling and coding, Mathematical *Preliminaries* for Lossless compression: A briefintroduction to information theory, Models: Physical models,Probability models, Markov models, composite source model, **Coding:** uniquely decodablecodes, Prefix codes.

The Huffman coding algorithm: Minimum variance Huffman codes, Adaptive Huffman coding:Update procedure, Encoding procedure, Decoding procedure. Golomb codes, Rice codes,Tunstall codes, Applications of Hoffman coding: Loss less image compression, Textcompression, Audio Compression.

MODULE-II

Coding a sequence, Generating a binary code, Comparison of Binary and Huffman cding,Applications: Bi- level image compression-The JBIG standard, JBIG2, Image compression.Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary.The LZ77 Approach, The LZ78 Approach, Applications: File Compression-UNIX compress.

Image Compression: The Graphics Interchange Format (GIF), Compression over Modems: V.42bits.Predictive Coding: Prediction with Partial match (ppm): The basic algorithm, The ESCAPE SYMBOL, length of context, The Exclusion Principle, The Burrows-Wheeler Transform: Moveto- front coding, CALIC, JPEG-LS, Multi-resolution Approaches, Facsimile Encoding, Dynamic Markoy Compression.

MODULE-III

Distortion criteria, Models, Scalar Ouantization: The Quantization problem, Uniform Quantizer, Adaptive Quantization, Non uniform Quantization.

Advantages of Vector Quantization over Scalar Quantization, The Linde-Buzo-Gray Algorithm, Tree structured Vector Quantizers. Structured Vector Quantizers.

Text Book:

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers

Course Outcomes: After the completion of the course the student will be able to:

CO1	Program, analyze Hoffman coding: Loss less image compression, Text compression, Audio Compression
CO2	Program and analyze various Image compression and dictionary-based techniques like static Dictionary, Diagram Coding, Adaptive Dictionary
CO3	Understand the statistical basis and performance metrics for lossless compression
CO4	Understand the conceptual basis for commonly used lossless compression techniques, and understand how to use and evaluate several readily available implementations of those techniques

BCS-073	NEURAL NETWORK	L T P 3 0 0	3 Credits

Course Objectives:

CO1	To understand the basic concepts of learning and decision trees.
CO2	To understand the neural networks and genetic algorithms
CO3	To understand the instant based learning
CO4	To understand the analytical learning and reinforced learning
CO5	To learn about SOM

Detailed Syllabus

MODULE-I

Neuro computing and Neuroscience: Historical notes, human Brain, neuron Mode l, Knowledge representation, Al and NN. Learning process: Supervised and unsupervised learning, Error correctionlearning, competitive learning, adaptation, statistical nature of the learning process.

Data processing: Scaling, normalization, Transformation (FT/FFT), principal component analysis, regression, covariance matrix, eigen values & eigen vectors. Basic Models of Artificial neurons, activation Functions, aggregation function, single neuron computation, multilayer perceptron, least mean square algorithm, gradient descent rule, nonlinearly separable problems and bench mark problems in NN.

MODULE-II

Multilayered network architecture, back propagation algorithm, heuristics for making BP algorithm performs better. Accelerated learning BP (like recursive least square, quick prop, PROP algorithm), approximation properties of RBF networks and comparison with multilayer perceptran.

MODULE-III

Recurrent network and temporal feed-forward network, implementation with BP, self organizing map and SOM algorithm, properties of feature map and computer simulation. Principal component and Independent component analysis, application to image and signal processing.

Complex valued NN and complex valued BP, analyticity of activation function, application in2D information processing. Complexity analysis of network models. Soft computing. Neuro-Fuzzy-genetic algorithm Integration.

CO1	Choose the learning techniques with this basic knowledge.
CO2	Apply effectively neural networks and genetic algorithms for appropriate applications.
CO3	Explain the different machine learning techniques
CO4	Choose and differentiate reinforcement and analytical learning techniques
CO5	Can implement about SOM

Text Books:

1. J.A. Anderson, AnIntoduction to Neural Networks, MIT
2. Hagen Demuth Beale, Neural Network Design, Cengage Learning

References:

1. R.L. Harvey, Neural Network Principles, PHI
2. Kosko, Neural Network and Fuzzy Sets, PHI

BCS-074	Android Operating System	L T P 3 0 0	3 Credits

Pre-requisites: None

Course Objectives:

CO1	To introduce Android platform and its architecture.
CO2	To learn activity creation and Android UI designing.
CO3	To be familiarized with Intent, Broadcast receivers and Internet services.
CO4	To integrate multimedia, camera and Location based services in Android Application.
CO5	To learn about publishing

Detailed Syllabus

MODULE-I

About Android , Smart phones future, **Preparing the environment-** Installing the SDK , Creating Android Emulator , Installing Eclipse , Installing Android Development Tools , Choosing which Android version to use **Android Architecture-** Android Stack, Android applications structure

MODULE 2

UI Architecture-Application context , Intents ,Activity life cycle , Supporting multiple screen sizes **User Interface Widgets**- Text controls , Button controls ,Toggle buttons , Images **Notifications and Toasts-** Parameters on Intents ,Pending intents ,Status bar notifications ,Toast notifications **Menus-** Localization, Options menu , Context menu **Dialogues-** Alert dialog , Custom dialog , Dialog as Activity

MODULE 3

Lists-Using string arrays, Creating lists, Custom lists **Location and Maps-** Google maps , Using GPS to find current location **Working of Data Storages-**Shared preferences ,Preferences activity ,Files access , SQLite database **Network Communication**-Web Services , HTTP Client , XML and JSON **Services-**Service lifecycle, Foreground service **Publishing the App**-Preparing for publishing ,Signing and preparing the graphics ,Publishing to the Android Market.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Describe Android platform, Architecture and features.
CO2	Design User Interface and develop activity for Android App.
CO3	Use Internet, Broadcast receivers and Internet services in Android App.
CO4	Use multimedia, camera and Location based services in Android App.
CO5	Understand about Publishing

Text Books:

1. Bill Philips & Brian Hardy, Android Programming: The Big Nerd Ranch Guide
2. Greg Nudelman, Android Design Patterns: Interaction Design Solutions for Developers
3. Ian G. Clifton, Android User Interface Design: Turning Ideas and Sketches into Beautifully Designed Apps
4. Ed Burnette, Hello, Android: Introducing Google's Mobile Development Platform (Pragmatic Programmers).

BCS-075	Client Server Computing	L T P 3 0 0	3 Credits

Pre-requisites: None

Course Objectives:

CO1	To introduce concept of client server computing
CO2	To apply the techniques and features of a client/server development language to construct a moderately complex client/server application
CO3	To learn the advantages of client-server systems over monolithic systems.
CO4	To understand the future and scope of client server computing
CO5	To learn about CGI

Detailed Syllabus

MODULE-I

Client/Server Computing: DBMS concept and architecture, Single system image, Client Server architecture, mainframe-centric client server computing, downsizing and client server computing, client server file system, client server development tools, advantages of client server computing. Components of Client/Server application: The client: services, request for services, RPC, windows services, fax, print services, remote boot services, Utility Services & Other Services, Example of authentication server, type of servers and their services, Network operating system, email servers.

MODULE-II

Client/Server Network: connectivity, communication interface technology, Interposes communication, wide area network technologies, network topologies (Token Ring, Ethernet, FDDI, CDDI) network management, Client-server system development: Software, Client– Server System Hardware: Network Acquisition, Secure Socket layer, Introduction to cloud architecture.

MODULE-III

Client server computing and Internet: Client server and internet, Web client server, 3 tier client server web style, CGI , the server side of web, CGI and State, SQL database servers, Middleware and federated databases, data warehouses, EIS/DSS to data mining, GroupWare Server , what is GroupWare, components of GroupWare. Client Server Systems Development: Naming, Addressing, and Location Services, Client/server security, Distributed file systems, Distributed DBMS, Data Replication, Distributed Programming, Managing a Client/Server Environment, The future of client server Computing Enabling Technologies.(Expert system, EDI, Multimedia, SET)

Course Outcomes: After the completion of the course the student will be able to:

CO1	Comprehend the basic concepts of the client-server model.
CO2	Understand how Client-Server systems work.
CO3	Improve the performance and reliability of Client Server based systems.
CO4	Identify security and ethical issues in Client Server Computing
CO5	Can aware about future of CSC

Text Books:

1. Patrick Smith &SteaveGuengerich, “Client / Server Computing”, PHI
2. Dawna Travis Dewire, “Client/Server Computing”, TMH
3. Majumdar& Bhattacharya, “Database management System”, TMH
4. Korth, Silberchatz, Sudarshan, “Database Concepts”, McGraw Hill
5. Elmasri, Navathe, S.B, “Fundamentals of Data Base System”, Addison Wesley

BCS-076	Distributed Database	L T P 3 0 0	3 Credits

Pre-requisites: students should know about the database and distribution system and how the data can distribute.

Course Objectives:

CO1	Enhanced the knowledge in the area of Distributed Database system.
CO2	Comprehend the Distributed query processing
CO3	The subject explores the ideas of Transaction management and concurrency control.
CO4	Know the parallel database system architecture.
CO5	To learn about Distributed Deadlock Detection

Detailed Syllabus

MODULE-I

Transaction and schedules: Concurrent Execution of transaction, Conflict and ViewSerializability, Testing for Serializability, Concepts in Recoverable and Cascadeless schedules.
Lock based protocols, time stamp based protocols, Multiple Granularity and MultiversionTechniques, Enforcing serializablity by Locks, Locking system with multiple lock modes, architecture for Locking scheduler.

MODULE-II

Distributed Transactions Management: Data Distribution, Fragmentation and ReplicationTechniques, Distributed Commit, Distributed Locking schemes, Long duration transactions,Moss Concurrency protocol.
Issues of Recovery and atomicity in Distributed Databases, Traditional recovery techniques, Logbased recovery, Recovery with Concurrent Transactions, Recovery in Message passing systems, Checkpoints, Algorithms for recovery line, Concepts in Orphan and Inconsistent Messages.

MODULE-III

Distributed Query Processing: Multiway Joins, Semi joins, Cost based query optimization for distributed database, Updating replicated data, protocols for Distributed Deadlock Detection, Eager and Lazy Replication Techniques.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Aware of fundamentals of Distributed Database systems.
CO2	Use the different techniques of Distributed query processing.
CO3	Set the rules over management of transaction and concurrency control.
CO4	Familiar with parallel database system architecture.
CO5	Understand Distributed Deadlock Detection

Text Books:

1. Silberschatz, orth and Sudershan, Database System Concept', McGraw Hill
2. Ramakrishna and Gehrke,' Database Management System, McGraw Hill

References:

1. Garcia-Molina, Ullman,Widom,' Database System Implementation' Pearson Education
2. Ceei and Pelagatti,'Distributed Database', TMH
3. Singhal and Shivratri, 'Advance Concepts in Operating Systems' MC Graw Hill

BCS-077	Software Quality Management	L T P 3 0 0	3 Credits

Pre-requisites: None
Course Objectives:

CO1	To make the students understand the quality management process in the development of software.
CO2	To make the students understand the importance of standards in the quality assurance process and their impact on the final product.
CO3	To understand quality control and reliability
CO4	To study ISO 9000 standard
CO5	To learn about CMM and CMMI – Six Sigma concepts.

Detailed Syllabus

MODULE - I

INTRODUCTION TO SOFTWARE QUALITY:
Software Quality – Hierarchical models of Boehm and McCall – Quality measurement – Metrics measurement and analysis – Gilb's approach – GQM Model
SOFTWAREQUALITY ASSURANCE: Quality tasks – SQA plan – Teams – Characteristics – Implementation – Documentation – Reviews and Audits

MODULE - II

QUALITY CONTROL AND RELIABILITY:
Tools for Quality – Ishikawa's basic tools – CASE tools – Defect prevention and removal – Reliability models – Rayleigh model – Reliability growth models for quality assessment

MODULE - III

QUALITY MANAGEMENT SYSTEM:
Elements of QMS – Rayleigh model framework – Reliability Growth models for QMS – Complexity metrics and models – Customer satisfaction analysis.
Quality Standards: Need for standards – ISO 9000 Series – ISO 9000-3 for software development – CMM and CMMI – Six Sigma concepts.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Distinguish between the various activities of quality assurance, quality planning and quality control
CO2	Aware of Ishikawa's basic tools
CO3	Familiar with quality standards
CO4	Familiar with basic tools and models for quality assessment
CO5	Understand about CMM and CMMI – Six Sigma concepts.

Text Books:

1. Allan C. Gillies, "Software Quality: Theory and Management", Thomson Learning, 2003.
2. Stephen H. Kan, "Metrics and Models in Software Quality Engineering", Pearson Education (Singapore) Pte Ltd., 2002.

References Books:

1. Norman E. Fenton and Shari Lawrence Pfleeger, "Software Metrics" Thomson, 2003
2. Mordechai Ben – Menachem and Garry S.Marliss, "Software Quality", Thomson Asia Pte Ltd, 2003.
3. Mary Beth Chrissis, Mike Konrad and Sandy Shrum, "CMMI", Pearson Education (Singapore) Pte Ltd, 2003.
4. ISO 9000-3 "Notes for the application of the ISO 9001 Standard to software development".

BCS-078	Simulation and Modeling	L T P 3 0 0	3 Credits

Pre-requisites: None

Course Objectives:

CO1	Define the basics of simulation modeling and replicating the practical situations in organizations
CO2	Generate random numbers and random variates using different techniques.
CO3	Develop simulation model using heuristic methods.
CO4	Analysis of Simulation models using input analyzer, and output analyzer
CO5	To learn about oriented simulation packages

Detailed Syllabus

MODULE-I

System definition and components, stochastic activities, continuous and discrete systems, system modeling, types of models, static and dynamic physical models, static and dynamic mathematical models, full corporate model, types of system study.

System simulation, why & when to simulate, nature and techniques of simulation, comparison of simulation and analytical methods, types of system simulation, real time simulation, hybrid simulation, simulation of pure-pursuit problem, single-server queuing system and an inventory problem, Monte-Carlo simulation, Distributed Lag models, Cobweb model.

MODULE-II

Simulation of continuous systems, analog vs. digital Simulation, Simulation of water reservoir system, Simulation of a servo system, simulation of an autopilot, Discrete system simulation, fixed time-step vs. even-to-even model, generation of random numbers, test for randomness, Monte-Carlo computation vs. stochastic simulation.

System dynamics, exponential growth models, exponential decay models, modified exponential growth models, logistic curves, generalization of growth models, system dynamic diagrams Introduction to SIMSCRIPT: Program, system concepts, origination, and statements, defining the telephone system model.

MODULE-III

Simulation of PERT Networks, critical path computation, uncertainties in activity duration, resource allocation and consideration. Simulation languages and software, continuous and discrete simulation languages, expression based languages, object oriented simulation, general purpose vs. application - oriented simulation packages, CSMP-III, MODSIM-III.**Course Outcomes:** After the completion of the course the student will be able to:

CO1	Describe the role of important elements of discrete event simulation and modeling paradigm.
CO2	Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.
CO3	Develop skills to apply simulation software to construct and execute goal-driven system models.
CO4	Interpret the model and apply the results to resolve critical issues in a real world environment.
CO5	Understand oriented simulation packages

. **Text Books:**

1. Geoftrey Gordon, " System Simulation", PHI
2. Jerry Banks, John S. C Barry L. Nelson David M. Nicol, "Discrete Event SystemSimulation", Pearson Education

References:

1. V P Singh, "System Modeling and simulation", New Age International.
2. Averill M. Law, W. David Kelton, "System Modeling and simulation and Analysis",TMH

BCS-079	Unix and Shell Programming	L T P 3 0 0	3 Credits

Pre-requisites: None

Course Objectives:

CO1	To enable the students to understand Features of UNIX
CO2	Understanding concept of Open Source Software
CO3	To learn basic commands of Linux
CO4	Understanding about Shell Script
CO5	To Know about Role of system administrator

Detailed Syllabus

MODULE I

Introduction to UNIX: Features of UNIX Operating System,UNIX system organization (the kernel and the shell), Files and directories, Library Functions and system calls, Editors (vi and ed). Introduction to the Concept of Open Source Software, Linux, Linux Architecture, Linux file system (inode, Super block, Mounting and Un- mounting), Essential Linux Commands (grep, fgrep, egrep, make, nmake, gmake, rcs, cvs, sccs, ar, tar, cpio, pax, RPM, autoconfig. Users and permissions- chmod, su, mount, df, fsck, dd, etc), Kernel, Process Management in Linux, Signal Handling, System call, System call for Files, Processes and Signals.

MODULE-II

Programming in shell script: Types of shells, Shell Meta characters, Shell variables, Shell scripts, Shell commands, the environment, Integer arithmetic and string manipulation, Special command line characters, Decision making and loop control, controlling terminal input, trapping signals, arrays. I/O Redirection and Piping, Vi and Emacs editor, Shell control statements, Find, Shell Meta- characters, Shell Scripts, Shell keywords, Shell Procedures and Reporting, Handling documents, scheduling of processes at command, cron, batch commands, Command line argument, Background processes, process synchronization, Sharing of data, user-id, group-id.

MODULE-III

Network Administration: System administration Common administrative tasks, identifying administrative files – configuration and log files, Role of system administrator, Managing user accounts- adding & deleting users, changing permissions and ownerships, Creating and managing groups, modifying group attributes, Temporary disable user's accounts, creating and mounting file system, checking and monitoring system performance file security & permissions, becoming super user using su. **Case study-** Amoeba, Corba, Mac, Eros, Ubuntu.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Ability to remember and understand factual knowledge relevant to system administration tools and technologies
CO2	Ability to write how-to documents, white papers, tutorials guiding other system administrators or users step-by-step through system administration tasks
CO3	Ability to identify abnormal behavior in a computing system, make hypothesis on how to address it, and implement solutions
CO4	Case study of Amoeba, Corba, Mac, Eros, Ubuntu
CO5	Aware about Role of system administrator

Text Book:

1. "Unix Programming Environment" The Kernighan and Pike Prentice – Hall of India

Reference Book:

1. "Unix –Shell Programming" Kochar

BCS-080	Digital Image Processing	L T P 3 0 0	3 Credits

Pre-requisites: None

Course Objectives:

CO1	To learn the advanced concepts of image processing and its implementation.
CO2	Enhance the visual quality of given grey/color image using well known transformations and filters.
CO3	Distinguish between lossy and lossless image compression prototypes.
CO4	Demonstrate the use of MATLAB to create correlative image processing applications
CO5	To learn about Max and Min filters

Detailed Syllabus

MODULE I

Introduction and Fundamentals Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization. Image Enhancement in Frequency Domain Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Filters – Low-pass, High-pass; Correspondence Between Filtering in Spatial and Frequency Domain; Smoothing Frequency Domain Filters – Gaussian Lowpass Filters; Sharpening FrequencyDomain Filters – Gaussian Highpass Filters; Homomorphic Filtering.

MODULE II

Image Enhancement in Spatial Domain Introduction; Basic Gray Level Functions – Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening – The Laplacian.

MODULE III

Image Restoration A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering – Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering – Bandpass Filters; Minimum Mean-square Error Restoration.

Course Outcomes: After the completion of the course the student will be able to:

CO1	To acquire the knowledge of soft computing and hard computing
CO2	To develop skill in soft computing methodology
CO3	To acquire the knowledge of the fuzzy Neural network and Genetic Language
CO4	To analyze and optimized the problem of real-life applications
CO5	Able to explain Max and Min filters

Text Books:

1. Digital Image Processing 2nd Edition, Rafael C. Gonzalvez and Richard E. Woods. Published by: Pearson Education.
2. Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: John Wiley and Sons, NY.
3. Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall, Upper Saddle River, NJ.
E

BOE-701	Soft Skills and Interpersonal Communication	L T P 3 0 0	3 Credits

Pre-requisites: students should have basic knowledge of English

Course Objectives:

CO1	To understand the fundamental soft skills and of their practical social and workplace usage.
CO2	To encourage the all round development of students by focusing on soft skills
CO3	To expose students to right attitudinal and behavioral aspects and to build the same through activities
CO4	To develop and nurture the soft skills of the students through individual and group activities.
CO5	To Learn about the time management

Detailed Syllabus

MODULE I

Soft Skills: An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development. **Self-Discovery:** Discovering the Self; **Positivity and Motivation:** Developing Positive Thinking and Attitude, **Interpersonal Communication:** Interpersonal relations, communication models, process and barriers listening skills; essential formal writing skills; corporate communication styles – assertion, persuasion, negotiation.

MODULE II

Interview Skills: Interviewer and Interviewee – in-depth perspectives. **Presentation Skills:** Types, Content, Audience Analysis, Etiquette and Manners – Social and Business. **Public Speaking:** Skills, Methods, Strategies and Essential tips for effective public speaking. Group Discussion: Importance, Planning, Elements, Skills assessed; Effectively disagreeing, Initiating, Summarizing and Attaining the Objective. **Non-Verbal Communication:** Importance and Elements; Body Language. Teamwork and Leadership Skills. **Time Management–** Concept, Essentials, Tips.

MODULE III

Personality Development – Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills, **Decision-Making and Problem-**Solving Skills: Meaning, Types and Models, Group and Ethical Decision-Making, **Stress Management:** Stress - Definition, Nature, Types, Symptoms and Causes; Stress Analysis Models and Impact of Stress; Measurement and Management of Stress, **Leadership and Assertiveness Skills:** A Good Leader; Leaders and Managers; Leadership Theories; Types of Leaders; Leadership Behavior, Assertiveness Skills. **Emotional Intelligence:** Meaning, History, Features, Components, Intrapersonal and Management Excellence; Strategies to enhance Emotional Intelligence.

.**Course Outcomes:** After the completion of the course the student will be able to:

CO1	Effectively communicate through verbal/oral communication and improve the listening skills
CO2	Actively participate in group discussion / meetings / interviews and prepare & deliver presentations
CO3	Become more effective individual through goal/target setting, self motivation and practicing creative thinking.
CO4	Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, stress management.
CO5	Can use time implement

Text Books:

1 Managing Soft Skills for Personality Development – edited by B.N.Ghosh, McGraw Hill India, 2012.
2. English and Soft Skills – S.P.Dhanavel, Orient Blackswan India, 2010.

BOE-702	Cyber Law and Ethics	L T P 3 0 0	3 Credits

Pre-requisites: students should know about the security of any system.

Course Objectives:

CO1	To Understand, Explore, And Acquire A Critical Understanding Cyber Law
CO2	Develop Competencies for dealing with Frauds and Deceptions (Confidence Tricks, Scams) And Other Cyber Crimes
CO3	Knowledge about Information Security policies
CO4	To understand the types of crime and precautions
CO5	To aware about Cyber-Stalking

Detailed Syllabus

MODULE I

Introduction to Computer Security: Definition, Threats to security, Government requirements, Information Protection and Access Controls, Computer security efforts, Standards, Computer Security mandates and legislation, Privacy considerations, International security activity.

MODULE II

Information security policies and procedures: Corporate policies- Tier 1, Tier 2 and Tier3 policies -process management-planning and preparation-developing policies-asset classification policy developing standards. cyber-crime, types of cyber-crimes, Digital evidence, nature of digital evidence, precautions while dealing with digital evidence

MODULE III

Information security: fundamentals-Employee responsibilities- information classification- Information handling- Tools of information security- Information processing-secure program administration, **Case Study on Cyber Crimes:** Harassment Via E-Mails, Email Spoofing (online a method of sending e-mail using a false name or e-mail address to make it appear that the e-mail comes from somebody other than the true sender), Cyber Pornography (Exm.MMS), Cyber-Stalking.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Make Learner Conversant with The Social and Intellectual Property Issues Emerging From 'Cyberspace.
CO2	Explore the Legal and Policy Developments in Various Countries to Regulate Cyberspace
CO3	Develop the Understanding of Relationship Between Commerce and Cyberspace
CO4	Make Study on Various Case Studies on Real Time Crimes.
CO5	Can Explain Cyber-Stalking

Text Books:

1. K.Kumar," Cyber Laws: Intellectual property & E Commerce, Security",1 st Edition, Dominant Publisher,2011.
2. Rodney D. Ryder, "Guide To Cyber Laws", Second Edition, Wadhwa And Company, New Delhi, 2007.
3. Information Security policy &implementation Issues, NIIT, PHI.

References:

1. Vakul Sharma, "Handbook Of Cyber Laws" Macmillan India Ltd, 2 nd Edition,PHI,2003.
2. Justice Yatindra Singh, " Cyber Laws", Universal Law Publishing, 1 st Edition,New Delhi, 2003.
3. Sharma, S.R., "Dimensions Of Cyber Crime", Annual Publications Pvt. Ltd., 1st Edition, 2004.
4. Augastine, Paul T.," Cyber Crimes And Legal Issues", Crecent Publishing Corporation, 2007.

BOE-703	Human Resource Development and Organizational Behavior	L T P 3 0 0	3 Credits

Pre-requisites: None

Course Objectives:

CO1	To learn about HRD marco and micro perspective
CO2	Knowledge about Instructional Technology for HRD
CO3	To learn various training methods
CO4	To learn Strategies of Training Programs
CO5	To learn about Team Development

Detailed Syllabus

MODULE I

HRD-Macro Perspective: HRD Concept, Origin and Need, HRD as a Total System; Approaches to HRD; Human Development and HRD; HRD at Macro and Micro Climate. **HRD–Micro Perspective:** Areas of HRD; HRD Interventions Performance Appraisal, Potential Appraisal, Feedback and Performance Coaching, Training, Career Planning, OD or Systems Development, Rewards, Employee Welfare and Quality of Work Life and Human Resource Information; Staffing for HRD: Roles of HR Developer; Physical and Financial Resources for HRD; HR Accounting; HRD Audit, Strategic HRD

MODULE II

Instructional Technology for HRD: Learning and HRD; Models and Curriculum; Principles of Learning; Group and Individual Learning; Transactional Analysis; Assessment Centre; Behavior Modeling and Self-Directed Learning; Evaluating the HRD, **Human Resource Training and Development:** Concept and Importance; Assessing Training Needs; Designing and Evaluating T&D Programs; Role, Responsibilities and challenges to Training Managers.

MODULE III

Training Methods: Training with in Industry (TWI): On the Job & Off the Job Training; Management Development: Lecture Method; Role Play; In-basket Exercise; Simulation; Vestibule Training; Management Games; Case Study; Programmed Instruction; Team Development; Sensitivity Training; Globalization challenges and Strategies of Training Program, Review on T&D programs in India.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Explore the roles and responsibilities of HRD
CO2	To analyze various types of training
CO3	Explore the roles and responsibilities to training managers
CO4	To Explore the Physical and Financial Resources for HRD
CO5	Explain Team Development

Text Books:

1. Nadler, Leonard: Corporat Human Resource Development, Van Nostrand Reinhold, ASTD, New York.
2. Rao, T.V and Pareek, Udai: Designing and Managing Human Resource Systems, Oxford IBH Pub. Pvt.Ltd., New Delhi, 2005.
3. Rao, T.V: Readings in HRD, Oxford IBH Pub. Pvt. Ltd., New Delhi, 2004.

BOE-704	Product Development	L T P 3 0 0	3 Credits

Pre-requisites: None

Course Objectives:

CO1	To understand basic concepts of product design, product features
CO2	Ability to coordinate multiple, interdisciplinary tasks in order to achieve a common objective.
CO3	Competence with a set of tools and methods for product design and development.
CO4	Reinforcement of specific knowledge from other courses through practice and reflection in an action-oriented setting.
CO5	Introduction about ROBUST DESIGN

Detailed Syllabus

MODULE I

Introduction: Need for IPPD, strategic importance of product development – integration of customer, designer, material supplier and process planner, Competitor and costumer – behavior analysis Understanding customer – promoting customer understanding – involve customer in development and managing requirements – Organization – process management and improvement – Plan and establish product specification.

MODULE II

Concept generation and concept selection: Activity of concept generation – Structured approaches – Five step Method: clarify – Search-Externally and internally – explore systematically – reflect on the solutions and processes – Concept selection – Integral part of PDD process-methodology – benefits. Investigation of customer needs –conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.

MODULE III

Product Architecture: Implications – Product change – variety – component standardization – Product performance – manufacturability Industrial design: Assessing the need for industrial design, impact – design process Integrate design process – assessing the quality of industrial design. ROBUST DESIGN – introduction, various steps in robust design.

Text Books:

1. Kari T.Ulrich and Steven D.Eppinger,"Product Design and Development", McGraw-Hill International Edns. 1999.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Students will able to design some products for the given set of applications
CO2	knowledge gained through prototyping technology will help the student to make a prototype of a problem
CO3	Evaluate the role of design in product development, and the ability to address costs issues through better design decisions
CO4	Understand and discuss key concepts and principles concerning the activities and competencies involved in new product development.
CO5	Explain ROBUST DESIGN

BOE-705	Queuing Theory and Modelling	L T P 2 1 0	3 Credits

Pre-requisites: None

Course Objectives:

CO1	To provide the ideas of formulating mathematical modeling
CO2	To give students a firm foundation in the advanced optimization techniques
CO3	Introduction to Queuing Systems and Notation.
CO4	Understand and compute quantitative metrics of performance for queuing systems.
CO5	To learn about maintenance and replacement systems

Detailed Syllabus

MODULE I

Systems, modelling, general systems theory, concept of simulation, simulation as a decision making tool, types of simulation. Pseudo random numbers, methods of generating random variables, discrete and continuous distributions, testing of random numbers, concepts of Queuing theory, The simplex computational procedure, development of minimum feasible solution, a first feasible solution using slack variables, the artificial basis technique. Two phase method and Charnels Method with artificial variables.

MODULE II

The duality problem of linear programming and its economic interpretation, transportation and assignment problems. Queueing Theory: Introduction of the queuing system, Various components of a queueing system. Pure Birth Process; Pure Death Process, Birth and Death Process, M/M/1, M/M/1 (Generalized), M/M/1/FCFS/K/∞, M/M/C, Erlang's loss model.

MODULE III

Case studies: Development of simulation models using simulation language studied for systems like queuing systems, Production systems, Inventory systems, maintenance and replacement systems and Investment analysis.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Design of experts system.
CO2	Study to design a model and simulate it for any real life complex problem.
CO3	Study of queuing model theory that is used to model and simulate real life problem.
CO4	Study to design a model and simulate it for any real life complex problem.
CO5	Explain about maintenance and replacement systems

Text Books:

1. Hillier, F.S. and Liebermann, G.J. (2009): Introduction to Operations Research; 9th Edition, McGraw Hill.
2. Gass, S.I. (2010): Linear Programming, Methods and Applications, 5th Edition, Dover Books.

BAS-701	Genetics Science	L T P 2 1 0	3 Credits

Pre-requisites: None

Course Objectives:

CO1	To discuss the genetic basis of cancer and implications for clinical diagnosis, prognostication and disease monitoring
CO2	To obtain basic knowledge of chromosomal abnormalities in tumour cells, methods for detection and their clinical significance
CO3	To Learn Induction of Mutation
CO4	To learn Structural alteration in chromosome
CO5	To discuss Detection of mutation in plants

Detailed Syllabus

MODULE - I

Linkage and Crossing over: Concept of linkage and factors affecting true strength of Linkage. Theories of crossing over at chromosomal & molecular level (Chiasmata, Precocity, Bellings, Whitehouse and Holiday model, Sobel's concept. Measurement of linkage from F2 and back cross data, Genetic map of chromosomes, double crossing over, interference and coincidence.

MODULE - II

Mutation: Types of mutation, mutation rate, Base substitution (transition and transversion) Frame shift mutation. Mechanism of gene mutation. **Induction of mutation:** Target theory, Peroxide formation, UV rays and Thymine dimer, Incorporation of base analogue. Tautomerization and chemical alteration in nucleic acids. Detection of mutation in plants and Drosophila.

MODULE - III

Polyploidy: Classification, cytological and genetical method of identification of autopolyploids and allopolyploids. Classification, method of production, identification and meiotic behaviour of aneuploids (Monosomics, Nullisomics and trisomics). **Structural alteration in chromosome:** Deletion, Duplication, Inversion & Translocation, hetrozygote.

Text Books:

1. Nussbaum, R. L. et al., Thompson & Thompson Genetics in Medicine.
2. Peter S. Harper, Practical genetic counselling.
3. Peter D. Turnpenny, Sian Ellard, Emery's elements of medical genetics.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Describe the genetic basis of cancers and explain the implications for clinical diagnosis, prognostication and disease monitoring
CO2	Distinguish the different types of genetic changes in cancers and their clinical applications
CO3	Explain Mutation and its types
CO4	Discuss the evidence for genetic susceptibility of cancers
CO5	Discuss the concept of Polyploidy

BCS-081	Computational Geometry	L T P 3 0 0	3 Credits

Pre-requisites: students should know about the computer graphics.

Course Objectives:

CO1	Introduce rigorous algorithmic analysis for problems in Computational Geometry.
CO2	Discuss applications of Computational Geometry to graphical rendering.
CO3	Introduce the notions of Voronoi diagrams and Delaunay Triangulations.
CO4	Develop expected case analyses for linear programming problems in small dimensions.
CO5	Discuss Trapezoidal maps

Detailed Syllabus

MODULE I

Introduction, Application domains of computational geometry, Limitations of computational geometry, Convex hulls, Jarvish March method, Graham's scan method, Planar Graphs, Regions, Dual of a graph, Geometric Dual, Triangulations: polygon triangulations, guarding, Art Gallery problem.

MODULE-II

Voronoi diagrams: construction and applications, Delauney triangulations, Divide and conquer approach, Flip and incremental algorithms, duality of Voronoi diagrams, min-max angle properties. Geometric searching: point-location, Trapezoidal maps, Fractional cascading, Finger trees, Segment trees, Interval trees, Visibility: weak and strong.

MODULE-III

Arrangements of lines: zone theorem, Combinatorial geometry: Ham-sandwich cuts. Sweep techniques: plane sweep for segment intersections, Fortune's sweep for Voronoi diagrams, Topological sweep for line arrangements.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Analyze randomized algorithms for small domain problems.
CO2	Use line-point duality to develop efficient algorithms.
CO3	Apply geometric techniques to real-world problems in graphics.
CO4	Solve linear programs geometrically.
CO5	Use Jarvish March method

Text Books:

1. Franco P. Preparata and Michael Ian Shamos, "Computational Geometry: An Introduction", Springer.
2. Mark de Berg, Marc van Kreveld, Mark Overmars, and Otfried Cheong, "Computational Geometry: Algorithms and Applications", Springer.

Reference Books:

1. Ketan Mulmuley, "Computational Geometry: An Introduction Through Randomized Algorithms", Prentice-Hall.
2. Joseph O'Rourke, "Computational Geometry in C", Cambridge University Press.

BCS-082	Computational Complexity	L T P 3 0 0	3 Credits

Pre-requisites: students should know about that how to calculate the complexity of the programs.

Course Objectives:

CO1	To introduce the fundamentals of computational complexity theory.
CO2	To discuss basic concepts such as computational models, computational complexity measures (e.g., time and space complexity measures), complexity classes, reducibility and completeness notions.
CO3	To familiarize the concepts of randomized and approximation algorithms and discuss the related complexity classes
CO4	Understand Communication complexity
CO5	Understand Counting problems

Detailed Syllabus

MODULE-I

Models of Computation, resources (time and space), algorithms, computability, complexity. Complexityclasses, P/NP/PSPACE, reduction s, hardness, completeness, hierarchy, relationships between complexity classes.

MODULE-II

Randomized computation and complexity; Logical characterizations, incompleteness; Approximability. Circuit complexity, lower bounds; Parallel computation and complexity; Counting problems; Interactiveproofs.

MODULE-III

Probabilistically checkable proofs; Communication complexity; Quantum computation

Text Books:

1 Christos H. Papadimitriou., Combinatorial Optimization: Algorithms and Complexity Prentice-Hall

Reference Books:

1. SanjeevArora and Boaz Barak , Complexity Theory: A Modern Approach, Cambridge University Press.
2. Steven Homer, Alan L. Selman, Computability and Complexity Theory, Springer.

Course Outcomes: After the completion of the course the student will be able to:

CO1	The students will able to determine whether a problem is computable, and prove that some problems are not computable.
CO2	The students will able to categorize problems into appropriate complexity classes
CO3	The students will able to classify problems based on their computational complexity using reductions
CO4	The students will able to analyze optimization problems using the concept of interactive proofs
CO5	The students will able to analyze Counting problems

BCS-083	IT in Forensics Science	L T P 3 0 0	3 Credits

Pre-requisites: Students should know about the symmetric and non symmetric technique.

Course Objectives:

CO1	To understand the nature, meaning and significance of forensic science and its relation to crime and criminal.
CO2	To Understand the knowledge of Biometrics
CO3	To learn the Principles of Steganography
CO4	To understand Watermarking and Copyright Protection
CO5	To understand the concept of Data recovery

Detailed Syllabus

MODULE-I

Overview of Biometrics: Biometric Identification, Biometric Verification, Biometric Enrollment, Biometric System Security. Authentication and Biometrics: Secure Authentication Protocols, Access Control Security Services, Matching Biometric Samples, Verification by humans. Common biometrics: Finger Print Recognition, Face Recognition, Speaker Recognition, Iris Recognition, Hand Geometry, Signature Verification. Introduction to Information Hiding: Technical Steganography, Linguistic Steganography, Copy Right Enforcement, Wisdom from Cryptography.

MODULE-II

Principles of Steganography: Framework for Secret Communication, Security of Steganography System, Information Hiding in Noisy Data, Adaptive versus non-Adaptive Algorithms, Active and Malicious Attackers, Information hiding in Written Text. A Survey of Steganographic Techniques: Substitution systems and Bit Plane Tools, Transform Domain Techniques: - Spread Spectrum and Information hiding, Statistical Steganography, Distortion Techniques, Cover Generation Techniques. Steganalysis: Looking for Signatures: - Extracting hidden Information, Disabling Hidden Information.

MODULE-III

Watermarking and Copyright Protection: Basic Watermarking, Watermarking Applications, Requirements and Algorithmic Design Issues, Evaluation and Benchmarking of Watermarking system. Computer Forensics, Rules of evidence, Evidence dynamics, Evidence collection, Data recovery, Preservation of digital evidence, surveillance tools for future warfare, cyber crime, types of cyber crimes, Digital evidence, nature of digital evidence, precautions while dealing with digital evidence.

Course Outcomes: After the completion of the course the student will be able to:

CO1	List the services performed by a crime investigators, crime laboratories and medical examiners.
CO2	Review the history and development of the forensic science sub-disciplines covered.
CO3	Discuss the role of a forensic scientist.
CO4	Familiarize oneself with the organization of a forensic science laboratory.
CO5	Students will able to recover data by using various techniques

Text Book:

1. Katzendbisser, Petitcolas, " Information Hiding Techniques for Steganography and Digital Watermarking", Artech House.

BCS-084	Advanced Computer Network	L T P 3 0 0	3 Credits

Pre-requisites: students should have the basic knowledge of computer network.

Course Objectives:

CO1	To build an understanding of the fundamental concepts of computer networking
CO2	To introduce the basic taxonomy and terminology of computer networking.
CO3	To introduce advanced networking concepts.
CO4	To understand various Network Layer Protocol
CO5	To understand the concept of Socket Interface

Detailed Syllabus

MODULE-I

Introduction: Uses of computer Networks, Reference Models, Channel allocation problem, Multiple access Protocols, Ethernet, Wireless LANs, Broadband Networks, Structure Overlay Networks, P2P Computing

MODULE-II

Network Layer Design Issues, Addressing: Internet Address, Classful Addressing, Subnetting, Supernetting, Classless Addressing, dynamic Address Configuration, Network Layer Protocol: ARP, ICMP, IPV4 and IPV6.

MODULE-III

Transport Service, Elements of transport protocol, Process to Process Delivery, Internet Transport Protocols UDP, Internet Transport Protocols TCP, Performance Issues. The Application Layer: Server Model, Socket Interface: sockets, Connectionless interactive server, Connection-Oriented concurrent server.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Enables the students to visualize the different aspects of networks, protocols and network design models.
CO2	Enables the students to examine various Data Link layer design issues and Data Link protocols.
CO3	Enables the students to analyze and compare different LAN protocols. Level 2,4
CO4	Enables the students to compare and select appropriate routing algorithms for a network
CO5	Enables the students to use Socket Interface

Text Books:

1. Computer Networks and Internets - Douglas E. Comer; PE.
2. Communication Networks - Leon-Garcia-Widjaja; TMH.
3. Internetworking with TCP / IP - Douglas E .Comer; PE.
4. TCP/IP protocol suite - ForouzanBehrouz A; TMH.
5. Computer Networks – Andrew S. Tannenbaum; PHI.
6. Data and Computer Communication - William Stallings; PHI

BCS-085	Big Data Analysis	L T P 3 0 0	3 Credits

Pre-requisites: Students should know about the data base.
Students should know about the data mining.

Course Objectives:

CO1	Provide an overview of Apache Hadoop
CO2	Provide HDFS Concepts and Interfacing with HDFS
CO3	Understand Map Reduce Jobs
CO4	Apply analytics on Structured, Unstructured Data.
CO5	Understand the analysis of Big data

Detailed Syllabus

MODULE-I

Introduction – distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix- Vector Multiplication by Map Reduce INTRODUCTION HADOOP Big Data – Apache Hadoop & Hadoop EcoSystem – Moving Data in and out of Hadoop.

MODULE 2

HADOOP ARCHITECTURE Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance

MODULE 3

HADOOP ECOSYSTEM AND YARN Hadoop ecosystem components - Schedulers – Fair and Capacity, Hadoop 2.0 New Features Name Node High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN, Hive Architecture and Installation, Comparison with Traditional Database, HiveQL - Querying Data - Sorting And Aggregating.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Analyze Infosphere BigInsights Big Data Recommendations.
CO2	Manage Job Execution in Hadoop Environment
CO3	Develop Big Data Solutions using Hadoop Eco System
CO4	Apply Machine Learning Techniques using R.
CO5	Analyze Big Data by using various techniques

Text Books:

1. The Big Data-Driven Business: How to Use Big Data to Win Customers, Beat Competitors, and Boost Profits Russell Glass,Sean Callahan.
2. Data Fluency: Empowering Your Organization with Effective Data Communication, Zach Gemignani,Chris Gemignani,Richard Galentino.
3. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data,Gebundene Ausgabe,von EMC Education Services (Herausgeber)
4. Hadoop: The Definitive GuideAuthor: Tom White Publisher: Hadoop: The Definitive Guide
5. Hadoop in Action Author: Chuck Lam Publisher: Manning

BCS-086	Advanced Computer Architecture	L T P 3 0 0	3 Credits

Pre-requisites: None

Course Objectives:

CO1	To make students know about the Parallelism concepts
CO2	To give the students an elaborate idea about the high-performance memory systems
CO3	To introduce the advanced processor architectures to the students
CO4	To make the students know about the importance of multiprocessor and multi computers and different programming models
CO5	To understand Memory hierarchy technology

Detailed Syllabus

MODULE-I

Introduction and performance: Evolution of computer Architecture, Architectural classification schemes and parallel computing models, conditions of parallelism, program flow mechanisms, performance evaluation and speedup performance laws, RISC and CISC processors, VLIW architecture

MODULE-II

Pipelining: Instruction level parallelism, principles of linear and nonlinear pipelining Techniques, Hazards, Instruction and arithmetic pipeline design, super scalar and super pipeline design.
Memory hierarchy technology: Cache memory organizations and performance issues; multilevel caches, Virtual memory technology and memory management.

MODULE-III

SIMD processor: SIMD array processor, Interconnection networks, SIMD matrix multiplication algorithm, vector processor architecture and instruction types.
MIMD multiprocessor: shared and distributed memory architectures, cache coherence and Synchronization.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Demonstrate concepts of parallelism in hardware/software.
CO2	Discuss memory organization and mapping techniques
CO3	Describe architectural features of advanced processors.
CO4	Interpret performance of different pipelined processors.
CO5	Discuss Memory hierarchy technology

Text Books:

1.Kai Hwang, “Advanced Computer Architecture,” McGraw-Hill.
2. Hwang and Briggs, “Computer Architecture and Parallel Processing,” McGraw Hill.

Reference Books:

1. Pipelined and Parallel processor design by Michael J. Fiynn – 1995, Narosa.
2. Computer Architecture A quantitative approach 3rd edition John L. Hennessy & David A. Patterson Morgan Kufmann (An Imprint of Elsevier)

BCS-087	Artificial Intelligence and Expert System	L T P 3 0 0	3 Credits

Pre-requisites: None

Course Objectives:

CO1	To learn about the knowledge of intelligent agents
CO2	To learn about machine learning
CO3	Understand Bayesian network and fuzzy logic in case of uncertainty.
CO4	To understand HMM model
CO5	To understand Uniformed search strategies

Detailed Syllabus

MODULE-I

Introduction: Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Possessing.

Introduction to Search: Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha – Betapruning.

MODULE-II

Knowledge Representation & Reasoning: Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.

MODULE-III

Machine Learning: Supervised and unsupervised learning, Decision trees, Statistical learning models, learning with complete data - Naive Bayes models, Learning with hidden data –EM algorithm, Reinforcement learning, Expert systems architecture. Generalities about expert systems. Conceptual infrastructure of expert systems.

Course Outcomes: After the completion of the course the student will be able to:

CO1	To apply the knowledge of intelligent agents and the heuristic search techniques.
CO2	To analyze the role of knowledge representation techniques such as propositional and predicate logic in AI.
CO3	To apply the Bayesian network and fuzzy logic in case of uncertainty.
CO4	To analyze different types of planning and learning techniques.
CO5	To apply Uniformed search strategies

Text Books:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", PearsonEducation.
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill

Reference Books:

1. E Charniak and D McDermott, "Introduction to Artificial Intelligence", PearsonEducation.
2. Dan W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall of India.

BCS-088	Data Warehouse and Mining	L T P 3 0 0	3 Credits

Pre-requisites: None

Course Objectives:

CO1	To learn a basic concept of Data warehousing.
CO2	To learn various models of data warehousing
CO3	To understand the concept of data mining
CO4	To understand the concept of Data Compression. Statistical measures in large Databases
CO5	To understand basic OLAP functions

Detailed Syllabus

MODULE-I

Data Warehousing: Overview, Definition, Delivery Process, Difference between Database System and Data Warehouse, Multi-Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept hierarchy, 3 Tier Architecture, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Testing Data Warehouse

MODULE-II

Data Mining: Overview, Definition & Functionalities, Data Processing, Form of Data Preprocessing, Data Cleaning: Missing Values, Noisy Data,(Binning, Clustering, Regression, Computer and Human inspection),Inconsistent Data, Data Integration and Transformation. Data Reduction: Data Cube Aggregation, Dimensionality reduction, Data Compression. Statistical measures in large Databases. Measuring Central Tendency, Measuring Dispersion of Data, Graph Displays of Basic Statistical class Description, Mining Association Rules in Large Databases, Association rule mining, Mining Single-Dimensional Boolean Association rules from Transactional Databases, Apriori-Algorithm, Mining Multilevel Association rules from Transaction Databases and Mining Multi-Dimensional Association rules from Relational Databases

MODULE-III

Classification and Predictions: What is Classification & Prediction, Issues regarding Classification and prediction, Decision tree, Bayesian Classification, Classification by Back propagation, Multilayer feed- forward Neural Network, Back propagation Algorithm, Classification methods K-nearest neighbor classifiers, Genetic Algorithm. Cluster Analysis: Data types in cluster analysis, Categories of clustering methods, Partitioning methods. Hierarchical Clustering- CURE and Chameleon, Grid Based Methods- STING, CLIQUE, Model Based Method –Statistical Approach, Neural Network approach, Outlier Analysis

Text Books:

1. Alex Berson, Stephen Smith,"Data Warehousing, Data Mining & OLAP" TMH Publication.
2. Jiawei Han, Micheline Kamber, "Data Mining Concepts & Techniques" Elsevier

Reference Books:

1. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World: A Practical Guide for Building Decision Support Systems, Pearson Education

2. Mallach,"Data Warehousing System", McGraw –Hill3. M.H. Dunham," Data Mining: Introductory and Advanced Topics" Pearson Education

Course Outcomes: After the completion of the course the student will be able to:

CO1	Analyze the basic functions of data warehouse and data mining.
CO2	Design data warehouse with dimensional modelling and apply different operations.
CO3	Analyze OLAP functions
CO4	Analyze appropriate data mining algorithms to solve real world problems
CO5	Evaluate different data mining techniques like classification, prediction.

BCS-089	Distributed System	L T P 3 0 0	3 Credits

Pre-requisites: None

Course Objectives:

CO1	To introduce fundamental principles of distributed systems, technical challenges and key design issues.
CO2	To impart knowledge of the distributed computing models, algorithms and the design of distributed system
CO3	To understand the concept of deadlock
CO4	To understand the Mechanism for building distributed file systems
CO5	To understand concept of Distributed Mutual Exclusion

Detailed Syllabus

MODULE-I

Characterization of Distributed Systems: Introduction, Examples of distributed Systems, Resource sharing and the Web Challenges. Architectural models, Fundamental Models. **Theoretical Foundation for Distributed System**: Limitation of Distributed system, absence of global clock, shared memory, Lamport's Logical clock, Vectors clocks.

Concepts in Message Passing Systems: causal order, total order, Techniques for Message Ordering, Causal ordering of messages, global state, termination detection.

Distributed Mutual Exclusion: Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, Token based and non token based algorithms, performance metric for distributed mutual exclusion algorithms.

MODULE-II

Distributed Deadlock Detection: system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized dead lock detection, distributed dead lock detection,path pushing algorithms, edge chasing algorithms. **Agreement Protocols**: Introduction, System models,classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Solution to Byzantine Agreement problem, Application of Agreement problem, Atomic Commit in Distributed Database system.

Distributed Resource Management: Issues in distributed File Systems, Mechanism for building distributed file systems, Design issues in Distributed Shared Memory, Algorithm for Implementation of Distributed Shared Memory**.**

MODULE-III

Failure Recovery in Distributed Systems: Concepts in Backward and Forward recovery, Recovery in Concurrent systems, obtaining consistent Checkpoints, Recovery in Distributed Database Systems.

Fault Tolerance: Issues in Fault Tolerance, Commit Protocols, Voting protocols, Dynamic voting protocols.

Transactions and Concurrency Control: Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering.

Distributed Transactions: Flat and nested distributed transactions, Atomic Commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery. Replication: System model and group communication, Fault - tolerant services, highly available services, Transactions with replicated data.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Illustrate the mechanisms of inter process communication in distributed system
CO2	Compare the concurrency control mechanisms in distributed transactional environment
CO3	Outline the need for mutual exclusion and election algorithms in distributed systems
CO4	Can apply the concept of distributed transaction
CO5	Can apply the concept of Dynamic voting protocols

Text Books:

1. Singhal&Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill
2. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson Education

Reference Books:

1. Tenanuanbaum, Steen," Distributed Systems", PHI
2. Gerald Tel, "Distributed Algorithms", Cambridge University Press.

BCS-090	IT Workshop (Sci Lab/ MATLAB)	L T P 3 0 0	3 Credits

Pre-requisites: None

Course Objectives:

CO1	To Impart the Knowledge to the students with MATLAB software.
CO2	To provide a working introduction to the Matlab technical computing environment.
CO3	To introduce students the use of a high-level programming language, Matlab.
CO4	To bridge the skill gaps and make students industry ready.
CO5	To provide an opportunity to students to develop inter-disciplinary skills.

Detailed Syllabus

MODULE-I

Programming Environment: MATLAB Windows, A First Program, Expressions, Constants, Variables and assignment statement, Arrays.

MODULE-II

Graph Plots: Basic plotting, Generating waveforms, Control Statements: Conditional statements: If, Else, Else-if, Repetition statements: While, for loop.

MODULE-III

Procedures and Functions: Built in functions. Manipulating Text: Writing to a text file, Reading from a text file.

Text Books:

1. MATLAB: An Introduction with Applications, by Amos Gilat, 2nd edition, Wiley, 2004,
2. C.B. Moler, Numerical Computing with MATLAB, SIAM, 2004.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Understand the need for simulation/implementation for the verification of mathematical functions.
CO2	Understand the main features of the MATLAB program development environment to enable their usage in the higher learning
CO3	Implement simple mathematical functions/equations in numerical computing environment such as MATLAB
CO4	Interpret and visualize simple mathematical functions and operations thereon using plots/display.
CO5	Analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using MATLAB tools

BCS-091	Cryptography and Network Security	L T P 3 0 0	3 Credits

Pre-requisites: Graduate student status or a Senior in Computer Science

Course Objectives:

CO1	To introduce fundamental concepts of symmetric and asymmetric cipher models
CO2	To introduce fundamental concepts of authentication.
CO3	To introduce network security and web security protocols.
CO4	To understand DES, AES
CO5	To understand Discrete Logarithmic Problem

Detailed Syllabus

MODULE-I

Introduction to security attacks: services and mechanism, Classical encryption techniques substitution ciphers and transposition ciphers, cryptanalysis, steganography, Stream and block ciphers.

Modern Block Ciphers: Block ciphers principles, Shannon's theory of confusion and diffusion, fiestal structure, Data encryption standard (DES), Strength of DES, block cipher modes of operations, Triple DES, Advanced Encryption Standard (AES) encryption and decryption.

MODULE-II

Introduction to group, field, finite field of the form GF(p): modular arithmetic, prime and relative prime numbers, Extended Euclidean Algorithm, Fermat's and Euler's theorem, Primality testing, Chinese Remainder theorem, Discrete Logarithmic Problem, Principals of public key crypto systems, RSA algorithm, security of RSA, Message Authentication Codes: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions, Secure hash algorithm(SHA), **Digital Signatures**: Digital Signatures, Elgamal Digital Signature Techniques, Digital Signature Standards (DSS).

MODULE-III

Key Management and distribution: Symmetric key distribution, Diffie-Hellman Key Exchange, Public key distribution, X.509 Certificates, Public key Infrastructure, Authentication Applications: Kerberos Electronic mail security: pretty good privacy (PGP), S/MIME, IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Introduction to Secure Socket Layer, Secure electronic, transaction (SET), System Security: Introductory idea of Intrusion, Intrusion detection, Viruses and related threats, firewalls.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Analyze solutions for effective key management and distribution and conduct cryptanalysis
CO2	Analyze and use cryptographic data integrity algorithms and user authentication protocols
CO3	Analyze the security requirements and solutions for wireless networks and distributed systems
CO4	Analyze Discrete Logarithmic Problem
CO5	Explore the attacks and controls associated with IP, transport-level, web and E-mail security

Text Books:

1. William Stallings, “Cryptography and Network Security: Principals and Practice”,Pearson Education.
2. Behrouz A. Frouzan: Cryptography and Network Security, Tata McGraw Hill

References:

1. Bruce Schiener, “Applied Cryptography”. John Wiley & Sons
2. Bernard Menezes,” Network Security and Cryptography”, Cengage Learning.
3. AtulKahate, “Cryptography and Network Security”, Tata McGraw Hill

BCS-092	.NET Framework	L T P 3 0 0	3 Credits

Pre-requisites: Basic knowledge of any programming language

Course Objectives:

CO1	To understand the knowledge of .Net Frameworks along with ASP.Net and C#
CO2	Introduction to Networking and the world wide web.
CO3	Building multi-tier enterprise applications.
CO4	Client-side programming: HTTP, CGI, Cookies, JavaScript, HTML, XML.
CO5	To understand the concept of Dialog Boxes and its Event Handling

Detailed Syllabus

MODULE-I

The .Net framework: Introduction, The Origin of .Net Technology, Common Language Runtime (CLR), Common Type System (CTS), Common Language Specification (CLS) and its Architecture, Microsoft Intermediate Language (MSIL), Just-In-Time Compilation, Framework Base Classes. **Programming Language C#:** Declaring implicit and explicit variables, Unicode characters and strings, creating Object and Classes, The Main method specification.

MODULE-II

Object oriented programming with C#: Inheritance, Method Overloading and method overriding, Polymorphism, Operator Overloading, Abstract Class, Inner Class, and Interface. Delegates, Partial Classes, Exception Handling, Creating Name-Space, Input-Output and File Handling, Multithreading,

Windows Application: Introduction of windows form, Linking Window Form, Creating Properties, window form controls, MDI form.

MODULE-III

Containers and its Event Handling: Flow Layout Panel, Group Box, Panel, Split Container, Tab Control, Table Layout Panel. Navigation Control and Its Event Handling: Context Menu Strip, Tool Strip, Status Strip, Tool Strip Container. **Dialog Boxes and its Event Handling:** Message Dialog Boxes, Color Dialog, Folder Browser Dialog, Font Dialog, Open File Dialog, Save File Dialog, Data Grid View, Dataset, Creating Setup of Web Application.

Introduction to ASP.NET with C#: Introduction of web application, web site, A Review of Classic ASP, ASP.NET Web Applications, Rendering HTML with Server Controls.

Working with Web Forms Controls and C#: Introduction to Web Forms Controls, Simple Input Controls, Hyperlinks, Button Controls and List Controls. Dropdown List Control, Overview of ASP.NET Validation Controls, Client-Side Validation, Server-Side Validation, File Upload controls, Wizard controls. Master Page, Ad Rotator Control, Login Controls, Session Management using Cookies, Session.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Student will be able to use the features of .Net Framework along with the features of C#
CO2	Create user interactive web pages using ASP.Net.
CO3	Create simple data binding applications using ADO.Net connectivity.
CO4	To use Dialog Boxes and its Event Handling
CO5	Performing Database operations for Windows Form and web applications.

Text Books:

1. Beginning Visual C# 2008, Wiley, Wrox Publication, 2nd Edition 2008
2. Programming with C#, E. Balagurusamy, TMH, 2nd Edition 1999
3. Microsoft .Net for Programmers, Fergal Grimes, SPI Edition,
4. C# Programming Language, Anders Hejlsberg, Mads Torgersen, Scott Wiltamuth, and Peter Golde, Pearson Education Inc, 4th Edition.

BCS-093	Mobile Computing	L T P 3 0 0	3 Credits

Pre-requisites: Students should know about the basics of networking.

Course Objectives:

CO1	To learn about the basic concepts of Mobile Computing.
CO2	To understand about networking concepts relevant to modern wireless systems.
CO3	To introduce emerging mobile computing ideas and best practices
CO4	To gain hands-on knowledge practice with mobile computing
CO5	To understand various types of Protocols

Detailed Syllabus

MODULE-I

Introduction: Issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, handoffs, channel allocation in cellular systems, CDMA, GPRS. Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, Mobile IP, WAP: Architecture, protocol stack, application environment,

MODULE-II

Data management issues: data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations. Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.

MODULE-III

Adhoc networks and localization: Adhoc Networks issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), AdHoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, applications.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Various wireless communication technologies.
CO2	Enables the students to visualize the various important steps in GSM communication
CO3	To acquire the knowledge of the fuzzy Neural network and Genetic Language
CO4	Enables the students to analyze the mobile IP and Transport Protocol.
CO5	To analyze various type of Protocols

Text Books:

1. J. Schiller, Mobile Communications, Addison Wesley.
2. Charles Perkins, Mobile IP, Addison Wesley.

Reference Books:

1. Charles Perkins, Ad hoc Networks, Addison Wesley.
2. Upadhyaya, "Mobile Computing", Springer

BCS-094	Machine Learning	L T P 3 0 0	3 Credits

Pre-requisites:

Course Objectives:

CO1	understanding of issues and challenges of Machine Learning
CO2	Should be able to select data, model selection, model complexity etc.
CO3	Understanding of the strengths and weaknesses of many popular machine learning approaches.
CO4	To learn about Artificial Neural Networks
CO5	To understand Logistic Regression

Detailed Syllabus

MODULE-I

Introduction to Machine Learning Supervised Learning, Unsupervised Learning, Reinforcement Learning. Probability Basics Linear Algebra Statistical Decision Theory – Regression & Classification Bias – Variance Linear Regression Multivariate Regression.
Dimensionality Reduction Subset Selection, Shrinkage Methods, Principle Components Regression Linear Classification, Logistic Regression, Linear Discriminant Analysis Optimization, Classification-Separating Hyperplanes Classification.

MODULE-II

Artificial Neural Networks (Early models, Back Propagation, Initialization, Training & Validation) Parameter Estimation (Maximum Likelihood Estimation, Bayesian Parameter Estimation) Decision Trees Evaluation Measures, Hypothesis Testing Ensemble Methods, Graphical Models.
Neural Networks, threshold logic units, linear machines, networks of threshold learning units, Training of feed forward networks by back propagations, neural networks vs. knowledge-based systems.

MODULE-III

Clustering, Gaussian Mixture Models, Spectral Clustering Ensemble Methods Learning Theory, Inductive Logic Programming, notation and definitions, introducing recursive programs, inductive logic programming vs decision tree induction.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Identify the characteristics of datasets and compare the trivial data and big data for various applications.
CO2	Understand machine learning techniques and computing environment that are suitable for the applications under consideration.
CO3	Develop scaling up machine learning techniques and associated computing techniques and technologies for various applications
CO4	Implement various ways of selecting suitable model parameters for different machine learning techniques.
CO5	Discriminate inductive logic programming and decision tree induction.

Text Books:

1. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2008.
2. Christopher Bishop. Pattern Recognition and Machine Learning.
3. Andreas, C. Muller & Sarah Guido, O'Reilly Introduction to Machine Learning with Python A guide for data scientists,
4. Nils J.Nilsson, Introduction to Machine learning.

BCS-095	Speech and Natural Language Processing	L T P 3 0 0	3 Credits

Pre-requisites:

Course Objectives:

CO1	To learn basic about NPL
CO2	To understand the basic use of formal languages
CO3	To learn about FST
CO4	To understand the concept of text to speech
CO5	TO understand concept of Regular Expressions

Detailed Syllabus

MODULE-I

Introduction of NLP: Knowledge in Speech and Language processing, ambiguity and models and algorithm, language and understanding, brief history. **Regular Expressions, Automata, Similarity Computation:** Regular Expressions, patterns, FA, Formal Language, NFSA, Regular Language and FSAs, Raw Text Extraction and Tokenization, Extracting Terms from Tokens, Vector Space Representation and Normalization, Similarity Computation in Text.

MODULE-II

Morphology and Finite-State Transducers: Inflection, Derivational Morphology, Finite-State Morphological Parsing, The Lexicon and Morphotactic, Morphological Parsing with Finite State Transducers, Combining FST Lexicon and Rules, **Lexicon-free FSTs:** The Porter Stemmer, Human Morphological Processing. Matrix Factorization and Topic Modeling: Introduction, Singular Value Decomposition, Nonnegative Matrix Factorization, Probabilistic Latent Semantic Analysis, Latent Dirichlet Allocation.

MODULE-III

Computational Phonology and Text-to-Speech: Speech Sounds and Phonetic Transcription, The Phoneme and Phonological Rules, Phonological Rules and Transducers, Advanced Issues in Computational Phonology, Machine Learning of Phonological Rules, Mapping Text to Phones for TTS, Prosody in TTS. Probabilistic Models of Pronunciation and Spelling: Dealing with Spelling Errors, Spelling Error Patterns, Detecting NonWord Errors, Probabilistic Models, Applying the Bayesian method to spelling, Minimum Edit Distance, English Pronunciation Variation, The Bayesian method for pronunciation and Weighted Automata, Pronunciation in Humans

Course Outcomes: After the completion of the course the student will be able to:

CO1	Student able to explain NPL
CO2	Students able to implement Regular Expressions
CO3	Students able to implement Bayesian method for pronunciation
CO4	Student implement the concept of Text to speech
CO5	Enable the students to use Formal Languages

Text Books:

1. Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python.
2. Daniel Jurafsky and James H. Martin, Speech and Language Processing.
3. James Allen, Natural Language Understanding