Course Description

CSE Electives:

Title: Compiler Design **Code: 18B14CI541**
L-T-P scheme: 3-0-0 **Credit: 3**

Prerequisite:

Students must have already registered for the course, "Data Structures" and "Theory of Computation ".

Objective:

- Deepen the understanding of compiler design
- Develop problem solving ability using programming
- Develop ability to design and analyze a compiler

Learning Outcomes:

Course Outcome	Description
CO1	Specify and analyze the lexical, syntactic and semantic structures of advanced language features.
CO2	Separate the lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation
CO3	Write a scanner, parser, and semantic analyzer without the aid of automatic generators
CO4	Turn fully processed source code for a novel language into machine code for a novel computer
CO5	Describe techniques for intermediate code and machine code optimization
CO6	Design the structures and support required for compiling advanced language features.

Course Content:

UNIT I: Introduction to Compilers
Translators-Compilation and Interpretation, Language processors, The Phases of Compiler, Errors Encountered in Different Phases,The Grouping of Phases of Compiler , Programming Language basics.

UNIT II: Lexical Analysis
Need and Role of Lexical Analyzer,Lexical Errors,Expressing Tokens by Regular Expressions, Converting Regular Expression to DFA ,Minimization of DFA, Language for Specifying Lexical Analyzers, LEX (Design of Lexical Analyzer for a sample Language).

UNIT III: Syntax Analysis
Need and Role of the Parser, Context Free Grammars , Top Down Parsing ,General Strategies, Recursive Descent Parser ,Predictive Parser ,LL(1) Parser,Shift Reduce Parser-LR Parser, LR (0)Item, Construction of SLR Parsing Table , Introduction to LALR Parser ,Error Handling and Recovery in Syntax Analyzer, YACC (Design of a syntax Analyzer for a Sample Language) .

UNIT IV: Syntax Directed Translation & Run Time Environment
Syntax directed Definitions, Construction of Syntax Tree, Bottom-up Evaluation of S-Attribute Definitions, Design of predictive translator, Type Systems, Specification of a simple type checker, Equivalence of Type Expressions, Type Conversions.
RUN-TIME ENVIRONMENT: Source Language Issues, Storage Organization-Storage Allocation, Parameter Passing, Symbol Tables.

UNIT V :Code Optimization
Principal Sources of Optimization, DAG, Optimization of Basic Blocks, Global Data Flow Analysis, Efficient Data Flow Algorithms.

UNIT VI: Code Generation
Issues in Design of a Code Generator, a Simple Code Generator Algorithm.

Teaching Methodology:
Teaching in this course is designed to engage the students in active and experimental learning by taking a problem solving and design oriented approach with special emphasis on real world applications. Students are expected to carry out lot of design and programming.

Evaluation Scheme:

Exams	**Marks**	**Coverage**
Test-1	15 Marks	Based on Unit-1, Unit-2
Test-2	25 Marks	Based on Unit-3 & Unit-4 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-5 to Unit-6 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:
Tutorials and lecture slides on Compiler Design (will be added from time to time): Digital copy will be available on the JUET server.

Text Books:
1. Compilers : Principles, Techniques and Tools, Aho, Sethi and Ullman, Pearson Education
2. Principles Of Compiler Design by Alfred V Aho and Ullman, Narosa Publication

Reference Books:
1. Compiler Design in C, Holub, Prentice Hall of India
2. Advanced Compiler Design and Implementation, Muchnick Steven, Morgan Kauffman Publishers
3. Compiler Design, Santanu Chattopadhyay, PHI
4. Compiler Construction Principles and Practice, Kenneth C. Louden, Thomson
5. Compiler Construction and Design, Rajni Jindal , Umesh Publications

Title of Course: Embedded System **Course Code: 18B14CI544**
L-T-P Scheme: 3-0-0 **Course Credit: 3**

Objectives: To develop an appreciation of the technology capabilities and limitations of the hardware, software components for building embedded systems, and methods to evaluate design tradeoffs between different technology choices-microcontroller, DSP and FPGA based. To model and specify an embedded system at a high –level of abstraction.

Learning Outcomes: Students will be able to

Course Outcome	Description
CO1	Express the evolution of Embedded Systems and Study the Real time Operating system
CO2	Illustrate CISC and RISC instruction set architecture and processor architecture and its applications
CO3	Understand various types of memory used in embedded system
CO4	Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits.
CO5	Identify the hardware and software components of an embedded system
CO6	Work as a team on a project.

Course Contents:

Unit I: Introduction to Embedded Computing Overview- Characteristics of Embedding Computing Applications, Concept of Real time Systems, Challenges in Embedded System Design. Design Process- Requirements, Specifications, Architecture Design, Designing of Components, System Integration

Unit II: Embedded System Architecture CISC and RISC instruction set architecture, Basic Embedded Processor/Microcontroller Architecture-CISC (Motorola-68HC11 and 8051 processor), CISC (ARM), DSP Processors and Harvard Architecture (PIC). Memory System Architecture-Caches and Virtual Memory. I/o Sub-system - Busy-wait I/0, DMA and Interrupt driven I/0.

Unit III: Designing Embedded Computing Platform Using CPU Bus- Bus Protocols and Bus Organization. Memory Devices and their Characteristics- RAM, ROM, UVROM, EEPROM, Flash Memory, DRAM. I/O Devices- Timers and Counters, Interrupt Controllers, DMA Controllers, A/D and D/A Converters, Displays, Keyboards and Infrared devices. Component Interfacing- Memory Interfacing and I/O Device Interfacing.

Unit IV: Design of Embedded Processors Application Specific Logic Design using Field Programmable Devices and ASICs, Introduction to Hardware Description Languages. Design Examples- Data Compressor and Alarm Clock

Unit V: Software Development and Tools Embedded system evolution trends, round-robin, robin with interrupts, function – one scheduling architecture, algorithms, introduction to- assembler - compiler-cross compilers and integrated development environment (IDE). Object oriented interfacing, recursion, debugging strategies, simulators

Teaching Methodology:

This course is introduced to help students transition from a simple understand the scientific principles and concepts behind embedded systems and "big ideas" in embedded systems.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	
Test-2	25 Marks	
Test-3	35 Marks	
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. F. Vahid & T. Givargis “Embedded System Design”, Wiley & Sons, 2002.
2. D. Gajski, F. Vahid, S.Narayan, and J. Gong “Specification and Design of Embedded Systems”, Prentice Hall.
3. H.Kopetz “Real-Time Systems”, Kluwer, 1997.

References

1. R.Gupta “Co-synthesis of Hardware and Software for Embedded Systems”, Kluwer 1995.
2. Steve Heath, “Embedded Systems Design”.
3. Ken Coffman “Real World FPGA Design with Verilog”, PHI 1999.
4. W. Wolf “Computers as Components: Principles of Embedded Computing System Design”, Morgan Kaufman, 2001.
5. Rozenberg, Grzegorz, Vaandrager, Frits W. (Eds.) “Lectures on Embedded Systems”, Springer.
6. Valvano Jonathan W “Embedded Microcomputer Systems: A Real Time Interfacing” Cengage Learning.

Title of Course: Advanced Concepts in DBMS **Course Code: 18B14CI547**
L-T Scheme: 3-0 **Course Credit: 3**

Objectives: To develop the ability to design, implement and manipulate databases as well as to build Advanced Database management systems.

Learning Outcomes:

Course Outcome	Description
CO1	Ability to build normalized databases.
CO2	Ability to design systems by using ER Modeling.
CO3	Ability to develop the skills of writing applications by using SQL.
CO4	Ability to understand query optimization techniques.
CO5	Understanding of transaction processing.
CO6	Ability to handle recovery and concurrency issues

Course Contents:

Unit-1 (Introduction): Overview of object-oriented concepts and characteristics, Objects, OIDs and reference types, Database design for ORDBMS, Comparing RDBMS, OODMBS, and ORDBMS.

Unit-2 (Distributed DBMSs-Concepts and Design): Introduction, Homogeneous and heterogeneous databases, Advantages and Disadvantages of DDBMS, Homogeneous and Heterogeneous DDBMSs, Overview of Networking , Functions and Architectures of a DDBMS, Distributed Relational Database Design, Date's Twelve Rules for a DDBMS.

Unit-3 (Distributed DBMSs- Advanced Concepts): Distributed Transaction Management, Distributed Concurrency Control, Distributed Deadlock Management, Distributed Database Recovery, Distributed Query Optimization.

Unit-4 (Replication and Mobile Databases): Introduction to Database Replication, Benefits of Database Replication, Applications of Replication, Basic Components of Database Replication, Database Replication Environments, Synchronous Versus Asynchronous Replication, Introduction to Mobile Databases.

Unit-5 (Object DBMS): Advanced Database Applications, Weaknesses of RDBMSs, Object-Oriented Concepts, Storing Objects in a Relational Database, Object-Oriented Database Design, Comparison of Object-Oriented Data Modeling, Conceptual Data Modeling ,Object-Oriented Analysis and Design with UML.

Unit-6 (Object-Oriented DBMSs Concepts): Introduction to Object-Oriented Data Models and OODBMSs, OODBMS Perspectives, Persistence, Issues in OODBMSs, Advantages and Disadvantages of OODBMSs.

Unit-7 (Object-Oriented DBMSs Standards and Systems): Object Management Group, Object Data Standard ODMG, Object Store.

Unit-8 (Object-Relational DBMSs): Introduction to Object-Relational Database Systems, The Third-Generation Database Manifestos, The Third-Generation Database System Manifesto The Third Manifesto, Postgres - An Early ORDBMS, SQL: 1999 and SQL: 2003, Query Processing and Optimization, Object-Oriented Extensions in Oracle, Comparison of ORDBMS and OODBMS.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	
Test-2	25 Marks	
Test-3	35 Marks	
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Book

1. Thomas M. Connolly Carolyn E. Begg, Database Systems: A Practical Approach to Design, implementation, and Management Fourth Edition.

Reference Books

1. Elmasri and Navathe, Fundamentals of Database Systems, Pearson Education
2. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw-Hill
3. Korth, Silberchatz, Sudarshan, Database System Concepts, McGraw-Hill.
4. Peter Rob and Coronel, Database Systems, Design, Implementation and Management, Thomson Learning.
5. C. J. Date & Longman, Introduction to Database Systems, Pearson Education

Title: Information Security **Code 18B14CI550**
L-T-P scheme: 3-0-0 **Credit: 3**

Objectives:

1. To provide an understanding of principal concepts, major issues, technologies, and basic approaches in information security.
2. Master the key concepts of information security and how they "work."
3. Develop a "security mindset:" learn how to critically analyze situations of computer and network usage from a security perspective, identifying the salient issues, viewpoints, and trade-offs.
4. To provide the ability to examine and analyze real-life security cases.

Learning Outcome:

Course Outcome	Description
CO1	Evaluate vulnerability of an information system and establish a plan for risk management.
CO2	Demonstrate basic principles of Web application security
CO3	Evaluate the authentication and encryption needs of an information system.
CO4	Demonstrate how to secure a network
CO5	Understanding of transaction processing.
CO6	Evaluate a company's security policies and procedures

Course Contents:

Introduction: Security mindset, Computer Security Concepts (CIA), Threats, Attacks, and Assets
Software Security: Vulnerabilities and protections, malware, program analysis
Practical Cryptography: Encryption, authentication, hashing, symmetric and asymmetric cryptography, Digital Signatures and Certificates
Network Security: Network security issues, Sniffing, IP spoofing, Common threats, E-Mail security, IPSec, SSL, PGP, Intruders, Virus, Worms, Firewalls-need and features of firewall, Types of firewall, Intruder Detection Systems.
Cyber Security: Cyber Crime and security, Security tools, Introduction to Digital Forensic, OS fingerprinting, TCP/IP stack masking, Social Engineering.
Applications and special topics: Web application Security, Privacy and Anonymity, public policy

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Book:

1. William Stallings; Lawrie Brown, Computer Security: Principles and Practice, Pearson; 4th edition, 2017

References:

1. Introduction to Computer Security, 2004 Matt Bishop, Addison-Wesley, ISBN 0-321-24744
2. Buchmann J. A., Introduction to Cryptography, Springer Verlag (2001).
3. Stallings William, Cryptography and Network Security, Pearson Education (2006).
4. Schneier Bruce, Applied Cryptography, John Wiley and Sons (1996).
5. **Britz M., Computer Forensic and cyber crime, Upper Saddle River, Prentice Hall (2003).**

Course Title: Computer Graphics **Course Code: 18B14CI643**
L-T Schème : 3-0 **Course Crédits: 3**

Scope and Objectives:

1. To learn and understand the basics of computer graphics applications and graphics devices
2. To learn and understand the geometric figure drawing algorithm on graphic device
3. To learn and understand the Two-Dimensional transformations
4. To learn and understand the Three-Dimensional transformations
5. To understand the concepts of solid modelling and representation
6. To learn about the Visible-Surface, Illumination and Shading

Learning Outcome:

Course Outcome	Description
CO 1	Student will learn about the overview of computer graphic applications and graphics devices (Display Technologies, Raster Refresh (Raster-Scan), CRT, LCD displays, etc.)
CO 2	Student will learn about the scan conversion - lines, circles and Ellipses, filling, clipping and aliasing
CO 3	Student will learn about the Two-Dimensional transformations and matrix representation of 2D Transformations (Translations, Rotation, Reflection, Scaling and Combined Transformation) and Window-to-Viewport transformations
CO 4	Student will learn about the Three-Dimensional transformations and viewing in 3D
CO 5	Student will learn about the solid modelling: representing solids, regularized Boolean Set operations, primitive instancing, sweep representations, spatial-partitioning representations - Octree representation, B-Reps and Constructive Solid Geometry
CO 6	Student will learn about the visible surface detection, illumination and shading

Course Contents:

Unit 1: Introduction to Computer Graphics: Overview of Computer Graphics, Computer Graphics Application and Software, Description of some graphics devices, Input Devices for Operator Interaction, Active and Passive Graphics Devices, Display Technologies, Storage Tube Graphics Displays, Calligraphic Refresh Graphics Displays, Raster Refresh (Raster-Scan) Graphics Displays, Cathode Ray Tube Basics, Colour CRT Raster Scan Basics, Video Basics, The Video Controller, Random-Scan Display Processor, LCD displays, Touch screen, Graphics Primitives.

Unit II: Scan conversion – lines, circles and Ellipses; Filling polygons and clipping algorithms, Scan Converting Lines, Mid-point criteria, Problems of Aliasing, end-point ordering and clipping lines, Scan Converting Circles, Scan Converting Ellipses, Filling Polygons, edge data structure, Clipping Lines algorithms– Cyrus-Beck, Cohen-Sutherland and Liang-Barsky, Clipping Polygons, problem with multiple components

Unit III: Two-Dimensional Transformations: Transformations and Matrices, Transformation Conventions, 2D Transformations, Homogeneous Coordinates and Matrix Representation of 2D

Transformations, Translations and Homogeneous Coordinates, Rotation, Reflection, Scaling, Combined Transformation, Transformation of Points, Transformation of The Unit Square, Solid Body Transformations, Rotation About an Arbitrary Point, Reflection through an Arbitrary Line, A Geometric Interpretation of Homogeneous Coordinates, The Window-to-Viewport Transformations.

Unit IV : Three-Dimensional Transformations and Viewing in 3D: Introduction, Three-Dimensional Scaling, Three-Dimensional Shearing, Three-Dimensional Rotation, Three-Dimensional Reflection, Three-Dimensional Translation, Multiple Transformation, Rotation about an Arbitrary Axis in Space, Reflection through an Arbitrary Plane, Matrix Representation of 3D Transformations, Composition of 3D Transformations, Affine and Perspective Geometry, Perspective Transformations, Techniques for Generating Perspective Views, Vanishing Points, the Perspective Geometry and camera models, Orthographic Projections, Axonometric Projections, Oblique Projections, View volumes for projections.

Unit V: Solid Modelling: Representing Solids, Regularized Boolean Set Operations, Primitive Instancing, Sweep Representations, Spatial-Partitioning Representations: Octree representation, B-Reps, Constructive Solid Geometry, Comparison of Representations

Unit VI: Visible-Surface Determination: Techniques for efficient Visible-Surface Algorithms, Categories of algorithms, Back face removal, The z-Buffer Algorithm, Scan-line method, Painter's algorithms (depth sorting), Area sub-division method, BSP trees, Visible-Surface Ray Tracing, comparison of the methods

Unit VII: Illumination and Shading: Illumination and Shading Models for Polygons, Reflectance properties of surfaces, Ambient, Specular and Diffuse reflections, Atmospheric attenuation, Phong's model, Gouraud shading, some examples.

Unit VIII: Image Manipulation and Storage: What is an Image? Digital image file formats, Image compression standard – JPEG, Image Processing - Digital image enhancement, contrast stretching, Histogram Equalization, smoothing and median Filtering.

Evaluation Scheme:

Exams	**Marks**	**Coverage**
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text book:

1. D. Hearn and M. P. Baker, Computer Graphics using C

Reference Books:

1. Foley, Van Darn, Feiner, Hughes, Computer Graphics, Second edition
2. D.F. Rogers, Mathematical elements for computer graphics, Second edition
3. Rogers, Procedural elements for Computer Graphics, Second edition

Online Resources: https://nptel.ac.in/courses/106106090
https://in.coursera.org/learn/interactive-computer-graphics

Title of Course: Graph Algorithm and Applications **Course Code: 18B14CI645**
L-T Scheme: 3-0-0 **Course Credits: 3**

Prerequisite: Data Structure and Algorithms

Objectives:

- Students will achieve command of the fundamental definitions and concepts of graph theory.
- Students will understand and apply the core theorems and algorithms, generating examples as needed, and asking the next natural question.
- Students will achieve proficiency in writing proofs, including those using basic graph theory proof techniques such as bijections, minimal counterexamples, and loaded induction.
- Students will work on clearly expressing mathematical arguments, in discussions and in their writing.
- Students will become familiar with the major viewpoints and goals of graph theory: classification, extremality, optimization and sharpness, algorithms, and duality.
- Students will be able to apply their knowledge of graph theory to problems in other areas, possibly demonstrated by a class project.

Learning Outcome:

Course Outcome	Description
CO1	Enhance your understanding of real-world graph properties and how to generate synthetic graphs
CO2	Describe parallelism and how it can be used to speed up graph processing
CO3	Examine performance characteristics of graph algorithms
CO4	Assess the state-of-the-art graph processing tools available today and learn to use certain graph software
CO5	Explore the pros and cons of different graph processing approaches
CO6	Acquire a new set of tools for improving the effectiveness and performance of graph algorithms

Course Contents:

Unit-I: Planar graphs: planarity testing, problems that are easier on planar graphs, drawing planar graphs.

Unit-II: Planar separators

Unit-III: Intersection graphs and related classes: interval and chordal graphs, unit disc graphs, etc.

Unit-IV: Trees and related graphs: treewidth, series parallel graphs, problems that are easier on these.

Unit-V: Introduction to graph minors.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus

Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. Introduction to Graph Theory by West Prentice Hall, ISBN: 0-13-227828-6
2. Graph Theory by Deistel, Springer, ISBN: 3-540-26183-4

Reference Books

1. Extremal Graph Theory by Bollobs, Academic Press, ISBN: 0-12-111750-2
2. Computers and Tractability, Grey and Johnson, Freeman, ISBN: 0-7167-1045-5

Links- 1 : https://nptel.ac.in/courses/111106102
2 : https://archive.nptel.ac.in/courses/128/106/128106001

Title of Course: Image Processing **Course Code: 18B14CI647**
L-T Scheme: 3-0 **Course Credits: 3**

Objectives: To introduce the students to the basic concepts and analytical methods of satellite remote sensing as applied to environmental systems (e.g., land-cover classification, vegetation monitoring, etc.). The course emphasizes the application of processing and analysis of digital satellite images, especially Landsat, SPOT, and AVHRR data, for classification of land cover, land-cover/land-use change analysis, and other geographic topics. The primary objective of the course is to provide students with the skills and knowledge to apply remote sensing to their own research problems.

Learning Outcomes: At the end of the course, the student is able to:

Course Outcome	Description
CO1	Describe the processes and hardware of image acquisition
CO2	Apply pre-processing operations in image enhancement
CO3	Compare various image segmentation and feature extraction operations
CO4	Identify image processing applications in various fields

Course Contents:

Unit-1 (Introduction and Digital Image Fundamentals): Digital Image Representation, Fundamental Steps in Image Processing, Elements of Digital image processing systems, Sampling and quantization, some basic relationships like neighbors, connectivity, Distance measure between pixels, Imaging Geometry.

Unit-2 (Image Transforms): Discrete Fourier Transform, Some properties of the two-dimensional Fourier transform, Fast Fourier transform, Inverse FFT.

Unit-3 (Image Enhancement): Spatial domain methods, Frequency domain methods, Enhancement by point processing, Spatial filtering, Lowpass filtering, Highpass filtering, Homomorphic filtering, Colour Image Processing.

Unit-4 (Image Restoration): Degradation model, Diagnolization of Circulant and Block-Circulant Matrices, Algebraic Approach to Restoration, Inverse filtering, Wiener filter, Constrained Least Square Restoration, Interactive Restoration, Restoration in Spatial Domain.

Unit-5 (Image Compression): Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Error free comparison, Lossy compression, Image compression standards.

Unit-6 (Image Segmentation): Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation.

Unit-7 (Representation and Description): Representations schemes like chain coding, Polygonal Approximation, Signatures, Boundary Segments, Skeleton of region, Boundary description, Regional descriptors, Morphology.

Unit-8 (Recognition and Interpretation): Elements of Image Analysis, Pattern and Pattern Classes, Decision-Theoretic Methods, Structural Methods, Interpretation.

Evaluation Scheme:

Exams	**Marks**	**Coverage**
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", AWL.
2. A.K. Jain, "Fundamental of Digital Image Processing", PHI.

References

1. Rosefield Kak, "Digital Picture Processing".
2. W. K. Pratt, "Digital Image Processing".
3. Paul Mather, "Computer Processing of Remotely-Sensed Imag", Third Edition. Wiley, ISBN 0-470-84919-3, 2004.
4. Awcock, G.W & R. Thomas. 1995. Applied image processing. McGraw Hill.
5. Gonzalez, Rafel C.; Richard E. Woods. 1993. Digital image processing.

Title: Soft Computing **Course Code: 18B14CI74**

L-T-P Scheme: 3-0-0 **Credit: 3**

Pre-requisite: Artificial Intelligence & Application

Course Objectives:

This course aims to develop students' abilities in using some contemporary approaches in solving problems in automation.

It will enable students to:
(a) Appreciate the advantages and limitations of fuzzy systems and their potential impacts and applications in intelligent control and automation;
(b) Appreciate the advantages and limitations of neural networks and their potential impacts and applications in intelligent automation; and
(c) Develop an understanding of generic algorithms and their potential applications.

Learning Outcomes:

After completing this course, you will be able to learn:

- Fuzzy logic and its applications.
- Artificial neural networks and its applications.
- Solving single-objective optimization problems using GAs.
- Solving multi-objective optimization problems using Evolutionary algorithms (MOEAs).
- Applications of Soft computing to solve problems in varieties of application domains.

Course Outcome	Description
CO1	Demonstrate knowledge of the building blocks of Soft Computing as presented in terms of intelligent agents.
CO2	Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
CO3	Develop algorithms for real life problems problems and also design intelligent systems.
CO4	Attain the capability to represent various real life problem domains using fuzzy logic, Artificial Neural Network and Genetic Algorithms based techniques.
CO5	Formulate and solve problems with uncertain information using Soft Computing approaches.
CO6	Apply concept of Soft Computing for processing to problems leading to understanding of cognitive computing.

Course Contents:
Basics of Soft Computing
Fundamental of Neural Networks
Back-propagation Networks
Associative Memory
Adaptive Resonance Theory
Fuzzy Set Theory

Fuzzy Systems
Fundamentals of Genetic Algorithms
Genetic Modeling
Integration of Neural Networks, Fuzzy Logic, and Genetic Algorithms

Learning Resources:
Lecture presentations, assignments will be posted on the student resource from time to time. In addition following additional online/downloadable resources will be useful.

Text Book:
1. "Neural Networks, Fuzzy Logic, and Genetic Algorithms" by **S. Rajasekaran, G.A. Vijayalakshmi Pai,** (Prentice-Hall of India Private Ltd.),

Other References:

1. "Neuro-Fuzzy And Soft Computing" by J. S. R. Jang, C. T. Sun, E. Mizutani (Pearson Education)
2. "Soft Computing in Human-Related Science" by Horia-Nicolai Teodorescu, Abraham Kandel, Lakhmi C. Jain (CRC Press)
3. "Genetic Algorithms" by David E. Goldberg (Pearson Education)
4. "Soft Computing and Intelligent Systems: theory and Application" by Sinha, Naresh K.
5. "Neural Networks and Fuzzy Systems: A Dynamical Systems Approach to Machine Intelligence" by Kosko, Bart

Title of Course: Network Management **Course Code: 18B14CI742**
L-T-P Scheme: 3-0-0 **Course Credits: 3**

Objectives:
The course covers Concepts of Computer networks and fundamental aspects of managing computer networks in a modern networked environment. It also dwells into details of Simple Network Management Protocol & Broadband Network Management like ATM networks.

Learning Outcomes:
After completing this course, students will be able to use network management tools, systems and applications in an organization. They should be able to explain the use of simple network management protocol & broadband network management

Introduction: Overview of Computer Network and Tele-Communications and Network, Basics of network management system, Need of NMS, Users of NMS, Network management standards, NMS models and languages, Challenges in NMS Operation: Domain management, Software Architecture, Quantifying Management Integration Complexity

NMS functional areas: Fault management, Configuration management, Accounting management, Performance management, Security management

NMS Components: Management information base, schema and Meta-schema, structure of management information, MIB-1 MIB-2

NMS Protocol: role of SNMP protocol, SNMP Header, SNMP Nodes, SNMP Agents, SNMP operations, BER, ASN.1, Versions of SNMP i.e. SNMPv1, SNMPv2, SNMP v3, SNMP management RMON, Netconf, Netconf Data-stores, Architecture and Operations

NMS Metrics: Network Management Business Impact: cost of ownership, enabling of revenues, network availability, trading off the benefits and cost of network management investments, factors that determine management effectiveness, assessing network management effectiveness, management metrics to track business impact, management metrics to track contribution to management effectiveness, assessing and tracking the state of management, using metrics to direct management investment

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Book:

T1. Mani Subramanian, Network Management Principals and Practices, Pearson Education.
T2. J. Richard Burke, Network Management: Concepts and Practice: A Hands-on Approach, Pearson Education

Reference Books:

R1. Behrouz A. Forouzan, Data Communication and Networking.
R2. Andrew S. Tanenbaum, Computer Networks.
R3. John Larmouth , ASN.1 Complete, Open system solution.

Title of Course: Ad-hoc and Wireless Networks **Course Code: 18B14CI744**
L-T Scheme: 3-0 **Course Credits: 3**

Prerequisites: Students must have knowledge of Wireless Communication fundamentals and Wired Networks

Objectives:

To understand wireless and ad hoc networks and design efficient protocols and algorithms for wireless networks, we need to understand the characteristics of wireless communications. Important building blocks of wireless and ad-hoc networks studies are various models like propagation models, energy models, interference models and mobility models. Apart from this, students should understand various existing standards for Wireless, Ad-hoc and Sensor networks.

Learning Outcomes:

This course will introduce students various aspects on Wireless as well as ad-hoc networks, and expose them to the fundamental concepts and issues in designing and analyzing wireless and ad-hoc networks. Students will study wireless transmission fundamentals as well models related to wireless networking. Learning these models should allow students understand and designing various protocols related to wireless networks. Students will be introduced with various wireless standards like IEEE 802.11 and IEEE 802.15.4. Students will be able to find issues related to Medium Access Control (MAC) and routing protocols.

Course Outcome	Description
CO1	Outline various wireless networks, their classification based on network architecture and communication coverage area.
CO2	Describe concept of wireless channels, free space propagation model, path loss model, basic propagation mechanisms
CO3	Develop the concept of interference and mobility models, RTS-CTS model, IEEE 802.11 protocols
CO4	Identify different approaches for contention based MAC, Distributed coordination function, WiMAX.
CO5	Applications ,challenges and deployment of wireless sensor network
CO6	Demonstrate the performance of routing protocols, design issues, classification.

Course Contents:

Unit-1 (History of Wireless Networks): Introduction, Wireless Network classification based on Network Architecture and Communication coverage area, Introduction to various wireless networks

Unit-2 (Radio wave Propagation models): Wireless Channels, Antenna gain, Aperture, Wavelength, Wireless channel models - Free-Space Propagation Model, Two-Ray Ground Model, The Log-Distance Path-Loss Model, Large-Scale and Small-Scale Variations, basic propagation mechanisms

Unit-3 (Interference and mobility models): Power Assignment and Topology Control, Wireless interference graph- Protocol-Interference Model, Fixed Power-Protocol-Interference Model, RTS/CTS Model and Physical-Interference Model, Energy consumption models for , Mobility models–Properties of mobility models, Random-Walk and Random-Direction Models, Random-Waypoint Model, Random-Trip Mobility Model, Markov Mobility Models, Smooth Random-Mobility Model, Group Mobility.

Unit-4 (Wireless Medium-Access Control Protocols): Contention based MAC, IEEE 802.11 Architecture and Protocols - Various IEEE 802.11 Protocols, Distributed Coordination Function, Problems and Solutions for the Ad Hoc Model, WiMAX.

Unit-5 (Wireless Sensor Networks): Introduction, need of WSNs, Applications, Challenges, Deployment of ad-hoc/sensor networks, MAC for WSNs, Introduction to IEEE 802.15.4, CSMA/CA for IEEE 802.15.4, Bianchi's Markov chain analysis of throughput for the CSMA protocol.

Unit-6 (Routing protocols): Issues in designing routing protocols, Classification of routing protocols, Routing protocols, various performance metrics

Teaching Methodology:

The Students will be able to learn basic concepts of information theory, memoryless channels and shannon's capacity. They will also learn different types of codes like block codes, cyclic codes and convolutional codes.

Evaluation Scheme:

Exams	**Marks**	**Coverage**
Test-1	15 Marks	Based on Unit-1, Unit-2
Test-2	25 Marks	Based on Unit-2, 3 & Unit-4 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 and Unit-5 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Adhoc Wireless Network (will be added from time to time): Digital copy will be available on the JUET server.

Text Books

1. Wireless Ad-hoc and Sensor Network by Xiang Yang Li, Cambridge Press, 2008.

Reference Books

1. Wireless Communications: Principles and Practice by Theodore S. Rappaport, Pearson Publications, 2010.
2. Holger Karl and Andreas Willig Protocols and Architectures for Wireless Sensor Networks WILEY, ISBN: 0-470-09510-5.
3. Ad Hoc Wireless Networks: Architectures and Protocols by C. Siva Ram Murthy and B. S. Manoj, Prentice Hall, 2004.

Title of Course: Design Patterns **Course Code: 18B14CI746**
L-T-P Scheme: 3-0-0 **Credits: 3**

Pre-requisite: Object Oriented Programming (OOP), Java as an OOP language.

Post Course: Object Oriented Software Engineering, Software Quality Management

Objective: To engineer good quality software from its specification

Learning Outcomes

After learning this course, a student should be able to:

Course Outcome	Description
CO1	Understand and use the basic design principles in solving real life problems
CO2	Appreciate the concept of pattern based analysis and design in software development
CO3	Identify appropriate patterns for design of solution to given problem.
CO4	Distinguish between different categories of design patterns.
CO5	Implement design patterns to solve the real life software design problems.

Course Outline:

Unit-I Software Maintenance and maintainability issues, Need for software design, Rules of an effective software design.
Unit-II Classes and objects revisited, class relationships, composition, inheritance versus interface, inheritance versus composition.
Unit-III Scope and aim of design patterns, object generation, object-object interaction, determining object granularity, specifying object interfaces, specifying object implementations, relating compile-time and run-time structures, frameworks.
Unit-IV Types of design patterns, Creational Patterns: Abstract Factory, Singleton, Factory, Prototype etc. Structural Patterns: Adapter, Composite, Decorator, Façade, etc. Behavioral Patterns: Chain of responsibility, Command, Interpreter, Mediator, Observer, State, Template, Strategy, Visitor, etc.
Unit-V Organization of design patterns, selection of design patterns, model-view-controller, an introduction to architectural and other software engineering patterns.

Teaching Methodology:

This course should be conducted in a highly interactive environment. Students will be taught on different software design principles and how each design pattern fulfils the requirements of one or more design principles. Design patterns will be introduced by taking a real-life example and then the importance of that design pattern in solving the problem will be discussed. Exercises shall almost exclusively consist of design work and students will be required to perform these exercises in the following lectures/ tutorials. Good solutions by students will be appreciated and discussed in the same class. There is a self learning component that shall be announced.

Evaluation Scheme:

Evaluations	Marks	Remarks
T-1	15 Marks (1-Hours)	1^{st} - 4^{th} Week
T-2	25 Marks (1:30 Hours)	5^{th} - 10^{th} Week
T-3	35 Marks (2-Hours)	11^{th} - 16^{th} Week
Assignments	10 Marks	
Tutorials / Subject Seminar	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Book

1. Grady Booch, James Rambaugh, Ivar Jacobson, "The Unified Modeling Language Users Guide", Addision Wesley.
2. Pressman S. Roger, "Software Engineering: A practitioner's Approach", 7^{th} Edition, McGraw Hill.
3. The Gang of Four, "Design Patterns: Elements of Reusable Object-Oriented Software", Addision Wesley.

Title of Course: Internet of Things **Course Code: 18B14CI747**

L-T-P scheme: 2-0-2 **Course Credits: 3**

Prerequisite: Students are expected to have a good understanding of computer networks, familiarity with network programming, and object oriented programming.

Objective:

The course is designed to provide an introduction to the Internet of Things (IoT) for postgraduate students who already have a background in electronic engineering or a related subject, an understanding of basic networking and some programming experience. The course is designed to give the students a solid grounding of the key technologies involved and how they are integrated to form complete IoT systems.

The course has a significant practical content in that half of the time will be spent on practical lab exercises, involving IoT system design and software development.

Learning Outcomes:

On completion of this course, students should be able to:

Course Outcome	Description
CO1	Explain the definition and usage of the term "The Internet of Things" in different contexts.
CO2	Understand where the IoT concept fits within the broader ICT industry and possible future trends.
CO3	Understand the various network protocols used in IoT.
CO4	Be familiar with the key wireless technologies used in IoT systems, such as WiFi, 6LoWPAN, Bluetooth and ZigBee.
CO5	Design a simple IoT system comprising sensors, wireless network connection, data analytics and display/actuators, and write the necessary control software.

Course Contents:

Introduction to the Internet of Things (IoT)

- What is the Internet of Things (IoT)?
- Technology drivers
- Business drivers
- Typical IoT applications
- Trends and implications

IoT Architectures

- Architectures for IoT
- Elements of an IoT Architecture
- Architectural design considerations

IoT Network protocols (MAC layer)

- Wireless sensor networks (WSNs) and power consumption
- CSMA/CA and slotting
- Centralized vs. distributed
- State-of-the-art MAC-layer protocols for WSNs

Wireless technologies for IoT

- WiFi (IEEE 802.11)
- Bluetooth/Bluetooth Smart
- ZigBee/ZigBee Smart
- UWB (IEEE 802.15.4)
- 6LoWPAN
- Proprietary systems

IoT application programming

- - Introduction to IoT device programming.
- - IoT application development.

Data analytics for IoT

- A framework for data-driven decision making
- Descriptive, Predictive and Prescriptive Analytics
- Business Intelligence and Artificial Intelligence
- Importance of impact and open innovation in data-driven decision making

IOT lab exercises

- Lab exercise: Programming for IoT system/Connection/Data Transfer etc.
- Lab exercise : Android programming

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books:

1. Zhao, Feng, and Leonidas J. Guibas. *Wireless sensor networks: an information processing approach*. Morgan Kaufmann, 2004.
2. Karl, Holger, and Andreas Willig. *Protocols and architectures for wireless sensor networks*. John Wiley & Sons, 2007.
3. Dargie, Waltenegus W., and Christian Poellabauer. *Fundamentals of wireless sensor networks: theory and practice*. John Wiley & Sons, 2010.

Title of Course: Network Security **Course Code: 18B14CI748**

L-T Scheme: 3 **Course Credits: 3**

Prerequisites: Knowledge of Computer Networks

Objectives:

To study the concepts of network security and various cryptographic algorithms, hardware and software security, IDS, wireless security, web security, security laws with Internet Governance & Email policy.

Learning Outcome:

Course Outcome	Description
CO1	Discuss the basic concepts of network security and various cryptographic algorithms.
CO2	Describe various hardware and software securities for information.
CO3	Discuss how Intrusion Detection System helps to provide security along with various types of firewalls.
CO4	Describe how wireless security provided to information
CO5	Discuss various concepts of web security.
CO6	Discuss security and law along with Internet Governance and Email policy.

Course Contents:

UNIT I : Introduction and Cryptography

Introduction: Computer security concepts, The OSI security architecture, Security attacks, Security services, Security mechanisms, A model for network security, Standards Cryptography: Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Random and Pseudorandom Numbers, Stream Ciphers and RC4, Cipher Block Modes of Operation, Approaches to Message Authentication, Secure Hash Function, Message Authentication Codes, Public Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures.

UNIT II: Hardware and Software Security

Hardware Security, Smart Cards, Biometrics, Virtual Private Networks, Types of VPN's, Trusted Operating Systems, Pretty Good Privacy (PGP), Security Protocols, Security Socket Layer, Transport Layer Security, IPSec, S/MIME(Secure/Multipurpose Internet Mail Extension).

UNIT III: Intrusion Detection System and Firewalls

IDS: What is not an IDS?, Infrastructure of IDS, Classification of IDS, Host-based IDS, Network based IDS, Anomaly Vs Signature Detection, Normal Behaviour Patterns-Anomaly Detection, Misbehaviour Signatures-Signature Detection, Parameter Pattern Matching, Manage an IDS. Malicious Software, Safeguards, Firewalls, Packet-Filtering Firewalls, State full Inspection Firewalls, Proxy firewalls, Guard, Personal Firewalls, Limitations of Firewalls.

UNIT IV: Wireless Security

Wireless Application Protocol, WAP Security, Authentication, Integrity, Confidentiality, Security Issues with Wireless Transport Layer Security (WTLS), Wireless LAN, WLAN Configuration, WLAN Technology consideration, Wireless LAN Security, Access Point Security, Work Station Security, Safeguarding Wireless LAN's.

UNIT V: Web Security

Client/Server Architecture, Security considerations and Threats, Web traffic security approaches, SSL/TLS for secure web services, The Twin concept of "SSL Connection" and "SSL Session", SSL session state, SSL Connection State, SSL Record Protocol, SSL Handshake Protocol, Secure Hypertext Transport Protocol(S-HTTP), Secure Electronic Transaction(SET), Business Requirements, SET Participants, SET Transaction Flow.

UNIT VI: Security and Law, Internet Governance and Email Policy

Security and Law: Regulations in India, Information Technology Act 2000, Cyber Crime and the IT Act 2000, Indian Contract Act, 1872, Indian Penal Code, Indian Copyright Act, Consumer Protection Act, 1986, Specific Relief Act, 1963, Government Initiatives, Future Trends-Law of Convergence.

Internet Governance and Email Policy: Internet Governance, Network Security Aspects in E-Governance, Security Monitoring Tools, Electronic Mail, What are the e-mail Threats that Organization's face?, Why do you need an E-mail Policy?, How do you create an E-mail Policy?, Publishing the E-mail Policy, University E-mail Policy, Electronic mail policy.

Teaching Methodology:

The course will be covered through lecture (power point presentation), Practical/Lab Assignment sheets and practical simulations in network security; Some Section of the course will include the study of additional literature to allow them to see how the leading edge is advanced in this area of the discipline. Full engagement in the course is a critical part of learning methods appropriate to this area of the discipline.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books:

1. W. Stalling, Cryptography and Network Security: Principles and Practices.
2. William Stallings, Network Security Essentials: Applications and Standards, Pearson Educaiton, ISBN: 9788131716649,
3. B. A. Forouzan, Cryptography and Network Security.

References:

1. Eric Cole, Network Security Bible, Wiley Publisher, ISBN:9788126523313
2. J. M. Kizza, Computer Network Security, Springer, 2005.
3. Peterson and Davie, Computer Networks a System Approach, Elsevier.

Title of Course: Software Engineering Management **Course code: 18B14CI750**
L-T Scheme: 3-0-0 **Course Credits: 3**

Pre-requisites
Students must have knowledge of "Software Engineering"

Objectives
1. To strengthen their ability to apply Software Engineering Principles and practices to manage individuals and teams in software projects.
2. To strengthen their skills in Requirements engineering, Configuration management, quality management, applying design patterns and software testing techniques.
3. To provide experience in the use of project management planning tools.

Learning Outcomes
Student will be able to:

Course Outcome	Description
CO1	Manage and Plan Team based Projects.
CO2	Elicit, document and validate requirements for projects.
CO3	Learn and apply Design pattern concepts in developing applications of varying complexities.
CO4	To achieve good quality software.
CO5	To ensure the delivery of the system is on time and within budget.
CO6	Develop test cases and automate software testing.

Course content:

1. **Introduction to Software Engineering & Project Management**
   Modeling Processes and Life-Cycle , Software process models , Process iteration , Process activities , Cost estimation, Project scheduling, Staffing,
2. **Software Configuration management**
   Base line, Software Configuration Items, The SCM Process, Version Control , Change Control , Configuration Audit , Status Reporting , SCM Standards
3. **Software Quality Management**
   Quality concepts, Quality Assurance, Quality Planning, Quality control, Software measurement And metrics.
4. **Software Reengineering and Maintenance:**

   Reverse engineering, Forward engineering, Restructuring, Reengineering Process Model.
5. **Risk Management**

   Risk strategies, Reactive & Proactive Risk strategies, Software Risk, Risk Identification, Risk projection, Risk Assessment, Risk Refinement, Risk Mitigation, monitoring and Management.
6. **AGILE**

   Agile development, Classification of methods, Agile principals, Agile project management, SCRUM, XP, EVO and UP Method overview, Life cycle, Work product, role and services, Common mistakes and misunderstandings, Process mixture, Adoption strategy.
7. **Software Reuse**

Introduction of software reuse, Basic Issues in any Reuse Program,Reuse Approach,Reuse at Organization Level, Introduction of Reusable Component, COTS,Component Adaptation Technoques.

Teaching Methodology

Course will be delivered through lecture sessions and assignments. Course will emphasize more on Mini-Projects. Students will apply advance concepts of Requirements Engineering, Agile methods, Design patterns, RMMM in their mini-projects. They will design test cases for their problem domain and also work on automated testing tools. Students will have to maintain a report on each mini-project. Research literature on topics mentioned in course outline will be studied and presented by the students.

Evaluation Scheme

Evaluations	**Marks**	**Remarks**
T-1	15 Marks(1-Hour)	
T-2	25 Marks (1 Hour 30 Min.)	
T-3	35 Marks (2- Hours)	
Tutorials and Case Study	5 Marks	
Assignments	10 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Reference Material

1. Agile and Iterative Development: A Manager's Guide, Craig Larman
2. Introduction to the Personal Software Process (SM), Watts Humphrey
3. Introduction to the Team Software Process(SM),Watts Humphrey
4. Software Engineering, R.S. Pressman, McGraw Hill
5. Software Engineering Project Management, by Richard Thayor, Forwarded By Edward Yourden
6. Software Testing Techniques, B. Beizer
7. Software Testing ,Louis Tamres
8. Aspect-Oriented Analysis and Design: The Theme Approach (The Addison-Wesley Object Technology Series)
9. Engineering and Managing Software Requirements, by Claes. Wohlin
10. Requirements Engineering, by Elizabeth. Hull, Ken. Jackson, Jeremy. Dick
11. User-Centered Requirements Engineering, by Alistair Sutcliffe

Title of Course: Information Retrieval & Data Mining **Course Code: 18B14CI752**
L-T Scheme: 3-0-0 **Course Credits: 3**

Pre-requisite: Students must have already registered for the course, "Database Management System".

Course Description: This Course introduces the core concepts of data mining (DM), its techniques, implementation, and benefits. Course also identifies industry branches that most benefit from DM, such as retail, target marketing, fraud protection, health care and science, and web and e-commerce. Detailed case studies and using leading mining tools on real data are presented.

Course Objective: This subject enables students to-

- Learn data mining concepts by means of data analysis techniques to make better decisions through proper data preparation and simple tools for solving data mining problems.
- Understand core topics like classification, clustering and association rules are exhaustively dealt with.
- learn the role that software tools/applications play in DM, with emphasis on industrial case studies and practical applications;
- Have an overall understanding of the major issues and applications in data mining, including a basic grasp of the algorithm classes and best practices for building successful data mining projects.

Learning Outcomes: Upon completion of the subject, students will be able to-

Course Outcome	Description
CO1	Examine the concepts of data warehousing and OLAP
CO2	Design various types of data models.
CO3	Apply the concepts of DM techniques for clustering, association, and classification on real datasets.
CO4	Select appropriate DM tools and methods to manipulate and achieve data
CO5	Apply DM concepts for formulating business strategies and programs to enhance business intelligence.

Course Contents:

Unit- I (Data Warehousing): Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata.

Unit- II (Data Preprocessing): Overview of different type of data and its format. Data collection, extraction and loading (ETL tools), data interestingness measures. Data cleaning, data integration and transformation, data reduction, discretization, concept hierarchies.

Unit-III (Data Mining): Data Mining Functionalities- Interestingness of Patterns-Classification of Data Mining Systems, Data Mining Task Primitives, Integration of a Data Mining System with a Data Warehouse.

Unit-IV (Association Rule Mining And Classification): Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining Various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction - Basic Concepts - Decision Tree.

Induction-Bayesian Classification, Rule Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction.

Unit-V (Clustering And Applications And Trends In Data Mining): Cluster Analysis - Types of Data, Categorization of Major Clustering Methods, Kmeans, Partitioning Methods, Hierarchical

Methods, Density-Based Methods, Grid Based Methods, Model-Based Clustering Methods, Clustering High Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis, Data Mining Application.

Unit-VI (Advance Topic in Data Mining): Mining Complex Data Types, Mining text databases, mining the Web, mining time-series and sequence datasets.

Teaching Methodology: This course relies on lectures to guide through the material, tutorial classes to provide students with class, and a sequence of written and online assignments to provide formative assessment opportunities for students to practice techniques and develop their understanding of the course.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. Alex Berson and Stephen J. Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Tenth Reprint 2007.
2. Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, Second Edition, Elsevier, 2007.

Reference Books

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction To Data Mining”, Person Education, 2007.
2. K.P. Soman, Shyam Diwakar and V. Ajay “, Insight into Data mining Theory andPractice”, Easter Economy Edition, Prentice Hall of India, 2006.
3. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.
4. Daniel T. Larose, “Data Mining Methods and Models”, Wile-Interscience, 2006

Title of Course: Component Based Software Engineering **Course Code: 18B14CI756**
L-T Scheme: 3 **Course Credits: 3**

Course Objectives:

The Course focuses on an approach to software development based on extensive use of pre-existing standard (or customizable) components. It also illustrates how a repository of reusable candidate components can be integrated into a typical evolutionary process model. The Component-based Software Engineering process involves identifying candidate components; qualify each component interface, and adapting components.

Learning Outcomes:

Course Outcome	Description
CO1	Describe the role of Component Based Software Engineering (CBSE) within the software life cycle.
CO2	Apply key elements and common methods for CBSE.
CO3	Describe, Compare, contrast and evaluate structured, Object Oriented, Data Oriented and formal approaches to component modeling.
CO4	Conduct a review of CBSE requirements and using best practices to determine the quality of the CBS.
CO5	Demonstrate the capacity to use a range of software tools in support of CBS.

Course Contents:

Introduction- Component definition, Definition of a Software Component and its elements, The Component Industry Metaphor, Component Models and Component Services, An example specification for implementing a temperature regulator Software Component. The Case for Components- The Business Case for components, COTS Myths. CBSE implementation in Java 8.

Planning Team Roles for CBD, **Common High-Risk Mistakes, and CBSE Success Factors**: Integrating Architecture, Process, and Organization. Software Engineering Practices - Practices of Software Engineering, From Subroutines to Subsystems: Component-Based Software Development, Case study of Car Navigation System.

The Design of Software Component Infrastructures - Software Components and the Modelling (UML), Component Infrastructures, Business Components, Components and Connectors, An OPEN process for CBD, Designing Models of Modularity and Integration. Software Architecture, Software Architecture Design Principles, Product-Line Architectures.

The Management of Component-Based Software Systems - Measurement and Metrics for Software Components, Implementing a Practical Reuse Program for Software Components, Selecting the Right COTS Software, Building instead of Buying, Software Component Project Management, The Trouble with Testing Components, Configuration Management and Component Libraries, The Evolution, Maintenance and Management of CBS.

Component Technologies - Overview of the CORBA Component Model, Overview of COM+, Overview of the EJB Component Model, Bonobo and Free Software GNOME Components, Choosing between COM+, EJB, and CCM, Event-driven component based architecture, Software Agents as Next Generation Software Components.

Teaching Methodology

Lectures would be interactive and it would cover the core concepts that are explained in the text and reference materials with adequate examples. The partly two Problem solving session will have conceptual and numerical questions that would aid in strengthening the component based software engineering.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	
Test-2	25 Marks	
Test-3	35 Marks	
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. Component - Based Software Engineering, G.T. Heineman and W.T. Councill, Addison-Wesley, Pearson Education.

Reference Books

1. Component Software, C.Szyperski, D.Gruntz and S.Murer, Pearson Education.
2. Software Engineering, Roger S. Pressman, 6th edition, Tata McGraw-Hill.
3. Software Engineering, Ian Sommerville, seventh edition, Pearson education, 2004.
4. Software Engineering Principles and Practice, Hans Van Vliet, 3rd edition, Wiley India edition.

Title of Course: Parallel Computing **Course Code: 18B14CI758**
L-T Scheme: 3-0-0 **Course Credits: 3**

Prerequisites: Data Structures

Objectives: To familiarize the students with classical results of parallel computing and to provide practical insights into how algorithms are made to run efficiently on processor arrays, multiprocessors and multi-computers.

Learning Outcomes: Students will be able to

Course Outcome	Description
CO1	Apply knowledge of mathematics, science, and engineering to real world problems
CO2	Design and conduct experiments, as well as to analyze and interpret data
CO3	Design a system, component, or process to meet desired needs within realistic constraints
CO4	Function on multi-disciplinary teams.
CO5	Ability to identify, formulates, and solves engineering problems.
CO6	Understand professional and ethical responsibility

Course Contents:

Unit-1 (Introduction): Paradigms of parallel computing: Synchronous - vector/array, SIMD, Systolic; Asynchronous - MIMD, reduction paradigm. Need for Higher-Performance computers, Methods used to achieve Higher Performance, Classifying Architectures Hardware taxonomy: Flynn's classifications, Handler's classifications.

Unit-2 (Abstract parallel computational models): Combinational circuits, Sorting network, PRAM models, Interconnection RAMs. Parallelism approaches - data parallelism, control parallelism, Models of Parallel Computation: Processor organization, Processor arrays, Multiprocessors and Multi-computers.

Unit-3 (Performance Matrices): Laws governing performance measurements. Matrices- speedups, efficiency, utilization, communication overheads, single/multiple program performances, bench marks. Parallel Processors: Taxonomy and topology - shared memory multiprocessors, distributed memory networks. Processor organization - Static and dynamic interconnections.

Unit-4 (Parallel Programming & Designing Parallel Algorithms): Developing algorithms for Processor Arrays, Shared memory programming, distributed memory programming, object oriented programming, data parallel programming, functional and dataflow programming.

Unit-5 (Sorting on different models of SIMD, Matrix Multiplication): Matrix multiplication for different models of Processor arrays and multiprocessors. Scheduling and Parallelization: Scheduling parallel programs. Loop scheduling. Parallelization of sequential programs. Parallel programming support environments.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. M. J. Quinn. Parallel Computing: Theory and Practice, McGraw Hill, New York, 1994.

References

1. T. G. Lewis and H. El-Rewini. Introduction to Parallel Computing, Prentice Hall, New Jersey, 1992.
2. T. G. Lewis. Parallel Programming: A Machine-Independent Approach, IEEE Computer Society Press, Los Alamitos, 1994. Research articles.

Title of Course: Data Mining Tools and Applications **Course Code: 18B14CI759**
L-T Scheme: 3-0-0 **Course Credits: 3**

Objectives: To study advanced aspects of data warehousing and data mining, encompassing the principles, research results and commercial application of the technologies.

Learning Outcomes:
At the end of the course the students will have knowledge of:

Course Outcome	Description
CO1	Data analysis methods, covering traditional methods but with greater emphasis on modern methods that locate and address common data foibles
CO2	Survey design & data collection issues
CO3	Multivariate methods: supervised/unsupervised classification, data reduction
CO4	Univariate methods: both basic (e.g. t-tests, ANOVA, linear models) and advanced (e.g. Generalized Linear Models, Generalized Additive Models).
CO5	Data mining methods: tree methods with boosting and bagging; Multivariate Adaptive Regression Splines; Random Forests; Neural Nets; model diagnostics
CO6	Tools for difficult data: ridge regression; basic data imputation

Course Contents:

Unit-I: Data Mining and Knowledge Discovery, The KDD process and methodology, Data preparation for knowledge discovery, Overview of data mining and Machine Learning techniques, Review of Python and overview of Python tools for Data Analysis.

Unit-II: Supervised Techniques, Classification and Prediction using K-Nearest-Neighbor, Classifying with Probability Theory; Naïve Bayes, Building Decision Trees, Forecasting and Regression models, Evaluating predictive models.

Unit-III: Unsupervised Learning, Clustering using K-Means, Association Rule discovery, Sequential Pattern Analysis, Principal Component Analysis and Dimensionality, Reduction.

Unit-IV: Possible Applications (covered throughout the course), Collaborative Recommender Systems, Content Based personalization, Predictive User Modeling, Concept Discovery from Documents, Blogs, Social Annotations, Finding groups using social or behavioral data, Building predictive models for target marketing, Customer or user segmentation.

Unit-V: Advance Topics (if time permits), SVD and Matrix Factorization, Search and Optimization Techniques, Markov Models, Dealing with Big Data and Map Reduce.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	

Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. "Building the Data Warehouse", W. H. Inman, 3rd edition, John Wiley & Sons.
2. "Data Mining Techniques", Arun K. Pujari, University Press.

References

1. W.H.Inmon, C.L.Gassey, "Managing the Data Warehouse", John Wiley & Sons.
2. Fayyad, Usama M. et. al., "Advances in knowledge discovery & Data-Mining", MIT Press.
3. Dunham, Margaret H.,"Data Mining –Introductory and Advanced Topics.

Title of Course: Distributed Systems **Course Code: 18B14CI760**
L-T Scheme: 3-0-0 **Course Credits: 3**

Objectives: Distributed systems techniques developed over the last two to three decades, such as inter-process communication and remote invocation, distributed naming, cryptographic security, distributed file systems, data replication and distributed transaction mechanisms, to provide the run-time infrastructure supporting today's networked computer applications will be covered under this course.

Learning Outcomes: With this course we will be able to convey insight into, and knowledge of, the principles and practice underlying the design of distributed systems, both Internet-based and otherwise. Information will be provided in sufficient depth to allow students to evaluate existing systems or design new ones. Detailed case studies illustrate the concepts for each major topic.

Course Contents:

Unit-1 (Introduction): Introduction to distributed systems, Definition of distributed systems, goals, hardware concepts, software concepts, the client-server model.

Unit-2 (Communication): Layered protocols, remote procedure call, remote object invocation, message-oriented communication, stream-oriented communication.

Unit-3 (Processes): Threads, clients, servers, code migration, software agents.

Unit-4 (Naming): Naming entities, location mobile entities, removing unreferenced entities.

Unit-5 (Synchronization): Clock synchronization, logical clocks, global state, election algorithms, mutual exclusion, and distributed transaction.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. Tanenbaum, Andrew S. Steen, Maarten Van , “Distributed Systems Principles and Paradigms”, Pearson Education.

References

1. Coulouris, George ,Dollimore, Jean , Distributed Systems: Concepts and Design” Person
2. Buchanan, William “Distributed Systems and Networks” TMGH
3. Ghosh, Sukumar, “Distributed Systems: An Algorithmic Approach”

Course Title: Cryptography Systems **Course Code: 18B14CI841**
L-T-P Scheme: 3-0-0 **Credit: 3**

Course Objective:

1. To provide comprehensive understanding of cryptographic principles, techniques, and applications.
2. To enable students to design, implement, and analyze secure cryptographic solutions.

Learning Outcomes:

CO1	Remember: Recall fundamental cryptographic principles, including encryption methods, cryptographic algorithms, and security properties such as confidentiality and integrity.
CO2	Understand: Explain the workings of various cryptographic techniques, such as symmetric-key cryptography, public-key cryptography, and cryptographic hash functions, and analyze their strengths and weaknesses.
CO3	Apply: Implement cryptographic algorithms and protocols using programming languages, demonstrate proficiency in encryption, decryption, digital signatures, and key management.
CO4	Analyze: Evaluate the security of cryptographic systems by identifying vulnerabilities, analyzing potential attacks, and assessing the effectiveness of cryptographic countermeasures.
CO5	Create: Design secure cryptographic solutions for real-world scenarios, including secure communication protocols, data encryption schemes, and authentication systems, considering factors such as efficiency, scalability, and resistance to attacks.

Course Content:

Unit-1: Introduction and Classical Ciphers

Security: Computer Security, Information Security, Network Security, CIA Triad, Cryptography, Cryptosystem, Cryptanalysis, Security Threats and Attacks, Security Services, Security Mechanisms. Classical Cryptosystems: Substitution Techniques: Ceasar, Monoalphabetic, Playfair, Hill, Polyalphabetic ciphers, One-time pad Transposition Techniques: Rail Fence Cipher, Modern Ciphers: Block vs. Stream Ciphers, Symmetric vs. Asymmetric Ciphers

Unit-2: Symmetric Ciphers

Feistel Cipher Structure, Substitution Permutation Network (SPN), Data Encryption Standards (DES), Double DES, Triple DES, Finite Fields: Groups Rings, Fields, Modular Arithmetic, Euclidean Algorithm, Galois Fields (GF(p) & GF(2n)), Polynomial Arithmetic, International Data Encryption Standard (IDEA), Advanced Encryption Standards (AES) Cipher, Modes of Block Cipher Encryptions (Electronic Code Book, Cipher Block Chaining, Cipher Feedback Mode, Output Feedback Mode, Counter Mode)

Unit-3: Asymmetric Ciphers

Number Theory: Prime Numbers, Fermat's Theorem, Euler's Theorem, Primality Testing, Miller-Rabin Algorithm, Extended Euclidean Theorem, Discrete Logarithms, Public Key Cryptosystems, Applications of Public Key Cryptosystems, Distribution of public key, Distribution of secret key by using public key cryptography, Diffie-Helman Key Exchange, Man-in-the-Middle Attack, RSA Algorithm, Elgamal Cryptographic System

Unit-4: Cryptographic Hash Functions and Digital Signatures

Message Authentication, Message Authentication Functions, Message Authentication Codes, Hash Functions, Properties of Hash functions, Applications of Hash Functions, Message Digests: MD4 and MD5Secure Hash Algorithms: SHA-1 and SHA-2.

Digital Signatures: Direct Digital Signatures, Arbitrated Digital Signature, Digital Signature Standard: The DSS Approach, Digital Signature Algorithm, Digital Signature Standard: The RSA Approach

Unit-5: Authentication

Authentication System, Password Based Authentication, Dictionary Attacks, Challenge Response System, Biometric System, Needham-Schroeder Scheme, Kerberos Protocol

Unit-6: Network Security and Public Key Infrastructure

Overview of Network Security, Digital Certificates and X.509 certificates, Certificate Life Cycle Management, PKI trust models, PKIX, Email Security: Pretty Good Privacy (PGP), Secure Socket Layer (SSL) and Transport Layer Security (TLS), IP Security (IPSec), Firewalls and their types.

Unit-7: Malicious Logic

Malicious Logic, Types of Malicious Logic: Virus, Worm, Trojan Horse, Zombies, Denial of Service Attacks, Intrusion, Intruders and their types, Intrusion Detection System

Teaching Methodology:

In this course, we will employ a multifaceted teaching methodology to ensure a comprehensive understanding of cryptography and network security principles, as well as practical application skills. Our teaching approach will encompass the following strategies:

1. Lecture Sessions: Engage in interactive lectures to introduce theoretical concepts, historical context, and fundamental principles of cryptography and network security.
2. Interactive Discussions: Encourage active participation through discussions, debates, and Q&A sessions to promote critical thinking and deeper understanding of the material.
3. Case Studies and Real-world Examples: Analyze case studies and real-world examples to demonstrate the relevance of cryptography and network security in various industries and contexts.
4. Group Projects: Assign group projects where students will apply their knowledge to solve real-world security challenges, design secure communication protocols, or propose innovative cryptographic solutions for specific applications.
5. Assessment: Evaluate student learning through quizzes, assignments, exams, and project presentations, assessing both theoretical understanding and practical skills.
6. Continuous Feedback: Provide regular feedback to guide student learning, address misconceptions, and encourage continuous improvement. Stay Updated: Incorporate the latest developments, research papers, and industry trends into the course content to ensure relevance and currency.

Evaluation Scheme:

Exams		Marks	Coverage
T-1		15 Marks	**Based on Units: 1-3**
T-2		25 Marks	**Based on Units: 1-5**
T-3		35 Marks	**Based on Units:1-7**
Teacher's Assessment	Assignment	10 Marks	**25 Marks**
	Tutorial	05 Marks	
	Quiz	05 Marks	
	Attendance	05 Marks	
Total		**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Cryptographic Systems (will be added from time to time): Digital copy will be available on the JUET server/ Google Classroom.

Books:

Text Book

[1] W. Stallings, Cryptography and Network Security, Pearson Education.

Reference Books

[1] William Stallings, Network Security, Principles and Practice
[2] Matt Bishop, Computer Security, Art and Science.
[3] Mark Stamp, Information Security: Principles and Practices.
[4] Bruce Schneier, Applied Cryptography.
[5] Douglas. R. Stinson. Cryptography: Theory and Practice.
[6] B. A. Forouzan, Cryptography & Network Security, Tata Mc Graw Hill.

Web References:

[1] https://www.w3schools.com/cybersecurity/
[2] https://www.geeksforgeeks.org/cryptography-and-its-types/

Course Title: Mobile Computing **Course Code: 18B14CI842**
L-T-P Scheme: 3-0-0 **Credit: 3**

Course Objective:

The objective of the course is to make the student understand the concept of mobile computing paradigm, its novel applications and limitations.

Learning Outcomes:

CO1	To understand the basic concepts of Mobile Computing, its characteristics, applications and limitations.
CO2	To explain the typical mobile networking infrastructure through a popular GSM protocol.
CO3	To understand the issues and solutions of various layers of mobile networks- MAC layer, Network Layer & Transport Layer
CO4	To analyze various protocols of all layers for mobile and wireless communication networks.
CO5	Able to explain & develop any existing or new protocol related to mobile environment

Course Content:

UNIT I Introduction

Introduction to Mobile Computing, Applications of Mobile Computing, Generations of Mobile Communication Technologies, Mobile Computing Vs wireless Networking , Mobile Computing Applications ,Characteristics of Mobile computing, Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.

UNIT II Mobile Telecommunication System

Introduction to Cellular Systems, GSM — Services & Architecture, Protocols, Connection Establishment, Frequency Allocation, Routing, Mobility Management, Security, GPRS- UMTS Architecture, Handover. Multiplexing — Spread spectrum -MAC Protocols — SDMA- TDMA- FDMA- CDMA

UNIT III Mobile Network Layer

Mobile IPIP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP

UNIT IV Mobile Transport Layer

Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks. Database Issues: Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation, Transactional Models, Query processing, Data Recovery Process & QoS Issues.

UNIT V Mobile Application Layer

Introduction of WAP, WAP applications, WAP Architecture, WAP Protocol Stack, Challenges in WAPWDP, WTLS, WTP, WSP, WAE, WTA Architecture, WML, Introduction to 4G, features and challenges, Applications of 4G, OFDM

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	
Test-2	25 Marks	
Test-3	35 Marks	
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

References:

1. Mobile Computing Technology, Applications and service creation, Asoke K Telukder, Roopa R Yavagal by TMH.
2. Mobile Computing, Raj Kamal by Oxford
3. Wireless Communications, Second Edition, Theodre S Rappaport
4. Mobile Computing Theory and Practice-Kumkum Garg-Pearson
5. TCP/IP Protocol Suite by Behrouz A Forouzan, Third Edition,TMH

Title of Course: Introduction to Machine Learning **Course Code: 18B11CI843**
L-T-P Scheme: 3-0-0 **Course Credit: 3**

Prerequisite: Students must have knowledge of statistical techniques

Objectives:
In this course we will study the basic component of an intelligence system i.e. machine learning, their functions, mechanisms, policies and techniques used in their implementation and examples.

Learning Outcomes:
The students will have

Course Outcome	Description
CO1	List various approaches of Machine Learning.
CO2	Describe machine learning algorithms to solve the real world problems
CO3	Develop Hypothesis and machine learning models
CO4	Identify appropriate models for solving machine learning problems.
CO5	Apply learning techniques to solve real world machine learning problems
CO6	Evaluate and interpret the results of the algorithms.

Course Contents:

1. Introduction:
   What Is Machine Learning?, Why Use Machine Learning? ,Types of Machine Learning Systems, Supervised/Unsupervised Learning, Batch and Online Learning, Instance-Based Versus Model-Based Learning, Hypothesis generation, Main Challenges of Machine Learning, Data sets and Testing and Validating.

2. Concept Learning:
   Introduction to Concept Learning, Concept Learning Task, Notation, Inductive Learning Hypotheses, Concept Learning as Search: Generic-to-Specific Ordering of Hypotheses, Finding a Maximally Specific Hypotheses, Version Spaces, Candidate-Elimination Algorithms.

3. Classification:
   MNIST Training a Binary Classifier, Performance Measures, Measuring Accuracy Using Cross-Validation, Confusion Matrix, Precision and Recall Precision/Recall Tradeoff, The ROC Curve, Multiclass Classification, Error Analysis, Multi label and Multi output classification
4. Training Models:
   Linear Regression, The Normal Equation, Computational Complexity, Gradient Descent, Polynomial Regression, Learning Curves, Regularized Linear Models, Logistic Regression, Estimating Probabilities, Training and Cost Function, and Decision Boundaries
5. Support Vector Machines
   Linear SVM Classification, Soft Margin Classification, Nonlinear SVM Classification,
   Polynomial Kernel, Adding Similarity Features, Gaussian RBF Kernel, Computational Complexity, SVM Regression, Decision Function and Predictions, and The Dual Problem
6. Decision Trees
   Training and Visualizing a Decision Tree, Making Predictions, Estimating Class Probabilities, The CART Training Algorithm, Computational Complexity, Gini Impurity or Entropy, Regularization of hyper parameters, and Random Forests

7. Dimensionality Reduction:
   The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, Projection, Manifold Learning, PCA, Preserving the Variance, Principal Components, Choosing the Right Number of Dimensions
8. Unsupervised Learning Techniques:
   Clustering, K-Means, Limits of K-Means, Using clustering for image segmentation, Using Clustering for Pre-processing and for Semi-Supervised Learning
9. Introduction to Neural Networks:
   From Biological to Artificial Neurons, Biological Neurons, Logical Computations with Neurons, The Perceptron, Multi-Layer Perceptron and Backpropagation

Evaluation Scheme:

Exams	**Marks**	**Coverage**
Test-1	15 Marks	
Test-2	25 Marks	
Test-3	35 Marks	
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Reference Books:

1: Machine Learning, TOM M MITCHELL, TMH
2: Introduction to Machine Learning, 2nd Ed, Ethem Alpaydin, The MIT Press Cambridge, Massachusetts,London, England.
3. Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Ed, Aurelien Geron, O'RIELLY

Title: Cloud Computing **Code: 18B14CI847**
L-T-P scheme: 3-0-0 **Credit: 3**

Objectives:

1. To provide introduction to the fundamental principles of cloud computing
2. Students should able to identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
3. Students should learn and investigate the hardware and software architecture of Cloud Computing and understand how virtualization is key to a successful Cloud Computing solution.

Learning Outcomes:

CO1.	Understand Cloud Computing Architectural Framework with Service Models.
CO2.	Demonstrate with different levels of Virtualization by creating Virtual Machine for different applications.
CO3.	Analyse cloud computing security challenges to design the security model.
CO4.	Appraise the cloud management with migration techniques.
CO5.	Develop the applications on Microsoft Azure, Google App Engine, Web 2.0 platforms.

Course Contents:

Fundamentals of Cloud Computing:

Fundamental concepts of Distributed Systems, IT Challenges, Technology Foundations of Cloud Computing, What is Cloud Computing? NIST Definition and Overview of Cloud Computing, Journey of the Cloud, Essential Characteristics of Cloud Computing, Cloud Components, Cloud Challenges, Economics of the Cloud

Understanding Cloud Architecture And Services:

Cloud Architecture, Service Model and Deployment Model, Stack, Management Layers, Standards, Interoperability, Cloud Maturity, Introducing SOA, Relating SOA and Cloud Computing, Architectural Influences, Services: Storage-as-a-Service, Database-as-a-Service, Information-as-a-Service, Identity-as-a-Service, Process-as-a-Service, Integration-as-a-Service, Compliance-as-a-Service, Security-as-a-Service, Management/Governance-as-a-Service, Testing-as-a-Service

Infrastructure-As-A-Service (Iaas):

Virtualization Overview, **Virtualized Data Center (VDC) – Compute**: Why Virtualize, How to Virtualize, Types of Virtualization, Understanding Hypervisors, Virtual Machine and its Components, Resource Management, Share, Limit and Reservation, Optimizing Memory Resource, Memory Ballooning, Virtual Machine Affinity, Physical to Virtual Conversion: Hot and Cold Conversion Process , **Virtualized Data Center (VDC) – Storage**: Benefits, Storage Virtualization at different Layers, Virtual Machine Storage Options and Considerations, Virtual Provisioning, Storage Tiering, **Virtualized Data Center (VDC) – Networking**: BenefitsComponents of VDC network infrastructure, Virtual Network Components, Virtual LAN, VLAN, Trunking, VLAN Tagging, Network Traffic Management, **Virtualized Data Center (VDC) - Desktop and Application**, VMware vSphere

Platform-As-A-Service (Paas):

PaaS: Overview, Web Application Frameworks, Web Hosting Services- 1: Google App Engine
Web Hosting Services- 2: Microsoft Azure Service

Software-As-A-Service (Saas):

SaaS: Overview, Web Services 2.0, REST API, SOAP API, User Authentication, Case Study: Healthcare or Banking

Cloud Security:

Cloud Security: Information Security, Basic Terminology, Security Domains, Security Concerns and Threats, Access Control and Identity Management in Cloud, Governance, Risk and Compliance, Virtualization Security Management, Cloud Security Risk, Incident Response, Retirement, Cloud

Computing Security Architecture, Architectural Consideration, Trusted Cloud Computing, Data Privacy, Testing from SOA to the Clouds

Business Continuity In Cloud:

Business Continuity in Cloud: Fault Tolerance Mechanisms in VDC, Backup in VDC, Replication and Migration in VDC, Capacity Planning, Vertical Scaling, Private Cloud Planning, Business Continuity Plan, Availability

Cloud Infrastructure, Management And Migration:

Cloud Infrastructure and Service Creation, Cloud Service Management, Cloud Administration, Cloud Monitoring, Cloud Migration Consideration: Migration Considerations, Phases to Adopt the Cloud

Hadoop In Cloud Computing:

Overview of Big Data Analytics, Overview of Hadoop and Map Reduce, Example of Map Reduce, Hadoop as a Service in Public Cloud, Hadoop in Private Cloud, HDInsight

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Book:

1. Rajkumar Buyya (Editor), James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley India Pvt Ltd, 2013.

References:

1. Rajkumar Buyya, Christian Vecchiola , Tamarai Selvi, Mastering Cloud Computing, First edition, McGraw Hill Education, 2013.
2. John Rhoton, Cloud Computing Explained, 2nd Edition , Recursive Press, , 2010.
3. Barrie Sosinsky, Cloud Computing: Bible, Wiley India, 2011
4. John W. Rittinghouse and James F. Ransome, Cloud Computing, Implementation, Management and Security, CRC Press, 2010
5. David S. Linthicum, Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide, Addison Wesley, 2009
6. Andrew S. Tanenbaum, Modern Operating Systems, 3rd Edition, Prentice Hall, 2007
7. George Reese, Cloud Application Architectures, O'Reilly, 2009
8. Mark C. Chu-Carroll, Code in the Cloud: Programming Google App Engine, Pragmatic Programmers, LLC, 2011
9. Roger Jennings, Cloud Computing with the Windows Azure Platform, Wrox, Wiley India, 2010

Title of Course: Software Quality Management **Course Code: 18B14CI850**
L-T-P Scheme: 3-0-0 **Course Credit: 3**

Pre-requisites: Students must have knowledge of "Software Engineering and Software Management"

Objectives: The course has the basic scope to provide the students with theoretical knowledge about concepts of software quality, about the quality- models, - standards and –methodologies used in the software industry. The theory is supported and supplemented by the lecturer's 10 years experience in software quality management. Understanding and usage of the theory are consolidated by the case studies and exercises.

Course Outcome	Description
CO1	List various principles Software Quality Management.
CO2	Describe the real world problems that may arise during software development and affects the quality.
CO3	Develop a appropriate plan for software quality management.
CO4	Explore key contributors / metrics for effective quality control
CO5	Identify appropriate international standard for real life software project for controlling and managing the quality of product.
CO6	Demonstrate and present the learning of course on real life problems.

Course Contents:

Introduction to Software Quality Engineering: what is software quality, who cares for software quality, benefits of software quality, phases in software development, views of quality, hierarchical models of quality**,** types of defects, cost of fixing defects, cost of poor quality, definitions used in software quality engineering, software quality assurance, quality control, software configuration management.

Software Testing: guiding principles of testing, composition of a testing team, skills of a tester, types of testing, evaluating the quality of test cases, techniques for reducing number of test cases, requirements for effective testing, test oracle, economics of software testing, handling defects, risk in software testing, requirement traceability matrix.

Metrics for Software Quality: categories of software metrics, metrics program, goal question metric method, types of metrics, commonly used software metrics, process metrics, product metrics, metrics for resources.

Tools for Quality Improvement: basic quality control tools, check sheet, cause and effect diagram, pareto diagram, histogram, scatter plot, run chart, control chart, orthogonal defect classification.

Software Quality Measurement: Measuring quality, software metrics, problems with metrics, an overall measure of software quality. Developments in Measuring Quality**:** The work of Gilb, the COQUAMO project.

The ISO9000 series of quality management standards: The purpose of standards, the ISO9000 series: a generic quality management standard, ISO9000-3: notes for guidance on the application of ISO9001 in software development, the impact of ISO9000 and TickIT. Models and standards for process improvement: The Capability Maturity Model, individual levels of CMM, the role of the CMM, SPICE modeling.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Book:

1. “Software Quality : Theory and Management” by Alan C Gillies, CENGAGE Learning, Second edition.
2. “ Software Quality Assurance, Testing and Metrics” by Anirban Basu, PHI Publication.

References:

1. Agile and Iterative Development: A Manager's Guide, Craig Larman.
2. Practical Guide to Software Quality Management, John W. Horch.
3. Introduction to the Team Software Process(SM),Watts Humphrey.
4. Software Engineering, R.S. Pressman, McGraw Hill.

Title of Course: Neural Network & Applications **Course Code: 18B14CI852**
L-T Scheme: 3-0-0 **Course Credits: 3**

Objectives: To introduce some of the fundamental techniques and principles of neural computation and to investigate some common models and their applications.

Prerequisites:
Basic knowledge of computer architecture, basics of algorithms.

Learning Outcomes:
On completion of this course, a student should be able to:

Course Outcome	Description
CO1	Understand the learning and generalization issue in neural computation.
CO2	Understand the basic ideas behind most common learning algorithms for multilayer perceptrons, radial-basis function networks, and Kohonen self-organising maps.
CO3	Implement common learning algorithms using an existing package
CO4	Apply neural networks to classification and recognition problems

Course Content:

1. **What Are Neural Networks:**
   History, Artificial and biological neural networks, Artificial intelligence and neural networks.
2. **Neurons and Neural Networks**
   Biological neurons, Models of single neurons, Different neural network models.
3. **Single Layer Perceptrons**
   Least mean square algorithm, Learning curves, Learning rates, Perceptron
4. **Multilayer Perceptrons**
   The XOR problem, Back-propagation algorithm, Heuristic for improving the back-propagation algorithm, Some examples
5. **Radial-Basis Function Networks**
   Interpolation, Regularization, Learning strategies
6. **Kohonen Self-Organizing Maps**
   Self-organizing map, The SOM algorithm, Learning vector quantization

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto T-1
Test-2	25 Marks	Syllabus covered upto T-2
Test-3	35 Marks	Entire Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Books

1. Introduction to Artificial Neural Systems, by Jacek Zurada
2. An Introduction to Neural Networks K. Gurney, UCL Press, London.
3. Introduction to Neural Networks, R. Beale and T. Jackson, IOP Press.
4. The Essence of Neural Networks, R. Callan, Prentice Hall Europe.
5. Neural Networks: A Comprehensive Foundation, Simon Haykin, Prentice Hall.
6. Book by Haykins
7. Book by Hassoul
8. Book by Yagnanarayana
9. Perceptrons, by Minsky and Papert
10. Parallel and Distributed Processing, by McClelland and Rumelhart
11. Neuro Computing - Volume 1 and Volume 2, edited by Anderson

Journals

1. IEEE transactions on Neural Networks
2. IEEE transactions on Systems, Man and Cybernetics (SMC)
3. IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI)
4. Neural Networks
5. Neuro Computing
6. Machine Learning

Title of Course: Web Engineering **Course Code: 18B14CI858**
L-T-P Scheme: 3-0-0 **Course Credits: 3**

Prerequisite: Students must have already registered for the courses, Software Engineering, Web Technology Lab.

Objective: To develop an ability to design and implement static and dynamic web-applications and mobile applications.

Web Engineering	
Course Outcome	**Description**
CO1	Outline various terminologies of web development based engineering approaches.
CO2	Describe the real world problems and able to identify suitable solution in terms of appropriate web development models.
CO3	Understanding the customer requirements and the complexities that may arise in achieving these requirements in web development.
CO4	Develop and analyze the approaches for designing web based applications
CO5	Identify and use various tools in various processes in web based application development
CO6	Apply suitable approach in controlling and managing quality in web based application.

Course Content:

Unit-1: Web-Based Systems**,** Web Applications, WebApps—A Philosophical View; Web Engineering: What Is Web Engineering?, The Components of Web Engineering, Web Engineering Best Practices; Communication: The Communication Activity, Formulation, Elicitation, Identifying WebApp Increments, Negotiation; Planning: Understanding Scope, Refining Framework Activities, Building a WebE Team,

Unit-2: The Modeling Activity: Modeling as a Concept, The Models We Create, Modeling Frameworks, Modeling Languages, Existing Modeling Approaches; Analysis Modeling for WebApps: Understanding Analysis in the Context of WebE, Analysis Modeling for WebApps, Understanding the Users.

Unit-3: Construction and Deployment: Construction and Deployment within the WebE Process, Construction Principles and Concepts, Deployment, Construction and the Use of Components, Component-Level Design Guidelines, Component Design Steps; Testing WebApps: Testing Concepts, The Testing Process—An Overview, Content Testing, User Interface Testing, Usability Testing, Compatibility Testing, Component-Level Testing, Navigation Testing, Configuration Testing, Security and Performance Testing.

Unit-4: The ISO9000 series of quality management standards: The purpose of standards, the ISO9000 series: a generic quality management standard, ISO9000-3: notes for guidance on the application of ISO9001 in software development, the impact of ISO9000 and TickIT. Models and standards for process improvement: The Capability Maturity Model, individual levels of CMM, the role of the CMM, SPICE modeling.

Unit-5: Tools for Quality Improvement: basic quality control tools, check sheet, cause and effect diagram, pareto diagram, histogram, scatter plot, run chart, control chart, orthogonal defect classification.

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Evaluation Scheme:

Evaluations	Marks	Remarks
T-1	15 Marks (1-Hours)	1st - 4th Week
T-2	25 Marks (1:30 Hours)	5th - 10th Week
T-3	35 Marks (2-Hours)	11th - 16th Week
Assignments	10 Marks	
Tutorials / Subject Seminar	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Teaching Methodology:

The course will be delivered through lecture oriented towards understanding and designing of web pages using the web tools. It will impart strong foundation of Web Application Terminologies, Internet Tools, E – Commerce and other web services.

Text Books

1. Web Engineering: A Practitioner's Approach/ Roger Pressman, David Lowe.
2. Web Technologies: Achyut Godbole, Atul Kahate, McGraw-Hill Publications (Third Edition).
3. Beginning Android Application Development, Wei-Meng Lee, Wrox.

Reference Books

1. Internet & World Wide Web How to Program / Deitel, H.M.
2. Web Design with HTML/Flash/Java Script and E-Commerce Bible / Crowder, David
3. Database Driven Web Sites / Feiler, Jesse
4. Web design: the complete reference / Powell Thomas A
5. Internet 101: a beginner's guide to the Internet and the WorldWideWeb/Lehnert Wendy G
6. E-Commerce: Fundamentals and Applications / Chan, Henry
7. E-commerce: strategy, technology & applications / Whiteley, David
8. E-Commerce Logistics & Fulfillment: delivering the goods / Bayles, Deborah L.

Web References

1. www.w3schools.com
2. http://www.techtutorials.info/ecommerce.html

Journals

1. ACM Transactions on the Web (TWEB).
2. ACM Transactions on the Information Systems (TOIC).
3. ACM Transactions on Graphics (TOG).
4. ACM Transactions on Internet Technology (TOIT).

Title of Course: Machine Learning **Course Code: 18B11CI918**
L-T-P scheme: 3-0-0 **Credit: 3**

Prerequisite: The mathematical tools needed for the course will be covered in some classes in the first week of the course.

Objective:
1. To learn and be able to implement the basic statistical techniques in the areas of interests.
2. To develop the abilities to apply the basic Machine Learning algorithms and interpret their results.

Learning Outcomes:

At the end of the course, students:

1. Get familiar with the fundamental methods at the core of modern machine learning.
2. Have a good grounding of the essential algorithms for supervised and unsupervised learning
3. Possess demonstrative skills in using and applying Machine Learning.
4. Work as a team on a project.

Course Outcome	**Description**
CO1	List various approaches of Machine Learning.
CO2	Describe machine learning algorithms to solve the real world problems
CO3	Develop Hypothesis and machine learning models
CO4	Identify appropriate models for solving machine learning problems.
CO5	Apply learning techniques to solve real world machine learning problems
CO6	Evaluate and interpret the results of the algorithms.

Course Content:

Unit-I: Introduction to machine learning, supervised and unsupervised machine learning, Applications of AI and machine learning , Linear Algebra, Matrices, Multi-Variable Calculus and Vectors, Mean, Median, mode, Dispersion.

Unit-II: Probability, Probability Distributions, and Central Limit Theorem.
Hypothesis Testing: The what, why and how of Hypothesis Testing are covered in this module. P-Value, different types of tests and implementation in Python.
Exploratory Data Analysis: EDA brings out the information from the Data. This module covers Data Cleaning, Univariate/ Bivariate analysis.

Unit-III: Linear Regression: Simple and Multiple, Issues in Regression like Collinearity. Project on Linear Regression. Logistic Regression Univariate and Multivariate Logistic Regression for classification in ML, Implementation in R/Python, Naive Bayes Classification. Bias-Variance Tradeoff, Evaluation metrics: Confusion Matrix, F1 Score, Root Mean Squared Error.

Unit-IV: Decision Tree, Random Forest, SVM, Validation Techniques: Leave one out cross-validation, K-fold cross-validation, Stratified k-fold cross-validation.

Unit-V: K-Means clustering, Introduction to Neural Networks, Convolutional Neural Network.

Teaching Methodology:

This course is introduced to help students understand the discipline of Machine Learning. The programming tool used to teach this course are R and Python. Starting from the basic mathematical tools, the student will slowly be exposed to inferential statistics, and later to Machine Learning Algorithms. This theory course is well complemented by a laboratory course under the name Machine Learning Lab in the same semester that helps a student learn with hand-on experience.

Evaluation Scheme:

Exams	**Marks**	**Coverage**
Test-1	15 Marks	Based on Unit-1 & Unit-2
Test-2	25 Marks	Based on Unit-3 & Unit-4 and around 20-30% from coverage till Test-1
Test-3	35 Marks	Based on Unit-5 to Unit-6 and around 30% from coverage till Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Machine Learning (will be added from time to time): Digital copy will be available on the JUET server.

Text Book:

- Hastie, Tibshirani and Friedman. Elements of statistical learning.

Reference Material:

- L. Rosasco. Introductory Machine Learning Notes.

Larry Wasserman. Clustering chapter

Title of Course: Data Analytics Systems and Algorithms **Course Code: 18B11CI917**
L-T-P Scheme: 3-0-0 **Credits: 3**

Pre-requisite:

- Students must have the minimal concept of Data Base Management Systems
- They must also have the concept of different types of algorithms used for searching data
- Students must have already studied the course "Business Analysis Techniques"

COURSE OVERVIEW:

This course will introduce students to this rapidly growing field of data analytics and equip them with some of its basic principles and tools as well as its general mindset. Students will learn concepts, techniques and tools they need to deal with various facets of data analytics practice, including data collection and integration, exploratory data analysis, predictive modelling, descriptive modelling, data product creation, evaluation, and effective communication.

Objective: The primary aim of this course is to further expand your understanding of data analytics and algorithms. To understand Data Analytics Life Cycle and Business Challenges. To understand Analytical Techniques and Statically Models

Learning Outcomes

Course Outcome	Description
CO1	**Demonstrate** proficiency with statistical analysis of data.
CO2	**Understand** the ability to build and assess data-based models.
CO3	**Demonstrate** skill in data management
CO4	**Illustrate** statistical analyses with professional statistical software.
CO5	**Implement** clustering algorithms like hierarchical Agglomerative clustering and k-means algorithm.
CO6	**Apply** data analytics concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

Course Outline:

Unit I: Introduction and Data Pre-processing: Data Science Introduction, Big Data and Data Science, Current landscape of perspectives

Unit II: Data Analysis and Correlations: Basic Concepts and Methods Populations and samples, Statistical modelling, probability distributions, Regression, fitting a model, Dimensionality Reduction: PCA & DWT, Correlation and regression analysis. Chi-square t and F distributions (definitions only) Confidence interval Single mean and difference known and unknown variances.

Unit III: Introduction to machine learning and Cluster Analysis: Basic Concept and Methods Supervised and unsupervised learning, Training and testing data, over fitting and under fitting. Distance measures: - Manhattan, Chebbychev, Mahalanobis Distance Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering, Clustering High-Dimensional Data Clustering Graph and Network Data

Unit IV: Classification Algorithms: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy, Support Vector Machines, Lazy Learners (or Learning from Your Neighbors)

Unit V: Introduction to Web Search and Social Media Analytics: Data Wrangling: APIs and other tools for scrapping the Web Mining Complex Data Types, Other Methodologies of Data, Mining, Data Mining Applications, Data Mining and Society, Data Mining Trends Social Media Analytics is the science of analyzing data to convert information to useful knowledge. This knowledge could help us understand our world better and, in many contexts, enable us to make better decisions.

Evaluation Scheme:

Evaluations	Marks	Remarks
T-1	15 Marks (1-Hours)	1^{st} - 4^{th} Week
T-2	25 Marks (1:30 Hours)	5^{th} - 10^{th} Week
T-3	35 Marks (2-Hours)	11^{th} - 16^{th} Week
Assignments	10 Marks	
Tutorials / Subject Seminar	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Text Book

1. Data Mining, Concepts and Techniques: Jiawei Han and Micheline Kamber, Elsevier 2nd edition.
2. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from the Frontline, O'Reilly. 2014.
3. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science.

Refernce Books:

1. Data Mining: Introductory and Advanced Topics: Margaret H. Dunham, Prentice Hall.
2. Data Warehousing, Data Mining and OLAP: Alex, Berson, Stephen J. Smith, Tata McGraw- Hill, 2004.
3. Mining the Web : Discovering knowledge from hypertext data: Soumen Chakrabarty, Morgan Kaufmann
4. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014.
5. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009.

Title of Course: Full Stack Development **Course Code: 21B14CI742**
L-T-P scheme: 3-0-0 **Credit: 3**

Prerequisite: Students must have already registered for the course, "***Introduction to Computers and Programming***" and "**Object Oriented Programming**".

Objective:

1. To learn and be able to implement the front-end and back-end web-technologies.
2. To develop the abilities to call oneself full-stack web developer.

Learning Outcomes:

At the end of the course, students will:

1 Get **familiar** with process of full stack Web Development.

2 Have a good grounding of Web Application Terminologies, Internet tools and languages like HTML5 and CSS, and identify the typical use cases where to **apply** these tools.

3. **Analyze** a problem and possess demonstrative skills in using and applying JavaScript to provide solutions.
4. **Design and code** the business requirements to come up with a technical solution using different web-based technologies including front-end and back-end frameworks; databases like MySQL and MongoDB.
5. Work as a team on a project.

CO	PO [As per NBA]
CO1	
CO2	PO1
CO3	PO2
CO4	PO3
CO5	PO5

Course Content:

Part-1: Fundamentals of Web Development

Unit-1 Creating first web-application, hosting a web application, creating websites, authoring tools, domain names. architectures.

Part-2: Front End Tools & Technologies

Unit-2 Markup and Styling: HTML, Cascading Style Sheets, using Bootstrap.

Unit-3 JavaScript Fundamentals: Language Features, JSON, Ajax, jQuery, Popular Frameworks like React, Angular JS.

Part-3: Back End Tools & Technologies

Unit-4 Web Programming through Node.js and/or Java. Node.js Modules, NPM, Events, Upload File, Email, Get/Post methods, Java Servlets vs. JSP, Request vs. Response objects, other Java objects and features.

Unit-5 Databases and Web Storage: Designing and creating databases, database connection through back-end programming languages, Web storage to store sessions, cookies, and cached data in the browser.

Part-4: Miscellaneous

Unit-6 HTTP & REST, RESTful API, Chrome DevTools, SSL Certificates, Web Application Architecture, MVC, Platforms as a service, Heroku and AWS, Web Security.

Unit-7 Git, Common git commands, Data Structures & Algorithms, Understanding hash tables, trees, graphs, Big-O analysis, object vs an array, pros and cons of in-memory vs disk storage, difference between queues and stacks.

Teaching Methodology:

This course is introduced to help students transition from a simple developer to a full stack developer. Starting from frontend development, the student will slowly progress to become to other aspects of development including backend, database, version control and other essential technologies that are helpful for a developer. The entire course is broken down into four separate parts: Fundamentals of Web Development, Front End tools &

Technologies, Back End Tools & Technologies, and Project Development. Each section includes multiple technologies to help a student gain more experience as a developer. This theory course is well complemented by a lab course under the name Full Stack Development Lab in the same semester that helps a student learn and discuss the technical details of the underlying technologies.

Evaluation Scheme:

Exams		Marks	Coverage
T-1		15 Marks	**Based on Units: 1-2**
T-2		25 Marks	**Based on Units: 1-4**
T-3		35 Marks	**Based on Units:1-6**
Teacher's Assessment	Assignment	10 Marks	**25 Marks**
	Tutorial	05 Marks	
	Quiz	05 Marks	
	Attendance	05 Marks	
Total		**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Full Stack Development (will be added from time to time): Digital copy will be available on the JUET server/ Google Classroom.

Text Book

[1] Web Technologies: Achyut Godbole, Atul Kahate, McGraw-Hill Education (Third Edition).
[2] Web Engineering: A Practitioner's Approach by Roger Pressman and David Lowe, McGraw-Hill, 2009.
[3] HTML and CSS: Comprehensive 7th edition, by by Denise M. Woods and William J. Dorin. Publisher: Cengage Learning; (2012) ISBN-10:1133526144
[4] Internet & World Wide Web How to Program, 5/e Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, Pearson Education 2012.

Reference Books

[3] Internet & World Wide Web How to Program / Deitel, H.M.
[4] Web Design with HTML/Flash/Java Script and E-Commerce Bible / Crowder, David
[5] Database Driven Web Sites / Feiler, Jesse
[6] Web design: the complete reference / Powell Thomas A
[7] Internet 101: a beginner's guide to the Internet and the WorldWideWeb/Lehnert Wendy G
[8] E-Commerce: Fundamentals and Applications / Chan, Henry
[9] E-commerce: strategy, technology & applications / Whiteley, David
[10] E-Commerce Logistics & Fulfillment: delivering the goods / Bayles, Deborah L.

Web References:

[1] www.w3schools.com
[2] http://www.techtutorials.info/ecommerce.html

Journals:

[1] ACM Transactions on the Web (TWEB).
[2] ACM Transactions on the Information Systems (TOIC).
[3] ACM Transactions on Graphics (TOG).
[4] ACM Transactions on Internet Technology (TOIT).