ANNEXTURE I
GOA UNIVERSITY
SECOND YEAR OF BACHELOR'S DEGREE COURSE IN COMPUTER ENGINEERING
(Revised in 2007-08)
SCHEME OF INSTRUCTION AND EXAMINATION

SEMESTER IV

Sub Code	Subjects	Scheme of Instruction Hrs/Week			Scheme of Examination					
		L	T	P	Th. Dur (Hrs)	Marks				
						Th.	S	P	O	Total
CE4.1DMS	Discrete Mathematical structures	3	1	0	3	100	20+5	-	-	125
CE4.2DS	Data Structures	3	1	2	3	100	20+5	50	-	175
CE4.3CO	Computer Organization	3	1	2	3	100	20+5	-	-	125
CE4.4EM	Electronic Measurements	3	1	0	3	100	20+5	-	-	125
CE4.5SAD	System Analysis and Design	3	1	2	3	100	20+5	-	-	125
CE4.6OOPC	Object Oriented Programming And Design using C++	3	1	2	3	100	20+5	50	-	175
	TOTAL	18	06	8	-	600	150	100	-	850

L-Lectures, T-Tutorials P-Practicals
Th-.Dur.- Duration of Theory paper
Th-Theory, S-Sessional, P-Pracital, O-Oral.

25 Sessional marks will be split as follows:

20 marks are for the Internal Test
5 marks are for continuous evaluation of Practicals/Assignments

CE4.1DMS DISCRETE MATHEMATICAL STRUCTURES

Lectures per week	:	3+1+0
Max. Marks for Theory paper	:	100
Max. Marks for Sessionals	:	20 + 5
Duration of paper	:	3 hours
Total no. of modules	:	4
No. of questions from each module	:	2
Total no. of questions to be answered	:	5

(At least one question from each module with two compulsory questions from any one module.)

MODULE 1

Set Theory (3 Hrs)

Set Operations**,** Relations, Equivalence Relations and Partially Ordered Sets**.**

Integers and Division (4 Hrs)

Divisibility in the Set of Integers, Fundamental Theorem of Arithmetic, Division algorithm, Modular Arithmetic**,** Congruence and Properties**.**

Functions: (2 Hrs)

One-to-One Functions, Onto Functions**,** One-to-One Correspondence, Inverse Function, Composition of functions.

Counting Principles: (5 Hrs)

Pigeon Hole Principle and Inclusion – Exclusion Principle with Applications.

MODULE 2

Monoids: (2 Hrs)

Introduction to monoids**,** Submonoids, Submonoid generated by a set.

Groups: (6 Hrs)

Introduction to Groups, Abelian groups, Subgroups, Subgroup generated by a set, Cyclic groups, Normal sub groups, Group homomorphism and isomorphism.

Vector spaces: (6 Hrs)

Introduction to rings, Introduction to fields, Introduction to vector spaces, Linear independence, Linear span, Basis, Dimension of a vector space, Subspaces, Linear transformations, Rank and Nullity.

MODULE 3

Boolean Algebra (4 Hrs)

Definition, Properties of Boolean Algebras, Boolean lattices, Boolean functions and expressions, Principal Disjunctive/Conjunctive Normal Forms

Propositional Calculus (5 Hrs)

Introduction to Propositional Calculus**,** Well formed statement formula, Substitution Instance, Replacement Process, Functionally Complete set of connectives, and Inference Theory of Propositional Calculus.

Mathematical Induction: (1 Hr)

Principle of Mathematical Induction and applications.

Recurrence relations: (4 Hrs)

Linear Recurrence relations with constant coefficients, Order of Linear Recurrence relations, General solution of Linear Recurrence Relations with Constant Coefficients, Solutions of Linear Recurrence Relations with Constant coefficients with Boundary Conditions, Formulation of Recurrence Relations

MODULE 4

Graph theory: (7 Hrs)

Introduction to Graphs, Types of Graphs, Representations of Graphs, Graph Isomorphism, Paths and Circuits, Connectedness, Shortest Path in a Graph, Dijkstra's Algorithm for Shortest Path in a Graph, Eulerian and Hamiltonian Paths/ Circuits, Algorithm to Determine Eulerian Paths/ Circuits.

Trees: (7 Hrs)

Introduction to Trees, Binary and m-ary trees, Spanning Trees, Minimal Spanning Trees, Kruskal's Algorithm to Determine a Minimal Spanning Tree, Transport Networks with Single Source and Single Sink, Ford- Fulkerson Labeling Procedure to Determine the Maximum Flow through a Transport Network.

Text Books

1. Discrete Mathematics and Its Applications – Kenneth H. Rosen, Tata McGraw Hill.
2. Discrete Mathematical Structures – B Kolman, R.C. Busby and Sharon C. Ross, Prentice Hall.
3. Foundation of Discrete Mathematics – K.D.Joshi , New Age International Ltd

Reference Books

1. Discrete Structures, An introduction to Computer Science– F. R. Norris, Prentince Hall.
2. Discrete Mathematical Structures with Applications to Computer Science – J. P. Tremblay and R. Manohar, McGraw Hill, NY.
3 Discrete Mathematics - S. Sarkar, S.Chand Publication
4. Concepts in Discrete Mathematics – S. Sahani, Narosa, New Delhi.
5. Basic Graph Theory – K. R. Parthasarathy, TMH

CE4.2DS DATA STRUCTURES

Lectures per week	:	3+1+2
Max. Marks for Theory paper	:	100
Max. Marks for Practicals	:	50
Max. Marks for Sessionals	:	20 + 5
Duration of paper	:	3 hours
Total no. of modules	:	4
No. of questions from each module	:	2
Total no. of questions to be answered	:	5

(At least one question from each module with two compulsory questions from any one module.)

MODULE 1

Overview of: **(3 HRS)**
Structures, Unions, Files, Macros, Strings, Pointers, Arrays

Recursion: (**2HRS)**
Recursive definitions and Processes, Writing Recursive Programs, Efficiency in Recursion, Towers of Hanoi problem

Linked Lists: **(6 HRS)**
Abstract Data Types, Dynamic Representation, Structure of linked lists (nodes and pointers to linked lists), Insertion and Deletion of Nodes, Circular linked lists, Doubly linked lists, Building a linked list implementation, Array implementation of linked lists, Comparison of Dynamic and Array Representations

MODULE 2

Stacks: **(2 HRS)**
Basic Stack Operations, Linked list implementation of Stacks, Array implementation of Stacks

Queues: **(3 HRS)**
Basic Queue Operations, Linked list implementation of Queues, Array implementation of Queues, Circular Queues, Priority Queues

Trees: **(6 HRS)**
Binary Trees: Terms associated with binary trees, Strictly binary, Complete binary, Almost complete binary tree, Operations on binary tree, Representation of trees, Linked array representation, Implicit array representation, Threaded binary trees

Tree Traversals, Properties and Terms associated with trees, Introduction to Balanced Trees, Representation of Balanced trees, Operations on Trees

MODULE 3

Graphs: **(5 HRS)**

Concept of linear graphs, Directed and undirected graphs, Degree-indegree, outdegree, C Representation of graphs, Adjacency matrix, Adjacency list, Connected components, Spanning trees, Graph Traversals

Storage Management: (6 HRS)

Automatic List Management, Collection and Compaction, Variations of Garbage management, Dynamic Memory Management, First Fit, Best Fit, and Worst Fit.

MODULE 4

Applications of different data structures: (4 HRS)

Application of Stacks: Conversion of Infix to Postfix, Evaluation of Postfix expression

Application of Queues: Implementation of a palindrome

Application of Linked Lists: The Josephus problem, Operations on polynomials

Application of Trees: The Huffman Algorithm, Game trees

Application of Graphs**:** Shortest Path Algorithm.

Study of different sorting techniques: (2 HRS)

Bubble Sort, Selection Sort, Insertion Sort, Radix Sort, Heap Sort

Study of different searching techniques (1 HRS)

Linear Search**,** Binary Search, Tree search .

Study of Hashing: (4 HRS)

Definition of Hashing, Linear Hashing, Chaining, Collision Handling Mechanisms

Text Books:-

1) Data Structure Using C & C++ – Yedidya Langsam, Moshej Augenstein, Aaron M. Tenenbaum, Prentice Hall of India.
2) Programming with C, K. R. Venugopal, Sudeep R. Prasad, Tata MacGraw Hill

Reference Books:

1) Fundamentals of Data Structures by Ellis Horowitz and Sartaj Sahni, Galgotia Publications
2) An introduction to data structures with applications by Jean Paul Tremblay and Paul G. Sorenson – Tata McGrawHill
3) Fundamentals of Computer Algorithms by Ellis Horowitz and Sartaj Sahni – Galgotia Publications

CE4.3CO COMPUTER ORGANIZATION

Lectures per week	:	3+1+2
Max. Marks for Theory paper	:	100
Max. Marks for Sessionals	:	20 + 5
Duration of paper	:	3 hours
Total no. of modules	:	4
No. of questions from each module	:	2
Total no. of questions to be answered	:	5

(At least one question from each module with two compulsory questions from any one module.)

MODULE 1

Introduction to Computer Organization (2 Hrs)

Computer components, Functions, Interconnection Structure, Bus Interconnection

Internal Memory (6 Hrs)

Semiconductor Memory: Memory Hierarchy, Characteristics of Memory System, Semiconductor RAM Memories, Internal Organization of Memory Chip, Static RAM, Asynchronous DRAM, Synchronous DRAM, Connection of Memory to the processor, RAM Bus memory.
Cache Memory: Basics of Cache, Structure, Read operation, Elements of Cache Design, Associative Memory / Mapping.

External Memory (3 Hrs)

Magnetic Disk, RAID, OPTICAL Memory

MODULE 2

Input/Output (5 Hrs)

External Devices, I/O Modules, Programmed I/O, Interrupt Driven I/O (Interrupt Controller and PPI), Direct Memory Access (DMA Controller), I/O Channel and Processor.

Computer Arithmetic (TB 8.1-8.5) (6 Hrs)

Arithmetic and Logic Unit: Integer Representation, Integer Arithmetic, Floating Point Representation, Floating Point Arithmetic

MODULE 3

Instruction Set (8086 based) (3 Hrs)

Elements of Machine Instructions, Representation of Instructions, Types of Instructions, Number of Addresses, Types of Operands, Addressing Modes.

CPU Structure and Functions (4 Hrs)

Processor Organization, Register Organization, CPU performance and its factors, Instruction Pipeline, Basic Concepts of Pipelining, Pipeline Performance

RISC CPU ARCHITECTURE (4 Hrs)

Instruction Execution Characteristics, Use of Large Register File, Compiler based register optimization, Reduced Instruction Set Architecture, RISC Pipelining, RISC v/s CISC with examples.

MODULE 4

Superscalar Processors (2 Hrs)

Overview and Design Issues

Control Unit Operation (3 Hrs)

Micro Operations, Control of the CPU, Hardwired Implementation

Microprogrammed Control (3 Hrs)

Basic Concepts, Microinstruction Sequencing, Microinstruction Execution

Parallel Processing (3 Hrs)

Multi Processing, Cache Coherence /MESI Protocol

Text Book:

1. Computer Organization and Architecture. Edition VI by William Stalling.

Reference Books:

1. Computer Organization and Architecture By M. Morris Mano
2. Microprocessors and Interfacing By Douglas V. Hall
3. Computer Organization And Design. Edition III By David A. Patterson, John L. Hennesy
4. Computer Organization. Edition V By Carl Hamacher, Zvonko Vranesic, Safal Zaky

CE4.4EM ELECTRONIC MEASUREMENTS

Lectures per week	:	3+1+0
Max marks for theory paper	:	100
Max marks for sessionals	:	20 + 5
Duration of paper	:	3 hours
Total no of modules	:	4
No of questions from each module	:	2
Total no of questions to be answered	:	5

(At least one question from each module with two compulsory questions from any one module)

Module 1 (11 Hrs)

Measurements and errors:

Definition, Accuracy, Precision, Significant figures, Types of errors.

Systems of units of measurements

Fundamental and derived units, system of units.

Standards of measurements

Classification of standards
Electrical Standards- The absolute ampere, voltage standard
IEEE standard.

Electromechanical Indicating Instruments

Permanent magnet moving coil mechanism.

Electronic Instruments: Electronic multimeter, Digital voltmeters
Q meter, Vector Impedance meter

Module 2 (11 Hrs)

Oscilloscopes:

Block diagram of oscilloscope, Cathode Ray Tube, Vertical deflection system, Horizontal deflection system, Delay line, Oscilloscope Techniques, Digital Storage oscilloscopes.

Signal Generation

Sine generator, Frequency synthesized signal generator, Pulse and square wave generator, Sweep frequency generator, Function generator, Audio frequency signal generator

Module 3 (11 Hrs)

Signal Analysis:

Wave analyzers, Harmonic distortion analyzer, Spectrum analyzer, Application of the spectrum analyzer

Frequency counters and time interval measurements:

Simple frequency counters, Display counters, Measurement errors, Extending the frequency range of the counter, Automatic and Computing counters

Module 4 (11 Hrs)

Transducers and Input Elements

Definitions
Strain gauges, Unbounded strain gauge,
Displacement transducers
Resistance Thermometers, Thermocouples, Thermistor characteristics,
Photosensitive devices: Multiplier photo tubes, Photoconductive cells, Photovoltaic cells

Analog and digital Data Acquisition Systems

Elements of analog DAS, Elements of digital DAS, Interfacing transducers to electronic control and measuring systems, Multiplexing.

Text Book

1. Modern electronic instrumentation and measurement techniques – Albert D. Helfrick and William D.Cooper, PHI

Reference Book

1. Electronic instrumentation – H.S. Kalsi, TMH

CE4.5SAD SYSTEM ANALYSIS AND DESIGN

Lectures per week	:	3+1+2
Max marks for theory paper	:	100
Max marks for sessionals	:	20 + 5
Duration of paper	:	3 hours
Total no of modules	:	4
No of questions from each module	:	2
Total no of questions to be answered	:	5

(At least one question from each module with two compulsory questions from any one module)

Module 1

(11 Hrs)

Systems Concepts and the Information Systems Environment

Introduction: The Systems Concept, Definition.

Characteristics of a System: Organization, Interaction, Interdependence, Integration, Central Objective.

Elements of a System: Outputs and Inputs, Processor(s), Controls, Feedback, Environment, Boundaries and Interface.

Types of Systems: Physical or Abstract Systems, Open or Closed Systems, Man-Made Information Systems, Illustration-A Dynamic Personnel Information System Model.

The System Development Life Cycle

Introduction.

The Systems Development Life Cycle: Recognition of Need-What Is the Problem? Feasibility Study, Analysis, Design, Implementation, Post-Implementation and Maintenance. Considerations for Candidate Systems: Political Considerations. Planning and Control for System Success, Prototyping.

The Role of the Systems Analyst

Introduction, Definition, Historical Perspective: The Early Years, The War Effort. What Does It Take to Do Systems Analysis, Academic and Personal Qualifications. The Multifaceted Role of the Analyst: Change Agent, Investigator and Monitor, Architect, Psychologist, Salesperson, Motivator, Politician. The Analyst/User Interface: Behavioral Issues, Conflict Resolution. The Place of the Analyst in the MIS Organization: The MIS Organization, Rising Positions in System Development: The Paraprofessional, The Technical Writer, Conclusions.

Module 2

(10 hrs)

Systems Planning and the Initials Investigation

Introduction, Bases for Planning in Systems Analysis: Dimensions of Planning, Initial Investigation: Needs Identification, Determining the Users Information Requirements, Case Scenario. Problem Definition and Project Initiation, Background Analysis, Fact Analysis, Determination of Feasibility.

Information Gathering
Introduction, What Kind of Information Do We Need: Information about User Staff, Information about Work Flow. Where does Information Originate? Information-Gathering Tools: Review of Literature, Procedure, & Forms, On-Site Observation, Interviews & Questionnaires, Types of Interview and Questionnaires.

The Tools of Structured Analysis
Introduction, what is Structured Analysis? The Tools of Structured Analysis: The Data Flow Diagram (DFD), Data Dictionary, Decision Tree and Structured English, Decision Tables, Pros and Cons of each Tool.

Feasibility Study
Introduction, Systems Performance Definition, Statement of Constraints, Identification of Specific System Objectives, Description of Outputs, Feasibility Considerations, Steps in Feasibility Analysis: Feasibility Report, Oral Presentation.

Cost/Benefit Analysis
Introduction, Data Analysis, Cost/Benefit Analysis: Cost and Benefit Categories. Procedure Cost/Benefit Determination, the System Proposal.

Module 3

(10 hrs)

The Process and Stages of Systems Design
Introduction, the Process of Design: Logical and Physical Design, Design Methodologies: Structured Design, Form-Driven Methodology-the IPO Charts. Structured Walkthrough . Major Development Activities: Personnel Allocation.
Audit Considerations: Processing Controls and Data Validations, Audit Trial and Documentation Control.

Input/output and Form Design
Introduction, Input Design: Input Data, Input Media and Devices, Output Design. Forms Design: What Is a Form? Classification of Forms, Requirements of Forms Design, Carbon Paper as a Form Copier, Types of Forms, Layout Considerations, Forms Control.

Data Base Design
Data Base Design: Objectives of Data Base, Key Terms, Logical and Physical Views of Data, Data Structure, Normalization, Role of the Data Base Administrator.

Module 4

(10Hrs)

System Testing and Quality Assurance
Introduction, Why System Testing? What do we test for? Nature of Test Data, The Test Plan: Activity Network for System Testing, System Testing, Quality Assurance

Goals in the Systems Life Cycle, Levels of Quality Assurance, Trends in Testing, Role of the Data Processing Auditor: The Audit Trail.

Implementation and Software Maintenance
Introduction, Conversion: Activity Network for Conversion. Combating Resistance to Change, Post-Implementation Review: Request for Review, A Review Plan. Software Maintenance: Maintenance or Enhancement? Primary Activities of a Maintenance Procedure, Reducing Maintenance Costs.

Hardware/Software Selection and the Computer Contract
Introduction, The Computer Industry: Hardware Suppliers, Software Suppliers, Service Suppliers. The Software Industry: Types of Software. A Procedure for Hardware/Software Selection: Major Phase in Selection, Software Selection. The Evaluation Process, Financial Considerations in Selection: The Rental Option, The Lease Option, The Purchase Option, The Used Computer. The Computer Contract: The Art Of Negotiation, Contract Checklist.

Project Scheduling and Software
Introduction, Why Do Systems Fail? What Is Project management?

Security, Disaster/Recovery, and Ethics in System Development
Introduction, System Security, Definitions , Threats to Systems Security. Control Measures, Disaster/Recovery Planning: The Plan, Ethics in System Development: Ethics Codes and Standards of Behavior.

Text Books

1. System analysis and design, Author: Elias M.Awad.

Reference Books

1. Analysis and Design of Information Systems, V. Rajaraman, PHI.
2. Analysis and Design of Information Systems, J.A. Senn TMH
3. System Analysis and Design Methods Author: Bently and Barlow 3rd. Edition, Irwin, 1994
4. Systems Analysis and Design, Author: Kenneth E. Kendall, Juliw E. Kendall, Prentice-Hall India, Fifth Edition

Suggestion for Practical:

Students are expected to take up at least two Case Studies in SYSTEM ANALYSIS AND DESIGN subject. Implementation is to be with application tools, database tools and test tools. A report needed to be developed and presented during practical exams.

CE4.6OOPC OBJECT ORIENTED PROGRAMMING AND DESIGN USING C++

Lectures per week	:	3+1+2
Max marks for theory paper	:	100
Max marks for Practical	:	50
Max marks for sessionals	:	20 + 5
Duration of paper	:	3 hours
Total no of modules	:	4
No of questions from each module	:	2
Total no of questions to be answered	:	5

(At least one question from each module with two compulsory questions from any one module)

MODULE 1

Review of Operator Overloading and Inheritance **(2 Hrs)**

Virtual Functions and Polymorphism **(4 Hrs)**

C++ Stream Input / Output **(5 Hrs)**

MODULE 2

Templates **(3 Hrs)**

Exception Handling **(4 Hrs)**

File Processing **(4 Hrs)**

MODULE 3

Preprocessor **(2 Hrs)**

String and Stream Processing **(3 Hrs)**

Standard Template Library **(6 Hr)**

Introduction to STL: Containers, Iterators, Algorithms

Sequence Containers: Vector, List, DeQue

Container Adapter: Stack Adapter, Queue Adapter

MODULE 4

UML Introduction, Development Process Outline, Use Cases, Class Diagrams **(4 Hrs)**

Class Diagrams: Advances Concepts, Interaction Diagrams **(4 Hrs)**

Packages, Collaborations, State Diagrams **(3 Hrs)**

Text Books:

1. C++ How To Program, 3rd Edition, By Deitel & Deitel, Published by Pearson Education, ISBN:81-7808-360-4
2. UML Distilled, Second Edition by Martin Fowler with Kendall Scott, Foreword by Grady Booch, Ivar Jacobson and James Rumbaugh, Published by Pearson Education ISBN:81-7808-248-9