COURSE CODE	COURSE TITLE	CREDIT
CSE31P8	**Object Oriented Programming – II Lab**	**1.5**

Experiments	Topics
01	Introduction to .NET frameworks
02	Understanding C# Language Fundamentals; Writing a Savings Account Calculator
03	Creating Objects in C#; Creating the Bank Account Objects
04	Implementing Object-Oriented Programming Techniques in C#; Creating Classes in C#
05	Programming with C#; Using Arrays; Using Indexers and Interfaces; Using Delegates and Events
06	Building .NET-based Applications with C#
07	Using ADO.NET to Access Data; Creating a Data Access Application with ADO.NET; Creating a Windows Application That Uses ADO.NET
08	Creating Windows-based Applications; Adding Common Dialog Boxes to an Application; Creating and Using Custom Dialog Boxes; Creating a Status Bar
09	Using XML Web Services in a C# Application
10	Creating a Web Application with Web Forms; Developing an ASP.NET Web Application; Completing the User Authentication Validation Code; Completing the Code for the Master.aspx Form; Testing the Application
11	Application Settings and Deployment; Adding a Setup Project to an Existing Application; Installing and Testing the Setup Application; Working with Application Settings; Adding the UserPreferences Class; Adding User Preferences to the Form Load Event; Adding User Preferences to the loadItem_Click Event Declaring an Instance of the UserPreferences Class in the Options Form; Setting the Checkbox Controls to the Values Contained in the Registry; Save the Checkbox Controls Values to the Registry; Testing the Zoo Information Application

COURSE CODE	COURSE TITLE	CREDIT
CSE31P9	**Numerical Analysis Lab**	**1.5**

Experiments	Topics
01	To Find the Roots of Non-Linear Equation Using Bisection Method.
02	To Find the Roots of Non-Linear Equation Using Newton's Method.
03	Curve Fitting by Least – Square Approximations, Regression method.
04	To Solve the System of Linear Equations Using Gauss - Elimination Method, Gauss Pivot Elimination Method.
05	To Solve the System of Linear Equations Using Gauss - Seidel Iteration Method
06	To Solve the System of Linear Equations Using Gauss - Jorden Method.
07	To Integrate Numerically Using Trapezoidal Rule.
08	To Integrate Numerically Using Simpson's Rules.
09	To Find the Largest Eigen Value of a Matrix By Power - Method.
10	To Find Numerical Solutions of Ordinary Differential Equations by Euler's Method.
11	To Find Numerical Solutions of Ordinary Differential Equations by Runge-Kutta Method.
12	To Find the Numerical Solution of the Laplace Equation
13	To Find the Numerical Solution of the Wave Equation
14	To Find the Numerical Solution of the Heat Equation.

Third Year Second Semester

COURSE CODE	COURSE TITLE	CREDIT
CSE3221	**E-commerce**	**2.0**

Introduction To E-Commerce: Meaning and concept of E-Commerce; History of E-Commerce; Traditional Commerce and E-Commerce; Different types of E-Commerce – B2B, B2C, C2C, B2E, G2C; Need and Role of E-Commerce; Advantage and Disadvantage of E-Commerce – organization, Consumer, Society; E-Business and E-Commerce; Value Chain in E-Business.

E-Commerce Technologies: Internet & WWW; Internet Protocols – OSI Model, TCP/IP, TCP, UDP, IP, DNS, FTP, SLIP, PPP; Multimedia technology – ISDN, ATM, Cell relay, desktop Video Conferencing; Information Publishing Technology - HTML, URL, HTTP, HTML FORM, HTTPD, CGI SERVICES, Web Server and client; Advance Technologies – Mobile Agents, WAP, XML, web 2.0, REST web services, Web Mashup.

E-Commerce Strategies: Consumer Oriented – strategies for marketing, sales & promotion, e-CRM, and order delivery Cycle; Business Oriented - strategies for purchasing & support activities (SCM), Strategies for Web Auction, Virtual Communities, Web Portal.

Electronic Payment System: Introduction to payment system; Online Payment System – prepaid e-payment service, postpaid e-payment system; SET protocol; Operational, Credit & legal risk of e-payment system.

Electronic Data Interchange: Meaning; EDI and Paperless trading; EDI architecture; EDI standards; VAN; Cost of EDI Infrastructure; Internet-based EDI; FTP- based messaging.

Electronic Data Interchange: Meaning; EDI and Paperless trading; EDI architecture; EDI standards; VAN; Cost of EDI Infrastructure; Internet-based EDI; FTP- based messaging.

Security & Legal Issues: Computer security classification; E-Commerce threats; Security of Clients and sever; Cyberlaw introduction; Copyright and Intellectual Property concept relating to e-commerce.

Books Recommended:

(i) Bhasker, B. (2013). Electronic Commerce: Framework, Technologies, and Applications (4th ed.). Tata McGraw Hill Education Private Limited.
(ii) Bajaj, K., & Nag, D. (1999). E-commerce: The cutting edge of business. New Delhi: Tata McGraw-Hill.
(iii) Kalakota, R., & Whinston, A. (1996). Frontiers of electronic commerce. Reading, Mass.: Addison-Wesley Pub.

(iv) Whitley, D. (2010). E-commerce. New Delhi: Tata Mcgraw Hill Education Private.
(v) Chaffey, D. (2011). E-business & e-commerce management: Strategy, implementation and practice (5th ed.). Harlow, England: Pearson/Financial Times Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
CSE3232	**Human-Computer Interaction**	**3.0**

Design Process: Humans, Information process, Computer, Information Process, Differences and Similarities between them, Need for Interaction, Models, Ergonomics, Style, Context, Paradigms, Designing of Interactive systems, Usability, Paradigm shift, Interaction design basics, Design Process, Scenarios, Users need, Complexity of design.

Design and Evaluation of Interactive Systems: Software Process, Usability engineering, Issue-based Information systems, Iterative design practices, Design rules, maximum usability, Principles, Standards and guidelines, design patterns, Programming Tools, Windowing systems, Interaction tool kit, User Interface management system, Evaluation techniques, evaluation design, Evaluating implementations, Observational Methods.

Models: Universal design principles, Multimodal systems, User Support, Presentation and Implementation Issues, types, requirements, approaches, Cognitive model, Hierarchical model, Linguistic model, physical and device models, Socio-technical models, Communication and Collaboration models, Task models, Task analysis and design.

Experimental Design and Statistical Analysis of HCI: Basic Design structure, Single independent variable, multiple independent variables, factorial design, split-plot design, random errors, experimental procedure, Statistical analysis, T-tests, Analysis of Variance test, Regression, Chi-Square test, Survey, Probabilistic sampling, Non-probabilistic sampling, developing survey questions.

Theories: Dialogue notations and design, Dialogue need, dialogue design notations, Graphical, Textual, representing dialogue, formal descriptions, Dialogue analysis, System models, Interaction models, relationship with dialogue, Formalisms, Formal notations, Interstitial behaviour, Virtual reality, Modeling rich interaction, Status Event analysis, Properties, Rich contexts, Sensor-based systems, Groupware, Applications, Ubiquitous computing, Virtual reality.

Books Recommended:

(i) Dix, A. (2004). Human-computer interaction (3rd ed.). Harlow, England: Pearson/Prentice-Hall.

(ii) Lazar, J., & Feng, J. (2010). Research methods in human-computer interaction. Chichester, West Sussex, U.K.: Wiley.
(iii) Shneiderman, B., & Plaisant, C. (2010). Designing the user interface: Strategies for effective human-computer interaction (5th ed.). Boston: Addison-Wesley.

COURSE CODE	COURSE TITLE	CREDIT
CSE3233	**Computer Networks**	**3.0**

Computer Network: Definitions, goals, components, structure, Architecture, Classifications & types, Growth, Complexity and applications etc. Layered Architecture: Protocol hierarchy, Connection Oriented & Connectionless Services, Service primitive Design issues & their functionality, ISO-OSI Reference Model: Principle, Model, Descriptions of various layers and its comparison with TCP/IP. Network standardization, Examples of Networks: Telecommunication Networks, Corporate Networks, Connection-oriented Networks i.e., X.25, Frame relay & ATM, Wireless LAN 802.11, Internet, Intranet, Extranet, SNA & DNA etc.

Data Link Layer: Need, Services Provided, Framing & its Methods, Flow Control, Error Control. DLL Protocol: Elementary & Sliding Window. Piggybacking & Pipelining. Protocol verification: Finite State Machine Models & Petri net models. Example in Data Link Layers: HDLC & Internet. Comparison of BISYNC and HDLC Features. Bridges and layer-2 switches.

MAC Sublayer: Static & Dynamic channel allocation, Media access control for LAN & WAN. Classification of MAC Sub layer protocol, Study of various collision, Collision free & limited contention protocols i.e., ALOHA: pure, slotted, CSMA, CSMA/CD, CSMA/CA, Bit Map, Binary count down, BRAP, MLMA, Adaptive tree walk & urn protocol etc. IEEE 802 standards for LAN & MAN & their comparison. Ethernet: Cabling, Binary exponentials algorithms, performance fast Ethernet, Gigabit Ethernet, FDDI. Wireless LANs, Broadband Wireless, Bluetooth: Architecture, Application & Layering.

Network Layer: Need, Services Provided, Design issues, Routing algorithms: Least Cost Routing algorithm, Dijkstra's algorithm, Bellman-ford algorithm, Hierarchical Routing, Broadcast Routing, Multicast Routing, Routing for mobile hosts, Routing in Ad Hoc Networks Routing Strategies, Congestion Control Algorithms: General Principles of Congestion control, Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram subnets. IP protocol, IP Addresses, Comparative study of IPv4 & IPv6, Mobile IP.

Processes to Processes Delivery: Transmission Control Protocol (TCP) – User Datagram Protocol, Data Traffic, Congestion Control and Quality of Service,

Techniques to improve QOS, Integrated Services, and Differentiated Services. Network Security: Cryptography, Message Security, Digital Signature, User Authentication, Key Management, Security Protocols in Internet, DNS, SMTP, FTP, HTTP, WWW, Virtual Terminal Protocol, VoIP: Basic IP Telephone System, H.323 Characteristic & Layering, SIP Characteristics, Method & Sessions.

Books Recommended:

(i) Tanenbaum, A., & Wetherall, D. (2011). Computer networks (5th ed.). Boston: Pearson Prentice Hall.
(ii) Halsall, F. (2005). Computer networking and the Internet (5th ed.). Harlow: Addison-Wesley.
(iii) Forouzan, B., & Fegan, S. (2007). Data communications and networking (4th ed.). New York: McGraw-Hill Higher Education.
(iv) Gupta, P. (2006). Data communications and computer networks. New Delhi: Prentice-Hall of India.
(v) Bertsekas, D., & Gallager, R. (1992). Data networks (2nd ed.). Englewood Cliffs, N.J.: Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
CSE32P4	**Computer Networks Lab**	**1.5**

Experiments	Topics
01	Study of Wiring Technology
02	Install and Configure Network Cards
03	Socket Programming
04	Implement Routing Protocols in C and Install and Configure Server
05	Install and Configure DHCP & DNS
06	Install and Configure Domain Controller
07	Install and Configure Web Server and Proxy Server
08	Install and Configure Mail Server
09	Install and Configure Samba
10	Testing and Troubleshoot Internet
11	Local Area Networks Design.
12	Wide Area Network Design
13	Configuring VLAN using Packet tracer
14	ATN & ACL
15	Router configuration using Packet tracer

COURSE CODE	COURSE TITLE	CREDIT
CSE3235	**Computer Peripherals and Interfacing**	**3.0**

Video Display: The basic principle of working of video monitors (CRT, LCD, LED), video display adapters, video modes, Video display EGA/VGA/SVGA/PCI adapters and their architecture, Overview of raster scan, vector graphic, their main difference and relative advantages, Concept of reduction and bandwidth of monitors refreshing of the screen.

Hardware Organization of PCs: Types of the motherboard and their details (Form Factor, Chipset), types of processors (INTEL, AMD) and their compatibility with motherboards, serial and parallel ports, PS/2, USB Ports, Interconnection between units, connectors and cables.

Storage Devices: Types of Hard Disk Drives - EIDE, SATA, SCSI, SAS External Hard Disk. Constructional features and working of hard disk drive, optical (CD, DVD and Blue Ray) disk drive and Flash Drive, Logical structure of Hard Disk and its organization, boot record.

Input Devices: Detailed working principle and troubleshooting of various input devices such as keyboard, mouse, scanner, Basic principle of touch screen, light pen, digitizers, and Drivers for various input devices and their role.

Output Devices: Overview of printer and its classification, impact and non-impact printer, principle and working of desk Jet, dot matrix, line Printer and laser printers(Monochrome and Color), plotter (Piezoelectric and Thermal), and modems. Software drivers for various output devices and their role.

Power Supplies: Explain the working of SMPS used in computers, On-Line/Off-Line/Line-Interactive/uninterrupted power supplies (UPS), basic principles of working their importance and maintenance.

The Basic Input/Output System: What is BIOS? Function of BIOS, software interrupts, testing and initialization, configuring the system.

Other Technologies: Mobile, digital camera, web camera, smart card, ATMs, CDMA etc., Blue Tooth, infrared, Wi-Fi, WiMax. Some aspects of cost performance analysis while procuring the computer.

Books Recommended:

(i) Govindarajalu, B. (2002). IBM PC and clones: Hardware, troubleshooting and maintenance (2nd ed.). New Delhi: Tata McGraw-Hill Pub.

(ii) Gupta, G. (n.d.). Computer Peripheral & Interfacing. Jalandhar: Eagle Prakashan.

(iii) Hall, D. (1992). Microprocessors and interfacing: Programming and hardware (2nd ed.). Lake Forest, Ill.: Glencoe.

(iv) Snehi, J. (2006). Computer peripherals and interfacing. S.l.: Laxmi Publications.
(v) Wilkinson, B., & Horrocks, D. (1980). Computer peripherals. London: Hodder and Stoughton.
(vi) Cook, B., & White, N. (1995). Computer peripherals (3rd ed.). London: E. Arnold.

COURSE CODE	COURSE TITLE	CREDIT
CSE32P6	**Computer Peripherals and Interfacing Lab**	**0.75**

Experiments	Topics
01	Demonstration of Trainer Board
02	Reading data from Trainer Board to Computer.
03	Write data from a computer to Trainer Board
04	Design and implementation of an IC tester
05	Design and implementation of a Transistor tester
06	Design and implementation of a Water Level controller
07	Serial data transfer through ports between computers
08	Parallel data transfer through ports between computers
09	Audio data reading
10	Audio data Writing
11	Control of digital voltage
12	Traffic control

COURSE CODE	COURSE TITLE	CREDIT
CSE3237	**Software Engineering**	**3.0**

Software Process Models: The Evolving role of Software, Software, The Changing Nature of Software, Legacy software, A generic view of the process, A layered Technology, A Process Framework, The Capability Maturity Model Integration (CMMI), Process Assessment, Personal and Team Process Models, Product and Process, Process Models, The Waterfall Model, Incremental Process Models, Incremental Model, The RAD Model, Evolutionary Process Models, Prototyping, The Spiral Model, The Concurrent Development Model, Specialized Process Models, the Unified Process.

Requirement Engineering: Software Engineering Practice, Communication Practice, Planning Practice, modelling practice, Construction Practice, Deployment. Requirements Engineering, Requirements Engineering tasks,

Initiating the Requirements Engineering Process, Eliciting Requirements, Developing Use Cases, Building the Analysis Models, Elements of the Analysis Model, Analysis pattern, Negotiating Requirements, and Validating Requirements.

Analysis Modeling: Requirements Analysis, Analysis Modeling approaches, data modelling concepts, Object-oriented Analysis, Scenario-based modelling, Flow-oriented Modeling, Class-based modelling, creating a behaviour model.

Design & Testing: Design Engineering, Design process, Design Quality, Design model, User interface Design, Testing strategies, Testing Tactics, Strategies Issues for conventional and object-oriented software, validation testing, system testing, Art of debugging, and Project management.

Quality & Maintenance: Software evolution, Verification and Validation, Critical Systems Validation, Metrics for Process, Project and Product-Quality Management, Process Improvement, Risk Management Configuration Management, and Software Cost Estimation.

Books Recommended:

(i) Pressman, R., & Maxim, B. (2014). Software engineering: A practitioner's approach (Eighth ed.). McGraw-Hill Science/Engineering/Math.
(ii) Sommerville, I. (2011). Software engineering (9th ed.). Boston: Pearson.
(iii) Schach, S. (2008). Object-oriented software engineering. Boston, Mass.: McGraw-Hill.
(iv) Pfleeger, S., & Atlee, J. (2010). Software engineering: Theory and practice (4th ed.). Upper Saddle River [N.J.: Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
CSE32P8	**Software Development Project**	**1.5**

Develop a software package in any application relevant to any area of study of your curriculum by applying the Software Engineering Practices generally done by software industries, which are

1. Identification of Use cases for each application system and SRS preparation.
2. Identification of reusable Components/Frameworks from open source and customizing them for each application.
3. Coding/Customizing/Wrapping for components/subsystems.
4. Testing – Scenario testing and test case preparation for each component/subsystem
5. Integration of subsystems and Testing
6. Simulation of datasets and load testing to analyze the performance of the system.

COURSE CODE	COURSE TITLE	CREDIT
CSE32P9	**Technical Writing and Seminar**	**1.5**

The goal of this course is to train the students to critically evaluate a well-defined set of research subjects and to summarize the findings in a paper of scientific quality. The paper will be evaluated based on the ability to understand a topic, communicate it and identify issues. Results from this term paper will be presented to fellow students and a committee of faculty members.

1) Every student selects a topic related to current trends and the same should be approved by the respective committee. This selection should have at least 5 distinct primary sources.
2) Every student must write a short review of the topic and present it to fellow students and faculty every week.
3) The faculty should evaluate the short review and award marks concerning the following.
    a. Has the student analyzed- not merely quoted-the most significant portions of the primary source employed?
    b. Has the student offered original and convincing insights?
    c. Plagiarism to be checked.
4) Every student should re-submit and present the review article including issues/comments/conclusions which had arisen during the previous discussion.
5) Every student should submit a final paper as per project specifications along with all short review reports and corresponding evaluation comments.
6) Every student should appear for a final external review exam to defend themselves.

Interpretation of Data and Paper Writing: Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.

Use of Encyclopedias, Research Guides and Handbooks: Academic Databases for Computer Science Discipline.

Use of tools/techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism.

Fourth Year First Semester

COURSE CODE	COURSE TITLE	CREDIT
CSE4121	**Professional Ethics and Cyber Law**	**2.0**

Engineering Ethics: Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

Evolution of Law in Cyberspace: The Online Landscape: Technological, Social and Legal Issues, Harmonization of Laws and the Issue of Jurisdiction Over the Internet, The Internet in the Context of International Commerce, Electronic Signature Legislation-a historical respective, An Overview of Specific Aspects, SEBI Guidelines, The UNCITRAL Model Law and Electronic Equivalents to Traditional Bills of Lading.

Security Concerns: The legal framework, Confidential Information, Protection of Confidential Information, Nature of confidential information, Confidence implied in a contract, Confidence implied by circumstances, Identification of confidential information, Essential requirements of breach of confidence, Exceptions to breach of confidence, Remedies for breach of confidence, Employee Privacy Rights, Employer Protection, Internet Banking in India: Analyzing Legal Issues, Negligent Misstatements.

Intellectual Property in Cyberspace: Intellectual Property on The Internet, Squatting in Cyberspace: A Web of Deception, WIPO Cases Involving Complainants from India, Intellectual Property (Trade Marks), Domain Names: ICANN and New Remedies Against Cybersquatting, Domain names, copyright intellectual Property and the Internet: A case study of the Indian approach to intellectual property and e-commerce, The CSS Technology License, DVD Audio Disc Copy Protection, Systems-on-a-Chip: Intellectual Property and Licensing Issues.

Protection of Personal Data and Privacy: Introduction, Personal Data, Data Subject, Data Processing: Definition and Grounds, Purpose Limitation, Legitimate Purposes, Data Controllers And Data Processors, Establishment, Data - Access and Information, Anonymous and Pseudonymous Data, Freedom of Expression, Free Flow of Data within the Eu, Data Transfer, Data Minimization.

Books Recommended:

(i) Martin, M., & Schinzinger, R. (2005). Ethics in engineering (4th ed.). Boston: McGraw-Hill.
(ii) Singh, Y. (2007). Cyber laws: A guide to cyber laws, information technology, computer software, intellectual property rights, e-commerce, taxation, privacy, etc., along with policies, guidelines, and agreements (3rd ed.). New Delhi: Universal Law Pub.
(iii) Sharma, V. (2002). Handbook of Cyber Laws: For Every Netizen. Macmillan India.
(iv) Craig, B. (2013). Cyberlaw: The law of the Internet and information technology. Upper Saddle River, N.J.: Pearson Education/Prentice Hall.
(v) Fleddermann, C. (2012). Engineering ethics (4th ed.). Upper Saddle River: Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
CSE4132	**Principles of Distributed Systems**	**3.0**

Introduction: Introduction to Distributed systems - challenges - architectural models - fundamental models P2P systems - Introduction to interposes communications - external data representation and marshaling- client-server communication - group communication-multicast/pub-sub - Energy Efficient Computing - Cloud computing.

Distributed Objects and File System: Introduction - Communication between distributed objects - Remote procedure call - Events and notifications - Java RMI case Study - Introduction to DFS - File service architecture – Google fie system - Introduction to Name Services- Name services and DNS - Directory and directory services-Cluster Computing - map-reduce/big table.

Distributed Operating System Support: The operating system layer – Protection - Process and threads - Communication and invocation - Operating system architecture - Introduction to time and global states - Clocks, Events and Process states - Synchronizing physical clocks - Logical time and logical clocks Global states - Distributed mutual exclusion - Overlay Networks - DHT.

Transaction And Concurrency Control-Distributed Transactions: Transactions – Nested transaction – Locks - Optimistic concurrency control - Timestamp ordering - Comparison of methods for concurrency control - Introduction to distributed transactions - Flat and nested distributed transactions - Atomic commit protocols - Concurrency control in distributed transactions - Distributed deadlocks - Transaction recovery - Data- Intensive Computing and Map Reduce.

Fault Tolerance, Security and Replication: Overview of security techniques - Cryptographic algorithms – Digital signatures - Cryptography pragmatics –

Distributed Replication - CDNs and replication – Fault-tolerant services - Byzantine Fault Tolerance - Detecting and Correcting Local Faults - Logging and Crash Recovery – Highly available services – Transactions with replicated data.

Case study: Multiplayer online games, Social networking services, Large object CDN's (video/audio streaming systems)

Books Recommended:

(i) Tanenbaum, A., & Steen, M. (2007). Distributed systems: Principles and paradigms (2nd ed.). Upper Saddle River, NJ: Pearson Prentice Hall.

(ii) Coulouris, G. (2012). Distributed systems: Concepts and design (5th ed.). Boston: Addison-Wesley.

(iii) Singhal, M., & Shivaratri, N. (1994). Advanced concepts in operating systems: Distributed, database, and multiprocessor operating systems. New York: McGraw-Hill.

(iv) Birman, K. (2005). Reliable distributed systems technologies, Web services, and applications. New York: Springer.

(v) Attiya, H., & Welch, J. (2004). Distributed computing fundamentals, simulations, and advanced topics (2nd ed.). Hoboken, NJ: Wiley.

COURSE CODE	COURSE TITLE	CREDIT
CSE4133	**Artificial Intelligence**	**3.0**

Introduction: What is intelligence? Foundations of artificial intelligence (AI), History of AI; Problem Solving- Formulating problems, problem types, states and operators, state space, search strategies.

Informed Search Strategies: Best first search, A* algorithm, heuristic functions, Iterative deepening A*(IDA), small memory A*(SMA); Game playing - Perfect decision game, imperfect decision game, evaluation function, alpha-beta pruning.

Reasoning: Representation, Inference, Propositional Logic, predicate logic (first-order logic), logical reasoning, forward chaining, backward chaining; AI languages and tools - Lisp, Prolog, CLIPS.

Planning: Basic representation of plans, partial order planning, planning in the blocks world, hierarchical planning, conditional planning, representation of resource constraints, measures, temporal constraints

Uncertainty: Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic; Decision making- Utility theory, utility functions, and Decision theoretic expert systems.

Inductive Learning: decision trees, rule-based learning, current-best-hypothesis search, least commitment search, neural networks, reinforcement learning, genetic algorithms; Other learning methods neural networks, reinforcement learning, genetic algorithms.

Communication: Communication among agents, natural language processing, formal grammar, parsing, grammar.

Books Recommended:

(i) Russell, S., & Norvig, P. (2010). Artificial intelligence: A modern approach (3rd ed.). Upper Saddle River, NJ: Prentice Hall.
(ii) Rich, E., & Knight, K. (2008). Artificial Intelligence (3rd ed.). New York: Tata McGraw-Hill.
(iii) Luger, G. (2009). Artificial intelligence: Structures and strategies for complex problem solving (6th ed.). Boston: Pearson Addison-Wesley.
(iv) Nilsson, N. (1998). Artificial Intelligence: A new synthesis. San Francisco, Calif.: Morgan Kaufmann.

COURSE CODE	COURSE TITLE	CREDIT
CSE 41P4	**Artificial Intelligence Lab**	**0.75**

Experiments	Topics
01	Implementing basic logic gates in Prolog.
02	Implementing human family relations using Prolog
03	Implementing monkey-banana problem using Prolog
04	Implement the logic for the selection process in an interview using Prolog
05	Using Dynamic Database using Prolog
06	Implement Fibonacci number and m^n value using Lisp.
07	Implementation of AND gate with Perceptions.
08	Implementation of NOR gate with Perceptions.
09	Implementation of XOR gate with Back Propagation Neural Network
10	Implementation of Genetic Algorithm.
11	Implementation of DFS and BFS

COURSE CODE	COURSE TITLE	CREDIT
CSE4135	**Web Engineering**	**3.0**

An Introduction to Web Engineering: Motivation, Categories of Web Applications, Characteristics of Web Applications, Product-related Characteristics, Usage-related Characteristics, Development-related Characteristics, Evolution of web engineering.

Requirements Engineering for Web Applications: Introduction, Fundamentals, Where Do Requirements Come From? Requirements Engineering (RE) Activities, RE Specifics in Web Engineering, Principles for RE of Web Applications, Adapting RE Methods to Web Application Development, Requirement Types, Notations, Tools.

Technologies for Web Applications: Client-side Technologies, ActiveX Controls, Document-specific Technologies, HTML- Hypertext Markup Language, DHTML, SMIL Synchronized Multimedia Integration Language, XML-eXtensible Markup Language, XSL-eXtensible Style sheet Language, Java Script, Server-side Technologies, Serve let, URI Handlers, Web Service, Middleware Technologies.

Web Application Architectures: Introduction, Fundamentals, What is Architecture? Developing Architectures Categorizing Architectures, Specifics of Web Application Architectures, Components of a Generic Web Application Architecture, Layered Architectures, 2-Layer Architectures, N- Layer Architectures Data-aspect Architectures, Database-centric Architectures, Architectures for Web Document Management, and Architectures for Multimedia Data.

Modelling Web Applications: Introduction, Fundamental, Modeling Specifics in Web Engineering, Levels, Aspects, Phases Customization, Modeling Requirements, Hypertext Modeling, Hypertext Structure Modeling Concepts, Access Modeling Concepts, Relation to Content Modeling, Presentation Modeling, Relation to Hypertext Modeling, Customization Modeling, Relation to Content, Hypertext and Presentation Modeling.

Web Application Design: Introduction, Web Design from an Evolutionary Perspective, Information Design, Software Design: A Programming Activity, Merging Information Design and Software Design, Problems and Restrictions in Integrated Web Design, A Proposed Structural Approach, Presentation Design, Presentation of Nodes and Meshes, Device-independent Development, Approaches, Interaction Design, User Interaction User Interface Organization, Navigation Design, Designing a Link Representation, Designing Link Internals, Navigation and Orientation, Structured Dialog for Complex Activities, Interplay with Technology and Architecture, Functional Design.

Testing Web Applications: Introduction, Fundamentals, Terminology, Quality Characteristics, Test Objectives, Test Levels, Role of the Tester, Test Specifics in Web Engineering, Test Approaches, Conventional Approaches, Agile Approaches, Test Scheme, Three Test Dimensions, Applying the Scheme to Web Applications, Test Methods and Techniques, Link Testing, Browser Testing, Usability Testing, Load, Stress, and Continuous Testing, Testing Security, Test-driven Development, Test Automation, Benefits and Drawbacks of Automated Test, Test Tools.

Web Project Management: Understanding Scope, Refining Framework Activities, Building a WebE Team, Managing Risk, Developing a Schedule, Managing Quality, Managing Change, Tracking the Project.

Books Recommended:

(i) Kappel, G. (2006). Web engineering: The discipline of systematic development of web applications. Hoboken, NJ: John Wiley & Sons.
(ii) Suh, W. (2005). Web engineering: Principles and techniques. Hershey, PA: Idea Group Pub.
(iii) Pressman, R., & Lowe, D. (2009). Web engineering: A practitioner's approach. Boston: McGraw-Hill Higher Education.
(iv) Thompson, G. (2008). Just enough Web Programming with XHTML, PHP, and MYSQL. Australia: Cengage Learning, Course Technology PTR.

COURSE CODE	COURSE TITLE	CREDIT
CSE41P6	**Web Engineering Lab**	**1.5**

Experiments	Topics
01	To Study Web servers and web Browsers
02	Create a web page purely in HTML code
03	Create a web page to show an application of CSS file
04	Study of JavaScript and applying javascript to validate form
05	Create a web page using HTML, javascript, CSS file
06	Create a web page to show an application of form controls
07	a) Write a code in ASP to format the text with HTML tags. b) Write a code to reverse the string. c) Write a code to check is user is connected or not
08	Create an XML document template to describe the result of a student in an examination.
09	Detail Learning about PHP
10	A mini project is desirable to be completed by a group of three that cover the following tools. a) HTML b) DHTML c) PHP d) XML e) Java Script/ CGI/ Pearl f) ASP

COURSE CODE	COURSE TITLE	CREDIT
CSE4137	**Computer Graphics and Multimedia System**	**3.0**

Computer Graphics Application: Introduction to Computer Graphics, Application of Computer Graphics.

Devices for Graphics Output: Monitor Basics, Picture Tube, Display Basics, Text Mode and Graphics Mode, Adapters and Displays, Monochrome Display Adapter (MDA), Color Graphics Adapter (CGA), Hercules Graphics Card, Enhanced Graphics Adapter, Professional Graphics Adapter, Digital vs Analog, Video Graphics Array, Super VGA, Refresh Cathode-Ray Tubes, Raster-Scan Displays, Random-Scan Displays.

Computer Display: Flat-Panel Displays, Raster Scan Systems, Random Scan Systems, Hard Copy Output Devices.

Graphics Input Devices: Keyboards, Mouse, Trackball and Space ball, Joysticks, Data Glove, Digitizers, Image Scanners, Touch Panels, Light Pens, Voice Systems, Input of Graphical Data, Logical Classification of Input Devices, Input Functions, Initial Values for Input Device Parameters, Interactive Picture Construction Techniques.

Matrices and Determinants: Matrices, Types of Matrices, Determinants, Matrix (Definition), Type of Matrices, Sub matrices of a Matrix: (Definition), Equality of Two Matrices: (Definition), Addition of Matrices, Scalar Multiplication, Multiplication of Two Matrices (Definition), Transpose of a Matrix (Definition), Symmetric and Skew-Symmetric Matrices, Adjoint and Inverse of a Matrix, Determinants, Properties of Determinants.

Vectors: Definition of a Vector, Vectors and Coordinate System, Algebra of Vectors Addition, Multiplication of a Vector by a Scalar, Components of a Vector, Direction and Magnitude of a Vector in Terms of its Components, Collinear and Coplanar Vectors, Some Applications to Geometry.

Raster Scan Graphics: Derivative of a Function, Digital Differential Analyzer, Bresenham's Algorithm, Integer Bresenham's Algorithm, General Bresenham's Algorithm, Circle Generation - Bresenham's Algorithm, Scan Conversion-Generation of the Display, Real-Time Scan Conversion, Run-Length Encoding, Cell Encoding, Frame Buffers, Addressing the Raster, Line Display, Character Display, Solid Area Scan Conversion, Polygon Filling, Scan-Converting Polygons, A Simple Ordered Edge List Algorithm, More Efficient Ordered Edge List Algorithms, The Edge Fill Algorithm, The Edge Flag Algorithm, Seed Fill Algorithms, A Simple Seed Fill Algorithm, A Scan Line Seed Fill Algorithm, Fundamentals of Antialiasing, Simple Area Antialiasing, The Convolution Integral And Antialiasing, Half toning.

Windows and Clipping: Two-Dimensional Clipping, Sutherland-Cohen Subdivision Line-Clipping Algorithm, Midpoint Subdivision Algorithm, Generalized Two-Dimensional Line Clipping for Convex Boundaries.

2D- Transformation: Representation of Points, Transformations and Matrix, Transformation of Straight Line, 2-D - Rotation, Reflection, Scaling, Combined Transformations, Translation and Homogeneous Coordinates, Translation, Rotation about an Arbitrary Point, Reflection through an Arbitrary Line.

3-D-Transformation: Representation of Points, 3D- Scaling, 3D- Shearing, 3D-Rotation, Three Dimensional Translation, 3D- Reflection, Multiple Transformations, Rotation about an Axis Parallel to a Coordinate Axis, Rotation about an Arbitrary Axis in Space, Three.

The Dimensional Perspective Geometry: Geometric Projection, Orthographic Projections, Oblique Projections, Perspective Transformations, Single-Point Perspective Transformation, Two-Point Perspective Transformation, Three-Point Perspective Transformation.

Hidden-Surface, Lines and Bezier Curve: Hidden Surfaces and Lines, Back-Face Detection, Back-Face Removal, Z-Buffers Algorithm, The Painter's Algorithm, Binary Space Partition, Franklin Algorithm, Cubic Belier Curve (No Derivations Needed), Properties of Bezier Curve, Joining Condition, Problems.

Multimedia and Animation: Multimedia, Multimedia Terms, Multimedia Hardware, Hardware Peripherals, Basic tools in Multimedia, Multimedia Building Blocks (Media Forms/Elements), Sound, Image, Animation, Video, JPEG, MPEG, DVI Indeo, P*64, Graphic File Formats, Multimedia Applications.

Books Recommended:

(i) Hearn, D., & Baker, M. (1994). Computer graphics (2nd ed.). Englewood Cliffs, N.J.: Prentice-Hall.
(ii) Hugues, J. (2014). Computer graphics: Principles and practice (3rd ed.). Upper Saddle River: Addison-Wesley.
(iii) Rogers, D. (1998). Procedural elements for computer graphics (2nd ed.). Boston, Mass.: WCB/McGraw-Hill.
(iv) Gibbs, S., & Tsichritzis, D. (1995). Multimedia programming: Objects, environments, and frameworks. New York: ACM Press;
(v) Li, Z., & Drew, M. (2004). Fundamentals of multimedia. Upper Saddle River, NJ: Pearson Prentice Hall.
(vi) Andleigh, P., & Thakrar, K. (1996). Multimedia systems design. Upper Saddle River, NJ: Prentice Hall PTR.

COURSE CODE	COURSE TITLE	CREDIT
CSE41P8	**Computer Graphics and Multimedia System Lab**	**0.75**

Experiments	Topics
01	A brief study of various types of input and output devices.
02	Program to implement a line using slope intercept formula.
03	Program to implement line using DDA algorithm.
04	Program to implement line using Bresenham's algorithm.
05	Program to implement circle using midpoint algorithm.
06	Program to implement translation of a line and triangle
07	Program to implement rotation of a line and triangle
08	Program to implement scaling transformation.
09	Program to implement 3d rotation about an arbitrary axis.
10	Program to implement Cohen Sutherland line clipping.
11	Program to implement Sutherland Hodgman polygon clipping.
12	Program to draw Bezier curve.
13	Program to draw b-spine curve.

Fourth Year Second Semester

COURSE CODE	COURSE TITLE	CREDIT
CSE4231	**Cryptography and Network Security**	**3.0**

Security Trends: Attacks and services, Classical crypto systems, Different types of ciphers, LFSR sequences, Basic Number theory, Congruence, Chinese Remainder theorem, Modular exponentiation, Fermat and Euler's theorem, Legendre and Jacobi symbols, Finite fields, continued fractions.

Simple DES: Differential crypto analysis, DES, Modes of operation, Triple DES, AES, RC4, RSA, Attacks, Primarily test, factoring.

Discrete Logarithms: Computing discrete logs, Diffie-Hellman key exchange, ElGamal Public key cryptosystems, Hash functions, Secure Hash, Birthday attacks, MD5, Digital signatures, RSA, ElGamal, DSA.

Authentication applications: Kerberos, X.509, PKI, Electronic Mail security, PGP, S/MIME, IP security, Web Security, SSL, TLS, SET.

System security: Intruders, Malicious software, viruses, Firewalls, Security Standards.

Books Recommended:

(i) Trappe, W., & Washington, L. (2006). Introduction to cryptography: With coding theory (2nd ed.). Upper Saddle River, N.J.: Pearson Prentice Hall.
(ii) Stallings, W. (2013). Cryptography and network security: Principles and practice (Sixth ed.). Pearson.
(iii) Mao, W. (2004). Modern cryptography: Theory and practice. Upper Saddle River, NJ: Prentice Hall PTR.
(iv) Pfleeger, C., & Pfleeger, S. (2007). Security in computing (4th ed.). Upper Saddle River, NJ: Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
CSE4232	**Compiler Design**	**3.0**

Front End of Compilers: The structure of Compiler, Lexical analysis: Role of Lexical analyzer, Specification and recognition of tokens, Syntax Analysis: Top down parsing, Bottom up parsing, LR Parsers: SLR, CLR, and LALR.

Intermediate Code Generation: Syntax Directed Definitions, Evaluation orders for syntax directed definitions, Syntax Directed Translation schemes, Intermediate languages : Three address code, Syntax tree, Postfix code – Declarations – Type checking – Expression translation – Back patching.

Object Code Generation: Storage organization, Stack allocation space, Access to non-local data on the stack, Heap management, Issues in code generation, Design of code generator, Register allocation and assignment, Instruction selection by tree rewriting, Optimal code generation for expressions, Dynamic programming code generation.

Code Optimization: Basic blocks and Flow graphs, Optimization of basic blocks, Principal sources of optimizations, Data flow analysis, Constant propagation, Partial redundancy elimination, Peephole optimizations.

Parallelizing Compiler: Basic concepts and examples, Iteration spaces, Affine array indexes, Data reuse, Array data dependence, Finding synchronization free parallelism, Synchronization between parallel loops, Locality optimizations.

Books Recommended:

(i) Aho, A. (2007). Compilers: Principles, techniques, & tools (2nd ed.). Boston: Pearson/Addison Wesley.
(ii) Allen, R., & Kennedy, K. (2001). Optimizing compilers for modern architectures a dependence-based approach. San Francisco: Morgan Kaufmann.
(iii) Muchnick, S. (1997). Advanced compiler design and implementation. San Francisco, Calif.: Morgan Kaufmann.
(iv) Cooper, K., & Torczon, L. (2012). Engineering a compiler (2nd ed.). Amsterdam: Elsevier/Morgan Kaufmann.
(v) Holub, A. (1990). Compiler design in C. Englewood Cliffs, NJ: Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
CSE42P3	**Compiler Design Lab**	**0.75**

Experiments	Topics
01	Lexical analyzer generators
02	Parser generators
03	Intermediate code generation of Expressions
04	Assignment statements with arrays, Control flow statements, Switch statements.
05	Identifying the various errors of a program like syntax error, logical error etc.
06	Code generation for any specific architecture supported by open source compilers.
07	Exploring and customizing different types of optimizations supported by any open source compiler
08	NFA and DFA design
09	**Case study:** Open source parallelizing compilers.

COURSE CODE	COURSE TITLE	CREDIT
CSE4234	**Mobile Application Development**	**3.0**

Introduction: Mobile operating system, Operating system structure, Constraints and Restrictions, Hardware configuration with mobile operating system, Features: Multitasking Scheduling, Memory Allocation, File System Interface, Keypad Interface, I/O Interface, Protection and Security, Multimedia features.

Introduction to Mobile development IDE's: Introduction to Worklight basics, Optimization, pages and fragments , Writing a basic program- in Worklight Studio, Client technologies, Client side debugging, Creating adapters, Invoking adapters from Worklight Client application, Common Controls, Using Java in adapters, Programming exercise with Skins, Understanding Apache Cordova, Offline access, Encrypted cache deprecated, Using JSONStore.

Understanding Mobile Applications: Understanding Apple iOS development, Android development, Shell Development, Creating Java ME application, Exploring the Worklight Server, Working with UI frameworks, Authentication, Push notification, SMS Notifications, Globalization, WebView overlay , Creating Authentication application: development for Apple iOS by using a login module, Device Analytics, Worklight Server Administration.

Windows Phone: Introduction to Windows Phone, Architecture, memory management, communication protocols, application development methods, deployment. Case Study: Design and development of Application using mobile application development platforms e.g. WorkLight, Kendo, Appcon, Xcode, Xpages.

Android: Introduction to Android, Architecture, memory management, communication protocols, application development methods, deployment. Case Study: Design and development of Application using mobile application development platforms e.g. WorkLight, Kendo, Appcon, Xcode, Xpages.

iOS: Introduction to iOS, Architecture, memory management, communication protocols, application development methods, deployment. Case Study: Design and development of Application using mobile application development platforms e.g. WorkLight, Kendo, Appcon, Xcode, Xpages.

Books Recommended:

(i) Pradhan, A., & Deshpande, A. (2014). Composing Mobile Apps: Learn, Explore, Apply using Android (1st ed.). Wiley India Private Limited.

(ii) McWherter, J., & Gowell, S. (2012). Professional mobile application development. Indianapolis, Ind.: John Wiley & Sons.

(iii) Burd, B. (2012). Android application development all-in-one for dummies. Hoboken: John Wiley.
(iv) Goldstein, N., & Bove, T. (2010). IPhone application development all-in-one for dummies. Hoboken, NJ: Wiley Pub.
(v) Lee, H., & Chuvyrov, E. (2012). Beginning Windows phone app development (3rd ed.). New York, N.Y.: Apress.
(vi) Schiller, J. (2006). Mobile communications (2.nd ed.). London: Addison-Wesley.

COURSE CODE	COURSE TITLE	CREDIT
CSE42P5	**Mobile Application Development Lab**	**1.5**

Experiments	Topics
01	Installing Android Environment like eclipse
02	Hello World Application
03	Sample Application about Android Resources
04	Sample Application about Layouts
05	Sample Application about Intents
06	Sample Application I about user interfaces
07	Sample Application II about user interfaces
08	Sample Application III about user interfaces
09	Sample Application of Animations
10	Sample Application about Android Data
11	Simple Project: Application Development

COURSE CODE	COURSE TITLE	CREDIT
CSE4246	**Project Work**	**4.0**

Learners will be assigned a project under a supervisor who will be a faculty of any recognized university and have experience in a relevant field. The project shall be completed either in groups consisting maximum of two members or individually.

COURSE CODE	COURSE TITLE	CREDIT
CSE4227	**Comprehensive VivaVoce**	**2.0**

At the end of the eighth semester, learners must appear in the comprehensive Viva-Voce examination. The examination shall be based on all courses and the viva-voce shall be conducted by a committee formed under the guidance of Article- 41 of the Examination regulation.