FACULTY OF ENGINEERING

Scheme of Instruction & Examination

and

Syllabi

B.E. V and VI Semesters

of

Four Year Degree Programme

in

COMPUTER SCIENCE AND ENGINEERING

(With effect from the Academic Year 2018 – 2019)
(As approved in the Faculty Meeting held on 26th June 2018)

Issued by
Dean, Faculty of Engineering
Osmania University, Hyderabad - 500 007
2018

SCHEME OF INSTRUCTION & EXAMINATION
B.E. V - Semester
(COMPUTER SCIENCE & ENGINEERING)

S.No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Course										
1.	PC501CS	Database Management Systems	3	-	-	3	30	70	3	3
2.	PC502CS	Data Communications	3	-	-	3	30	70	3	3
3.	PC503CS	Automata, Languages & Computation	3	1	-	4	30	70	3	3
4.	PC504CS	Operating Systems	3	-	-	3	30	70	3	3
5.	PC505CS	Computer Graphics	3	1	-	4	30	70	3	3
6.	HS901 MB	Managerial Economics and Accountancy	3	-	-	3	30	70	3	3
7.	PE –I	Professional Elective-I	3	-	-	3	30	70	3	3
8	MC901EG	Gender Sensitization	3	-	-	3	30	70	3	0
Practical/ Laboratory Course										
9.	PC551CS	Database Management Systems Lab	-	-	2	2	25	50	3	1
10.	PC552CS	Operating Systems Lab	-	-	2	2	25	50	3	1
11.	PC553CS	Computer Graphics Lab	-	-	2	2	25	50	3	1
		Total	**24**	**02**	**06**	**32**	**315**	**710**	**-**	**24**

Professional Elective – I		
S. No.	**Course Code**	**Course Title**
1	PE501 CS	Advanced Computer Architecture
2	PE502 CS	Artificial Intelligence
3	PE503 CS	Simulation and Modeling

PC: Professional Course **PE**: Professional Elective
HS: Humanities and social science **MC**: Mandatory Course
L: Lecture **T**: Tutorial **P**: Practical **D**: Drawing
CIE: Continuous Internal Evaluation, **SEE**: Semester End Examination (Univ. Exam)

Note:
1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment

Course Code	Course Title						Core/Elective
PC 501CS	**DATABASE MANAGEMENT SYSTEMS**						Core
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- To introduce three schema architecture and DBMS functional components
- To learn formal and commercial query languages of RDBMS
- To understand the principles of ER modeling and theory of normalization
- To study different file organization and indexing techniques
- To familiarize theory of serializablity and implementation of concurrency control, and recovery

Course Outcomes :

Student will be able to:

- Understand the mathematical foundations on which RDBMS are built
- 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
- Develop Database application using SQL and Embedded SQL
- Use the knowledge of file organization and indexing to improve database application performance
- Understand the working of concurrency control and recovery mechanisms in RDBMS

UNIT–I

Introduction: Database System Applications, Purpose of Database Systems, View of Values, Nested Sub-queries, Complex Queries, Views, Modification of the Database, Joined Relations
Data, Database Languages, Relational Databases, Database Design, Object–based and Semi-structured Databases, Data Storage and Querying, Transaction Management, Data Mining and Analysis, Database Architecture, Database Users and Administrators.

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, Fundamental Relational-Algebra Operations, Additional Relational–Algebra Operations, Extended Relational-Algebra Operations, Null Values, Modification of the Databases.

Structured Query Language: Data Definition, Basic Structure of SQL Queries, Set Operations, Aggregate Functions, Null

UNIT–III

Advanced SQL: SQL Data Types and Schemas, Integrity Constraints, Authorization, Embedded SQL, Dynamic SQL, Functions and Procedural Constructs, Recursive Queries, Advanced SQL Features. **Relational Database Design:** Features of Good Relational Design, Atomic Domains and First Normal Form, Functional-Dependency Theory, Decomposition using Functional Dependencies.

UNIT–IV

Indexing and Hashing: Basic Concepts, Ordered Indices, B^+-tree Index Files, B-tree Index Files, Multiple-Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices.

Index Definition in SQL Transactions: Transaction Concepts, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability.

UNIT–V

Concurrency Control: Lock-based Protocols, Time stamp-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

Suggested Readings:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, Database System Concepts, McGraw-Hill International Edition, 6thEdition, 2010
2. Ramakrishnan,Gehrke,DatabaseManagementSystems,McGraw-HillInternationalEdition, 3rdEdition,2003
3. Elmasri, Navathe, Somayajulu, Fundamentals of Data base Systems, Pearson Education, 4thEdition,2004

Course Code	Course Title						Core/Elective
PC 502CS	**DATA COMMUNICATIONS**						Core
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- To learn about basic building blocks of Data communication network such as protocol , topologies and standards
- To understand different issue in link layer such as framing, multiplexing, error correction and flow control
- To acquire knowledge of infrastructure for Local Area Networks (MAC CSMA-CD/Ethernet, Token Ring etc)
- To learn the basic design principles of broadband wired and wireless communication networks (802.11x)

Course Outcomes :

Student will be able to:

- Describe the data communications and telecommunications models, topologies, protocols, standards and architectures in use today
- Explain the basic components and media of data communication networks and distinguish between LANs and WANs.
- Compare and contrast the historical evolution of the switched and routed infrastructures
- Evaluate different data communication hardware and network designs

UNIT–I

Data Communication and Networking Overview, Protocol Architectures: OSI, TCP/IP and ATM. Data transmission, Guided and Wireless transmission.

Data Encoding: digital data-digital signals, digital data-analog signals, analog data-digital signals, analog data-analog signals

UNIT–II

Multiplexing, Circuit switching and Packet switching, Digital Data Communication Techniques, Asynchronous and Synchronous transmission, DSL and ADSL.

UNIT–III

Data Link Control: Error detection techniques, interfacing. Line configurations, Flow control, Error control, Data link control protocols, Protocol verification

UNIT–IV

Local Area Networks, LAN Technologies, MAC sub layer, CSMA/CD, Token Ring, Fibre channel, IEEE Standards, High Speed LAN: Switched, Fast, Gigabit Ethernets.

UNIT–V

Wireless LANs, 802.11 Broad band wireless, 802.16 Bluetooth, Bridge, Spanning Tree Bridge, Source Routing Bridge, Repeaters, Hubs, Switches, Routers and Gateways, Virtual LANs.

Suggested Readings:

1. William Stallings, Data and Computer Communications, 8thEdition, Prentice Hall of India, 2012
2. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, 5thEdition, Pearson, 2012

Course Code	Course Title						Core/Elective
PC 503CS	**AUTOMATA, LANGUAGES & COMPUTATION**						Core
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- Introduce the concept of formal specification of languages and different classes of formal languages
- Discuss automata models corresponding to different levels of Chomsky hierarchy Understand the concept of computability and decidability

Course Outcomes :

Student will be able to:

- Design Finite State Machine, Pushdown Automata, and Turing Machine
- Determine a language's place in the Chomsky hierarchy (regular, context-free, recursively enumerable)
- Convert among equivalently powerful notations for a language, including among DFAs, NFAs, and regular expressions, and between PDAs and CFGs
- Explain why the halting problem has no algorithmic solution

UNIT–I

Introduction: Finite state automata, Non-deterministic finite state automata, FA with-transitions, Regular expressions, FA with outputs, Applications of FA. Properties of regular sets-Pumping Lemma, Closure properties, Myhill-Nerode Theorem, Minimization of FA, Decision Algorithms.

UNIT–II

Context Free Grammars and Languages: Derivations, Parse-trees, Ambiguity in Grammars and Languages. Pushdown Automata–Definitions, The languages of PDA, Equivalence of PDAs and CFGs, Deterministic Pushdown Automata (DPDA).

UNIT–III

Properties of CFLs: Normal forms for CFGs, Pumping Lemma, Closure properties, Decision algorithms, Deterministic Context Free Languages, Predicting machines, Decision properties, LR(0) grammars, LR(0) and DPDA,LR(k) grammars

UNIT–IV

Turing Machines: Introduction, Computational Languages and Functions, Techniques for construction of Turing machines. Modifications of TM, TM as enumerator, Restricted TM.

UNIT–V

Undecidability: Recursive and Recursively enumerable languages, UTM and undecidable problem, Rice Theorem, Post's correspondence problem. Chomsky's Hierarchy–Regular grammars, Unrestricted grammar, CSL, Relationship between classes of languages.

Suggested Readings:

1. John E. Hopcroft, Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation,Narosa,1979
2. Zvi Kohavi, Switching and Finite Automata Theory, TMH,1976

Course Code	Course Title						Core/Elective
PC 504CS	**OPERATING SYSTEMS**						Core
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- To introduce the concepts of OS structure and process synchronization
- To study different memory management strategies
- To familiarize the implementation of file system
- To understand the principles of system security and protection
- To discuss the design principles and structure of Windows 7 and Linux

Course Outcomes:

Student will be able to:

- Evaluate different process scheduling algorithms
- Describe the steps in address translation and different page replacement strategies
- Compare different file allocation methods and decide appropriate allocation strategy for given type of file
- Explain the mechanisms available in an OS to control access to resource

UNIT-I

Introduction to Operating Systems: OS structure and strategies, Process concepts, Multithreaded Programming, Process scheduling, Process synchronization, Deadlocks.

UNIT-II

Memory management strategies with example architectures: Swapping, Contiguous allocation, Paging, Segmentation, Segmentation with paging, Virtual memory management: Demand paging, Page replacement, Thrashing.

UNIT-III

File system interface: File concepts, Access methods and protection. File system implementation: File system structure, Allocation methods, Directory implementation of file systems, Mass storage structures, I/O systems

UNIT-IV

System Protection: Principles and Domain, Access Matrix and implementation, Access control and access rights, Capability based systems, and Language based Protection

System Security: Problem, Program threats, cryptography, user authentication, implementing security defenses, Firewalling, Computer Security Classification

UNIT-V

Case Studies: The Linux System–Design principles, Kernel modules, Process management, Scheduling, Memory management, File systems, Input and Output, Inter process communication. Windows7–Design principles, System components, Terminal services and fast user switching File systems, Networking, Programmer interface.

Suggested Reading:

1. Abraham Silberschatz, Peter B Galvin, Operating System Concepts,9th Edition, Wiley, 2016
2. William Stallings, Operating Systems-Internals and Design Principles, 8thedition, Pearson, 2014
3. Andrew S Tanenbaum, Modern Operating Systems, 4th edition, Pearson, 2016.

Course Code	Course Title						Core/Elective
PC 505CS	**COMPUTER GRAPHICS**						Core
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- To introduce the concept of synthetic camera model , programmable pipeline and OpenGL API
- To study different interaction modes and data structures that store 2-D and 3-D geometric objects
- To understand different transformations in 2-D and 3-D To study different rasterization and rendering algorithms

Course Outcomes:

Student will be able to:

- Describe the steps in graphics programming pipe line
- Write interactive graphics applications using OpenGL geometric primitives
- Apply affine transformations for viewing and projections
- create realistic images of 3-d objects that involve lighting shading aspects
- Describe the mathematical principles to represent curves and surfaces

UNIT-I

Graphics Systems and Models: Graphics system, Images, Physical and Synthetic, Imaging system, Synthetic camera model, Programming interface, Graphics architectures, Programmable pipelines, Performance characteristics. Graphics Programming: Programming two-dimensional applications, Open GLAPI, Primitives and attributes, Color, Viewing and Control functions.

UNIT-II

Input and Interaction: Input devices, Clients and Servers, Display lists, Display lists and modeling, Programming event-driven input, Picking, Building interactive models, Animating interactive programs and Logic operations. Geometric Objects: Three-dimensional primitives, Coordinate systems and frames, Frames in OpenGL, Modeling colored cube.

UNIT-III

Transformations: Affine transformations, Transformations in homogeneous coordinates, Concatenation of transformations, OpenGL transformation matrices. Viewing: Classical and Computer views, Viewing with a computer, Positioning of camera, Simple projections, Projections in OpenGL, Hidden surface removal, Parallel-projection matrices, Perspective-projection matrices.

UNIT-IV

LightingandShading: Lightsources, ThePhonglightingmodel, Computationalvectors, Polygonal shading, Light sources in OpenGL, Specification of matrices in OpenGL, Global illumination.

FromVerticestoFrames: Basicimplementationstrategies,Line-segmentclipping,Polygonclipping, Clipping of other primitives, Clipping in three dimensions, Rasterization, Bresenham'salgorithm, Polygon Rasterization, Hidden-surface removal, Anti-aliasing, Display considerations.

UNIT-V

Modeling & Hierarchy: Hierarchal models, Trees and traversal, Use of treed at a structure, Animation, Graphical objects, Scene graphs and Simple scene graph API, Open Scene graph, Other tree structures.

Curves & Surfaces: Representation of curves and surfaces, Design criteria, Bezier curves and surfaces, Cubic B-splines, General B-splines, Rendering curves and surfaces, Curves and surfaces in OpenGL.

Suggested Reading:

1. Edward Angel, Interactive Computer Graphics: A Top-Down Approach Using OpenGL, Pearson Education, 5th edition, 2009
2. Francis S Hill Jr., Stephen MKelley, Computer Graphics using OpenGL, Prentice HallInc., 3rdedition, 2007
3. JimX.Chen, Foundations of 3D Graphics Programming using JOGL and Java3D, Springer Verlag, 2006
4. Hearn Donald, Pauline MBaker, Computer Graphics, 2ndedition,1995

Course Code	Course Title						Core/Elective
HS 901MB	**MANAGERIAL ECONOMICS AND ACCOUNTANCY**						Core
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	-	-	**30**	**70**	**3**

Course Objectives:

- To learn important concepts of Managerial Economics and apply them to evaluate business decisions
- To understand various parameters that determines the consumers' behavior. To evaluate the factors that affect production
- To understand the concepts of capital budgeting and payback period. To study the concepts of various book-keeping methods.

Course Outcomes:

Student will be able to:

- Apply the fundamental concepts of managerial economics to evaluate business decisions Understand types of Demand and factors related to it
- Identify different types of markets and determine price –output under perfect competition
- Determine working capital requirement and payback
- Analyze and interpret financial statements through ratios

UNIT–I

Meaning and Nature of Managerial Economics: Managerial Economics and its useful nessto Engineers, Fundamental Concepts of Managerial Economics-Scarcity, Marginalism, Equimarginalism, Opportunity costs, Discounting, Time Perspective, Risk and Uncertainty, Profits, Case study method.

UNIT–II

Consumer Behavior: Law of Demand, Determinants, Types of Demand; Elasticity of Demand (Price, Income and Cross-Elasticity); Demand Forecasting, Law of Supply and Concept of Equilibrium. (Theory questions and small numerical problem can be asked)

UNIT–III

Theory of Production and Markets: Production Function, Law of Variable Proportion, ISO quant's, Economics of Scale, Cost of Production (Types and their measurement), Concept of Opportunity Cost, Concept of Revenue, Cost-Output relationship, Break-Even Analysis, Price-Output determination under Perfect Competition and Monopoly (theory and problem scan be asked)

UNIT–IV

Capital Management: Significance, determination and estimation of fixed and working capital requirements, sources of capital, Introduction to capital budgeting, methods of payback and discounted cash flow methods with problems. (Theory questions and numerical problems on estimating working capital requirements and evaluation of capital budgeting opportunities can be asked)

UNIT–V

Book-keeping: Principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance, concept and preparation of Final Accounts with simple adjustments, Analysis and interpretation of Financial Statements through Ratios.

(Theory questions and numerical problems on preparation of final accounts, cashbook, petty cash book, bank reconciliation statement, calculation of some ratios)

Suggested Readings:

1. 1.Mehta P.L., Managerial Economics—Analysis, Problems and Cases , Sulthan Chand & Sons Educational Publishers, 2011
2. Maheswari S.N.,Introduction to Accountancy ,Vikas Publishing House, 2005
3. Pandey I.M.,FinancialManagement ,Vikas Publishing House, 2009

Course Code	Course Title						Core/Elective
PE 501CS	**ADVANCED COMPUTER ARCHITECTURE**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	-	-	**30**	**70**	**3**

Course Objectives:

- To learn the models of computer architecture beyond the classical von Neumann model-pipelining , vector and array processors.
- To understand different performance enhancement techniques of superscalar architecture To study the issues of memory management and synchronization in Multiprocessors and Multi computers

Course Outcomes:

Student will be able to:

- Understand the limitations of uni-processor and appreciate the need for parallel processing
- Explain the concept of branch prediction and its utility.
- Explain the concept of interconnection networks and characterize different approaches.
- Compare and contrast shared memory and distributed memory architectures

UNIT–I

Measuring Performance and cost: Performance measurement, Enhancements to Uniprocesssor models, Benchmarks, Basic model of advanced computer architectures

UNIT–II

Pipelining and super scalar techniques: Basic pipe lining, data and control hazards, Dynamic instruction scheduling, Branch prediction techniques, Performance evaluation, case study-Sun Microsystems -Microprocessor.

UNIT–III

Vector Processors: Vector Processor Models, Vector architecture and Design, performance evaluation, Programming Vector processors.

UNIT–IV

Array Processors: parallel array processor model, memory organization, inters connection networks performance measures, static and dynamic topologies.

UNIT–V

Multiprocessors and Multi computers: Multi processor models, Shared-memory and distributed memory architectures, memory organization, Cache Coherence and Synchronization Mechanisms, parallel computer, performancemodels.

Suggested Readings:

1. John L. Hennessey and David A. Patterson, Computer Architecture, A Quantitative Approach, Elsevier, 4th Edition, 2007.
2. Sajjan G. Shiva, Advance Computer Architecture, Taylor Series Group, CRCpress, 2006.
3. Kai Hwang, Advanced Computer Architecture, McGraw Hill, 1999.

Course Code	Course Title						Core/Elective
PE 502CS	**ARTIFICIAL INTELLIGENCE**						Elective
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	-	-	**30**	**70**	**3**

Course Objectives:

- To familiarize the principles of Artificial Intelligence
- To study the techniques for knowledge representation and inference
- To learn the techniques involved in the creation of intelligent systems
- To study different applications like Game Playing Expert Systems, machine learning and natural language processing

Course Outcomes:

Student will be able to:

- Identify problems that are amenable to solution by AI method
- Understand and analyze working of an AI technique
- Formalize a given problem in the language/framework of different AI methods

UNIT-I

Introduction, History, Intelligent Systems, Foundations of AI, Sub-areas of AI, Applications, Problem Solving. State-Space Search and Control Strategies: Introduction, General Problem Solving, Characteristics of Problem, Exhaustive Searches, Heuristic Search Techniques, Iterative-Deepening, A*, Constraint Satisfaction. Game Playing, Bounded Look-ahead Strategy and use of Evaluation Functions, Alpha-Beta Pruning

UNIT–II

Logic Concepts and Logic Programming: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Propositional Logic, Resolution Refutation in Propositional Logic, Predicate Logic, Logic Programming.

Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Knowledge Representation using Frames

UNIT–III

Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Expert Systems vs Traditional Systems, Truth Maintenance Systems, Application of Expert Systems, List of Shells and Tools.

Uncertainty Measure-Probability Theory: Introduction, Probability Theory, Bayesian Belief Networks, Certainty Factor Theory, Dempster-Shafer Theory.

UNIT–IV

Machine-Learning Paradigms: Introduction, Machine Learning Systems, Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees (Suggested Reading2), Deductive Learning, Clustering, Support Vector Machines.

Artificial Neural Networks: Introduction, Artificial Neural Networks, Single-Layer Feed-Forward Networks, Multi-Layer Feed-Forward Networks, Radial-Basis Function Networks, Design Issues of Artificial Neural Networks, Recurrent Networks.

UNIT–V

Advanced Knowledge Representation Techniques: Case Grammars, Semantic Web.

Natural Language Processing: Introduction, Sentence Analysis Phases, Grammars and Parsers, Types of Parsers, Semantic Analysis, Universal Networking Knowledge.

Suggested Readings:

1. SarojKaushik, Artificial Intelligence, Cengage Learning, 2011
2. Russell,Norvig, Artificial Intelligence- A Modern Approach, Pearson Education, 2nd Edition,2004
3. Rich,Knight, Nair, Artificial Intelligence, Tata McGraw Hill, 3rd Edition, 2009

Course Code	Course Title						Core/Elective
PE 503CS	**SIMULATION AND MODELING**						Elective
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	-	-	**30**	**70**	**3**

Course Objectives:

- To familiarize the basic concepts of simulation and different types of models
- To learn software tools, packages and languages that support simulation and modeling
- To study different techniques of generating random numbers and various discrete probability distributions
- To understand foundational approaches to validating models

Course Outcomes:

Student will be able to:

- Demonstrate the ability to apply the techniques of modeling and simulation to a range of problems in computer systems
- Verify and validate the results of a simulation
- Infer the behavior of a system from the results of a simulation of the system.

UNIT–I

Introduction to Simulation: Advantages and Disadvantages of Simulation, Areas of applications, Systems and System Environment, Concepts of a System, Discrete and Continuous Systems. Models, Types of Models, Steps in Simulation Study-examples, Discrete-event System Simulation.

UNIT-II

Overview of Statistical Models and Queuing Systems: Continuous and Discrete Simulation using MATLAB and SIMULINK

UNIT-III

Random Numbers: Generation, Properties of Random Numbers, Generation of Pseudo-random Numbers, Tests for Random Numbers.

Random variate: Generation, Inverse Transformation Technique, Uniform distribution, Exponential distribution, we ibull distribution, Triangular distribution, Empirical Continuous distributions, Discrete distributions, Direct transformation for the Normal distribution, Convolution method of Erlang distribution.

Acceptance /Rejection techniques: Poisson distribution, Gamma distribution.

UNIT-IV

Input Data Analysis: Data collection-Identification of the Distribution, Parameter & Estimation.

Goodness off it tests: Chisquare test-KS test. Multivariate and Time Series Input Models, Verification and Validation of Simulation models, Model building, Calibration and Validation of Models, Face Validity, Validation of Model assumptions, Validation of input/output Transformations, Input/output Validation using Historical input data, Input/output validation using Turing test.

UNIT-V

Output Data Analysis: Stoch as ticnature of Output data, Types of Simulation with respect to Output Analysis, Measures of Performance and their Estimation, Output Analysis for terminating simulations, Output Analysis for steady-state simulations. Comparison and Evaluation of Alternative System Designs: Comparison of several system designs, Statistical models for estimating the effect of design alternatives.

Suggested Reading:

1. Jerry Banks, JohnS. Carson and Barry L.Nelson, Discrete Event System Simulation, Prentice Hall of India, 2001
2. Narsing Deo ,System Simulation with Digital Computers ,Prentice Hall of India, 1979
3. Averill M.Law and W. David Kelton, Simulation Modeling and Analysis, McGraw Hill, 2001
4. Agam kumar tyagi, MATLAB and Simulink for Engineers, Oxford Publishers, 2011

Course Code	Course Title						Core/Elective
PE 551CS	**DATABASE MANAGEMENT SYSTEMS LAB**						Core
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**25**	**50**	**1**

Course Objectives:

- To practice various DDL commands in SQL
- To write simple and Complex queries in SQL
- To familiarize PL/SQL

Course Outcomes:

Student will be able to:

- Design and implement a database schema for a given problem
- Populate and query a database using SQL and PL/SQL
- Develop multi-user database application using locks

Creation of database (exercising the commands for creation).

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 over3 sessions.

Note: The creation of sample database for the purpose of the experiments is expected to be pre-decided by the instructor.

Course Code	Course Title						Core/Elective
PE 552CS	**OPERATING SYSTEMS LAB**						Core
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**25**	**50**	**1**

Course Objectives:

- To learn shell programming and the use of filters in the LINUX environment
- To practice multithreaded programming
- To implement CPU Scheduling Algorithms and memory management algorithms

Course Outcomes:

Student will be able to:

- Write shell scripts for simple system administration tasks
- Write concurrent programs with synchronization constricts
- Compare the performance of various CPU Scheduling Algorithm
- Critically analyze the performance of the various Memory management algorithms

List of Experiments:

1 to 3. Memory Management Algorithms
4-5. Examples of Multithreading

6. Producer & Consumer problem using Semaphores and shared memory

7-8.Processor Scheduling algorithms

9. Dining Philosophers problem using Semaphores

10.Readers and Writers problem using Semaphores

11. Shell-programming exercises

Course Code	Course Title						Core/Elective
PE 553CS	**COMPUTER GRAPHICS LAB**						Core
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**25**	**50**	**1**

Course Objectives:

- Learn to use basic geometric primitives and transformations in OpenGL
- To practice various interactive input methods in OpenGL
- Learn to use rendering primitives in OpenGL

Course Outcomes:

Student will be able to:

- Write interactive graphics applications using OpenGL geometric primitives
- Create realistic images of 3-d objects with light sources and shading
- Write animation and walkthrough programs using OpenGL

List of Experiments:

1. Program to draw simple 2-D images using basic OpenGL functions.
2. Program to draw simple 3-D shapes using polygonal approximations.
3. Program to demonstrate the usage of display lists.
4. Createa simple game with interactive graphics programming.
5. Program to demonstrate animation effect using transformations and double buffering.
6. Createa simple walk through program.
7. Program using projections in OpenGL.
8. Programwith light sources and shading.
9. Program that defines and renders a scene graph using Open Scene Graph API.
10. Program using OpenGL Bezier curves and B-Splines.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. VI - Semester
(COMPUTER SCIENCE & ENGINEERING)

S. No	Course code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Course										
1	PC601CS	Design and Analysis of Algorithms	3	1	-	4	30	70	3	3
2	PC602CS	Software Engineering	3	1	-	4	30	70	3	3
3	PC603CS	Web Programming	3	1	-	4	30	70	3	3
4	PC604CS	Computer Networks & Programming	3	1	-	4	30	70	3	3
5	PE-II	Professional Elective-II	3	1	-	4	30	70	3	3
6	OE	Open Elective-I	3	-	-	3	30	70	3	3
Practical/ Laboratory Course										
7.	PC651CS	Software Engineering Lab	-	-	2	2	25	50	3	1
8.	PC652CS	Web Programming Lab	-	-	2	2	25	50	3	1
9.	PC653CS	Computer Networks &Programming Lab	-	-	2	2	25	50	3	1
10.	MC	Mandatory Course	-	-	3	3	50	-	3	0
11.	SI671CS	Summer Internship*	-	-	-	-	-	-	-	-
Total			**18**	**05**	**09**	**32**	**305**	**570**		**21**

PC: Professional Course **PE**: Professional Elective **MC**: Mandatory Course
OE: Open Elective **SI**: Summer Internship
L: Lecture **T**: Tutorial **P**: Practical **D**: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

Note-1:

1. Each contact hour is a Clock Hour
2. The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.

Note-2:

*The students have to undergo a Summer Internship of four weeks duration after VI semester and credits will be awarded in VII semester after evaluation.

****** Subject is not offered to the students of CSE and IT Department.

Open Elective-I:

S.No	Course Code	Course Title
1	OE601CE	Disaster Management
2	OE602CE	Geo Spatial Techniques
3	OE601CS	Operating Systems**
4	OE602CS	OOP using Java**
5	OE601IT	Database Systems**
6	OE601EC	Principles of Embedded Systems
7	OE602EC	Digital System Design using HDL Verilog
8	OE601EE	Reliability Engineering
9	OE602EE	Basics of Power Electronics
10	OE601ME	Industrial Robotics
11	OE602ME	Material Handling
12	OE632AE	Automotive Safety & Ergonomics

Professional Elective – II

S.No	Course Code	Course Title
1	PE 601CS	Graph Theory and Its Applications
2	PE 602CS	Advanced Computer Graphics
3	PE 603CS	Advanced Databases

Mandatory Course

S.No	Course Code	Course Title
1	MC951SP	Yoga Practice
2	MC952SP	National Service Scheme
3	MC953SP	Sports

Course Code	Course Title						Core/Elective
PC 601 CS	**DESIGN AND ANALYSIS OF ALGORITHMS**						Core
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- To review elementary data structures , order notation and algorithm analysis
- To learn algorithm design strategies such as Divide-and-Conquer, greedy method, dynamic programming, back tracking and branch & bound technique
- To understand the concepts of NP-hard and NP-complete

Course Outcomes:

Student will be able to:

- Design algorithms for various computing problems
- Analyze the time and space complexity of algorithms
- Critically analyze the different algorithm design techniques for a given problem.
- Modify existing algorithms to improve efficiency

UNIT–I

Introduction & Elementary Data Structures: Order notation, Analysis of algorithms, Review of elementary data structures–Heaps and Heap sort, Hashing. Sets–representation, UNION, FIND operations.

UNIT–II

Divide-and-Conquer Method: The general method, Binary search, Finding maximum and minimum, Merge sort, Quick sort and Selection sort.

Greedy Method: Knapsack problem, Optimal storage on tapes, Job sequencing with deadlines, Optimal merge pattern, Minimum spanning trees, Single source shortest path.

UNIT–III

Dynamic programming method and traversal techniques: Multi stage graphs, All pairs shortest paths, Optimal binary search tress, 0/1 Knapsack problem, Reliability design, Traveling salesman problem, Game trees, Biconnected components and Depth first search.

UNIT–IV

Back tracking and branch-and-bound methods Hamiltonian cycles, Knapsack problem and problem.

Lower-bound Theory methods: N-queens problem, Graph coloring, 0/1 Knapsack problem, Traveling sales person

UNIT–V

NP-hard and NP-complete problems: Basic concepts, Non-deterministic algorithms, NP-hard graph problems and scheduling problems, NP-hard code generation problem, Decision problem, Node cover problem.

Suggested Reading:

1. Horowitz E, SahniS, Fundamentals of Computer Algorithms, 2nd Edition, Universities Press, 2007
2. AhoA.V.HopcroftJ.E,UllmanJ.D, TheDesignandAnalysisofComputerAlgorithms, Addison Wesley, 1974
3. Michael T. Goodrich, Roberto Tamassia, Algorithm Design: Foundations, Analysis and Internet Examples, John Wiley & Sons,2002

Course Code	Course Title						Core/Elective
PC 602 CS	**SOFTWARE ENGINEERING**						Core
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- To introduce the basic concepts of software development- processes from defining a product to shipping and maintaining that product
- To impart knowledge on various phases , methodologies and practices of software development
- To understand the importance of testing in software development and study various testing strategies and software quality metrics

Course Outcomes:

Student will be able to:

- Acquire working knowledge of alternative approaches and techniques for each phase of software development
- Acquire skills necessary for independently developing a complete software project
- Understand the practical challenges associated with the development of a significant software system

UNIT-I

Introduction to Software Engineering:

Ageneric view of Process: Software Engineering, Process Framework, CMM Process Patterns, Process Assessment.

Process Models: Prescriptive Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, The Unified Models, Personal and Team Process Models, Process Technology, Product and Process.

An Agile view of Process: Introduction to Agility and Agile Process, Agile Process Models.

UNIT-II

Software Engineering Principles: SE Principles, Communication Principles, Planning Principles, Modeling Principles, Construction Principles, Deployment.

System Engineering: Computer-based Systems, The System Engineering Hierarchy, Business Process Engineering, Product Engineering, System Modeling.

Requirements Engineering: A Bridge to Design and Construction, Requirements Engineering Tasks, Initiating Requirements Engineering Process, Eliciting Requirements, Developing Use-Cases, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

UNIT-III

Building the Analysis Model: Requirements Analysis Modeling Approaches, Data Modeling Concepts, Object-Oriented Analysis, Scenario-based Modeling, Flow-oriented Modeling, Class-based Modeling, Creating a Behavioral Model.

Design Engineering: Design within the context of SE, Design Process and Design Quality, Design Concepts, The Design Model, Pattern-based Software Design.

UNIT-IV

Creating an Architectural Design : Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design, Assessing Alternative Architectural Designs, Mapping Data Flow into a Software Architecture.

Modeling Component-Level Design: Definition of Component, Designing Class-based Components, Conducting Component-level Design, Object Constraint Language, Designing Conventional Components.

Performing User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

UNIT-V

Software Quality Assurance: Basic Elements, Tasks, Goals and Metrics, Formal Approaches, Statistical Software Quality Assurance, Software Reliability, ISO9000 Quality Standards, SQA Plan.

Testing Strategies: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for O-O Software, Validation Testing, System Testing, The Art of Debugging.

Testing Tactics: Software Testing Fundamentals, Black-box and White-box Testing, Basis Path Testing, Control Structure Testing, O-O Testing Methods, Testing Methods applicable on the Class Level, Inter Class Test Case Design, Testing for Specialized Environments, Architectures and Applications, Testing Patterns.

Product Metrics: Software Quality, A Frame work for Product Metrics, Metrics for the Analysis Model, Metrics for the Design Model, Metrics for Source Code, Metrics for Testing, Metrics for Maintenance.

Suggested Reading:

1. Roger S. Pressman, Software Enigneering: A Practitioner's Approach, 7thEdition, McGraw Hill, 2009
2. Ali Behforooz and Frederick J. Hudson, Software Engineering Fundamentals, Oxford University Press, 1996
3. Pankaj Jalote, An Integrated Approach to Software Engineering, 3rdEdition, Narosa Publishing House, 2008

Course Code	Course Title						Core/Elective
PC 603 CS	**WEB PROGRAMMING**						Core
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- To learn HTML5 and JavaScript
- To familiarize the tools and technologies to process XML documents
- To learn various server-side and database connectivity technologies

Course Outcomes:

Student will be able to:

- Design a website with static and dynamic web pages
- Develop a web application with session tracking and client side data validations
- Develop web content publishing application that accesses back-end data base and publishes data in XML format

UNIT-I

IntroductiontoWorldWideWeb, WebBrowsers, WebServers, UniformResourceLocators, HTTP.
HTML5: Introduction, Links, Images, Multimedia, Lists, Tables, CreatingForms, Styling Forms.

UNIT-II

Introduction to XML, XML document structure, Document Type Definition, Name spaces, XML Schemas, Display in graw XML documents, Displaying XML documents with CSS, XPath Basics, XSLT, XML Processors.

UNIT-III

Introduction to JavaScript: JavaScript and Forms Variables, Functions, Operators, Conditional Statements and Loops, Arrays DOM, Strings, Event and Event Handling, Java Script Closures.
Introduction to Ajax: Pre-Ajax JavaScript Communication Techniques, XML HTTP Request Object, Data Formats, Security Concerns, User Interface Design for Ajax.
Introduction to Python: Objects and Methods Flow of Control, Dynamic Web Pages.

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. Java Server Pages: Introduction to JSP, JSP Tags, Variables and Objects, Methods, Control Statements, Loops, Request String, User Sessions, Session Object, Cookies.

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 Perl-Database access with PHP-Database access with JDBC.

Suggested Reading:

1. Robert W.Sebesta, Programming the World Wide Web, 3rdEdition, Pearson Education, 2006
2. Wendy Willard, HTML5, McGraw Hill Education (India) Edition, 2013
3. Thomas Powell, the Complete Reference: Ajax, Tata-McGraw-Hill, 2011
4. John Pollock, Java Script, 4thEdition, McGraw Hill Education (India) Edition, 2013
5. Jim Keogh, J2EE: The Complete Reference, Tata-McGraw-Hill, 2002

Course Code	Course Title						Core/Elective
PC 604 CS	**COMPUTER NETWORKS & PROGRAMMING**						Core
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- To study the design issues in network layer and various routing algorithms
- To introduce internet routing architecture and protocols
- To learn the flow control and congestion control algorithms in Transport Layer
- To introduce the TCP/IP suite of protocols and the networked applications supported by it
- To learn basic and advanced socket system calls

Course Outcomes:

Student will be able to:

- Explain the function of each layer of OSI and trace the flow of information from one node to another node in the network
- Understand the principles of IP addressing and internet routing
- Describe the working of various networked applications such as DNS, mail, file transfer and www
- Implement client-server socket-based networked applications.

UNIT-I

Review of ISO OSI Reference Model and TCP/IP Architectures. Network Layer: Design issues, Services, Internal organization, Comparison of Virtual circuits and Datagram subnets. Routing **Algorithms:** The Optimality principle, Shortest path routing, Flooding, Flow based algorithms, Distance vector, Link state, Hierarchical algorithms, Broad cast and Multi cast routings.

Congestion control algorithms: General principles, Traffic shaping, Congestion control in virtual circuit subnets, Choke packets and Load shedding, Jitter control and Congestion control for multicasting, Quality of Service (QoS)

UNIT-II

Inter networking: How networks differ, Concatenated virtual circuits, Connectionless internetworking, Tunneling, Internetwork routing, Fragmentation and Firewalls.

The Network Layer of the Internet: The IP protocol, IP addresses, Subnets, Internet control protocols, Gateway routing protocols, Multicasting, CIDR.

UNIT-III

Transport Layer: Service primitives, Addressing, Establishing a connection, Releasing a connection, Flow control, Buffering, Multiplexing and Crash recovery.

Internet Transport Protocols (TCP and UDP): The TCP service model, The TCP protocol, The TCP Segment Header, TCP connection management, Transmission policy: Congestion control, Timer management and UDP, Performance issues.

UNIT-IV

Application Layer: Domain Name System: DNS name space, Resource records and Name services. SMTP and MIME, HTTP, SNMP, Telnet, ftp, Multimedia.

UNIT-V

Socket programming : Socket address, Elementary socket system calls, Advanced socket system calls, Reserved ports, Socket options, Asynchronous I/O, Input/Output Multiplexing, Out-of-Band data, Sockets and Signals, Internet Super Server, DNS.

Suggested Reading:

1. Andrew S.Tanenbaum, David J.Wetherall, Computer Networks, 5thEdition, Pearson, 2012
2. Chwan-Hwa (John)Wu, J.David Irwin, Introduction to Computer Networks and Cyber Security, CRC Press, 2013
3. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, 5thEdition, Addison-Wesley, 2012
4. W. Richard Stevens, Unix Network Programming, Prentice Hall / Pearson Education, 2009
5. W.Richard Stevens, Andrew M Rudoff, Bill Fenner, Unix Network Programming: Networking APIs: Sockets and XTI (Volume 1) 3rdEdition, PHI

Course Code	Course Title						Core/Elective
PE 601 CS	**GRAPH THEORY AND ITS APPLICATIONS**						Elective
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- To familiarize a variety of different problems in Graph Theory
- To learn various techniques to prove theorems
- To understand and analyze various graph algorithms

Course Outcomes:

Student will be able to:

- Write precise and accurate mathematical definitions of objects in graph theory
- Validate and critically assess a mathematical proof
- Develop algorithms based on diverse applications of Graphs in different domains

UNIT-I

Preliminaries: Graphs, isomorphism, sub graphs, matrix representations, degree, operations on graphs, degree sequences.

Connected graphs and shortest paths: Walks, trails, paths, connected graphs, distance, cut-vertices, cut-edges, blocks, connectivity, weighted graphs, shortest path algorithms T**rees:** Characterizations, number of trees, minimum spanning trees

UNIT-II

Special classes of graphs: Bipartite graphs, line graphs, chordal graphs

Eulerian graphs: Characterization, Fleury's algorithm, chinese-postman-problem

UNIT-III

Hamilton graphs: Necessary conditions and sufficient conditions

Independent sets, coverings, matchings: Basic equations, matching sin bipartite graphs, perfect matchings, greedy and approximation algorithms

UNIT-IV

Vertex colorings: Chromatic number and cliques, greedy coloring algorithm, coloring of chordal graphs, Brook's theorem

Edge colorings: Gupta-Vizing theorem, Class-1 graphs and class-2 graphs, equitable edge-coloring

UNIT-V

Planar graphs: Basic concepts, Euler's formula, polyhedrons and planar graphs, characterizations, planarity testing, 5-color-theorem.

Directed graphs: Out-degree, in-degree, connectivity, orientation, Eulerian directed graphs, Hamilton directed graphs, tournaments

Suggested Reading:

1. F. Harry, Graph theory, Narosa Publications, 1988.
2. C.Berge: Graphs and Hyper graphs, North Holland/Elsevier, 1973
3. J A Bondy and U.S. R Murthy, Graph Theory with Applications, Elsevier Science Ltd, 1976.
4. Douglas B West, Introduction to Graph Theory, Prentice Hall, 2004

Course Code	Course Title						Core/Elective
PE 602 CS	**ADVANCED COMPUTER GRAPHICS**						Elective
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- To review three dimensional geometric transformations and viewing pipeline
- To familiarize animation and texture mapping techniques
- To understand the mathematical principles of representation of curves and surfaces
- To learn advanced rendering and algorithmic modeling techniques

Course Outcomes:

Student will be able to:

- Apply 3D graphics techniques to generate various models in engineering and science domains
- Design animation sequences and realistic images in virtual reality applications
- Implement parallel renderer on GPU

UNIT-I

Three-Dimensional Geometric Transformations: Three-Dimensional Translation; Three-Dimensional Rotation; Three-Dimensional Scaling; Composite Three-Dimensional Transformations; Other Three-Dimensional Transformations; Transformations between Three-Dimensional Coordinate Systems; Affine Transformations; OpenGL Geometric-Transformation Functions;

Three-Dimensional Viewing: Overview of Three-Dimensional Viewing Concepts; The Three-Dimensional Viewing Pipeline; Three-Dimensional Viewing-Coordinate Parameters; Transformation from World to Viewing Coordinates; Projection Transformations; Orthogonal Projections; Oblique Parallel Projections; Perspective Projections; The Viewport Transformation and Three-Dimensional Screen Coordinates; OpenGL Three-Dimensional Viewing Functions

UNIT-II

Computer Animation: Raster Methods for Computer Animation; Design of Animation Sequences; Traditional Animation Techniques; General Computer-Animation Functions; Computer-Animation Languages; Key-Frame Systems; Motion Specifications; Character Animation; Periodic Motions; OpenGL Animation Procedures

Three-Dimensional Object Representations: Polyhedral; OpenGL Polyhedron Functions; Curved Surfaces; Quadric Surfaces; Super quadrics; OpenGL Quadric-Surface and Cubic Surface Functions

UNIT-III

Spline Representations: Inter polation and Approximation Splines; Parametric Continuity Conditions; Geometric Continuity Conditions; Spline Specifications; Spline Surfaces; Trimming Spline Surfaces; Cubic-Spline Interpolation Methods; Bézier Spline Curves ; Bézier Surfaces ;B-Spline Curves; B-Spline Surfaces; Beta-Splines; Rational Splines; Conversion Between Spline Representations; Displaying Spline Curves and Surfaces; OpenGL Approximation-Spline Functions.

Other Three-Dimensional Object Representations: Blobby Objects; Sweep Representations; Constructive Solid-Geometry Methods; Octrees; BSP Trees; Physically Based Modeling.

UNIT-IV

Texturing and Surface-Detail Methods: Modeling Surface Detail with Polygons; texture Mapping; Bump mapping; Frame Mapping; OpenGL Texture Functions.

Algorithmic Modeling: Fractal-Geometry Methods, Fractal-Generation Procedures, Classification of Fractals, Fractal Dimension, Geometric Construction of Deterministic Self-Similar Fractals, Geometric Construction of Statistically Self-Similar Fractals. Affine Fractal-Construction methods, Random Midpoint-Displacement Methods, Controlling Terrain Topography, Self-squaring Fractals, Base Modeling Methods Self-inverse Fractals; Particle Systems; Grammar.

UNIT-V

Advanced Rendering: Going Beyond Pipeline Rendering, Ray Tracing, Building a Simple Ray Tracer; The Rendering Equation; Radiosity; Global Illumination and Path Tracing; Render Man; Parallel Rendering; Hardware GPU Implementations; Implicit Functions and Contour Maps ; Volume Rendering; Is surfaces and Marching Cubes; Marching Tetrahedral; Mesh Simplification; Direct Volume Rendering; Image-Based Rendering.

Suggested Reading:

1. Hearn Donald, Pauline Baker M., Computer Graphics with OpenGL, Pearson Education, 4thEdition, 2011.
2. Edward Angel, Dave Shreiner, Interactive Computer Graphics A Top-Down Approach with WebGL, 7th Edition, Addison-Wesley 2015
3. Foley, Vandam, Feiner, Hughes, Computer Graphics- Principles & Practice, Addison- Wesley, 2ndEdition,1996.
4. David F Rogers, Procedural Elements for Computer Graphics, McGraw-Hill, 2ndEdition, 2001.
5. Hill,Jr. &Kelley by F.S., Hill Jr, Kelley Jr, Stephen M, Computer Graphics Using OpenGL, PHI, 3rdEdition, 2009.

Course Code	Course Title						Core/Elective
PE 603 CS	**ADVANCED DATABASES**						Elective
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- To understand the concept of storing complex types using object oriented data bases To learn the concepts of XML Schema, X Path and X Query
- To familiarize the concepts of query processing and optimization
- To learn the concepts of fragmentation, replication and concurrency in distributed databases

Course Outcomes:

Student will be able to:

- Describe the features added to object-relational systems to distinguish them from standard relational systems.
- Model a relational / semi-structured database using XML Schema
- Understand different algorithms used in the implementation of query evaluation engine
- Understand the different concurrency control and commit protocols in distributed databases
- Demonstrate an understanding of the role and the concepts involved in special purpose databases such as Temporal, Spatial, Mobile and other similar database types

UNIT-I

Object Based Databases: Overview, Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multi-set. Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R features, Persistent Programming Languages, Object-Relational Mapping, and Object-Oriented versus Object-Relational.

UNIT-II

XML: Motivation, Structure of XML data, XML Document Schema, Querying and Transformation, Application Program Interface to XML, Storage of XML data, XML applications.

UNIT-III

Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, join Operation, Other Operations, Evaluation of Expressions.

Query Optimization: Overview, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized Views.

UNIT-IV

Parallel Databases : Introduction, 1/0 Parallelism, Inter query Parallelism, Intra query Parallelism, Intra-operation Parallelism, Interoperation Parallelism, Query Optimization, Design of Parallel Systems.

Distributed Databases: Homogeneous and Heterogeneous Database, Distributed Data Storage, Distributed. Transactions, Commit Protocols, Concurrency Control in Distributed Databases, Availability and Distributed Query Processing, Heterogeneous Distributed Databases, Cloud-Based Databases and Directory Systems.

UNIT-V

Advanced Application Development: Performance Tuning, Performance Benchmarks Other Issues in Application Development, Standardization.

Spatial and Temporal Data and Mobility: Motivation, Time in Databases, Spatial and Geographic Data, Multimedia Databases, Mobility and Personal Databases.

Suggested Reading:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, Database System Concepts, McGraw Hill International Edition, 6thEdition, 2010.
2. Elmasri Navathe, Somayajulu, Gupta, Fundamentals of Database Systems, Pearson Education, 4thEdition, 2006.
3. CJ Date, A Kannan, S Swamynathan, An Introduction to Database Systems, Pearson Education, 8thEdition, 2006.
4. Raghu Rama Krishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill International Edition, 3rdEdition, 2002.

Course Code	Course Title						Core/Elective
PC 651 CS	**SOFTWARE ENGINEERING LAB**						Core
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**25**	**50**	**1**

Course Objectives:

- To understand the software engineering methodologies for project development.
- To gain knowledge about open source tools for Computer Aided Software Engineering
- To develop test plans and perform validation testing.

Course Outcomes:

Student will be able to:

- Use open source case tools to develop software
- Analyze and design software requirements in efficient manner.
- Implement the design , debug and test the code

Prepare the following documents for each experiment and develop the software using software Engineering methodology

1. **Problem Analysis and Project Planning-** Thorough study of the problem–Identify Project scope, Objectives and Infrastructure.
2. **Software Requirement Analysis-** Describe the individual Phases/modules of the project and Identify deliverables.
3. **Data Modelling-Use work products–**data dictionary, use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams.
4. **Software Development and Debugging–**implement the design by coding
5. **Software Testing-** Prepare test plan, perform validation testing, coverage analysis, memory leaks, develop test case hierarchy, Site check and site monitor

Sample Experiments:

Academic domain

1. Course Registration System
2. Student marks analyzing system **Railway domain**
3. Online ticket reservation system
4. Platform assignment system for the trains in a railway station **Medicine domain**
5. Expert system to prescribe the medicines for the given symptoms
6. Remote computer monitoring **Finance domain**
7. ATM system
8. Stock maintenance **Human Resource management**
9. Quiz System
10. E-mail Client system

SOFTWAREREQUIRED: Open source Tools: Star UML / UML Graph / Top cased

Course Code	Course Title						Core/Elective
PC 652 CS	**WEB PROGRAMMING LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**25**	**50**	**1**

Course Objectives:

- Learn to create WebPages using HTML 5
- Learn to process XML documents using SAX/DOM API
- Learn to create dynamic web pages using server side scripting

Course Outcomes:

Student will be able to:

- Design a Web site using HTML/DHTML and style sheets
- Create dynamic web pages using server side scripting
- Develop a web application with backend database connectivity

List of Experiments:

1. Develop College Website using HTML5 and CSS\
2. Develop HTML5 form with client validations using Java Script
3. Publishing XML document using XSLT
4. XML document processing using SAX and DOM
5. Write a program to encrypt the given number to display the encrypted data using JavaScript
6. Write a Python program which generates an output file based on one-line instructions in an input file
7. Develop a simple Java Servlet application
8. Develop a Java Servlet application with session tracking
9. Develop a simple JSP application
10. Creation of an application to have access from a database using JDBC
11. Develop a full-fledged web application with database access spreading over to 3 session
12. Write a web application using Ajax to do the following:

A. check to make sure that the credit card number is composed of exactly 16 numerical digits

A check to make sure that a Visa card number starts with a "4" and a MasterCard Number starts with a "5"You can check for these things using regular expressions in combination with the PHP function preg_match. A really good regex will allow for an optional"- "between every grouping of 4numbers. For example, 4111111111111111 and 4111-1111-1111-1111 would both be valid credit card numbers. If the user has not supplied a card number with the correct number of digits, show an error message.

Course Code	Course Title						Core/Elective
PC 653 CS	**COMPUTER NETWORKS & PROGRAMMING LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**25**	**50**	**1**

Course Objectives:

- To familiarize POSIX: IPC
- To use socket interface to write client-server network applications
- To effectively use sockets to write simple network monitoring tools

Course Outcomes:

Student will be able to:

- Write concurrent programs using message queues and semaphores
- Use connection-oriented , connectionless and Asynchronous sockets
- 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

Note: The above experiments[2-7] have to be carried out using socket programming interface. Multi- threading has to be employed wherever it is required.

Suggested Reading:

1. Andrew S.Tanenbaum, David J.Wetherall, Computer Networks, 5th Edition, Pearson, 2012
2. Chwan-Hwa (John)Wu, J.David Irwin, Introduction to Computer Networks and Cyber Security, CRC Press, 2013
3. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, 5th Edition, Addison-Wesley, 2012
4. W. Richard Stevens, Unix Network Programming, Prentice Hall / Pearson Education, 2009
5. W.Richard Stevens, Andrew M Rudoff, Bill Fenner, Unix Network Programming: Networking APIs: Sockets and XTI (Volume 1) 3rd Edition, PHI

Course Code	Course Title						Core / Elective
OE 601 CE	**DISASTER MANAGEMENT**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

Course Outcomes

- The students will be able to understand impact on Natural and manmade disasters.
- Able to classify disasters and destructions due to cyclones
- Able to understand disaster management applied in India

UNIT-I

Introduction to Disasters: Concepts and definitions of Disaster, Hazard, Vulnerability, Resilience, Risks. Natural and Manmade disasters, impact of drought, review of past disasters and drought in India, its classification and characteristics. Classification of drought, causes, Impacts (including social, economic. political, environmental, health, psychosocial, etc.).

UNIT-II

Disaster: Classifications, Causes, Impacts including social, economic, political, environmental, health, psychosocial etc. Differential Impacts, in terms of caste, class, gender, age, location, disability Global trends in disasters, urban disasters, pandemics, complex emergencies, climate change. Cyclones and Floods: Tropical cyclones & Local storms, Destruction by tropical cyclones and local storms, Cumulative atmospheric hazards/ disasters, Cold waves, Heat waves, Causes of floods, Rood hazards in India.

UNIT-III

Approaches to Disaster Risk Reduction: Disaster cycle, its analysis, Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural sources, roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRis/ULBs), states, Centre, and other stake-holders.

UNIT-IV

Inter-relationship between Disasters and Development: Factors affecting Vulnerabilities, differential impacts, impact of development projects such as darns, embankments, changes in Land-use etc. Climate Change, Adaptation, Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT-V

Disaster Risk Management in India: Hazard and Vulnerability profile of India

Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, OM Act and Policy, other related policies, plans, programmes and legislation)

Field Work and Case Studies: The field work is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the college is located.

Suggested readings:

1. Sharma V. K., "**Disaster Management, National Centre for Disaster Management**", IIPE, Delhi, 1999.
2. Gupta Anil K, and Sreeja S. Nair., "**Environmental Knowledge for Disaster Risk Management"**, NIDM, New Delhi, 2011.
3. Nick., **"Disaster Management: A Disaster Manager's Handbook"** Asian Development Bank, Manila Philippines, 1991.
4. Kapur, et al. , "**Disasters in India Studies of Grim Reality"**, Rawat Publishers, Jaipur, 2005.
5. Pelling Mark, "**The Vulnerability of Cities**: **Natural Disaster and Social Resilience**", Earth scan publishers, London, 2003.

Course Code	Course Title						Core / Elective
OE 602 CE	**GEO-SPATIAL TECHNIQUES**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- Description about various spatial and non-spatial data types, and data base management techniques
- Development of the concepts and professional skills in utility of geospatial techniques Enhancement of knowledge of geospatial techniques to field problems

Course Outcomes

- The students will be able to understand and apply GIS tools
- Will be able to analyse and process data to apply to the GIS tools.
- Will be able assimilate knowledge on field problems using remote sensing

UNIT I

Introduction: Basic concepts, socioeconomic challenges, fundamentals of geographical information systems (GIS), history of geographical information system, components of geographical information systems. Projections and Coordinate Systems: Map definitions, representations of point, line, polygon, common coordinate system, geographic coordinate system, map projections, transformations map analysis.

UNIT II

Data Acquisition and Data Management: data types, spatial, non-spatial (attribute) data, data structure and database management, data format, vector and raster data representation, object structural model filters and files data in computer, key board entry, manual digitizing, scanner, aerial photographic data, remotely sensed data, digital data, cartographic database, digital elevation data, data compression, data storage and maintenance, data quality and standards, precision, accuracy, error and data uncertainty. Data Processing: Geometric errors and corrections, types of systematic and non-systematic errors, radiometric errors and corrections, internal and external errors.

UNIT III

Data Modeling: Spatial data analysis, data retrieval query, simple analysis, recode overlay, vector data model, raster data model, digital elevation model, cost and path analysis, knowledge based system. GIS Analysis and Functions: Organizing data for analysis, analysis function, maintenance and analysis of spatial data, buffer analysis, overlay analysis, transformations, conflation, edge matching and editing, maintenance and analysis of spatial and non-spatial data

UNIT IV

Applications of GIS: Environmental and natural resource management, soil and water resources, agriculture, land use planning, geology and municipal applications, urban planning and project management, GIS for decision making under uncertainty, software scenario functions, standard GIS packages, introduction to Global Positioning Systems (GPS) and its applications.

UNIT V

Introduction to Remote Sensing: General background of remote sensing technology, objectives and limitations of remote sensing, electro-magnetic radiation, characteristics, interaction with earth surface and atmosphere, remote sensing platforms and sensors, satellite characteristics, digital image processing, IRS series and high resolution satellites, software scenario functions, remote sensing applications to watershed modeling, environmental modeling, urban planning and management.

Suggested readings:

1. Burrough, P. A., and McDonnell R. A., '**Principles of Geographical Information Systems'**, Oxford University Press, New York, 1998.
2. Choudhury S., Chakrabarti, D., and Choudhury S. **'An Introduction to Geographic Information Technology**', I.K. International Publishing House (P) Ltd, New Delhi, 2009.
3. Kang-tsung Chang , "**Introduction to Geographical information Systems'**, Tata McGraw-Hill Publishing Company Ltd., Third Edition, New Delhi, 2006.
4. Lilysand T.M., and Kiefer R.W. '**Remote Sensing and Image Interpretation'**, John Wiley and Sons, Fourth Edition, New York, 2002.
5. Tor Bernhardsen, **'Geographical Information System'**, Wiley India (P) Ltd., Third Edition, New Delhi, 2002.
6. Hoffman-Wellenhof, B, et al. '**GPS Theory and Practice'**, Fourth Edition, Springer Wein, New York, 1997.

Course Code	Course Title						Core / Elective
OE 601 CS	**OPERATING SYSTEMS**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- To understand CPU, Memory, File and Device management
- To learn about concurrency control, protection and security
- To gain knowledge of Linux and Windows NT internals

Course Outcomes

- Explain the components and functions of operating systems.
- Analyze various Scheduling algorithms.
- Apply the principles of concurrency
- Compare and contrast various memory management schemes
- Perform administrative tasks on Linux Windows Systems

UNIT-I

Introduction to Operating Systems: OS structure and strategies, Process concepts, Threads, Inter process communication. CPU scheduling algorithms, Process synchronization, Critical section problem, Semaphores, Monitors.

UNIT-II

Memory Management: Swapping, Contiguous allocation, Paging, Static and Dynamic partitions, Demand paging, Page replacement algorithms, Thrashing, Segmentation, Segmentation with paging. File system interface: File concepts, Access methods and protection. File system implementation: File system structure, Allocation methods, Directory implementation.

UNIT-III

Deadlocks: Necessary conditions, Resource allocation graph, Methods for handling deadlocks, Prevention, Avoidance, Detection and Recovery. Protection: Goals, Domain of protection, Access matrix. Security: Authentication, Threat monitoring, Encryption. UNIT-IV Device Management: Disk scheduling methods, Disk management, Device drivers and interfaces, CPU- Device interactions, I/O optimization.

UNIT-V

Case Studies: The Linux System, Design principles, Kernel modules, Process management, Scheduling, Memory management, File systems, Input and Output, Inter process communication Windows NT, General Architecture, The NT kernel, The NT executive

Suggested readings:

1. Abraham Silberschatz, Peter B Galvin, ***"Operating System Concepts",*** Addison Wesley, 2006
2. William Stallings, "***Operating Systems-Internals and Design Principles"***, 8th edition, Pearson, 2014
3. Andrew S Tanenbaum, "***Modern Operating Systems"***, 4th edition, Pearson, 2016.

Course Code	Course Title						Core / Elective
OE 602 CS	**OOPS USING JAVA**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- To introduce fundamental object oriented concepts of Java programming Language, such as classes, inheritance packages and interfaces.
- To introduce concepts of exception handling and multi-threading.
- To use various classes and interfaces in java collection framework and utility classes.
- To understand the concepts of GUI programming using AWT controls.
- To introduce Java I/O streams and serialization

Course Outcomes

- Able to develop java applications using OO concepts and packages.
- Able to write multi-threaded programs with synchronization
- Able to implement real world applications using java collection frame work and I/O classes Able to write Event driven GUI programs using AWT/Swing

UNIT – I

Object Oriented System Development: understanding object oriented development, understanding object oriented concepts, benefits of object oriented development. Java Programming Fundamentals: Introduction, overview of Java, data types, variables and arrays, operators, control statements

UNIT – II

Java Programming Object Oriented Concepts: classes, methods, inheritance, packages and interfaces. Exceptional Handling, Multithreaded Programming

UNIT – III

I/O Basics, Reading Console Input and Output, Reading and Writing Files, Print Writer Class, String Handling Exploring Java. Lang, Collections Overview, Collection Interfaces, Collection Classes, Iterators, Random Access Interface, Maps, Comparators, Arrays, Legacy Classes and Interfaces, String Tokenizer

UNIT – IV

Introducing AWT Working with Graphics: AWT Classes, Working with Graphics Event Handling: Two Event Handling Mechanisms, the Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces. AWT Controls: Control Fundamentals, Labels, Using Buttons, Applying Check Boxes, Check box Group, Choice Controls, Using Lists, Managing Scroll Bars, Using Text Field, Using Text Area, Understanding Layout Managers, Menu bars and Menus, Dialog Boxes, File Dialog, Handling events by Extending AWT Components, Exploring the controls, Menus and Layout Managers.

UNIT – V

Java I/O Classes and Interfaces: Files, Stream and Byte Classes, Character Streams, Serialization.

Suggested readings:

1. Herbert Schildt, "**The Complete Reference JAVA"**, Tata McGraw Hill, 7thEdition, 2005
2. James M Slack, **"Programming and Problem Solving with JAVA"**, Thomson learning, 2002
3. C.Thomas Wu,**"An Introduction to Object-Oriented Programming with Java"**, Tata McGraw Hill, 5thEdition, 2005.

Course Code	Course Title						Core/Elective
OE601IT	**DATABASE SYSTEMS**						**Elective**
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- To introduce E-R Model and Normalization
- To learn formal and commercial query languages of RDBMS
- To understand the process of database application development
- To study different database architectures
- To introduce security issues in databases

Course Outcomes:

Student will be able to:

- Understand the mathematical foundations of Database design
- Model a set of requirements using the Entity Relationship (E-R)Model , transform an E-R model into a relational model ,and refine the relational model using theory of Normalization
- Understand the process of developing database application using SQL
- Understand the security mechanisms in RDBMS

UNIT 1

Design: Conceptual design (E-R modeling), the relational model, normalization

UNIT II

Queries: algebra and logic (relational algebra and calculus), relational query languages and queries (namely SQL),select, project, join, union, intersection, except, recursion, aggregation, data manipulation

UNIT III

Applications: application development, database application interfaces (e.g., JDBC), internet applications,proper database application paradigms, transactions, transaction management, concurrency control, crash recovery

UNIT IV

Distributed DB, Architecture, Query processing and Optimization in Distributed DB, Introduction to NoSQL Databases, Graph databases, Columnar Databases

UNIT V

Introduction to Database Security Issues, Security mechanism, Database Users and Schemas, Privileges

Suggested Books

1. Jim Melton and Alan R. Simon.SQL 1999: Understanding Relational Language Components.First Edition, 1999.Morgan Kaufmann Publishers.
2. Don Chamberlin.Using the New DB2: IBM's Object-Relational Database System.First Edition, 1996.Morgan Kaufmann Publishers.
3. Database System Concepts Sixth Edition, by Abraham Silberschatz , Henry F Korth, S Sudarshan,Mc Graw-Hill Education
4. Fundamentals of Database Systems , Elmasri, Navathe, Sixth Edition , Addison- Wesley

Course Code	Course Title						Core / Elective
OE 601 EC	**PRINCIPLES OF EMBEDDED SYSTEMS**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	0	0	**30**	**70**	3

Course Objectives

- To understand the fundamentals of embedded systems
- To study the block diagram and advanced hardware fundamentals
- To study the software architecture of embedded systems
- To learn the tool chain of embedded systems
- To understand the tools and debugging process of embedded systems.

Course Outcomes

Student will be able:

- To acquire an overview of what an embedded system implies
- To understand the architecture of a microprocessor and microcontroller to enable to design embedded applications using them.
- To apply theoretical learning to practical real time problems for automation.
- To understand how to build and debug an embedded system application.
- To analyze and design real world applications and interface peripheral devices to the microprocessor.

UNIT – I

Fundamentals of Embedded Systems: Definition of Embedded system, Examples of Embedded Systems, Typical Hardware, Terminology, Gates, A few other basic considerations, Timing Diagrams, Memory

UNIT – II

Advanced Hardware Fundamentals: Microprocessors, Buses, Direct Memory Access, Interrupts, Other Common Parts, Built-Ins on the Microprocessor, Conventions used in Schematics, Microprocessor Architecture, Interrupts Basics, Shared Data Problem, Interrupt Latency.

UNIT – III

Software Architecture of Embedded Systems: Round- Robin, Round-Robin with Interrupts, Function-Queue- Scheduling Architecture, Real- Time Operating System Architecture, Selecting Architecture

UNIT – IV

Embedded Software Development Tools: Host and Target Machines, Cross compilers, Cross Assemblers and Tool Chains, Linkers /Locaters for Embedded Software, Getting Embedded Software into Target System: PROM programmers, ROM Emulators, In-Circuit Emulators.

UNIT – V

Debugging Techniques: Testing on your host machine, Instruction Set Simulators, The assert Macro, Using Laboratory Tools

Suggested readings:

1. David. E. Simon, "**An Embedded Software Primer**", Low price edition, Pearson Education, New Delhi, 2006.
2. Frank Vahid and Tony Givargis "**Embedded System Design: A Unified Hardware/Software. Approach"**. John Wiley & Sons, October 2001.
3. Rajkamal, "**Embedded systems: Programming, architecture and Design",** second edition, McGraw-Hill Education (India), March 2009.

Course Code	Course Title						Core / Elective
OE 602 EC	**DIGITAL SYSTEM DESIGN USING VERILOG HDL**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	0	0	**30**	**70**	3

Course Objectives

- Describe Verilog hardware description languages (HDL).
- Develop Verilog HDL code for combinational digital circuits.
- Develop Verilog HDL code for sequential digital circuits.
- Develop Verilog HDL code for digital circuits using switch level modeling and describes system tasks, functions and compiler directives
- Describes designing with FPGA and CPLD.

Course Outcomes

After completion of this course, students should be able:

- To understand syntax of various commands, data types and operators available with verilog HDL
- To design and simulate combinational circuits in verilog
- To design and simulate sequential and concurrent techniques in verilog
- To write Switch level models of digital circuits
- To implement models on FPGAs and CPLDs

UNIT I

Introduction to Verilog HDL: Levels of Design Description, Concurrency, Simulation and Synthesis, Function Verification, System Tasks, Programming Language Interface, Module, Simulation and Synthesis Tools

Verilog Data Types and Operators: Binary data manipulation, Combinational and Sequential logic design, Structural Models of Combinational Logic, Logic Simulation, Design Verification and Test Methodology, Propagation Delay, Truth Table models using Verilog.

UNIT II

Combinational Logic Circuit Design using Verilog: Combinational circuits building blocks: Multiplexers, Decoders , Encoders , Code converters, Arithmetic comparison circuits, Verilog for combinational circuits , Adders-Half Adder, Full Adder, Ripple-Carry Adder, Carry Lookahead Adder, Subtraction, Multiplication.

UNIT III

Sequential Logic Circuit Design using Verilog: Flip-flops, registers & counters, synchronous sequential circuits: Basic design steps, Mealy State model, Design of FSM using CAD tools, Serial Adder Example, State Minimization, Design of Counter using sequential Circuit approach.

UNIT IV

Switch Level Modeling: Basic Transistor Switches, CMOS Switches, Bidirectional Gates, Time Delays with Switch Primitives, Instantiation with Strengths and Delays, Strength Contention with Trireg Nets.

System Tasks Functions and Compiler Directives: Parameters, Path Delays, Module Parameters. System Tasks and Functions, File Based Tasks and Functions, Computer Directives, Hierarchical Access, User Defined Primitives.

UNIT V

Designing with FPGAs and CPLDs: Simple PLDs,ComplexPLDs,Xilinx 3000 Series FPGAs, Designing with FPGAs, Using a One-Hot State Assignment, Altera Complex Programmable Logic Devices (CPLDs), Altera FLEX 10K Series CPLDs.

Suggested readings:

1. T.R. Padmanabhan, B Bala Tripura Sundari, "**Design Through Verilog HDL**", Wiley 2009.
2. Samir Palnitkar, "**Verilog HDL**", 2nd Edition, Pearson Education, 2009.
3. Stephen Brown, Zvonko Vranesic , "**Fundamentals of Digital Logic with Verilog Design**, TMH, 2nd Edition 2003.

Course Code	Course Title						Core / Elective
OE 601 EE	**RELIABILITY ENGINEERING**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	0	0	**30**	**70**	3

Course Objectives

- To understand the concepts of different types of probability distributions importance of reliability evaluation of networks.
- To make the students understand about Reliability, availability model of Power Systems and markov modeling of Power Plants. With identical and no identical units.

Course Outcomes

- Able to understand the meaning of discrete and continuous random variables and their significance, causes of failures of a system.
- Able to acquire the knowledge of different distribution functions and their applications.
- Able to develop reliability block diagrams and evaluation of reliability of different systems.

UNIT- I

Discrete and Continuous Random Variables: probability density function and cumulative distribution function, Mean and Variance, Binomial, Poisson, Exponential and Weibull distributions.

UNIT, II

Failure and Causes of Failure: Failure rate and failure density, Reliability function and MTTF, Bath tub curve for different systems, parametric methods for above distributions, Non- Parametric methods from field data.

UNIT- III

Reliability Block Diagram: Series and parallel systems, Network reduction technique, Examples, Evaluation of failure rate, MTTF and reliability, Active and Standby Redundancy, r out of n configuration. Non-series, parallel systems. Path based and cut set methods.

UNIT- IV

Availability, MTTR and MTBF: Markov models and State transition matrices, Reliability models for single component, two components, Load sharing and standby systems, Reliability and availability models of two unit parallel system with repair and standby systems with repair.

UNIT- V

Repairable Systems: Maintainability, Preventive maintenance, Evaluation of reliability and J1TTF, Overhauling and replacement, Optimum maintenance policy, Markov model of a power plant with identical units and non-identical unit, Capacity outage probability table. Frequency of failures and Cumulative frequency

Suggested readings:

1. Charles E.Ebeling, "**Reliability and Maintainabelity Engineering**", Mc Graw Hill International Edition, 1997.
2. Balaguruswamy, "**Reliability Engineering,**"Tata McGraw Hill Publishing company Ltd,1984.
3. R.N.Allan. "**Reliability Evaluation of Engineering Systems**", Pitman Publishing, 1996.
4. Endrenyi. "Reliability Modelling in Electric Power Systems". JohnWiley & Sons, 1978.

Course Code	Course Title						Core / Elective
OE602EE	BASICS OF POWER ELECTRONICS						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	0	0	30	70	3

Course Objectives

- To be able to understand various power switching devices, characteristics and applications.
- To learn and understand the various converters like rectifiers, choppers and inverters principle operation, characteristics and applications.

UNIT I: Power Switching Devices

Concept of power electronics, scope and applications, types of power converters; Power semiconductor switches and their V-I characteristics - Power Diodes, Power BJT, SCR, Power MOSFET, Power IGBT; Thyristor ratings and protection, methods of SCR commutation, UJT as a trigger source, gate drive circuits for BJT and MOSFETs

UNIT II: AC-DC Converters (Phase Controlled Rectifiers)

Principles of single-phase fully-controlled converter with R, RL, and RLE load, Principles of single-phase half-controlled converter with RL and RLE load, Principles of three-phase fully-controlled converter operation with RLE load, Effect of load and source inductances, General idea of gating circuits, Single phase and Three phase dual converters

UNIT III: DC-DC Converters (Chopper/SMPS)

Introduction, elementary chopper with an active switch and diode, concepts of duty ratio, average inductor voltage, average capacitor current Buck converter - Power circuit, analysis and waveforms at steady state, duty ratio control of output voltage. Boost converter - Power circuit, analysis and waveforms at steady state, relation between duty ratio and average output voltage. Buck-Boost converter - Power circuit, analysis and waveforms at steady state, relation between duty ratio and average output voltage

UNIT IV: DC-AC Converters (Inverters)

Introduction, principle of operation, performance parameters, single phase bridge inverters with R, RL loads, 3-phase bridge inverters - 120 and 180 degrees mode of operation, Voltage control of single phase inverters –single pulse width modulation, multiple pulse width modulation, sinusoidal pulse width modulation.

UNIT V: AC-AC Converters

Phase Controller (AC Voltage Regulator)-Introduction, principle of operation of single phase voltage controllers for R, R-L loads and its applications. Cycloconverter-Principle of operation of single phase cycloconverters, relevant waveforms, circulating current mode of operation, Advantages and disadvantages

Suggested Reading:

1. Singh.M.D and Khanchandani.K.B, Power Electronics, Tata McGraw Hill, 2nd Edition, 2006.
2. Rashid.M.H, Power Electronics Circuits Devices and Applications. Prentice Hall of India, 2003
3. M.S.Jamil Asghar, Power Electronics, Prentice Hall of India, 2004 With effect from Academic Year 2016-2017
4. Bimbra.P.S, Power Electronics, Third Edition, Khanna Publishers, 1999
5. Mohan, Undeland, Robbins, Power Electronics, John Wiley, 1996

Course Code	Course Title						Core / Elective
OE 601 ME	**INDUSTRIAL ROBOTICS**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- To familiarize the student with the anatomy of robot and their applications.
- To provide knowledge about various kinds of end effectors usage.
- To equip the students with information about various sensors used in industrial robots.
- To make the student understand the importance of spatial transformation of robots using forward and inverse kinematics.
- To specify and provide the knowledge of techniques involved in robot vision in industry.
- To equip students with latest robot languages implemented in industrial manipulators.

Course Outcomes

- Able to demonstrate knowledge of the relationship between mechanical structures of industrial robots and their operational workspace characteristics and have an understanding of the functionality and limitations of robot actuators and sensors.
- Able to demonstrate an ability to apply spatial transformation to obtain forward/Inverse kinematics equation of robot manipulators using analytical/numerical/simulation tools.
- Able to apply knowledge and choose the best & economically suitable sensors/end effectors required for specific applications.
- Able to understand the importance of robot vision and apply the learnt techniques to get the required information from input images.
- Able to design and develop a industrial robot for a given purpose economically.
- Appreciate the current state and potential for robotics in new application areas.

UNIT – I

Introduction to Robotics: Basic structure of Robots. Degree of freedom of Robots, Work envelope, Classification of Robots based on Drive Technology, Work-Envelope and motion control methods. Application of Robots in Industry, Repeatability, Precision and Accuracy as applied to Robots, Specifications of robots used for various applications. End effectors, Grippers: Mechanical grippers, pneumatic and hydraulic grippers, magnetic grippers, vacuum grippers, RCC grippers, Two fingered and three fingered grippers, internal grippers and external grippers, Selection and design considerations.

UNIT – II

Requirements of a Sensor: Principles and Applications of the following types of sensors- Position of sensors (Piezo electric sensor, LVDT, Resolvers, Optical encoders, Pneumatic position sensors), Range sensors (Triangulation principle, Structured, Lighting approach, Time of flight range finders, Laser range meters), Proximity sensors (Inductive, Hall effect, Capacitive, Ultrasonic and Optical proximity sensors), Touch sensors (Binary sensors, Analog sensors), Wrist Sensors, Compliance Sensors, Slip Sensors.

UNIT – III

Kinematic Analysis of Robots: Rotation matrix. Homogeneous transformation matrix, Denavit & Hartenberg representation, Euler and RPY angles representation. Representation of absolute position and orientation in terms of joint parameters, Direct Kinematics of manipulators, Inverse kinematics of Robot arm for position and orientation. Redundancy in Robots, Static force analysis

UNIT – IV

Introduction to Techniques used in Robot Vision: Image acquisition, illumination techniques, imaging geometry, basic relationship pixels, preprocessing, segmentation & description of 3- dimensional structures, their recognition and interpretation. Types of Camera, frame grabbing, sensing and digitizing image data, Signal conversion, Image Storage, Lighting techniques, Image processing and analysis, Data

reduction, Segmentation, Feature extraction, Object recognition, and various algorithms, Applications, Inspection, identification, visual serving and navigation.

UNIT – V

Robot Programming Languages: Characteristics of robot level languages, task level languages. Teach pendant programming, Lead through programming, Robot programming languages, VAL programming, Motion commands, Sensor commands. End effecter commands, Simple programs. RGV, AGV, Implementation of robots in industries, various steps, Safety considerations for robot operations. Economic analysis of robots, Pay back method, EUAC method and Rate of return method

Suggested readings:

1. Groover M P, **"Industrial Robotics"**, McGraw Hill Publications, 1999.
2. Fu. K.S., Gon Zalez R.C., Lee C.S.G. "**Robotics, Control-sensing vision and Intelligence**", McGraw Hill, Int. Ed., 1987.
3. Spong and Vidyasagar, "**Robot Dynamics & Control**", John Wiley and Sons, Ed.,1990.
4. Mittal and Nagrath, "**Industrial Robotics**", Tata McGraw Hill Publications, 2004.
5. Saha & Subir kumar saha, '**Robotics'**, TMH, India.

Course Code	Course Title						Core / Elective
OE 602 ME	**MATERIAL HANDLING**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- To know about the working principle of various material handling equipments.
- To understand the Material handling relates to the loading, unloading and movement of all types of materials.
- To understand the estimation of storage space and maintenance of material handling equipments.

Course Outcomes

- Able to understand various conveying systems that available in industry.
- Able to understand various bulk solids handling systems and their design features.
- Able to understand and various modern material handling systems and their integration.
- Able to calculate number of MH systems required, storage space, cost and maintenance.

UNIT – I

Mechanical Handling Systems: Belt Conveyors and Desing, Bucket Elevators, Package conveyors, Chain and Flight Conveyors, Screw Conveyors, Vibratory Conveyors, Cranes and Hoists.

UNIT – II

Pneumatic and Hydraulic Conveying Systems: Modes of Conveying and High pressure conveying systems, Low Velocity Conveying System. Components of Pneumatic Conveying Systems: General Requirements, Fans and Blowers, Boots-Type Blowers, Sliding-Vane Rotary Compressors, Screw Compressors, Reciprocating Compressors, Vacuum Pumps.

UNIT – III

Solids Handling: Particle and Bulk Properties- Adhesion, Cohesion and Moisture Content. Gravity Flowof Bulk Solids: Static and Dynamic Pressure Distribution in Bulk Solids. Modes of Flow: Mass Flow, Funnel Flow and Expanded Flow from Hoppers, Bins and Silos.

Unit IV

Modern Material Handling Systems: Constructional features of (i) AGV (ii) automated storage and retrieval systems. Sensors used in AGVs and ASRS.Bar code systems and RFID systems: Fundamentals and their integration with computer-based information systems.

UNIT – V

Total MH Throughput: Calculation for no. of MH systems; storage space estimation based on number of aisles. Maintenance of MH equipment, spare parts management, cost of materials handling, cost per unit load computations

Suggested readings:

1. Dr. Mahesh Varma, "**Construction Equipment and its Planning & Application**", Metropolitan Book Co. (P) Ltd., New Delhi, India, 1997.
2. James M. Apple, **"Material Handling Systems Design",** the Ronald Press Company, New York, USA, 1972.
3. Woodcock CR. and Mason J.S., **"Bulk Solids Handling: An Introduction to Practice Technology**", Leonard Hill USA, Chapman and Hall, New York.
4. M P Groover etal, **"Industrial Robotics**", Me Graw Hill, 1999.

Course Code	Course Title						Core / Elective
OE 632 AE	**AUTOMOTIVE SAFETY AND ERGONOMICS**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives:

It is intended to make the students to

- Understand the basics of vehicle collision and its effects
- Understand the various safety concepts used in passenger cars.
- Gain knowledge about various safeties and its equipment.
- Understand the concepts of vehicle ergonomics.
- Gain knowledge about various automotive comforts features.

Course Outcomes:

After the completion of this unit, the student is able to

- Break down the importance of safety in Automobiles
- Describe the various safeties equipment used in Automobiles
- Explain about Vehicle ergonomics and Comforts in Automobiles

UNIT-I

Introduction: Design of the Body for safety, Energy equations, Engine location, Effects of Deceleration inside passenger compartment, Deceleration on impact with stationary and movable obstacle, Concept of Crumble zone and Safety sandwich construction, Active and passive safety, Characteristics of vehicle structures, Optimization of vehicle structures for crash worthiness, Types of crash / roll over tests, Regulatory requirements for crash testing, instrumentation, High speed photography, image analysis.

UNIT-II

Safety Concepts: Active safety- driving safety, Conditional safety, Perceptibility safety and Operating safety, Passive safety: Exterior safety, Interior safety, Deformation behaviour of vehicle body, Speed and acceleration characteristics of passenger compartment on impact, pedestrian safety, human impact tolerance, determination of injury thresholds, severity index, study of comparative tolerance, Study of crash dummies.

UNIT-III

Safety equipments: Seat belt, automatic seat belt fastening system, Collapsible steering column, tilt-able steering wheel, Air bags, electronic systems for activating air bags, Frontal design for safety, collision warning system, Causes of rear end collision, frontal object detection, rear vehicle object detection system, Object detection system with braking system interactions. Anti-lock braking system ESP and EBD systems

UNIT- IV

Vehicle Ergonomics: Introduction to human body - anthropometrics and its application to vehicle ergonomics, Cockpit design, Driver comfort – seating, visibility, Man-machine system- psychological factors – stress, attention, Passenger comfort - ingress and egress, spaciousness, Ventilation, temperature control, Dust and fume prevention and vibration, Interior features and conveniences, Use of modern technology for the same

UNIT-V

Comfort and Convenience System: Cabin comfort - in-car air conditioning – overall energy efficiency, Air management, central and Unitary systems, air flow circuits, air cleaning, ventilation, air space diffusion, Compact heat exchanger design, controls and instrumentation, Steering and mirror adjustment, central locking system, Garage door opening system, tire pressure control system, rain sensor system, environment information system, Automotive lamps, types, design, construction, performance, Light signalling devices- stop lamp, Rear position lamp, Direction indicator, Reverse lamp, reflex reflector,

position lamp, gas discharge lamp, LED, Adoptive front lighting system (AFLS) and Daylight running lamps (DRL).

Suggested Reading

1. Prasad, Priya and BelwafaJamel, "Vehicles Crashworthiness and Occupant Protection", American Iron and Steel Institute, USA.
2. JullianHappian-Smith "An Introduction to Modern Vehicle Design" SAE, 2002
3. Bosch - "Automotive Handbook" - 5th edition - SAE publication - 2000.
4. "Recent development in Automotive Safety Technology", SAE International Publication. Editor: Daniel J Helt, 2013.
5. Keitz H.A.E. "Light Calculations and Measurements", Macmillan 1971.

Course Code	Course Title						Core/Elective
MC 951 SP	**YOGA PRACTICE**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**20**	**30**	**3U**

Course Objectives:

- Enhances body flexibility
- Achieves mental balance
- Elevates Mind and Body co-ordination
- Precise time management
- Improves positive thinking at the expense of negative thinking

Course Outcomes:

Student will be able to:

- Students will become more focused towards becoming excellent citizens with more and more discipline in their day-to-day life.
- An all-round development-physical, mental and spiritual health-takes place.
- Self-discipline and discipline with respect society enormously increases.
- University environment becomes more peaceful and harmonious.

UNIT-I

Introduction: Yoga definition – Health definition from WHO-Yoga versus Health-Basis of Yoga-yoga is beyond science-Zist of 18 chapters of Bhagavadgita- 4 types of yoga: Karma, Bhakti, Gnyana and Raja yoga–Internal and External yoga-Elements of Ashtanga yoga (Yama, Niyama, Asana, Pranayama, Prathyahara, Dharana, Dhyana and Samadhi)-Panchakoshas and their purification through Asana, Pranayama and Dhyana.

UNIT-II

Surya Namaskaras (Sun Salutations): Definition of sun salutations-7 chakras (Mooladhaar, Swadhishtaan, Manipura, Anahata, Vishuddhi, Agnya and Sahasrar)- Various manthras (Om Mitraya, Om Ravaye, Om Suryaya, Om Bhanave, Om Marichaye, Om Khagaye, Om Pushne, Om Hiranya Garbhaye, Om Adhityaya, Om Savitre, Om Arkhaya and Om Bhaskaraya) and their meaning while performing sun salutations-Physiology-7systems of human anatomy-Significance of performing sun salutations.

UNIT-III

Asan as (Postures): Pathanjali's definition of asana-Sthiram Sukham Asanam-3rdlimbofAshtangayoga-Looseningorwarmingupexercises- Sequence of perform in as an as (Standing, Sitting, Prone, Supine and Inverted)-Nomenclature of as an as (animals, trees, rishis etc)-As an as versus Chakras-As an as versus systems-As an as versus physical health-Activation of Annamaya kosha

UNIT-IV

Pranayama (Breathing Techniques): Definition of Pranayama as per Shankaracharya-4th limb of Ashtanga yoga-Various techniques of breathing-Pranayama techniques versus seasons-Band has and their significance in Pranayama-Mudras and their significance in Pranayama-Restrictions of applying band has with reference to health disorders-Pranayama versus concentration-Pranayama is the bridge between mind and body-Pranayam versus mental health-Activation of Pranamaya kosha through Pranayama.

UNIT-V

Dhyana (Meditation): Definition of meditation-7th limb of Ashtanga yoga- Types of mind (Conscious and Sub-Conscious)-various types of dhyana. Meditation versus spiritual health-Dharana and Dhyana-Extention of Dhyana to Samadhi-Dhyana and mental stress-Activation of Mano mayakosha through dhyana- Silencing the mind

Suggested Reading:

1. Light on Yoga by BKS lyengar
2. Yoga education for children Vol-1 by Swami Satyananda Saraswati
3. Light on Pranayama by BKS lyengar
4. Asana Pranayama Mudra and Bandha by Swami Satyananda Saraswati
5. Hatha Yoga Pradipika by Swami Mukhtibodhananda
6. Yoga education for children Vol-11 by Swami Niranjan an and a Saraswati
7. Dynamics of yoga by Swami Satyananda Saraswati

Course Code	Course Title						Core/Elective
MC 952 SP	**NATIONAL SERVICE SCHEME (NSS)**						**Elective**
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**25**	**50**	**3U**

Course Objectives:

- To help in Character Molding of students for the benefit of society
- To create awareness among students on various career options in different fields
- To remold the students behavior with assertive skills and positive attitudes
- To aid students in developing skills like communication, personality, writing and soft skills
- To educate students towards importance of national integration, participating in electoral process etc. by making them to participate in observing important days.

Course Outcomes:

Student will be able to:

- Students will become more focused towards becoming excellent citizens with more and more discipline in their day-to-day life.
- An all-round development-physical, mental and spiritual health-takes place.
- Self-discipline and discipline with respect society enormously increases.
- University environment becomes more peaceful and harmonious.

List of Activities:

1. Orientation programme about the role of NSS in societal development
2. Swachh Bharath Programme
3. Guest lecture's from eminent personalities on personality development
4. Plantation of saplings/Haritha Haram Programme 5.BloodDonation / Blood Grouping Camp
5. Imparting computer education to schoolchildren
6. Creating Awareness among students on the importance of Digital transactions
7. Stress management techniques
8. Health Checkup Activities
9. Observation of Important days like voters day, World Water Day etc.
10. Road Safety Awareness Programs
11. Energy Conservation Activities
12. Conducting Programme' son effective communication skills
13. Awareness programme's on national integration
14. Orientation on Improving Entrepreneurial Skills
15. Developing Effective Leadership skills
16. Job opportunity awareness programs in various defence, public sector undertakings
17. Skill Development Programmes
18. Creating awareness among students on the Importance of Yoga and other physical activities
19. Creatingawarenessamongstudentsonvariousgovernmentsponsoredsocialwelfare schemes for the people

Note: At least Ten Activities should be conducted in the Semester**.** Each event conducted under Swachh Barath, Plantation and important days like voters day, world water day may be treated as a separate activity.

Course Code	Course Title						Core/Elective
MC 953 SP	**SPORTS**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**20**	**30**	**3U**

Course Objectives:

- To develop an understanding of the importance of sport in the pursuit of a healthy and active lifestyle at the College and beyond.
- To develop an appreciation of the concepts of fair play, honest competition and good sportsmanship.
- To develop leadership skills and foster qualities of co-operation, tolerance, consideration, trust and responsibility when faced with group and team problem-solving tasks.
- To develop the capacity to maintain interest in a sport or sports and to persevere in order to achieve success.
- To prepare each student to be able to participate fully in the competitive, recreational and leisure opportunities offered outside the school environment.

Course Outcomes:

Student will be able to:

- Students' sports activities are an essential aspect of university education, one of the most efficient means to develop one's character and personal qualities, promote the fair game principles, and form an active life position.
- Over the past year, sports have become much more popular among our students. Let us remember the most memorable events related to sports and physical training.
- Special attention was paid to team sports. Our male and female games and sports have achieved remarkable progress at a number of competitions.
- Our teams in the main sports took part in regional and national competitions. Special thanks to our team in track and field athletics, which has been revitalized this year at ICT and which has won Javelin competition.
- Staff of our faculties and students of Sports, Physical Development, & Healthy Lifestyle of Faculty congratulates everyone on the upcoming New Year and wishes you robust health and new victories in whatever you conceive.

I. Requirements:

i) Track Pant (students should bring)
ii)Shoes
iii) Volley Ball, Foot Ball and Badminton (Shuttle)
iv) Ground, Court, indoor stadium and swimming pool

II. Evaluation Process:

Total Marks 50
i) 20marks for internal exam (continuous evaluation) a) 8 marks for viva
b) 12marks for sports & fitness

ii) 30marksforendexam a) 10marks for viva
b) 20marks for sports & fitness

Course Code	Course Title						Core/Elective
SI 671 ME	**SUMMER INTERNSHIP**						**Core**
Prerequisite	**L**	**T**	**D**	**P**	**CIE**	**SEE**	**Credits**
-	**0**	**0**	**0**	**2**	**50**	**0**	**2***

Course Objectives: To prepare the students

- To give an experience to the students in solving real life practical problems with all its constraints.
- To give an opportunity to integrate different aspects of learning with reference to real life problems.
- To enhance the confidence of the students while communicating with industry engineers and give an opportunity for useful interaction with them and familiarize with work culture and ethics of the industry.

Course Outcomes: On successful completion of this course student will be

- Able to design/develop a small and simple product in hardware or software.
- Able to complete the task or realize a prespecified target, with limited scope, rather than taking up a complex task and leave it.
- Able to learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to prespecified criteria.
- Able to implement the selected solution and document the same.

Summer Internship is introduced as part of the curricula for encouraging students to work on problems of interest to industries. A batch of two or three students will be attached to a person from an Industry / R & D Organization / National Laboratory for a period of 4 weeks. This will be during the summer vacation following the completion of the VI semester course. One faculty member will act as an internal guide for each batch to monitor the progress and interacts with the Industry guide.

After the completion of the project, students 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 sessional marks are based on the performance of the student at the work place and awarded by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will coordinate the overall activity of Summer Internship.

Note: * Students have to undergo summer internship of 4 weeks duration at the end of semester VI and credits will be awarded after evaluation in VII semester.