SCHEME OF INSTRUCTION AND EXAMINATION

B. E (CSE) - V – Semester

SNo	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Examination			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	**PC501CS**	Artificial Intelligence and Machine Learning	3	0	-		3	40	60	3
2	**PC502CS**	Database Management Systems	3	0	-		3	40	60	3
3	**PC503CS**	Number Theory &Cryptography	3	0	-		3	40	60	3
4	**PC504CS**	Software Engineering	3	0	-		3	40	60	3
5	**PC505CS**	Web Programming	3	0	-		3	40	60	3
6	**Professional Elective – II**									
	PE511CS	Image Processing	3	0	-		3	40	60	3
	PE512CS	Data Mining								
	PE513CS	Computer Graphics								
	PE514CS	Advanced Computer Architecture								
	PE515CS	Software Quality & Testing								
Practicals										
7	**PC551CS**	Artificial Intelligence and Machine Learning Lab	-	-	2		3	25	50	1
8	**PC552CS**	Database Management Systems Lab	-	-	2 x 2		3	25	50	2
9	**PC553CS**	Web Programming Lab	-	-	2		3	25	50	1
		Total	**18**	**0**	**8**		27	**315**	**510**	**22**

PC501CS	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING					
Prerequisites	**Programming Languages**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To familiarize the principles of Artificial Intelligence
2.	To study the techniques for knowledge representation and inference
3.	To learn the techniques involved in the creation of intelligent systems
4.	To study different applications like Game Playing Expert Systems, machine learning and natural language processing
5.	To understand Natural Language Processing Techniques.

Course Outcomes : At the end of the course the student will be able to:	
1.	Use different logical systems for inference over formal domain representations.
2.	Formalize a given problem in the language/framework of different AI methods
3.	Design and perform an empirical evaluation of different algorithms on a problem Formalization.
4.	Implement different Machine Learning Algorithms.
5.	Apply NLP techniques to build new models.

UNIT – I

Overview of Artificial Intelligence: Introduction. The Turing Test, Strong AI versus Weak AI, Heuristics, Identifying Problems Suitable for AI, Applications and Methods, Early History of AI, Recent History of AI to the Present, AI in the New Millennium

Uninformed Search: Introduction: Search in Intelligent Systems, State-Space Graphs, Generate-and-Test Paradigm, Blind Search Algorithms, Implementing and Comparing Blind Search Algorithms

Informed Search: Introduction, Heuristics, Informed Search Algorithms – Finding Any Solution, The Best-First Search, The Beam Search, Additional Metrics for Search Algorithms, Informed Search – Finding An Optimal Solution, Informed Search – Advanced Search Algorithms.

UNIT – II

Search Using Games: Introduction, Game Trees and Minimax Evaluation, Minimax with Alpha-Beta Pruning, Variations and Improvements To Minimax, Games of Chance and the Expect mini max Algorithm, Game Theory

Logic in Artificial Intelligence: Introduction, Logic and Representation, Propositional Logic, Predicate Logic – Introduction, Several Other Logics

Knowledge Representation: Introduction, Graphical Sketches and the Human Window, Graphs and the Bridges of Königsberg Problem, Search Trees, Representational Choices, Production Systems, Object Orientation, Frames, Scripts and the Conceptual Dependency System, Semantic Networks, Associations, More Recent Approaches, Agents: Intelligent or Otherwise

UNIT – III
Production Systems: Introduction, Background, Basic Examples, Production Systems and Inference Methods, Production Systems and Cellular Automata, Stochastic Processes and Markov Chains. **Uncertainty in AI:** Introduction, Fuzzy Sets, Fuzzy Logic, Fuzzy Inferences, Probability Theory and Uncertainty. **Expert Systems:** Introduction, Background, Characteristics of Expert Systems, Knowledge Engineering, Knowledge Acquisition, Case-Based Reasoning, More Recent Expert Systems.

UNIT – IV
Machine Learning : Introduction, Machine Learning: A Brief Overview, The Role of Feedback in Machine Learning Systems, Inductive Learning, Learning With Decision Trees, Problems Suitable for Decision Trees, Entropy, Constructing A Decision Tree With ID3. **Neural Networks :**Neural Networks Introduction, Rudiments of Artificial Neural Networks, McCulloch-Pitts Network, The Perceptron Learning Rule, The Delta Rule, Backpropagation, Implementation Concerns, Discrete Hopfield Networks, Application Areas.

UNIT – V
Natural Language Understanding: Introduction, History of Natural Language Processing, Syntax and Formal Grammars, Semantic Analysis and Extended Grammars, Statistical Methods in NLP, Probabilistic Models for Statistical NLP, Linguistic Data Collections for Statistical NLP

References:	
1.	Stephen Lucci, Danny Kopec. Artificial Intelligence iMercury Learning and Information. 2nd Edition. 2016
2.	Russell, Norvig: Artificial Intelligence, A Modern Approach, Pearson Education, Second Edition. 2004

Suggested Readings:	
1.	Rich, Knight, Nair: Artificial Intelligence, Tata McGraw Hill, Third Edition 2009
2.	Saroj Kaushik. Artificial Intelligence. Cengage Learning. 2011

PC502CS	**DATABASE MANAGEMENT SYSTEMS**					
Prerequisites	**ER Model, SQL**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To introduce three schema architecture and DBMS functional components
2.	To learn formal and commercial query languages of RDBMS
3.	To understand the principles of ER modeling and theory of normalization
4.	To study different file organization and indexing techniques
5.	To familiarize theory of serializablity and implementation of concurrency control, and recovery

Course Outcomes : At the end of the course the student will be able to:	
1.	Understand the mathematical foundations on which RDBMS are built
2.	Model a set of requirements using the Extended Entity Relationship Model (EER), transform an EER model into a relational model, and refine the relational model using theory of Normalization.
3.	Develop Database application using SQL and Embedded SQL
4.	Use the knowledge of file organization and indexing to improve database application Performance.
5.	Understand the working of concurrency control and recovery mechanisms in RDBMS.

UNIT – I

Introduction: Data, File systems, Database, Database System Applications, Purpose of Database Systems, View of data, Database Languages, Database Design, Database Architecture, Database Users and Administrators, History of database systems

Database Design and the E-R Model: Overview of the Design Process, The Entity- Relationship Model, Constraints, Entity-Relationship Diagrams, Entity – Relationship Design Issues, Weak Entity Sets, Extended E-R Features, Database Design for Banking Enterprise, Reduction to Relational Schemas, Other Aspects of Database Design.

UNIT – II

Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query languages, Relational-Algebra Operations, Additional Relational – Algebra Operations, Extended Relational - Algebra Operations, Null Values, Modification of the Databases.

Structured Query Language: Overview of SQL Query language, SQL Data Definition, Basic Structure of SQL Queries, Set Operations, Aggregate Functions, Null Values, Nested Sub-queries, Complex Queries, Views, Modification of the Database.

UNIT – III

Intermediate SQL: Join Expressions, Views, Transactions, Integrity Constraints, SQL data Types and Schemas

Advanced SQL: Functions and Procedural Constructs, Triggers, Recursive Queries, Advanced SQL Features.

Relational Database Design: Features of Good Relational Design, Atomic Domains and Normal

Forms, Functional-Dependency Theory, Decomposition using Functional Dependencies.

UNIT – IV
Indexing and Hashing: Basic Concepts, Ordered Indices, B+-tree Index Files, B-tree Index Files, MultipleKey Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices. **Database System Architectures:**Overview-Centralized Database Systems, Parallel Systems, Distributed Systems, Block-chain Databases-Overview, Big data-Motivation, Big Data Storage Systems, Data warehousing, Data Mining.

UNIT – V
Transactions: Transaction Concepts, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability. **Concurrency Control:** Lock-based Protocols, Timestamp-based Protocols, Validation-based Protocols, Multiple Granularity, Multi-version Schemes, Deadlock Handling, Insert and Delete Operations, Weak Levels of Consistency, Concurrency of Index Structures. **Recovery System:** Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, Advanced Recovery Techniques, Remote Backup Systems.

References:	
1.	Abraham Silberschatz, Henry F Korth, S Sudarshan, Database System Concepts, McGraw-Hill International Edition, 7th Edition, 2019
2.	Ramakrishnan, Gehrke, Database Management Systems, McGraw-Hill International Edition, 3rd Edition, 2003.

Suggested Readings:	
1.	Elmasri, Navathe, Somayajulu, Fundamentals of Database Systems, Pearson Education, 4th Edition, 2004.

PC503CS	**NUMBER THEORY AND CRYPTOGRAPHY**					
Prerequisites	**Probability, Computer Networks**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To understand the significant aspects of Number Theory
2.	To comprehend secret and public key cryptography
3.	To Learn hash functions and digital signatures
4.	To study the digital signatures and smart cards
5.	To comprehend the applications of network applications

Course Outcomes : At the end of the course the student will be able to:	
1.	Explain the fundamentals of Number Theory
2.	Elaborate the concepts secret and public key cryptography
3.	Elucidate the hash functions digital signatures
4.	Describe the digital signatures and smart cards
5.	Eenlighten the applications of network security

UNIT – I

Introduction to Number Theory: Euclidean algorithm, Modular arithmetic, Prime numbers, Fermat‟s and Euler‟s theorem, Testing for Primality, The Chinese Remainder theorem, Discrete Logarithms.
Computer and Network Security concepts: security attacks, security services and security mechanisms, security design principles and model for network security.

UNIT – II

Secret Key Cryptography: DES, Double and Triple DES, AES, Block cipher Modes: ECB, CBC, CFB, and CTR; XTS-AES mode of operation.
Public Key Cryptography: RSA, ECC, Diffie-Hellman Key Exchange.

UNIT – III

Integrity, Authentication and Non-Repudiation: Hash Function (MD5, SHA-1), Message Authentication Code (MAC), **Digital Signature**: Introduction and using RSA and DSA schemes **Authentication**: Principles, Using symmetric key: Kerberos and using Asymmetric key.

UNIT – IV

Key Management and Distribution: Digital Certificates, Certifying Authorities, Public-key infrastructure.
Email Security: PGP and PEM-S/MIME.

UNIT – V

Web Security Protocols (SSL), IPSec, Secure Electronic Transaction (SET), System Security using Firewalls and VPN.

References:	
1.	William Stallings, "Cryptography and Network Security, Principles and Practice", 7th Edition, Pearson, 2017.
2.	Behrouz A Forouzan, "Cryptography and Network Security", TMH, 2009.

Suggested Readings:	
1.	An Introduction to the Theory of Numbers, G.H. Hardy and E.M. Wright.
2.	Introduction to Modern Cryptography: Principles and Protocols, Jonathan Katz and Yehuda Lindell

PC504CS	**SOFTWARE ENGINEERING**					
Prerequisites	**Fundamentals of IT**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To understand Software Processes and Project Management
2.	To master Requirements Engineering
3.	To design Effective Software Architectures
4.	To develop and Validate Software Solutions
5.	To manage Software Projects and Adopt Emerging Technologies

Course Outcomes : At the end of the course the student will be able to:	
1.	Apply project management principles and software processes to manage and deliver software projects efficiently
2.	Defining and managing software requirements, creating system models, and applying formal specification techniques.
3.	Designing robust software architectures, including real-time and user interface designs.
4.	Utilize verification and validation methods and to ensure the reliability and correctness of software products.
5.	Demonstrate the ability to manage software projects, apply cost estimation and quality management practices.

UNIT – I
Overview
Introduction, Socio-Technical Systems, Critical Systems, Software Processes, Project Management.

UNIT – II
Requirements
Software Requirements, Requirements engineering processes, system models, critical system specification and formal specification.

UNIT – III
Design
Architectural design, Application architectures, object oriented design, real time software design, user interface design.

UNIT – IV
Development
Rapid software development, software reuse, component based software engineering, critical systems development.
Verification and Validation
Verification and Validation, Software testing, critical system validation.

UNIT – V
Managing People
Managing people, software cost estimation, quality management, process improvement, configuration management.
Emerging Technologies
Security engineering, service oriented software engineering, aspect oriented software development.

References:	
1.	Software Engineering, Sommerville, 8th Edition, Pearson Education Limited, 2007.
2.	Software Engineering: A Practitioner's Approach, Roger S. Pressman and Bruce R. Maxim.

Suggested Readings:	
1.	Software Engineering: Principles and Practice, Hans van Vliet

PC505CS	**WEB PROGRAMMING**					
Prerequisites	**Databases**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To learn HTML5 and JavaScript.
2.	To familiarize the tools and technologies to process XML documents.
3.	To learn various server-side and database connectivity technologies.
4.	To gain knowledge on Sevlets .
5.	To work wirh PHP.

Course Outcomes : At the end of the course the student will be able to:	
1.	Design a website with static and dynamic web pages.
2.	Develop a web application with session tracking and client side data validations.
3.	Develop web content publishing application that accesses back-end data base and publishes data in XML format.
4.	Build an application with PHP.
5.	Understand database design.

UNIT – I

Introduction to World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, HTTP. HTML5: Introduction, Links, Images, Multimedia, Lists, Tables, Creating Forms, Styling Forms.

UNIT – II

Introduction to XML, XML document structure, Document Type Definition, Namespaces, XML Schemas, Displaying XML documents with CSS, XPath Basics, XSLT, XML Processors.

UNIT – III

Introduction to Java script, Java Script and Forms Variables, Functions, Operators, Conditional Statements and Loops, Arrays DOM, Strings, Event and Event Handling, Java Script Closures. Introduction to Ajax, Pre-Ajax Java Script Communication Techniques, XML HTTP Request Object, Data Formats, Security Concerns, User Interface Design for Ajax.

UNIT – IV

Java Servlets: Java Servlets and CGI Programming, Benefits of Java Servlet, Life Cycle of Java Servlet, Reading data from client, HTTP Request Header, HTTP Response Header, working with Cookies, Tracking Sessions.
Introduction to MERN stack and LAMP stack, React JS.

UNIT – V

Introduction to PHP: Overview of PHP, General Syntactic Characteristics, Primitives, Operations, Expressions, Control Statements, Arrays, Functions, Pattern matching, Form handling, Files, Cookies, Session Tracking.

Database access through Web: Architectures for Database Access- **Database access with Mongo DB** - Database access with PHP-Database access with JDBC.

References:	
1.	Robert W.Sebesta, Programming the World Wide Web, 3rd Edition, Pearson Education, 2006.
2.	Wendy Willard, HTML5, McGraw Hill Education (India) Edition, 2013

Suggested Readings:	
1.	Thomas Powell, The Complete Reference: Ajax, Tata-McGraw-Hill, 2011.
2.	John Pollock, Java Script, 4th Edition, McGraw Hill Education (India) Edition, 2013.
3.	Jim Keogh, J2EE : The Complete Reference, Tata-McGraw-Hill, 2002.

PE511CS	**IMAGE PROCESSING**					
Prerequisites	**signals and systems**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To introduce students to the Basic concepts and analytical methods of analysis of digital images
2.	To Study fundamental concepts of Digital Image Processing and basic relations among pixels
3.	To Study different Spatial and Frequency domain concepts.
4.	To understand Restoration process of degraded image and Multi resolution processing.
5.	To understand image compression and Segmentation Techniques.

Course Outcomes : At the end of the course the student will be able to:	
1.	Understand different components of image processing system
2.	Describe various image transforms, enhancement techniques using various processing methods
3.	Illustrate the compression and segmentation techniques on a given image
4.	Demonstrate the filtering and restoration of images(pixels) with examples
5.	Illustrate the various schemes for image representation and edge detection techniques with examples

UNIT – I

Introduction: Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. Digital Image Fundamentals: Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels

UNIT – II

Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformation, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing spatial Filters, Sharpening spatial Filters.

Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain, Smoothing frequency-domain Filters, Sharpening Frequency-domain Filters, Homomorphic Filtering, Implementation.

UNIT – III

Image Restoration: A Model of the Image Degradation/Restoration Process, Linear, PositionInvariant Degradations, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. Wavelets and Multi resolution Processing: Multi resolution Expansions, Wavelet Transforms in one Dimension, The Fast Wavelet Transform, Wavelet Transforms in Two Dimensions.

UNIT – IV
Image Compression: Image Compression Models, Error-free Compression, Lossy Compression, Image Compression Standards. Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation

UNIT – V
Representation and Description: Various schemes for representation, boundary descriptors, and regional descriptors.

References:	
1.	Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing. Prentice Hall India/Pearson Education.
2.	A.K.Jain, Fundamentals of Digital Image Processing. Prentice Hall India.

Suggested Readings:	
1.	Madhuri.A.Joshi, Digital Image Processing, PHI.
2.	Sonka, Image Processing, Analysis and Machine Vision. Cengage Publications.

PE512CS	**DATA MINING**					
Prerequisites	**Databases**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To understand the importance of data mining and explore major issues
2.	To Learn the fundamental concepts and methods for mining frequent patterns, associations, and correlations.
3.	To understand and apply basic and advanced classification techniques,
4.	To explore and apply cluster analysis techniques and evaluate the effectiveness of clustering results.
5.	To examine current trends and research frontiers in data mining

Course Outcomes : At the end of the course the student will be able to:	
1.	Analyze and describe datasets using basic statistical techniques and data visualization, and apply methods.
2.	Evaluate patterns to uncover meaningful associations and correlations in large datasets
3.	Implement and evaluate various classification algorithms to effectively classify and predict data patterns
4.	Perform cluster analysis using various methods; assess the quality of clustering outcomes.
5.	Identify and analyze emerging trends in data mining, apply advanced methodologies to complex data types

UNIT – I
Introduction: Importance of Data Mining, Major issues in Data Mining, Getting to know your data: Data objects and attributed types. Basic statistical descriptions of data. Data visualization, Measuring data similarity and dissimilarity.

UNIT – II
Mining frequent patterns, Associations and correlations: Basic concepts and methods, Frequent Item set Mining Methods, Pattern evaluation methods.

UNIT – III
Classification: Basic concepts, Decision tree induction, Bayes classification methods, Advance methods, Bayesian Belief Network, Classification by back propagation, Support vector machines.

UNIT – IV
Cluster Analysis: Concepts and Methods: Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering.

UNIT – V
Data Mining Trends and Research Frontiers: Mining Complex Data Types, Other Methodologies of Data Mining, Data Mining Applications, Data Mining and Society, Data Mining trends.

References:	
1.	Jiawei Han, Micheline Kamber, Jin Pei, "Data Mining: Concepts & Techniques", 3rd Edition., Morgon Kauffman, 2011.
2.	Vikram Pudi, P.Radha Krishna, "Data Mining", Oxford University Press, 1st Edition, 2009.

Suggested Readings:	
1.	Pang-Ning Tan, Michael Steinbach, Vipin Kumar," Introduction to Data Mining", Pearson Education, 2008

PE513CS	**COMPUTER GRAPHICS**					
Prerequisites	**Programming, Matheamtics**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To introduction of fundamental concepts and theory of computer graphics.
2.	To learn the 2D and 3D object transformations and algorithms
3.	To understand the computer animation sequence and its methods
4.	To impart knowledge on 3D Geometric transformation.
5.	To gain skills on detection methods.

Course Outcomes : At the end of the course the student will be able to:	
1.	Acquire familiarity with the relevant mathematics of computer graphics.
2.	Design basic graphics application programs, including animation
3.	Design applications that display graphic images to given specifications
4.	Implement 3D Transformations.
5.	Work with different computer animation applications.

UNIT – I

Introduction: Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices Output primitives: Points and lines, line drawing algorithms (Bresenham's and DDA Algorithm), midpoint, Circle and ellipse algorithms, Polygon Filling: Scan-line algorithm, boundary-fill and flood-fill algorithms.

UNIT – II

2-D geometrical transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems. 2-D viewing: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland algorithms, Sutherland – Hodgeman polygon clipping algorithm.

UNIT – III

3-D object representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon rendering methods.

UNIT – IV

3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations. viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.

UNIT – V

Computer Animation: Design of animation sequence, general computer animation functions, raster

animation, computer animation languages, key frame systems, motion specifications. **Visible surface detection methods:** Classification, back-face detection, depth-buffer, BSP-tree methods and area sub-division methods.

References:	
1.	Computer Graphics C version, Donald Hearn and M. Pauline Baker, Pearson Education, 2nd Edition, 1997.
2.	Computer Graphics Principles & Practice", 2nd Edition in C, Foley, Van Dam, Feiner and Hughes, Pearson Education, 1996.

Suggested Readings:	
1.	Computer Graphics- A programming Approach, Steven Harrington, TMH, 1987.

PE514CS	**ADVANCED COMPUTER ARCHITECTURE**					
Prerequisites	**CO**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To analyze the principles of scalable performance in parallel computing.
2.	To Examine and evaluate advanced processor technologies.
3.	To Analyze cache memory organizations and shared memory systems, along with the principles of pipeline processing.
4.	To Understand and evaluate scalable and multithreaded architectures, focusing on cache coherence, synchronization mechanisms, and latency-hiding techniques.
5.	To Analyze scalable and multithreaded architectures, including dataflow and hybrid models, and apply latency-hiding techniques.

Course Outcomes : At the end of the course the student will be able to:	
1.	Work with computational models and computer architectures.
2.	Analyze the concepts of computer models.
3.	Gain knowledge in bus, cache and shared memory architectures.
4.	Hands on experience on scalable architectures, pipelining, superscalar processors, multiprocessors.
5.	Learn advanced and hybrid architectures.

UNIT – I

Theory of Parallelism: Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputer ,Multivector and SIMD Computers, PRAM and VLSI Models, Program and Network Properties, Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.

UNIT – II

Hardware Technologies: Processors and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

UNIT – III

Bus, Cache, and Shared Memory : Bus Systems ,Cache Memory Organizations ,Shared Memory Organizations ,Sequential and Weak Consistency Models ,Pipelining and Superscalar Techniques ,Linear Pipeline Processors ,Nonlinear Pipeline Processors ,Instruction Pipeline Design ,Arithmetic Pipeline Design.

UNIT – IV

Parallel and Scalable Architectures: Multiprocessors and Multicomputers, Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multicomputers, Message-Passing Mechanisms, Multivector and SIMD Computers ,Vector

Processing Principles , Multivector Multiprocessors ,Compound Vector Processing , SIMD Computer Organizations.

UNIT – V
Advanced Architectures Scalable, Multithreaded and Dataflow Architectures, Latency-hiding techniques, Principals of Multithreading, Fine-Grain Multicomputers, Scalable and multithreaded Architectures, Dataflow and hybrid Architectures.

References:	
1.	Kai Hwang and Naresh Jotwani, Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability, McGraw Hill Education 3/e. 2015.
2.	Advanced Computer Architecture Second Edition, Kai Hwang, Tata McGraw Hill Publishers.

Suggested Readings:	
1.	John L. Hennessy and David A. Patterson, Computer Architecture: A quantitative approach, 5th edition, Morgan Kaufmann Elseveir, 2013

PE515CS	**SOFTWARE QUALITY & TESTING**					
Prerequisites	**SE, STM**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	Learn the essentials of software quality
2.	Study methods to integrate software quality activities in the project
3.	Understand the software quality metrics
4.	Learn building software testing strategy
5.	Comprehend testing various artifacts of a software project

Course Outcomes : At the end of the course the student will be able to:	
1.	Explain the essentials of software quality
2.	Elaborate the methods to integrate software quality activities in the project
3.	Describe the software quality metrics
4.	Discuss building software testing strategy
5.	Perform testing various artifacts of a software project

UNIT – I

The Software Quality Challenge, Introduction Software Quality Factors, The Components of the Software Quality Assurance System – Overview, Development and Quality Plans.

UNIT – II

Integrating Quality Activities in the Project Life Cycle, Assuring the Quality of Software Maintenance Components, CASE Tools and their effect on Software Quality, Procedure and Work Instructions, Supporting Quality Devices, Configuration Management, Documentation Control, Project Progress Control.

UNIT – III

Software Quality Metrics, Costs of Software Quality, Quality Management Standards - ISO 9000 and Companion ISO Standards, CMM, CMMI, PCMM, Malcom Balridge, 3 Sigma, 6 Sigma, SQA Project Process Standards – IEEE Software Engineering Standards.

UNIT – IV

Building a Software Testing Strategy, Establishing a Software Testing Methodology, Determining Your Software Testing Techniques, Eleven – Step Software Testing Process Overview, Assess Project Management Development Estimate and Status, Develop Test Plan, Requirements Phase Testing, Design Phase Testing, Program Phase Testing, Execute Test and Record Results, Acceptance Test, Report Test Results, Test Software Changes, Evaluate Test Effectiveness.

UNIT – V

Testing Client / Server Systems, Testing the Adequacy of System Documentation, Testing Web-

based Systems, Testing Off – the – Shelf Software, Testing in a Multiplatform Environment, Testing Security, Testing a Data Warehouse, Creating Test Documentation, Software Testing Tools, Taxonomy of Testing Tools, Methodology to Evaluate Automated Testing Tools, Load Runner, Win Runner and Rational Testing Tools, Java Testing Tools, JMetra, JUNIT and Cactus.

References:	
1.	Daniel Galin, Software Quality Assurance – From Theory to Implementation, Pearson Education.2004.
2.	Mordechai Ben – Menachem / Garry S.Marliss, Software Quality – Producing Practical, Consistent Software, BS Publications, 2014.

Suggested Readings:	
1.	William E. Perry, Effective Methods for Software Testing, 3 rd Edition, 2006, Wiley .
2.	Srinivasan Desikan, Gopalaswamy Ramesh, Software Testing, Principles and Practices, 2006. Pearson Education.
3.	Dr.K.V.K.K. Prasad, Software Testing Tool, Wiley Publishers.

PC551CS	**ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LAB**					
Prerequisites	**Python**		**L**	**T**	**P**	**C**
			0	**0**	**2**	**1**
Evaluation	**CIE**	**25 Marks**	**SEE**		**50 Marks**	

Course Objectives :	
1.	To understand different searching algorithms.
2.	To build and train the datasets with respect to suitable models.
3.	To gain knowledge on clustering algorithms.

Course Outcomes : At the end of the course the student will be able to:	
1.	Apply knowledge on small and large datasets.
2.	Build a model to mimic real time applications.
3.	Impart knowledge on Artificial Neural Networks.
4.	Work with clustering algorithms with real time scenarios.
5.	Use python libraries for data preprocessing POS tagging.

1. Implement A* Search algorithm.
2. Implement AO* Search algorithm.
3. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
4. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
5. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
6. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
7. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
8. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
10. Write a program to implement data preprocessing and text cleaning using python.
11. Write a program to demonstrate parts-of-speech tagging and named entity recognition.

PC552CS	**DATABASE MANAGEMENT SYSTEMS LAB**					
Prerequisites	**SQL**		**L**	**T**	**P**	**C**
			0	**0**	**2 X 2**	**1**
Evaluation	**CIE**	**25 Marks**	**SEE**		**50 Marks**	

Course Objectives :	
1.	To practice various DDL. commands in SQL
2.	To write simple and Complex queries in SQL
3.	To familiarize PL/SQL

Course Outcomes : At the end of the course the student will be able to:	
1.	Design and implement a database schema for a given problem
2.	Populate and query a database using SQL and PL/SQL
3.	Develop multi-user database application using locks
4.	Understand locking system.
5.	Developing full-fledged database applications.

1. Simple to Complex condition query creation using SQL Plus.
2. Usage of Triggers and Stored Procedures.
3. Creation of Forms for Student information, Library information, Pay roll etc.
4. Writing PL/SQL procedures for data validation.
5. Report generation using SQL reports.
6. Creating password and security features for applications
7. Usage of File locking. Table locking facilities in applications.
8. Creation of small full-fledged database application spreading over 3 sessions.

PC553CS	**WEB PROGRAMMING LAB**					
Prerequisites	**HTML, JAVA**		**L**	**T**	**P**	**C**
			0	**0**	**2**	**1**
Evaluation	**CIE**	**25 Marks**	**SEE**		**50 Marks**	

Course Objectives :	
1.	To develop an ability to design and implement static and dynamic website
2.	To understand, analyze and create XML documents and XML Schema
3.	To understand, analyze and build web applications using PHP

Course Outcomes : At the end of the course the student will be able to:	
1.	Create web pages using HTML and Cascading Styles sheets
2.	Create dynamic web pages using JavaScript
3.	Understand, analyze and apply the role of languages like HTML, CSS, XML, JavaScript, PHP, SERVLETS, JSP and protocols in the workings of the web and web applications
4.	Build web applications using PHP
5.	Analyze a web page and identify its elements and attributes

1. Develop and demonstrate the usage of inline, internal and external style sheet using CSS
2. Write JavaScript to validate the following fields of the Registration page.
   a. First Name (Name should contains alphabets and the length should not be less than 6 characters).
   b. Password (Password should not be less than 6 characters length).
   c. E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com)
   d. Mobile Number (Phone number should contain 10 digits only).
   e. Last Name and Address (should not be Empty).
3. Create an XML document that contains 10 users information. Write a Java Program, which takes User Id as input and returns the user details by taking the user information from XML document using DOM parser or SAX parser.
4. Write an HTML page including any required JavaScript that takes a number from text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets and special characters.
5. Implement the web applications with Database using
   (a) PHP
   (b) Servlets and
   (c) JSP
6. Develop and demonstrate PHP Script for the following problems:
   a) Write a PHP Script to find out the Sum of the Individual Digits.
   b) Write a PHP Script to check whether the given number is Palindrome or not
7. Write an HTML page including any required JavaScript that takes a number from one text field in the range of 0 to 999 and shows it in another text field in words. If the number is out of range, it should show "out of range" and if it is not a number, it should show "not a number" message in the result box.

8. Write a HTML page that has one input, which can take multi-line text and a submit button. Once the user clicks the submit button, it should show the number of characters, words and lines in the text entered using an alert message. Words are separated with white spaces and lines are separated with new line character.

9. Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next to the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).

10. Create and save an XML document at the server, which contains 10 users information. Write a program which takes User Id as input and returns the user details by taking the user information from the XML document.

Install the following on the local machine: Apache Web Server, Tomcat Application Server locally, Install MySQL and install PHP and configure it to work with Apache web server and MySQL.

11. Implement the following web applications using (a) PHP, (b) Servlets and (c) JSP.

i) A user validation web application, where the user submits the login name and password to the server. The name and password are checked against the data already available in Database and if the data matches, a successful login page is returned. Otherwise a failure message is shown to the user.
ii) Modify the above program to use an XML file instead of database.

iii) Modify the above program using AJAX to show the result on the same page below the submit button.

iv) A simple calculator application that takes two numbers and an operator (+,-,*,/,%) from an HTML page and returns the result page with the operation performed on the operands.

v) A web application takes a name as input and on submit it shows a hello<name>page where <name> is taken from the request. It shows the start time at the right top corner of the page and provides the logout button. On clicking this button, it should show a logout page with Thank You<name> message with the duration of
usage.(Use session to store name and time).

SCHEME OF INSTRUCTION AND EXAMINATION

B. E (CSE) - VI – Semester

SNo	Code	Course Title	Scheme of Instruction			Contact Hrs/ Wk	Scheme of Examination			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	**PC601CS**	Compiler Design	3	0	-		3	40	60	3
2	**PC602CS**	Computer Networks	3	0	-		3	40	60	3
3	**PC603CS**	Distributed Systems	3	0	-		3	40	60	3
4	**PC604CS**	Deep Learning	3	0	-		3	40	60	3
5	***Professional Elective – III***									
	PE611CS	Virtual & Augmented Reality	3	0	-		3	40	60	3
	PE612CS	Information Retrieval System								
	PE613CS	Block Chain Technologies								
	PE614CS	Human Computer Interaction								
6	***Open Elective –I***									
	OE601BM	Engineering Applications in Medicine	3	0	-		3	40	60	3
	OE602BM	Human Assistive Technologies								
	OE601CE	Disaster Management								
	OE602CE	Road Safety Engineering								
	OE601CS	Python Programming								
	OE602CS	Cyber Security								
	OE601EC	Verilog HDL								
	OE602EC	Principles of Electronic Communication Systems								
	OE601EE	Applications of Electrical Energy								
	OE602EE	Electrical Safety Management								
	OE601ME	3D Printing Technology								
	OE602ME	Finite Element Methods								

Practicals										
7	**PC651CS**	Compiler Design Lab	-	-	2		3	25	50	1
8	**PC652CS**	Computer Networks Lab	-	-	2		3	25	50	1
9	**PC653CS**	Deep Learning Lab	-	-	2		3	25	50	1
10	**PW656CS**	Mini-Project	-	-	6		-	50	-	3
11	**PW 961 CS**	**Summer Internship** Six Weeks during summer vacation			Evaluation will be done in VII-Semester					
		Total	**18**	**0**	**12**		**27**	**365**	**510**	**24**

PC601CS	**COMPILER DESIGN**					
Prerequisites	**Automata Theory and Data Structures and Algorithms**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To introduce the steps in language translation pipeline and runtime data structures used in translation.
2.	To learn about Scanning (lexical analysis) process using regular expressions and use of LEX to generate scanner.
3.	To introduce different Parsing strategies including top-down (e.g., recursive descent, Earley parsing, or LL) and bottom-up (e.g., backtracking or LR) techniques.
4.	Describe semantic analyses using an attribute grammar.
5.	To learn how to build symbol tables and generate intermediate code.

Course Outcomes : At the end of the course the student will be able to:	
1.	Create lexical rules and grammars for a given language
2.	Generate scanners and parsers from declarative specifications.
3.	Describe an abstract syntax tree for a small language.
4.	Use program analysis techniques for code optimization.
5.	Develop the compiler for a subset of a given language.

UNIT – I
Introduction: Compilers, The translation process, Data structures and issues in compiler structure, Bootstrapping and Porting. **Scanning:** The scanning process, Regular expressions, Finite Automata, Regular expressions to DFA,,s, use of LEX to generate scanner.

UNIT – II
Context Free Grammars & Parsing: The parsing process, Context free grammars, Parse tree & Abstract syntax trees, EBNF and syntax diagrams, and Properties of CFLs. **Top Down Parsing:** Recursive descent parsing, LL (1) parsing, First and follow sets, Recursive descent parser, and Error recovery in top down parsers.

UNIT – III
Bottom-up Parsing: Overview, LR (0) items and LR (0) Parsing, SLR (1) Parsing, general LR(1) and LALR(1) parsing, YACC, and Error recovery in bottom-up parsers.

UNIT – IV
Semantic Analysis: Attributes and attribute grammars, Algorithms for attribute computation, Symbol table, Data types and Type checking. **Runtime Environments:** Memory organization during program execution, Fully static runtime

environments, Stack-based runtime environments, Dynamic memory, and Parameter parsing mechanisms.

UNIT – V
Code Generation: Intermediate code and data structures for code generation, Basic code generation techniques, Code generation of data structure references, Code generation of control statements and logical expressions, Code generation of procedure and function calls, Code generation in commercial compilers, Code optimization techniques, and Data flow equation.

References:	
1.	Kenneth C. Louden, ―Compiler Construction: Principles and Practice‖, Thomson Learning Inc., 1997.
2.	Ravi Sethi, Aho & Ullman JP, ―Compilers: Principles, Techniques and Tools‖, Addison Wesley publishing co., 1986.

Suggested Readings:	
1.	J.P. Tremblay and P.S. Sorenson, ―The Theory and Practice of Compiler Writing‖, TMH-1985.

PC602CS	**COMPUTER NETWORKS**					
Prerequisites	**Data Structures and Programming Concepts**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To study the design issues in network layer and various routing algorithms.
2.	To introduce internet routing architecture and protocols.
3.	To learn the flow control and congestion control algorithms in Transport Layer.
4.	To introduce the TCP/IP suite of protocols and the networked applications supported by it.
5.	To learn basic and advanced socket system calls.

Course Outcomes : At the end of the course the student will be able to:	
1.	Apply the function of each layer of OSI and trace the flow of information from one node to another node in the network.
2.	Understand the principles of IP addressing and internet routing.
3.	Analyze the working of networked applications such as DNS, mail file transfer and www.
4.	Implement client-server socket-based networked applications.
5.	

UNIT – I

Data Communications: Components, analog and digital signals and Encoders, Modems, RS232 Interfacing.
Switching: Circuit Switching, Message Switching and Packet Switching.
Topologies – Concept of layering.-Protocols and Standards – ISO / OSI model, TCP/IP.

UNIT – II

Data Link Layer: Error Control: Error detection and correction (CRC and Hamming code for single bit correction).
Flow Control: stop and wait – - sliding window protocols-go Back-N ARQ – selective repeat ARQ.
MAC LAYER: Ethernet IEEE 802.3LAN, Manchester encoding, Binary exponential algorithm, Efficiency calculation, ARP and RARP.

UNIT – III

Network Layer : Internetworks – virtual circuit and Datagram approach Routing – Distance Vector Routing ,Link State Routing , OSPF and BGP IPv4 , addressing, Subnetting, IPv6, CIDR, ICMP and IGMP protocols.

UNIT – IV

Transport Layer: Services of transport layer, Multiplexing and crash recovery.
Transmission Control Protocol (TCP) – TCP window management Congestion Control, timer management and User Datagram Protocol (UDP).

UNIT – V
Socket Programming: Primitive and advanced system calls, client/server iterative and concurrent programs IO multiplexing, Asynchronous IO and select system call. **Application Layer:** Domain Name Space (DNS) – SMTP – FTP – HTTP.

References:	
1.	Computer Networks, 5th Edition, Andrew S. Tanenbaum , David J. Wetherall , Pearson Education, 2021.
2.	Computer Networks: A Systems Approach, Larry Peterson and Bruce Davie, Elsevier , 5th Edition, 2021.

Suggested Readings:	
1.	Computer Networking: A Top-Down Approach, 6th Edition, James F. Kurose , Keith W. Ross, Pearson , 2022.

PC603CS	**DISTRIBUTED SYSTEMS**					
Prerequisites	**Operating Systems**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To acquire an understanding of the issues in distributed systems.
2.	To study architectures and working of distributed file systems.
3.	To expose the students to distributed transaction management and replication.
4.	To explore knowledge on Distributed fault tolerant Systems
5.	To understand map-reduce algorithms.

Course Outcomes : At the end of the course the student will be able to:	
1.	Describe the problems and challenges associated with distributed systems.
2.	Implement small scale distributed systems.
3.	Understand design tradeoffs in large-scale distributed systems.
4.	Gain knowledge on Consistency and Replication
5.	Familiar with Distributed Fault Tolerant systems

UNIT – I

Introduction: From networked systems to distributed systems , Design goals, A simple classification of distributed ystems , Pitfalls

Architectures: Architectural Styles, Middleware and distributed systems, Layered-system architectures, Symmetrically distributed system architectures , Hybrid system architectures

Processes: Threads, Virtualization, Clients, Servers, and Code Migration.

Communication: Foundations, Remote Procedure Call, Message-Oriented Communication, Stream-Oriented Communication, and Multicast Communication.

UNIT – II

Coordination : Clock Synchronization, Logical Clocks, Mutual Exclusion, Election Algorithms, Gossip based Coordination, Distributed Event Matching, Location Systems.

Transactions- The Slippery Concept of a Transaction, Weak Isolation Levels, serializability

Naming: Names, Identifiers and Addresses, Flat Naming, Structured Naming, and Attribute-Based Naming, Named Data Networking

UNIT – III

Consistency and Replication: Introduction, Data-Centric Consistency Models, Client-Centric Consistency Models, Replica Management, and Consistency Protocols.

Replication- Leaders & Followers, Problems with Replication Lag, Multi-Leader Replication, Leaderless Replication

Partitioning - Partitioning and Replication, Partitioning of Key- Value Data, Partiotining and Secondary Indexes, Rebalancing Partitions, Request Routing

Consistency And Consensus- Consistency Guarantees, Linearizability, Ordering Guarantees, Distributed Transactions and Consensus

UNIT – IV

The Trouble with Distributed Systems- Faults and Partial Failures, Unreliable Networks, Unreliable Clocks, Knowledge, Truth and Lies

Fault Tolerance: Introduction to Fault Tolerance, Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, and Recovery.

UNIT – V

Map-Reduce and Distributed File Systems : Example, Scaling, programming model, Apache Hadoop, Amazon Elastic Map Reduce, Mapreduce.net, Pig and Hive.

Beyond Map Reduce

References:

1.	Maarten Van Steen, and Andrew S. Tanenbaum, *Distributed Systems*, PHI 4nd Edition, 2023
2.	Martin Kleppman , Designing Data Intensive Systems, O'Reilly, 2017

Suggested Readings:

1.	R.Hill, L.Hirsch, P.Lake, S.Moshiri, *Guide to Cloud Computing, Principles and Practice*, Springer, 2013.

PC604CS	**DEEP LEARNING**					
Prerequisites	**Machine Learning**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To understand complexity of Deep Learning algorithms and their limitations.
2.	To understand modern notions in data analysis oriented computing.
3.	To apply Deep Learning algorithms in practical applications.
4.	To perform experiments in Deep Learning using real-world data.
5.	To impart skills on autoencoders.

Course Outcomes : At the end of the course the student will be able to:	
1.	Understand the concepts of TensorFlow, its main functions, operations and the execution pipeline.
2.	Implement deep learning algorithms, understand neural networks and traverse the layers of data abstraction..
3.	Learn topics such as convolutional neural networks, recurrent neural networks, training deep networks and high-level interfaces.
4.	Build deep learning models in TensorFlow and interpret the results.
5.	Understand the language and fundamental concepts of artificial neural networks.

UNIT – I
Artificial Neural Networks: Introduction, Perceptron, XOR Gate ,Perceptron Training Rule, Activation Functions.
Linear Neural Networks: Linear Regression, Implementation of Linear Regression, Softmax Regression, The Image Classification Dataset , Implementation of Softmax Regression.

UNIT – II
Multilayer Perceptrons, Implementation of Multilayer Perceptrons, Model Selection, Underfitting and Overfitting, Weight Decay, Dropout, Forward Propagation, Backward Propagation, and Computational Graphs, Numerical Stability and Initialization, Considering the Environment, Predicting House Prices on Kaggle.
Optimization Algorithms: Optimization and Deep Learning, Convexity, Gradient Descent, Stochastic Gradient Descent, Mini batch Stochastic Gradient Descent, Momentum, Adagrad, RMS Prop, Ada delta, Adam, Learning Rate Scheduling.

UNIT – III
Introduction to Convolutional Neural Networks: Introduction to CNNs, Kernel filter, Principles behind CNNs, Multiple Filters,
Modern Convolutional Neural Networks Deep Convolutional Neural Networks (AlexNet), Networks Using Blocks (VGG), Network in Network (NiN), Networks with Parallel Concatenations (GoogLeNet), Batch Normalization, Residual Networks (ResNet), Densely Connected Networks (DenseNet).

UNIT – IV
Recurrent Neural Networks: Sequence Models, Text Preprocessing, Language Models and the Dataset, Recurrent Neural Networks, Implementation of Recurrent Neural Networks from Scratch, Concise Implementation of Recurrent Neural Networks, Back propagation Through Time.
Modern Recurrent Neural Networks: Gated Recurrent Units (GRU), Long Short Term Memory (LST), Deep Recurrent Neural Networks, Bidirectional Recurrent Neural Networks, Machine Translation and the Dataset, Encoder-Decoder Architecture, Sequence to Sequence, Beam Search.

UNIT – V
Auto Encoders : Types of Auto Encoders and its applications.
Generative Adversarial Networks: Generative Adversarial Network, Deep Convolutional Generative Adversarial Networks.

References:	
1.	Goodfellow, I., Bengio,Y., and Courville, A., "Deep Learning", MIT Press, 2016
2.	Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, "Dive into Deep Learning", 2020.

Suggested Readings:	
1.	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron

PE611CS	**VIRTUAL & AUGMENTED REALITY**					
Prerequisites	**Mathematics, Programming**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	Learn the fundamental Computer Vision, Computer Graphics and Human-Computer interaction Techniques related to VR/AR.
2.	Review the Geometric Modeling Techniques
3.	Discuss and Examine VR/AR Technologies.
4.	Use of various types of Hardware and Software in Virtual Reality systems.
5.	Simulate and Apply Virtual/Augmented Reality to varieties of Applications

Course Outcomes : At the end of the course the student will be able to:	
1.	Understand fundamental Computer Vision, Computer Graphics and Human Computer Interaction Techniques related to VR/AR.
2.	Understand Geometric Modeling Techniques.
3.	Understand the Virtual Environment.
4.	Apply various types of Hardware and Software in Virtual Reality systems.
5.	Design and Formulate Virtual/Augmented Reality Applications.

UNIT – I

Introduction to Virtual Reality (VR)

Virtual Reality and Virtual Environment, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark.

UNIT – II

Computer Graphics and Geometric Modelling

The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Color theory, Conversion From 2D to 3D, 3D space curves, 3D boundary representation, Simple 3D modelling, 3D clipping, Illumination models, Reflection models, Shading algorithms, Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection.

UNIT – III

Virtual Environment

Input/Output Devices: Input (Tracker, Sensor, Digital Gloves, Movement Capture, Videobased Input, 3D Menus & 3D Scanner, etc.), Output (Visual/Auditory/Haptic Devices) Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems, Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object in between, free from deformation, particle system Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles,

simple pendulum, springs, Flight dynamics of an aircraft.
UNIT – IV
Augmented Reality (AR) Taxonomy, Technology and Features of Augmented Reality, AR Vs VR, Challenges with AR, AR systems and functionality, Augmented Reality Methods, Visualization Techniques for Augmented Reality, Enhancing interactivity in AR Environments, Evaluating ARsystems

UNIT – V
Development Tools and Frameworks Human factors: Introduction, the eye, the ear, the somatic senses Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML. **AR / VR Applications.** Introduction, Engineering, Entertainment, Science, Training, Game Development.

References:	
1.	Coiffet, P., Burdea, G. C., (2003), "Virtual Reality Technology," Wiley-IEEE Press, ISBN: 9780471360896.
2.	Schmalstieg, D., Höllerer, T., (2016), "Augmented Reality: Principles & Practice," Pearson, ISBN: 9789332578494.

Suggested Readings:	
1.	Norman, K., Kirakowski, J., (2018), " Wiley Handbook of Human Computer Interaction," Wiley-Blackwell, ISBN: 9781118976135.
2.	LaViola Jr., J. J., Kruijff, E., McMahan, R. P., Bowman, D. A., Poupyrev, I., (2017), "3D User Interfaces: Theory and Practice," Pearson, ISBN: 9780134034324.

PE612CS	**INFORMATION RETRIEVAL SYSTEM**					
Prerequisites	**Machine Learning**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To understand indexing and querying in information retrieval systems.
2.	To learn the different models for information retrieval.
3.	To expose the students to text classification and clustering.
4.	To learn about web searching.
5.	To understand Web crawling and Indexes.

Course Outcomes : At the end of the course the student will be able to:	
1.	Understand the algorithms and techniques for information retrieval (document indexing and retrieval, query processing).
2.	Quantitatively evaluate information retrieval systems.
3.	Classify and cluster documents.
4.	Understand the practical aspects of information retrieval such as those in web search engines.
5.	Expertise in matrix decompositions and latent semantic indexing.

UNIT – I

Boolean Retrieval: example information, Building an inverted index, processing Boolean queries, the extended Boolean model versus ranked retrieval.

The term vocabulary and postings lists: Document delineation and character sequence decoding, determining the vocabulary of terms, faster postings list intersection via skip pointers, Positional postings, and Phrase queries.

Dictionaries and tolerant retrieval: Search structures for dictionaries, Wildcard queries, spelling correction.

Index Construction: Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, dynamic indexing, Other types of indexes.

UNIT – II

Index Compression: Statistical properties of terms in information retrieval, Dictionary compression, Postings file compression.

Scoring, term weighting and the vector space model: Parametric and zone indexes, Term frequency and weighting, The vector space model for scoring, and Variant tf-idf functions.

Computing scores in a complete search system: Efficient scoring and ranking, Components of an information retrieval system, Vector space scoring and query operator interaction.

Evaluation in information retrieval: Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results, Assessing relevance.

UNIT – III
Relevance feedback and query expansion: Relevance feedback and pseudo relevance feedback, Global methods for query reformulation. **XML retrieval:** Basic XML concepts, Challenges in XML retrieval, a vector space model for XML retrieval, Evaluation of XML retrieval, Text-centric vs. data-centric XML retrieval. P**robabilistic information retrieval:** Basic probability theory, The Probability Ranking Principle,The Binary Independence Model. **Language models for information retrieval:** Language models, the query likelihood model.

UNIT – IV
Text classification and Naive Bayes: The text classification problem, Naive Bayes text classification, The Bernoulli model, Properties of Naive Bayes, and Feature selection. Vector space classification: Document representations and measures of relatedness in vector spaces, Rocchio classification, k- nearest neighbour, Linear versus nonlinear classifiers. **Flat clustering:** Clustering in information retrieval, Problem statement, Evaluation of clustering, k-means. **Hierarchical clustering:** Hierarchical agglomerative clustering, Single-link and complete- link clustering, Group-average agglomerative clustering, Centroid clustering, Divisive clustering.

UNIT – V
Matrix decompositions and latent semantic indexing: Linear algebra review, Term- document matrices and singular value decompositions, Low-rank approximations, Latent semantic indexing. **Web search basics:** Background and history, Web characteristics, Advertising as the economic model, The search user experience, Index size and estimation, Near-duplicates and shingling. **Web crawling and Indexes:** Overview, Crawling, Distributing indexes, Connectivity servers. Link analysis: The Web as a graph, Page Rank, Hubs and Authorities.

References:	
1.	Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, An Introduction to Information Retrieval, Cambridge University Press, Cambridge, England, 2008.
2.	David A. Grossman, Ophir Frieder, Information Retrieval – Algorithms and Heuristics, Springer, 2 nd Edition (Distributed by Universities Press), 2004.

Suggested Readings:	
1.	Gerald J Kowalski, Mark T Maybury. Information Storage and Retrieval Systems, Springer, 2000.
2.	Soumen Chakrabarti, Mining the Web: Discovering Knowledge from Hypertext Data, Morgan-Kaufmann Publishers, 2002.

PE613CS	**BLOCKCHAIN TECHNOLOGIES**					
Prerequisites	**Computer Security, Cryptography, Networking**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To Introduce the Theoretical Foundations of blockchain through bitcoin.
2.	To Introduce the Theoretical Foundations of blockchain through bitcoin.
3.	To Study Algorithms for Mining and Consensus implementation.
4.	To Study Ethereum and Smart contracts concepts.
5.	To Learn the concepts of Oracles and Decentralized Applications (DApps).

Course Outcomes : At the end of the course the student will be able to:	
1.	Understand the principles of blockchain technologies and bitcoin.
2.	Be familiar with hash functions with wallets.
3.	Understand mining and consensus strategies.
4.	Understand Ethereum and tockens.
5.	Understand smart contracts of ethereum.

UNIT – I

Introductio: Bitcoin Uses, Users ,Getting Started ,Getting your first bitcoins ,Sending and receiving bitcoins, Transactions, Blocks, Mining, The Genesis Block,Merkle Trees,Block Header Hash and the Blockchain.

Keys, Addresses, Wallets

Introduction of Crptography, Public key cryptography and crypto-currency ,Private and Public Keys ,Elliptic Curve Cryptography Explained Generating a public key ,Bitcoin Addresses, Base58 and Base58Check Encoding Key Formats, Implementing Keys and Addresses ,Wallets ,Non-Deterministic (Random) Wallets, Deterministic (Seeded) Wallets, Mnemonic Code Words ,Hierarchical Deterministic Wallets (BIP0032/BIP0044), Advanced Keys and Addresses ,Encrypted Private Keys (BIP0038) ,Pay To Script Hash (P2SH) and Multi-Sig Addresses ,Vanity Addresses , Paper Wallets.

UNIT – II

Transactions

Introduction of Transaction Lifecycle ,Creating Transactions ,Broadcasting Transactions to the Bitcoin Network ,Propagating Transactions on the Bitcoin Network ,Transaction Structure,Transaction Outputs and Inputs ,Transaction Outputs ,Transaction Inputs , Transactio fees ,Adding Fees to Transactions.

Transaction Chaining and Orphan Transactions ,Transaction Scripts and Script Language, Script Construction (Lock + Unlock) ,Scripting Language ,Turing Incompleteness ,Stateless Verification ,Standard Transactions ,Pay to Public Key Hash (P2PKH) ,Pay-to-Public-Key ,Multi-Signature ,Data Output (OP_RETURN) Pay to Script Hash (P2SH)

Mining and Consensus

De-centralized Consensus, Independent Verification of Transactions, Mining Nodes, Aggregating Transactions into Blocks, Transaction Age, Fees, and Priority, The Generation Transaction, Coinbase Reward and Fees ,Structure of the Generation Transaction, Coinbase Data, Constructing the Block Header ,Mining the Block ,Proof-of-Work Algorithm ,Difficulty Representation ,Difficulty Target and Re-Targeting ,Successfully Mining the Block ,Validating a New Block ,Assembling and Selecting Chains of Blocks, Blockchain Forks, Mining and the Hashing Race ,The Extra Nonce Solution ,Mining Pools ,Consensus Attacks

UNIT – III

What Is Ethereum

Compared to Bitcoin , Ether Currency Units ,Choosing an Ethereum Wallet Control and Responsibility ,Getting Started with MetaMask ,Creating a Wallet Switching Networks ,Getting Some Test Ether ,Sending Ether from MetaMask Exploring the Transaction History of an Address ,Introducing the World Computer

Externally Owned Accounts (EOAs) and Contracts ,A Simple Contract: A Test Ether Faucet.

Cryptography

Ethereum‘s Cryptographic Hash Function: Keccak-256 , Ethereum Addresses , Ethereum Address Formats ,Inter Exchange Client Address Protocol, Hex Encoding with Checksum in Capitalization (EIP-55)

The Ethereum Virtual Machine

What Is the EVM? Comparison with Existing Technology ,The EVM Instruction Set (Bytecode Operations) , Ethereum State ,Compiling Solidity to EVM Bytecode ,Contract Deployment Code ,Disassembling the Bytecode

UNIT – IV

Transactions

Transmitting Value to EOAs and Contracts, Transmitting a Data Payload to an EOA or Contract,Special Transaction: Contract Creation ,Digital Signatures ,The Elliptic Curve Digital Signature Algorithm ,How Digital Signatures Work ,Verifying the Signature ,ECDSA Math ,Transaction Signing in Practice ,Raw Transaction Creation and Signing ,Raw Transaction Creation with EIP-155 ,The Signature Prefix Value (v) and Public Key Recovery, Separating Signing and Transmission (Offline Signing) ,Transaction Propagation ,Recording on the Blockchain ,Multiple-Signature (Multisig) Transactions

Tokens

How Tokens Are Used, Tokens and Fungibility ,Counterparty Risk ,Tokens and Intrinsicality, Using Tokens: Utility or Equity ,ERC223: A Proposed Token Contract Interface Standard, ERC777: A Proposed Token Contract Interface Standard, ERC721: Non-fungible Token (Deed) Standard

UNIT – V
Oracles: Why Oracles Are Needed ,Oracle Use Cases and Examples ,Oracle Design,Patterns Data Authentication ,Computation Oracles ,Decentralized Oracles, Oracle Client Interfaces in Solidity
Decentralized Applications (DApps): Introduction, Backend (Smart Contract), Frontend (Web User Interface) ,Data Storage, Decentralized Message Communications Protocols, A Basic DApp Example: Auction DApp ,Auction DApp: Backend Smart Contracts ,Auction DApp: Frontend User Interface, Further Decentralizing the Auction DApp, Storing the Auction DApp on Swarm ,Preparing Swarm ,Uploading Files to Swarm ,The Ethereum Name Service (ENS) ,History of Ethereum Name Services ,The ENS Specification ,Bottom Layer: Name Owners and Resolvers ,Middle Layer: The .eth Nodes ,Top Layer: The Deeds, Registering a Name, Managing Your ENS Name ,ENS Resolver,Resolving a Name to a Swarm Hash (Content) ,From App to DApp

References:	
1.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies, Princeton University Press and Oxford, 2016
2.	Andreas M. Antonopoulos, Mastering Bitcoin: Programming the Open Blockchain, O'Reilly, 2017.

Suggested Readings:	
1.	Dr. Gavin Wood, Andreas M. Antonopoulos, Mastering Ethereum: Building Smart Contracts and Dapps, O'Reilly, 2018.

PE614CS	**HUMAN COMPUTER INTERACTION**					
Prerequisites	**Basics of Computers**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To introduce the concepts of user goals , conceptual models and process of interaction Design.
2.	To study cognitive, social and emotional aspects of interaction.
3.	To learn Data Analysis, Interpretation, and Presentation techniques.
4.	To learn the concepts of prototyping and discovering user requirements.
5.	To introduce the concepts of controlled evaluation and Walk-Throughs.

Course Outcomes : At the end of the course the student will be able to:	
1.	Understand the concept of user experience design, interaction types , and frameworks.
2.	Use cognitive frameworks, principles of social interaction in the design of Interfaces.
3.	Gather data and use various quantitative and qualitative analytic techniques.
4.	Design prototypes and Use predictive models and conduct usability testing.
5.	Understand evaluation studies in detail.

UNIT – I

Interaction Design: Introduction, Good and Poor Design, what is Interaction Design, The User Experience, Understanding Users Accessibility and Inclusiveness, Usability and User Experience Goals.

Process of Interaction Design: Introduction, What is Involved in Interaction Design, Practical Issues. **Conceptualizing Interaction:** Introduction, Conceptualizing Interaction, Conceptual Models, Interface Metaphors, Interaction Types, Paradigms, Visions, Theories, Models, and Frameworks.

UNIT – II

Cognitive Aspects: Introduction, What is Cognition, Cognitive Frameworks.

Social Interaction: Introduction, Being Social, Face-to-Face Conversations, Remote Conversations, Co-presence, Social Engagement.

Emotional Interaction: Introduction, Emotions and the User Experience, Expressive Interfaces and Emotional Design, Annoying Interfaces, Affective Computing and Emotional AI, Persuasive Technologies and Behavioural Anthropomorphism Change.

UNIT – III

Interfaces: Introduction, Interface Types, Natural User Interfaces and Beyond, Which Interface.

Data Gathering: Introduction, Five Key Issues, Data Recording, Interviews, Questionnaires, Observation, Choosing and Combining Techniques.

Data Analysis, Interpretation, and Presentation : Introduction, Quantitative and Qualitative, Basic Quantitative Analysis, Basic Qualitative Analysis, Kind of Analytic Framework to Use, Tools to

Support Data Analysis, Interpreting and Presenting the Findings

UNIT – IV
Discovering Requirements: Introduction, Data Gathering for Requirements, Bringing Requirements to Life: Personas and Scenarios, Capturing Interaction with Use Cases. **Design, Prototyping, and Construction:** Introduction, Prototyping, Conceptual Design, Concrete Design, Generating Prototypes, Construction. **Interaction Design in Practice:** Introduction, AgileUX, Design Patterns ,Open Source Resources, Tools for Interaction Design.

UNIT – V
Introducing Evaluation: Introduction, Types of Evaluation, Evaluation Case Studies, Case Studies, Other Issues to Consider in Evaluation. **Evaluation Studies: From Controlled to Natural Settings:** Introduction, Usability Testing, Conducting Experiments, Field Studies. **Evaluation: Inspections, Analytics, and Models:** Introduction, Inspections: Heuristic Evaluation and Walk-Throughs, Analytics and A/B Testing, Predictive Models.

References:	
1.	Helen Sharp, Jennifer Preece, Yvonne Rogers Interaction Design: Beyond Human-Computer Interaction wiley Publishing 5th Edition 2019
2.	Jenifer Tidwell, Charles Brewer, Aynne Valencia, Designing Interfaces, O'REllIEY 3rd Edition 2020.

Suggested Readings:	
1.	Alan Cooper, Robert Reimann, David Cronin, Christopher Noessel, About Face: The Essentials of Interaction Design Wiley, 4th Edition 2014.
2.	Elizabeth Goodman, Mike Kuniavsky, Observing the User Experience, Elsevier 2nd Edition 2012
3.	Jesmond Allen, James Chudley,Smashing UX Design,Wiley ,1st Edition 2012.

OE601BM	**ENGINEERING APPLICATIONS IN MEDICINE**					
Prerequisites			**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To make the students gain basic knowledge of Human Physiology.
2.	To make the students learn the applications of various branches of engineering in Medicine.
3.	To gain skills in Solid mechanics.
4.	To work with brain computer interface.
5.	To impart knowledge on Types of Biomaterials.

Course Outcomes : At the end of the course the student will be able to:	
1.	Describe the major organ systems of the human body
2.	Understand the concepts of bioelectricity and medical instruments
3.	Apply solid and fluid mechanics principles to joints and blood flow respectively
4.	Learn the need and applications of BCI
5.	Analyze and choose proper biomaterial for various applications

UNIT – I
Evolution of Modern healthcare, Major organ systems- Cardiovascular, Respiratory, Nervous, Skeletal, Muscular. Homeostasis. Physiological signals and their diagnostic importance.

UNIT – II
Bioelectricity-Excitable cells, Resting potential, Action potential, Accommodation, Strength-Duration Curve, Propagation of impulses in myelinated and unmyelinated nerves. Medical Instrumentation System-Functions, Characteristics, Design Challenges. Signal Processing-QRS detection.

UNIT – III
Solid mechanics-Analysis of muscle force and joint reaction force for the limb joints. Fluid mechanics-Factors governing and opposing blood flow, Wind-Kessel model, Application of Hagen-Poiseuille flow to blood flow.

UNIT – IV
Brain-Computer Interface: Brain signals for BCIs, Generic setup for a BCI, Feature extraction and Feature translation involved in BCIs. Typical applications-Word forming, Device control.

UNIT – V
Materials and Tissue Replacements-Types of Biomaterials- Metals, Polymers, Ceramics and

Composites and their applications in Soft and Hard tissue replacements. Implants- Manufacturing process, Design, fixation.

References:	
1.	John Enderle, Susan M. Blanchard and Joseph Bronzino, Introduction to Biomedical Engineering, Second Edition, Elsevier, 2005.
2.	Ozkaya, Nordin. M, Fundamentals of Biomechanics, Springer International Publishing, 4th Edition, 2017.

Suggested Readings:	
1.	John Enderle, Susan M. Blanchard and Joseph Bronzino, Introduction to Biomedical Engineering, Second Edition, Elsevier, 2005.
2.	Ozkaya, Nordin. M, Fundamentals of Biomechanics, Springer International Publishing, 4th Edition, 2017.
3.	Khandpur R.S., Handbook of Biomedical Instrumentation, Tata McGraw Hill, 2016.
4.	John G.Webster, Medical Instrumentation: Application and Design, John Wiley and Sons Inc., 3rd Ed., 2003.

OE602BM	**HUMAN ASSISTIVE TECHNOLOGIES**					
Prerequisites			**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To extend knowledge of the amputee, of lost and remaining functions affecting locomotion, and to collect information on the best possible medical treatment.
2.	To improve fitting techniques and practices, including training, so that existing devices might be used with greater comfort and function.
3.	To develop improved lower-extremity devices.
4.	To impart knowledge on orthotic devices.
5.	To do real time applications.

Course Outcomes : At the end of the course the student will be able to:	
1.	Apply fundamental knowledge of engineering in rehabilitation.
2.	Apply analytical skills to assess and evaluate the need of the end-user.
3.	Develop self-learning initiatives and integrate learned knowledge for problem solving.
4.	Understand the basics of robotics and apply their principles in developing prosthetics.
5.	Apply the knowledge of computers in solving rehabilitation problems.

UNIT – I

Introduction to Rehabilitation Engineering, Definition of Rehabilitation Engineering, Scope and importance of the field, Historical perspective. Interdisciplinary nature and collaboration with healthcare professionals. Physical disabilities: mobility impairments, spinal cord injuries. Cognitive disabilities: learning disabilities, traumatic brain injuries. Psychosocial aspects of disability.

UNIT – II

Assistive Technology, Human Factors and Ergonomics in Assistive Technology Design. Mobility Aids, Types of Wheelchairs and design aspects: Manual wheelchairs, Powered wheelchairs, Customizable features and design considerations, Auxiliary devices and systems. Human-Centered Designing

UNIT – III

Sensory disabilities: visual and hearing impairments. Sensory augmentation and substitution: Visual system: Visual augmentation. Tactual vision substitution, Auditory vision substitution; Auditory system: Auditory augmentation. Cochlear implantation, Visual auditory substitution, Tactual auditory substitution, Tactual system: Tactual augmentation. Tactual substitution. Assessment and Outcome Measurement

UNIT – IV

Rehabilitation Robotics, Exoskeletons, Major Limb Prosthetic Devices, Orthotic Devices, Types of orthotics and prosthetics, Intelligent prosthetic Knee, Prosthetic Hand, Controlled orthotics and

prosthetics Materials and fabrication techniques, Functional and cosmetic considerations. FES system, Restoration of Hand function, Restoration of standing and walking, Myo-electric Hand.

UNIT – V
Case Studies and Real-World Applications. Augmentative and Alternative communications, Software tools for simulation and testing. Virtual reality applications in rehabilitation. Machine learning applications in assistive technology. Predictive analytics for personalized rehabilitation

References:	
1.	Robinson C.J., *Rehabilitation Engineering,* CRC Press, 1995.
2.	Ballabio E., et al., *Rehabilitation Technology*, IOS Press, 1993.

Suggested Readings:	
1.	Rory A Cooper, Hisaichi Ohnabe, Douglas A. Hobson, *Series in medical physis and biomedical engineering: An introduction to rehabilitation engineering,* Taylor and Francis Group, London, 2007.
2.	Joseph D. Bronzino *The biomedical engineering handbook -biomedical engineering fundamentals*, 3rd Ed., CRC Press, Taylor & Francis Group, London, 2006.

OE601CE	**DISASTER MANAGEMENT**					
Prerequisites			**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To introduce basic conceptual understanding of natural & man-made hazards and different contextual aspects.
2.	To develop the knowledge and understanding of the International and national strategy for disaster reduction (UN-ISDR).
3.	To ensure skills and abilities to analyze potential effects of disasters.
4.	To promote the use of science and technology for implementing the disaster risk reduction (DRR) plans and policies.
5.	To understand the strategies and methods to deliver public health response to avert these effects.

Course Outcomes : At the end of the course the student will be able to:	
1.	Aptitude to link hazards, risk, vulnerability, differential impacts and capacity building to the life and property loss during disasters and its impacts on the society and sustainability.
2.	Ability to understand various aspects of natural and man-made hazards and emerging trends.
3.	Acquaintance with different steps involved in disaster risk reduction (DRR) and international initiatives for prevention, mitigation and preparedness.
4.	Knack to appreciate the national policy and role of individuals, communities, and government organizations in disaster management.
5.	Capacity to identifying current technological constraints and hazard specific solutions, particularly construction codes etc.

UNIT – I

Understanding the Concepts, Definitions and Terminologies used in the field of Disaster Management (i.e. Hazard, Risk, Vulnerability, Resilience, and Capacity Building).
Differential impacts of Disasters in terms of Gender, Age, Social Status, Location, Prosperity, Disabilities.
Disaster- Development Nexus.

UNIT – II

Classification, Causes, Consequences and Controls of Geophysical hazards-Earthquakes, Landslides, Tsunami Weather related hazards- Meteorological (Cyclones, Storm-surge and Lighting) Hydrological (Floods, Droughts, Avalanches) Climatological (Wildfire, Cold & Heat Waves) Biological hazards-Epidemic & Pandemics, Technological hazards-Chemical, Industrial, Nuclear Man-made hazards-Structural Failure, Fire, Transportation accidents, Terrorism and Wars Emerging Disasters- Urban Areas, Climate Change. Regional and Global Trends-loss of life & Property in various hazards.

UNIT – III
DISASTER MANAGEMENT CYCLE AND INTERNATIONAL FRAMEWORK Disaster Management Cycle Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness During Disaster – Evacuation – Disaster Communication – Search and Rescue– Emergency Operation Centre – Incident Command System – Relief and Rehabilitation Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment Paradigm Shift in Disaster Management: International Decade for Natural Disaster Reduction; Yokohama Strategy; Hyogo Framework of Action

UNIT – IV
DISASTER RISK MANAGEMENT IN INDIA Disaster Profile of India – Mega Disasters of India and Lessons Learnt**,** Disaster Management Act 2005 – Institutional and Financial Mechanism**,** National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national),Non-Government and Inter- governmental Agencies**.**

UNIT – V
TECHNOLOGICAL APPROACHES TO DISASTER RISK REDUCTION Geo-informatics in Disaster Management (RS, GIS, GPS and RS)**,** Disaster Communication System (Early Warning and Its Dissemination)**,** Land Use Planning and Development Regulations**,** Disaster Safe Designs and Constructions**,** Structural and Non Structural Mitigation of Disasters**,** Science &Technology Institutions for Disaster Management in India**.**

References:	
1.	Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.
2.	Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi.

Suggested Readings:	
1.	World Disasters Report, 2009. International Federation of Red Cross and Red Crescent, Switzerland.

OE602CE	**ROAD SAFETY ENGINEERING**					
Prerequisites			**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To introduce the fundamentals of road safety and road safety audit
2.	To get familiarized with various road safety techniques, measures and their applications
3.	To be able to understand and evaluate various traffic control devices
4.	Familiarize with traffic management techniques
5.	To examine and analyze the incident management process

Course Outcomes : At the end of the course the student will be able to:	
1.	Analyze Accident data
2.	Plan and design of road safety improvement programs
3.	Apply the principles of road safety in urban transport
4.	Apply traffic management techniques
5.	Able to plan effective incident management program

UNIT – I

Road accidents: Causes, scientific investigations and data collection, analysis of individual accidents to arrive at real causes, statistical methods of analysis of accident data, Basic concepts of road accident statistics, safety performance function: The empirical Bayes method identification of hazards road location. Application of computer analysis of accident data.

UNIT – II

Safety in Road Design: Operating the road network for safety, highway operation and counter measures, road safety audit, principles-procedures and practice, code of good practice and checklists, vehicle design factors & driver characteristics influencing road safety.

UNIT – III

Road Signs and Traffic Signals: Classification, Location of signs, measures of sign effectiveness, Types of visual perception, sign regulations, sign visibility, sign variables, Text versus symbols, Road marking: Role of road marking, classification, visibility. Traffic signals: Need, Signal face illumination and location of signals, factors affecting signal design, pedestrian's safety, fixed and vehicle actuated signals. Design of signals, area traffic control, Delineators, traffic impact attenuators, road side rest areas, safety barriers, traffic aid posts.

UNIT – IV

Traffic Management Techniques: Integrated safety improvement and traffic calming schemes, speed and load limit, traffic lights, safety cameras, tests on driver and vehicles, pedestrian safety issues, parking, parking enforcement and its influence on accidents, travel demand management,

methods of traffic management measures: restriction of turning movements, One way streets, tidal flow operation methods, exclusive bus lanes and closing side-streets; latest tools and techniques used for road safety; legislation, enforcement, education and propaganda.

UNIT – V
Incident Management: Introduction, characteristics of traffic incidents types of incidents, impacts, incident management process, incident traffic management; application of ITS: Motorist information, equipment used; planning effective incident management program, best practice in incident management programs. National importance of survival of transpiration systems during and after all natural disasters especially cyclones, earthquakes, floods etc and manmade disasters like sabotage, terrorism etc.

References:	
1.	Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017.
2.	KadiyaliL.R, Lal, N.B., 'Principles and Practices of Highway Engineering' Khanna Publishers, 7e, 2017.

Suggested Readings:	
1.	IRC 93 ' Guidelines for the design of road traffic signals' IRC, New Delhi.

OE601EC	**Verilog HDL**					
Prerequisites			**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To familiarize with various modeling styles: structural, dataflow and behavioral of Verilog HDL.
2.	To develop combinational and sequential circuits using various modeling styles of Verilog HDL.
3.	To design and develop Verilog HDL models of combinational and sequential circuits.
4.	To learn Synthesis and FPGA design flo To design and develop real time applications: Booth‘s multiplier, Divider, hardwired control for basic CPU, FIR filter.
5.	To design and develop real time applications: Booth‘s multiplier, Divider, hardwired control for basic CPU, FIR filter.

Course Outcomes : At the end of the course the student will be able to:	
1.	Implement and distinguish different Verilog HDL modeling styles.
2.	Construct and analyze Verilog HDL models of combinational and sequential circuits
3.	Design and develop Verilog HDL modeling and test bench for digital systems for the given specifications.
4.	Outline FPGA design flow and timing analysis.
5.	Understand implementation of real time applications.

UNIT – I

Introduction to HDL: Overview and Importance of HDLs, Differences between HLL, HDL and ALP. Design methodologies, Modules, Lexical Conventions, Number Specifications, Strings, Identifiers and Keywords Data types, System task and compiler Directives, Port declaration and port connection rules.

UNIT – II

Structural and Dataflow modeling: gate-level modeling, delays, hazards, dataflow modeling: Continuous Assignments, Delays, Expressions, Operators and Operands, Operator Types and Design Examples.

UNIT – III

Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing Controls, Conditional Statements, multi-way branching, Loops, Sequential and Parallel blocks, Generate blocks. Combinational, sequential logic modules Simulation: Types of Simulation, Event driven Simulation and Cycle Based Simulation; design examples.

UNIT – IV
Synthesis and Verification: Tasks and Functions: Differences between Tasks and Functions, Tasks and Functions. Verilog HDL synthesis, synthesis, Application Specific IC (ASIC) and Field Programmable Gate Array (FPGA) design flow. Verification: Timing analysis and Test bench design. Design examples.

UNIT – V
Real time implementations: Fixed-Point Arithmetic modules: Addition, Multiplication, Division, Arithmetic and Logic Unit (ALU), Timer, Universal Asynchronous Receiver and Transmitter (UART), DSP modules: FIR and IIR filters, CPU design: Data path and control units.

References:	
1.	Samir Palnitkar, ―Verilog HDL A Guide to Digital Design and Synthesis, 2nd Edition, Pearson Education, 2006.
2.	Ming-Bo Lin, ―Digital System Designs and Practices: Using Verilog HDL and FPGA, Wiley India Edition, 2008.

Suggested Readings:	
1.	Bhasker, ―A Verilog HDL Primer, 2nd Edition, BS Publications, 2001.

OE602EC	**PRINCIPLES OF ELECTRONIC COMMUNICATION SYSTEMS**					
Prerequisites			**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	Provide an introduction to fundamental concepts in the understanding of Electronic communications systems
2.	Provide an introduction to network model and some of the network layers including physical layer, data link layer, network layer and transport layer
3.	Provide an introduction to the evolution of wireless systems and current wireless technologies
4.	Provide an introduction to fundamental concepts in the understanding of Telecommunication and optical communications systems
5.	Provide an introduction to fundamental concepts in Analog and Digital Communications

Course Outcomes : At the end of the course the student will be able to:	
1.	Understand the working of analog and digital communication systems.
2.	Understand the Data Communication and Networking
3.	Understand the concepts of modulation and demodulations
4.	Understand the evolution of communication technologies from traditional telephony systems to modern wireless communication systems
5.	Understand the principles of optical communications systems

UNIT – I

Introduction to communication systems: Electromagnetic Frequency Spectrum, Signal and its representation, Elements of Electronic Communications System, Types of Communication Channels, Signal Transmission Concepts-Baseband transmission and Broadband transmission, Communication parameters-Transmitted power, Channel bandwidth and Noise, Need for modulation Signal Radiation and Propagation-Principle of electromagnetic radiation, Types of Antennas, Antenna Parameters and Mechanisms of Propagation.

UNIT – II

Analog and Digital Communications: Amplitude modulation and demodulation, FM modulation and demodulation, Digital converters, Digital modulation schemes – ASK, FSK, PSK, QPSK, Digital demodulation.

UNIT – III

Data Communication and Networking: Network Models, OSI Model, Data Link Layer – Media Access control, Ethernet, Network Layer – Internet Protocol (IPv4/IPv6), Transport Layer – TCP, UDP.

UNIT – IV
Telecommunication Systems: Telephones, Telephone system, Paging systems, Internet Telephony. Optical Communications: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT – V
Wireless Communications: Evolution of Wireless Systems: AMPS, GSM, CDMA, WCDMA, And OFDM. Current Wireless Technologies: Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFID communication, UWB, Wireless mesh networks, Vehicular adhoc networks.

References:	
1.	Louis E. Frenzel, "Principles of Electronic Communication Systems", 3e, McGraw Hill publications, 2008.
2.	Behrouz A. Forouzan,"Data Communications and Networking", 5e TMH, 2012.

Suggested Readings:	
1.	Kennady, Davis, "Electronic Communications systems", 4e, TMH, 1999.

OE601ME	**3D PRINTING TECHNOLOGY**					
Prerequisites			**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To understand the fundamental concepts of 3D Printing, its advantages and limitations.
2.	To know the working principle, advantages, disadvantages and applications of liquid, solid and Powder based 3D Printing Technologies.
3.	To know the various types of STL file errors and other data formats used in 3D Printing Technology.
4.	To know the features of various 3D Printing software's.
5.	To know diversified applications of 3D Printing Technologies
Course Outcomes : At the end of the course the student will be able to:	
1.	Interpret the features of 3D Printing and compare it with conventional methods.
2.	Illustrate the working principle of liquid, solid and powder based 3D Printing Technologies.
3.	Identify various types of errors in STL file and other data formats used in 3D Printing Technology.
4.	Select suitable software used in 3D Printing Technology.
5.	Apply the knowledge of various 3D Printing technologies for developing innovative applications.

UNIT – I

Introduction: Prototyping fundamentals: Need for time compression in product development, Historical development, Fundamentals of 3D Printing, 3D Printing Process Chain, Advantages and Limitations of 3D Printing, 3D Printing wheel, Commonly used Terms, Classification of 3D printing processes, Fundamental Automated Processes: Distinction between 3D Printing and Conventional Machining Processes.

UNIT – II

Liquid-based 3D Printing Systems: Stereo Lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Polyjet: Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies Solid-based 3D Printing System: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

UNIT – III
Powder Based 3D Printing Systems: Working principle, Specifications, Materials used, Process, Applications, Advantages and Disadvantages, Case studies of the following 3D Printing Technologies like Selective laser sintering (SLS), Selective Laser Melting (SLM) and Direct Metal Laser Sintering (DMLS), Laser Engineered Net Shaping (LENS), Electron Beam Melting (EBM).

UNIT – IV
3D Printing Data Formats & Software: STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. 3D Printing Software's Features: Magics, Mimics, Solid View, View Expert, 3 D Rhino, 3 D doctor, Flash Print, Object Studio, Cura, ITK Snap, 3-matic, Simplant, 3-matic, Simplant, MeshLab, Ansys for Additive Manufacturing.

UNIT – V
Applications of 3D Printing : Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Electronic Industry, Jewellery Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules. Biopolymers, Packaging, Disaster Management, Entertainment and Sports industry.

References:	
1.	Chee Kai Chua and Kah Fai Leong, "3D Printing and Additive Manufacturing Principles and Applications" Fifth Edition, World scientific
2.	Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing- Ian Gibson, David W Rosen, Brent Stucker, Springer, Second Edition, 2010.

Suggested Readings:	
1.	Rapid Prototyping & Engineering Applications – Frank W.Liou, CRC Press, Taylor & Francis Group, 2011.

OE602ME	**FINITE ELEMENT METHODS**					
Prerequisites			**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To understand the theory and application of the finite element method for analyzing structural systems.
2.	To learn Approximation theory for structural problems as the basis for finite element methods.
3.	To learn formulations for a variety of elements in one, two, and three dimensions.
4.	Implementations of element formulations will be examined using Matlab.
5.	

Course Outcomes : At the end of the course the student will be able to:	
1.	Demonstrate a basic understanding of the concepts, mathematical formulation and numerical implementation.
2.	Demonstrate the ability to invoke appropriate assumptions, select proper elements and develop FEA models that adequately and efficiently represent physical systems.
3.	Underlying the FEA as applied to solid mechanics.
4.	Solve 2D vector variable problems and analyze higher order elements and its applications.
5.	Create his/her own FEA computer programs using Matlab to solve simple engineering problems.

UNIT – I

Introduction

Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

UNIT – II

One-Dimensional Problems

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices – Solution of problems from solid mechanics and heat transfer. Longitudinal vibration frequencies and mode shapes.

UNIT – III

Two Dimensional Scalar Variable Problems

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation – Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems – Thermal problems – Torsion of Non circular shafts – Quadrilateral elements – Higher Order Elements.

UNIT – IV
Two Dimensional Vector Variable Problems Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations – Plate and shell elements.

UNIT – V
Isoparametric Formulation Natural co-ordinate systems – Isoparametric elements – Shape functions for iso parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems – Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software.

References:	
1.	Tirupathi R. Chandraputla and Ashok, D. Belgundu" Introduction to Finite Elements in Engineering", Pearson Education, 2002, 3rd Edition.
2.	Rao S.S., "The Finite Element Methods in Engineering", pergamon Press, 1989.

Suggested Readings:	
1.	Segerlind, L.J. "Applied Finite Element Analysis", Wiley Publication, 1984.

OE601EE	**APPLICATIONS OF ELECTRICAL ENERGY**					
Prerequisites			**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To introduce the students and understand Utilization of electrical energy for various applications like industrial heating.
2.	To understand various techniques of electric welding and types of batteries.
3.	To understand the concept of illumination and study about the laws of illumination.
4.	To know the applications of various lamps to factory lighting, street lighting etc.
5.	To understand the concept of electric traction including speed – time curves of different traction services.

Course Outcomes : At the end of the course the student will be able to:	
1.	Identify a suitable heating scheme for a given application.
2.	Identify proper welding technique and various characteristics of batteries.
3.	Study the nature and production of light and laws related to illumination.
4.	Classify types of electric light sources based on nature and operation and their objectives, performance and reliability.
5.	Determine the speed-time characteristics of various traction services and also estimate the energy consumption levels at various modes of operation.

UNIT – I

Industrial Heating: Advantages and methods of electric heating. Description, operation and performance of resistance ovens, Design of heating element. High frequency heating, Induction Heating, Induction furnaces, Core type, Coreless furnaces, Dielectric heating. Electric Arc furnaces, Direct Arc furnace, Indirect Arc furnaces

UNIT – II

Electric welding: Classification of electric welding, welding transformer and its rating, various types of Electric arc welding and electric resistance welding.
Batteries: Lead acid batteries, SMF batteries, Construction and maintenance, Charging and rating of batteries.

UNIT – III

Illumination: Introduction, nature and production of light, Sensitivity of the eye, Units of light. The inverse square law and cosine law, Solid angle, Lighting calculations, Determination of M.S.C.P, Rousseau‟s construction.

UNIT – IV

Types of lamps - Discharge lamps, Sodium vapour lamps, Mercury vapour lamps, Fluorescent lamp. Starting and power factor corrections, stroboscopic effects, Neon signs, Application to factory lighting, Street lighting and Flood lighting.

UNIT – V
Electric Traction: System of Electric Traction, Transmission of drive, Systems of track electrification, Traction mechanics, Speed time curves, Tractive effort, Power of Traction motor, Specific energy consumption, Mechanics of train movement, Coefficient of adhesion.

References:	
1.	Partab H, Art and Science of Utilization of Electric Power, Dhanpat Rai & Sons, 1997.
2.	K.B. Raina & S.K. Bhattacharya, Electrical Design, Estimating 1. and Costing, Wiley Eastern Ltd., 1991.

Suggested Readings:	
1.	Partab H, Modern Electric Traction, Dhanpat Rai & Sons, 2000.

OE602EE	**ELECTRICAL SAFETY MANAGEMENT**					
Prerequisites			**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	Understand electrical safety measures, the hazards associated with electric current, and voltage identify different types of electrical shocks
2.	Understand installation work of electrical plant and equipment. Safety during installation of outdoor switchyard equipment, safety during installation of electrical rotating machines.
3.	Understand procedure of domestic wirings, to handle different domestic electrical appliances, Procedure of Agricultural pump installation
4.	Identifies different hazardous zones, classification of equipment enclosure for various hazardous gases, importance of earthing system. Understand Management Safety Policy
5.	Understand standards on electrical safety, different IE Rules and Acts

Course Outcomes : At the end of the course the student will be able to:	
1.	Explain the objectives and precautions of Electrical safety, effects of shocks and their prevention.
2.	Summarize the safety aspects during installation of plant and equipment.
3.	Describe the electrical safety in residential, commercial and agricultural installations.
4.	Describe the various Electrical safety in hazardous areas, Equipment earthing and system neutral earthing.
5.	State the electrical systems safety management and IE rules.

UNIT – I

INTRODUCTION TO ELECTRICAL SAFETY, SHOCKS AND THEIR PREVENTION:

Terms and definitions, objectives of safety and security measures, Hazards associated with electric current, and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents, scope of subject electrical safety. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shops.

UNIT – II

SAFETY DURING INSTALLATION OF PLANT AND EQUIPMENT:

Introduction, preliminary preparations, preconditions for start of installation work, during, risks during installation of electrical plant and equipment, safety aspects during installation, field quality and safety during erection, personal protective equipment for erection personnel, installation of a large oil immersed power transformer, installation of outdoor switchyard equipment, safety during installation of electrical rotating machines, drying out and insulation resistance measurement of rotating machines.

UNIT – III
ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND AGRICULTURAL INSTALLATIONS: Wiring and fitting – Domestic appliances – water tap giving shock – shock from wet wall – fan firing shock – multi-storied building – Temporary installations – Agricultural pump installation – Do's and Don'ts for safety in the use of domestic electrical appliances.

UNIT – IV
ELECTRICAL SAFETY IN HAZARDOUS AREAS: Hazardous zones – class 0,1 and 2 – spark, flashovers and corona discharge and functional requirements – Specifications of electrical plants, equipment for hazardous locations – Classification of equipment enclosure for various hazardous gases and vapours – classification of equipment/enclosure for hazardous locations.

UNIT – V
SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS: Principles of Safety Management, Management Safety Policy, Safety organization, safety auditing, Motivation to managers, supervisors, employees. **REVIEW OF IE RULES AND ACTS AND THEIR SIGNIFICANCE**: Objective and scope – ground clearances and section clearances – standards on electrical safety - safe limits of current, voltage –Rules regarding first aid and firefighting facility. The Electricity Act, 2003, (Part1, 2, 3, 4 & 5).

References:	
1.	S.Rao, Prof. H.L.Saluja, "Electrical safety, fire safety Engineering and safety management", 1st edition
2.	Khanna Publishers. New Delhi, 2016 Reprint.

Suggested Readings:	
1.	Pradeep Chaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997.

OE601CS	**PYTHON PROGRAMMING**					
Prerequisites			**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To know the basics of Programming.
2.	To convert an algorithm into a Python program.
3.	To construct Python programs with control structures.
4.	To structure a Python Program as a set of function.
5.	To use Python data structures-lists, tuples, dictionaries.

Course Outcomes : At the end of the course the student will be able to:	
1.	Develop algorithmic solutions to simple computational problems.
2.	Develop and execute simple Python programs.
3.	Develop simple Python programs for solving problems.
4.	Structure a Python program into functions.
5.	Represent compound data using Python lists, tuples, dictionaries.

UNIT – I

Introduction to Computing and Problem Solving: Fundamentals of Computing – Computing Devices – Identification of Computational Problems – Pseudo Code and Flowcharts – Instructions – Algorithms Building Blocks of Algorithms.

Introduction to Python Programming: Python Interpreter and Interactive Mode– Variables and Identifiers – Arithmetic Operators – Values and Types – Statements, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: The if, The if…else, The if…elif…else Decision Control Statements, Nested if Statement, The while Loop, The for Loop, The continue and break Statements.

UNIT – II

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters;

Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

UNIT – III

Files and Exception: Text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file. Strings: Basic String Operations, String Slicing, Testing, Searching, and

Manipulating Strings Dictionaries and Sets: Dictionaries, Sets, Serializing Objects.

UNIT – IV
Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance The Polymorphism. **Functional Programming:** Lambda. Iterators, Generators, List Comprehensions

UNIT – V
GUI Programming: Graphical User Interfaces, Using the tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons.

References:	
1.	Richard L. Halterman, "Learning To Program With Python", Copyright © 2011.
2.	Dr. Charles R, "Python for Everybody, Exploring Data Using Python 3", Severance. 2016.

Suggested Readings:	
1.	Gowrishankar S., Veena A, "Introduction to Python Programming", CRC Press, Taylor & Francis Group, 2019.

OE602CS	**CYBER SECURITY**					
Prerequisites			**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To learn the various threats in networks and security concepts.
2.	To apply authentication applications in different networks.
3.	To understand security services for email.
4.	To awareness of firewall and IT laws and policies.
5.	To understand different IT Policies.

Course Outcomes : At the end of the course the student will be able to:	
1.	Understand the various network threats.
2.	Analyze the forensic tools for evidence collection.
3.	Apply the firewalls for threat analysis.
4.	Understand OS artifact.
5.	Evaluate Different IT Acts.

UNIT – I

Ethical hacking, Attack Vectors, Cyberspace and Criminal Behaviour, Clarification of Terms, Traditional Problems associated with Computer Crimes, Realms of Cyber world, brief history of the internet, contaminants and destruction of data, unauthorized access, computer intrusions, white-collar crimes, viruses and malicious code, virus attacks, pornography, software piracy, mail bombs, exploitation, stalking and obscenity in internet, Cyber psychology, Social Engineering.

UNIT – II

Introduction to Digital forensics, Forensic software and handling, forensic hardware and handling, analysis and advanced tools, forensic technology and practices, Biometrics: face, iris and fingerprint recognition, Audio-video evidence collection, Preservation and Forensic Analysis

UNIT – III

Investigation Tools, e-discovery, EDRM Models, digital evidence collection and preservation, email investigation, email tracking, IP tracking, email recovery, search and seizure of computer systems, password cracking.

UNIT – IV

Forensic Analysis of OS artifact, Internet Artifacts, File System Artifacts, Registry Artifacts, Application Artifacts, Report Writing, Mobile Forensic- identification, collection and preservation of mobile evidences, social media analysis, data retrieval, Email analysis from mobile phones.

UNIT – V

Ethics, Policies and IT Act.

Basics of Law and Technology, Introduction to Indian Laws, Scope and Jurisprudence, Digital Signatures, E Commerce-an Introduction, possible crime scenarios, law coverage, data interchange,

mobile communication development, smart card and expert systems Indian Laws, Information Technology Act 2000, Indian Evidence Act, India Technology Amendment Act 2008, Indian Penal Code, Computer Security Act 1987, National Information Infrastructure Protection Act 1996, Fraud Act 1997, Children Online Protection Act 1998, Computer Fraud and Abuse Act 2001, Intellectual Property, IP Theft, Copyright, Trademark, Privacy and Censorship, ,Introduction to Cyber Ethics, rights over intellectual property, Corporate IT Policy Formulations, Compliance Auditing.

References:	
1.	Charles P. Fleeger, "Security in Computing", Prentice Hall, New Delhi, 2009.
2.	BehrouzA.Forouzan, “Cryptography & Network Security”, Tata McGraw Hill, India, New Delhi, 2009.

Suggested Readings:	
1.	William Stallings, “Cryptography and Network Security”, Prentice Hall, New Delhi, 2006.

PC651CS	**COMPILER DESIGN LAB**					
Prerequisites			**L**	**T**	**P**	**C**
			0	**0**	**2**	**1**
Evaluation	**CIE**	**25 Marks**	**SEE**		**50 Marks**	

Course Objectives :	
1.	To learn usage of tools LEX, YAAC
2.	To develop a code generator
3.	To implement different code optimization schemes

Course Outcomes : At the end of the course the student will be able to:	
1.	Generate scanner and parser from formal specification
2.	Design a compiler for a subset of any High level languag

1. Construction of DFA from NFA.
2. Scanner program using LEX.
3. Construction of a Predictive parsing Table.
4. SLR Parser table generation.
5. Implement unification Algorithm.
6. LR Parser table generation.
7. Parser Generation using YACC.
8. Write a program on code generation.
9. Write a program on code optimization.

PC652CS	**COMPUTER NETWORKS LAB**					
Prerequisites			**L**	**T**	**P**	**C**
			0	**0**	**2**	**1**
Evaluation	**CIE**	**25 Marks**	**SEE**		**50 Marks**	

Course Objectives :	
1.	To familiarize POSIX: IPC
2.	To use socket interface to write client-server network applications
3.	To effectively use sockets to write simple network monitoring tools

Course Outcomes : At the end of the course the student will be able to:	
1.	Write concurrent programs using message queues and semaphores
2.	Use connection-oriented , connectionless and Asynchronous sockets
3.	Implement networked applications in TCP/IP protocol Suite

1. Examples using IPC
2. Echo Server using TCP (Concurrent or Iterative) and UDP
3. Time of the day server
4. Talker and Listener
5. Ping routine
6. Trace route
7. Mini DNS

PC653CS	**DEEP LEARNING LAB**					
Prerequisites			**L**	**T**	**P**	**C**
			0	**0**	**2**	**1**
Evaluation	**CIE**	**25 Marks**	**SEE**		**50 Marks**	

Course Objectives :	
1.	Implement RNN and CNN for multiple problems
2.	Implement Autoencoders and GAN

Course Outcomes : At the end of the course the student will be able to:	
1.	Make use of deep learning APIs like Keras
2.	Implement multiple conversions for Analysis
3.	Apply deep learning techniques for object identification and segmentation

1. Build a deep neural network model start with linear regression using a single variable
2. Build a deep neural network model start with linear regression using multiple variables.
3. Write a program to convert speech into text.
4. Write a program for Time-Series Forecasting with the LSTM Model.
5. Write a program to predict a caption for a sample image using LSTM.
6. Write a program for character recognition using CNN.
7. Write a program to predict a caption for a sample image using CNN
8. Write a program for character recognition using RNN and compare it with CNN.
9. Write a program to detect Dog image using YOLO Algorithm.
10. Write a program to develop a GAN for Generating MNIST Handwritten Digits.

PW656CS	**MINI PROJECT**					
Prerequisites			**L**	**T**	**P**	**C**
			0	**0**	**6**	**3**
Evaluation	**CIE**	**-**	**SEE**		**50 Marks**	

Course Objectives :	
1.	To develop capability to analyze and solve real world problems with an emphasis on Applying/integrating knowledge acquired.
2.	To learn the communication and presentation of the project work

Course Outcomes : At the end of the course the student will be able to:	
1.	Analyze and solve real world problems.
2.	Implement the system using SQL, data structures, C/C++, JAVA, Python and different software engineering models.

The department can initiate the project allotment procedure at the end of V semester and finalize it in the first two weeks of VI semester. The department will appoint a project coordinator who will coordinate the following: Collection of project topics/ descriptions from faculty members (Problems can also be invited from the industries) Grouping of students (max 3 in a group)

Allotment of project guides

The aim of mini project to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices.

This requires students to understand current problems in their domain and methodologies to solve these problems.

To get awareness on current problems and solution techniques, the first Two (2) weeks of VI semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions.

After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide.

Seminar schedule will be prepared by the coordinator for all the students from the 5^{th} week to the last week of the semester which should be strictly adhered to.

Each group will be required to:

1. Submit a one page synopsis before the seminar for display on notice board.
2. Give a 30 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write-up on the talk.

At least two teachers will be associated with the Mini Project to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above.

The seminar presentation should include the following components of the project:

- Problem definition and specification
- Literature survey
- Broad knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of bar (activity) charts
- Presentation- oral and written.

PW961CS	**SUMMER INTERNSHIP**					
Prerequisites			**L**	**T**	**P**	**C**
			0	**0**	**6**	**3**
Evaluation	**CIE**	**-**	**SEE**		**50 Marks**	

Course Objectives :	
1.	To train and provide hands-on experience in analysis, design, and programming of information systems by means of case studies and projects.
2.	To expose the students to industry practices and team work.
3.	To provide training in soft skills and also train them in presenting seminars and technical report writing.

Course Outcomes : At the end of the course the student will be able to:	
1.	Get Practical experience of software design and development, and coding practices within Industrial/R&D Environments.
2.	Gain working practices within Industrial/R&D Environments.
3.	Prepare reports and other relevant documentation.

Summer Internship is introduced as part of the curricula of encouraging students to work on problems of interest to industries. A batch of three students will be attached to a person from the Computer Industry/Software Companies/R&D Organization for a period of 8 weeks.

This will be during the summer vacation following the completion of the III year Course.

One faculty coordinator will also be attached to the group of Three (3) students to monitor the progress and to interact with the industry co-ordinate (person from industry). After the completion of the project, student will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the Department.

Award of sessionals are to be based on the performance of the students, to be judged by a committee constituted by the department. One faculty member will co-ordinate the overall activity of Industry Attachment Program.

Students have to undergo summer internship of Six Weeks duration at the end of semester VI and the credits will be awarded after evaluation in VII semester.