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, 8th Edition, Prentice Hall of India, 2012
2. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, 5th Edition, 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.