Bachelor of Technology (Computer Science and Engineering) Credit Based Scheme of Studies/Examination Semester III (w.e.f Session 2019-2020)

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1	ES-205	Principles of Programming Languages	3:0:0	3	3	75	25	0	100	3
2	PC-CS-201	Data Structure and Algorithms	3:0:0	3	3	75	25	0	100	3
3	ES-207	Digital Electronics	3:0:0	3	3	75	25	0	100	3
4	PC-CS-203	Object Oriented Programming	3:0:0	3	3	75	25	0	100	3
5	BS-205	Mathematics-III	3:0:0	3	3	75	25	0	100	3
6	HM-902	Business Intelligence and Entrepreneurship	2:0:0	3	3	75	25	0	100	3
7	PC-CS-205L	Data Structure and Algorithms Lab	0:0:4	4	2	0	40	60	100	3
8	ES-209L	Digital Electronics Lab	0:0:4	4	2	0	40	60	100	3
9	PC-CS-205 L	Object Oriented Programming Lab	0:0:4	4	2	0	40	60	100	3
		Total		**30**	**24**	**450**	**270**	**180**	**900**	
10	SIM-201*	Seminar on Summer Internship	2:0:0	2		0	50	0	50	

***Note: SIM-201* is a mandatory credit-less course in which the students will be evaluated for the Summer Internship (training) undergone after 2nd semester and students will be required to get passing marks to qualify.**

ES-205	Principles of Programming Languages						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**75**	**25**	**100**	**3 Hour**
Purpose	To introduce the principles and paradigms of programming languages for design and implement the software intensive systems.						
Course Outcomes (CO)							
CO 1	Understand the Fundamental concept of different programming languages.						
CO 2	Enhances the skill to Design a new programming language.						
CO 3	Outline the pre requisites for creating a new programming language.						
CO 4	To introduce the concepts of storage management using programming languages.						
CO5	To outline the sequence control and data control						
CO6	Develop an understanding of the compilation process.						

Unit-I: Introduction, Syntax and Semantics

Introduction: A brief history, Characteristics of a good programming language, Programming language translators-compiler and interpreters, Elementary data types – data objects, variable and constants, data types. Specification and implementation of elementary data types, Declarations, type checking and type conversions, Assignment and initialization, Numeric data types, enumerations, Booleans and characters.

Syntax and Semantics: Introduction, general problem of describing syntax, Formal method of describing Syntax, attribute grammar dynamic semantic.

Unit-II: Structured data objects, Subprograms and Programmer Defined Data Types

Structured data objects: Structured data objects and data types, specification and implementation of structured data types, Declaration and type checking of data structure, vector and arrays, records Character strings, variable size data structures, Union, pointer and programmer defined data objects, sets, files.

Subprograms and Programmer Defined Data Types: Evolution of data type concept abstraction, encapsulation and information hiding, Subprograms, type definitions, abstract data types, over loaded subprograms, generic subprograms.

Unit–III: Sequence Control and Data Control

Sequence Control: Implicit and explicit sequence control, sequence control within expressions, sequence control within statement, Subprogram sequence control: simple call return, recursive subprograms, Exception and exception handlers, co routines, sequence control. Concurrency – subprogram level concurrency, synchronization through semaphores, monitors and message passing

Data Control: Names and referencing environment, static and dynamic scope, block structure, Local data and local referencing environment, Shared data: dynamic and static scope, Parameter and parameter transmission schemes.

Unit-IV: Storage Management and Programming Languages

Storage Management: Major run time elements requiring storage, programmer and system controlled storage management and phases, Static storage management, Stack based storage management, Heap storage management, variable and fixed size elements.

Programming Languages: Introduction to procedural, non-procedural, structured, logical, functional and object oriented programming language, Comparison of C and C++ programming languages.

Suggested Books:

Terrence W. Pratt, Marvin V. Zelkowitz, Programming Languages Design and Implementation, Pearson.

Allen Tucker and Robert Noonan, Programming Languages–Principles and Paradigms, Tata McGraw-Hill, 2009.

Ellis Horowitz, Fundamentals of Programming Languages, Galgotia Publications, 2010.

C. Ghezzi, Programming Languages Concepts, Wiley Publications, 2010.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

Lecture Plan (ES-205N)

Lectures	TOPICS
L1	A brief History, Characteristics of good programming language
L2	Programming Language translators compiler and interpreters,
L3	Elementary data types –data objects, variable and constants, data types.
L4	Specification and implementation of elementary data types , Declarations,
L5	Type checking and type conversions, assignment and initialization
L6	Numeric Data types, enumerations, Booleans and characters
L7	Syntax and semantics: introduction, general problem of describing syntax,
L8	Formal method of describing syntax, attribute grammar dynamic semantic
L9	Structured data objects and data types, specification and implementation of structured data types
L10	Declaration and type checking of data structured, vector and arrays,
L11	Records character strings, variable size data structures, Union,
L12	pointer and programmer defined data objects
L13	sets
L14	files
L15	Evolution of data type concept abstraction ,
L16	encapsulation and information hiding,
L17	Subprograms, type definition,
L18	abstract data types
L19	over loaded subprograms, generic subprograms,
L20	Implicit and explicit sequence control
L21	sequence control within expression,
L22	Sequence control within statement ,
L23	subprogram sequence control
L24	simple call return,
L25	Recursive subprograms, , coo routines
L26	exception and exception handlers
L27	Sequence control .,
L28	Concurrency subprogram level concurrency
L29	synchronization through semaphores
L30	monitors and message passing
L31	Data control Names and referencing environment
L32	static and dynamic scope
L33	Block structure ,
L34	shared data
L35	local data and local referencing environment
L36	Dynamic and static scope
L37	parameter and parameter transmission schemes
L38	Major run time elements requiring storage,
L39	programmer and system controlled storage management and phases,
L40	Static storage management , stack based storage management,
L41	Heap storage management ,
L42	variable and fixed size elements
L43	Introduction to procedural , non procedural structured
L44	Logical , functional and object oriented programming language,
L45	Comparison of C and C++ programming languages,

Tutorial Sheet -1

Q.1 discuss different characteristics of a good programming language
Q.2 Explain different programming language translator.
Q.3 What is binding ? Explain its types.
Q.4 What is sub program ?
Q.5 Describe method of syntax and semantics

Tutorial Sheet -2

Q.1 What are structured data objects and data types ?
Q.2 Difference between data abstraction and data hiding.
Q.3 Explain overloaded sub program.
Q.4 What are different types of errors that might be present in a program ?
Q.5 Data Control and dynamic scope .

Tutorial Sheet -3

Q.1 Difference between C and C++.
Q.2 Explain structured PL and Logical PL.
Q.3 Explain different elementary data types and specification.
Q.4 Explain different features of OOP.
Q.5 Explain static & dynamic scope with implementation .

Tutorial Sheet -4

Q.1 Explain system control storage management schemes.
Q.2 Explain parameter transmission schemes .
Q.3 Explain referencing environment .
Q.4 Discuss type checking and type conversion .
Q.5 Differentiate between stack based storage management and heap based storage management.

Tutorial Sheet -5

Q.1 What is semaphore ? how they are used for synchronization ?
Q.2 Explain implicit and explicit sequence control .
Q.3 What is exception and exception handler ?
Q.4 Explain control state and dynamic scope .
Q.5 Differentiate between iterative and recursive procedures explain with example .

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PROGRAMMING LANGUAGES

CSE-209-N

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) Define data types. Describe the specification and implementation of data types in various programming languages. **7.5**

   (b) What do you mean by BNF grammar. Explain with example. **7.5**

2. (a) Explain the specification and implementation of character strings with example. **10**

   (b) Describe the concept of type checking and type conversion in various languages with suitable example. **5**

Unit II

3. (a) Define Records. Describe the specification and implementation of records in various languages. Also discuss about variant records. **7.5**

   (b) What do you understand by abstraction, encapsulation and information hiding ? Explain using suitable example. **7.5**

4. (a) Define Lists. Discuss the syntax, specification and implementation of lists in some programming languages. http://www.kuonline.in **7.5**

   (b) How pointers are handled in various programming languages ? How much efficient are pointers, if used for dynamic allocation ? **7.5**

Unit III

5. (a) What do you understand by pattern matching ? Discuss its implementation with example. **7.5**

   (b) What do you understand by backtracking ? Write the general backtracking algorithm. **7.5**

6. (a) Define Recursive subprogram. Explain the specification and implementation of recursive subprogram. **5**

(b) Differentiate the following :

(i) Static and dynamic scope

(ii) Local and global scope. **2×5=10**

Unit IV

7. What are the various programmer and system controlled storage Management ? Explain the heap storage management in detail using suitable example. **15**

8. Explain the features of the following :

(i) Non-procedural programming language.

(ii) Logical programming language.

(iii) Object-oriented programming language. **3×5=15**

PC-CS201	Data Structure and Algorithms						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**75**	**25**	**100**	**3 Hour**
Purpose	To introduce the principles and paradigms of Data Structures for design and implement the software systems logically and physically.						
Course Outcomes (CO)							
CO 1	Understand and determine the usage of primitive data structures.						
CO 2	Implement and analyze real life applications of various data structures such as array						
CO 3	To study concept of binary tree, BST, AVL trees, B tree and their implementation.						
CO 4	To study graphs traversal techniques and spanning techniques						
CO5	To teach the concept of protection and management of data.						
CO6	To improve the logical ability.						

Unit-1

Introduction to Data Structures, Data Types, Built in and User Defined Data Structures, Applications of Data Structure, Algorithm Analysis, Worst, Best and Average Case Analysis, Notations of Space and Time Complexity, Basics of Recursion.

Arrays, One Dimensional Arrays, Two Dimensional Arrays and Multi-Dimensional Arrays, Sparse Matrices, Searching from array using Linear and Binary Searching Algorithm, Sorting of array using Selection, Insertion, Bubble, Radix Algorithm

Unit-2

Stacks: Definition, Implementation of Stacks and Its Operations, Evaluation of Infix, prefix and Postfix Expression, Inter-conversion of Infix, Prefix and Post-Fix Expression, Implementation of Merge Sort and Quick Sort Algorithm.

Queues: Definition, Sequential Implementation of Linear Queues and Its Operations, Circular Queue and Its Implementation, Priority Queues and Its Implementation, Applications of queues.

Unit-3

Linked Lists: Need of Dynamic Data Structures, Single Link List and Its Dynamic Implementation, Traversing, Insertion, Deletion Operations on Single Link Lists. Comparison between Static and Dynamic, Implementation of Linked List.

Circular Link Lists and Doubly Link List, Dynamic Implementation of Primitive Operations on Doubly Linked Lists and Circular Link List. Dynamic Implementation of Stacks and Queues.

Unit-4

Trees: Definition, Basic Terminology, Binary Tree, External and Internal Nodes, Static and Dynamic Implementation of a Binary Tree, Primitive Operations on Binary Trees, Binary Tree Traversals: Pre-Order, In-Order and Post-Order Traversals. Representation of Infix, Post-Fix and Prefix Expressions using Trees.

Introduction to Binary Search Trees: B+ trees, AVL Trees, Threaded Binary trees, Balanced Multi-way search trees, Implementation of Heap Sort Algorithm.

Graphs: Basic Terminology, Definition of Undirected and Directed Graphs, Memory Representation of Graphs, Minimum-Spanning Trees, Warshal Algorithm, Graph Traversals Algorithms: Breadth First and Depth First.

Suggested Books:

Theory and Problems of Data Structures by Jr. Symour Lipschetz, Schaum's outline, TMH.

Data Structures and Algorithms by PAI, TMH.

Fundamentals of Data structures by Ellis Horowitz and Sartaj Sahni, Pub, 1983, AW.

Data Structures and Algorithms by A.V. Aho, J.E. Hopcroft and T.D. Ullman, Original edition, Addison-Wesley, 1999, Low Priced Edition.

Data Structures and Program Design in C by Robert Kruse, PHI,

Shukla, Data Structures using C++, Wiley India

Introduction to Computers Science -An Algorithms Approach , Jean Paul Tremblay, Richard B. Bunt, 2002, T.M.H.

Data Structure and the Standard Template library – Willam J. Collins, 2003, T.M.H.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

Lecture Plan (PC-CS-201)

Lectures	TOPICS
L1	Data Types , Built in and User Defined Data Structures
L2	Applications of Data structure , Algorithm Analysis , Worst ,
L3	Best and Average Case Analysis
L4	Notations of Space and Time Complexity Basics of Recursion
L5	One Dimensional Arrays, Two Dimensional Arrays and Multi-Dimensional Arrays
L6	Sparse matrices,
L7	Searching from array using Linear And Binary Searching Algorithm
L8	Sorting of array using Selection
L9	Insertion Sort
L10	Bubble sort
L11	Radix Algorithm
L12	Definition, Implementation of Stacks and its operations,
L13	Evaluation of Infix
L14	Prefix expression inter conversion of infix,
L15	Postfix expression inter conversion of infix
L16	prefix and post –fix expression
L17	Implementation of Merge sort
L18	quick sort Algorithm
L19	Definition , Sequential implementation of linear Queues and its operations,
L20	Circular Queue and its implementation
L21	Priority Queues and its implementation
L22	Application of queues , need of dynamic Data structures
L23	single link list and
L24	Its dynamic implementation , traversing insertion,
L25	deletion operations on single link list
L26	Comparison between static and dynamic, implementation of linked list
L27	Circular link list
L28	doubly link list , dynamic implementation of primitive
L29	Operations on Doubly linked lists and circular link list ,
L30	Dynamic implementation of stacks
L31	Dynamic implementation of queues
L32	Definition , Basic terminology, Binary tree, external and internal nodes
L33	Static and dynamic implementation of a binary tree
L34	Static and dynamic implementation of a binary tree
L35	primitive operation on Binary tree
L36	Primitives operation of binary trees,
L37	binary tree traversals pre-order,
L38	In –order and post order traversals,
L39	Representation of infix , post fix and prefix expression using trees
L40	Introduction to binary search trees B+ trees ,
L41	Threaded Binary trees, balanced multi way search trees,
L42	Implementation of heap sort algorithm
L43	Basic Terminolgy , Definition of undirected and directed Graphs,
L44	Memory Representation of Graphs, minimum spanning trees, warshal algorithm
L45	Graph traversals algorithms, Breadth first and depth first

Tutorial Sheet -1

Q.1 What is a data structure? Write difference between primitive data structure and non primitive data structure .
Q.2 What is an algorithm ? What are best case, average case and worst case analysis of an algorithm ?
Q.3 What are space complexity and time complexity of a algorithm .
Q.4 What is a stack ? Explain all basic operation performed on a stack.
Q.5 Convert following infix 3expression to postfix notation .
(a) (A+B) *D+E /(F+G+D)
(b) (A*B) +(C-D)
Q.6 What is Queue ? How it is different from stack ?

Tutorial Sheet -2

Q.1 What is sparse matrix ? How do you represents sparse matrix?
Q.2 What is priority Queue ? Discuss its any application .
Q.3 Write a recursive procedure to perform Binary search .
Q.4 What is Tree? Define the following terms .
(a) Degree
(b) Depth
(c) Path
(d) Forest
Q.5 Write an algorithm for linear search and Binary Search . Explain which is the best.
Q.6 Write the PUSH and POP procedure for linked implementation of stack.

Tutorial Sheet -3

Q.1 Write an algorithm to insert a node in linked list at the following positions.
(a) In the beginning of the list .
(b) After a specified element .
(c) Before a specified element .
Q.2 Explain the Radix sort using suitable example.
Q.3 Draw the tree from following order
Q.4 Preorder: G,B,Q,A,C,F,P,D,E,R,H
Inorder : Q,B,K,C,F,A,G,P,E,D,H,R
Q.5 What is a Graph ? Differentiate between an undirected and directed graph .

Tutorial Sheet -4

Q.1 Write an algorithm and Analyse each of the following sorting algorithm
(a) Selection sort (b) Insertion sort (c) Bubble sort
Q.2 What is the differences between structure and union ? discuss using suitable examples.
Q.3 Explain depth first Search algorithm and Breadth first algorithm .
Q.4 How a Queue can be implemented using an array and using linked list ?
Q.5 Explain Adjecency matrix representation of a graph . Explain path matrix .

Tutorial Sheet -5

Q.1 Write an algorithm for merge sort. Write time complexity of merge sort.
Q.2 Write an algorithm for each of the following .
(a) in order traversals (b) Pre order traversals (c) Post order traversals
Q.3 Explain following terms
(a) De Queue (b) Circular Queue (c) Priority Queue
Q.4 How stack can be implemented using linked list ?
Q.5 What are threaded tree and balanced tree ?

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DATA STRUCTURE AND ALGORITHMS

PC-CS201A

Time : Three Hours] [Maximum Marks : 75

Note : All questions in Part A and Part B are compulsory. Attempt any *four* questions from Part C selecting at least *one* question from each Unit.

Part A **15**

1. Answer the following questions : **5×3=15**
   (i) Differentiate between linear and non-linear data structures.
   (ii) List the operations performed in splay tree.
   (iii) Write prefix and postfix expression for (A – B/C + D)/(A + B).
   (iv) State and *two* differences between static and dynamic memory allocation.
   (v) Write the application of Warshal algorithm.

Part B **20**

Unit I

2. Discuss the use of accumulator and counter in developing algorithm. **5**

Unit II

3. Write algorithm to delete element in stack. **5**

Unit III

4. Write algorithm for insert an element from a linked list. **5**

Unit IV

5. Write algorithm for insert an element in binary tree. **5**

Part C **40**

Unit I

6. Differentiate linear and binary search. Write algorithm for linear search. **10**

7. Differentiate Insertion and radix sort with example. **10**

Unit II

8. Derive equation to determine the time complexity of quick sort. **10**

9. Differentiate doubly link list and circularly link list with example. **10**

Unit III

10. Discuss the dynamic implementation of queue with example. **10**

11. Discuss the traversing of in single link list with example. **10**

Unit IV

12. Differentiate static and dynamic implementation of binary tree with example. **10**

13. Compare Prim's and Kruskal's algorithm with suitable example. **10**

ES-207	Digital Electronics						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**75**	**25**	**100**	**3 Hour**
Purpose	To learn the basic methods for the design of digital circuits and provide the fundamental concepts used in the design of digital systems.						
Course Outcomes (CO)							
CO1	Students will learn basic postulates of Boolean algebra and shows the correlation between Boolean expressions						
CO2	Students may implement the Boolean Expression to design circuit for any function.						
CO3	Students will learn the various methods for simplifying Boolean expressions						
CO4	Students will be able to design state machine circuits using sequential circuits.						
CO5	Students may also design State M/Cs circuits using combinational circuits						
CO6	Students will be able to understand the basics memories and PLDs.						

UNIT I MINIMIZATION TECHNIQUES AND LOGIC GATES

Binary Digits, Logic Levels, and Digital Waveforms, Logic Systems-Positive and negative, Logic Operations,Logical Operators, Logic Gates-AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR, Active high and Active low concepts, Universal Gates and realization of other gates using universal gates, Gate Performance Characteristics and Parameters.Boolean Algebra: Rules and laws of Boolean algebra, Demorgan's Theorems, Boolean Expressions and Truth Tables, Standard SOP and POS forms; Minterm and Maxterms, Canaonical representation of Boolean expressions, Duality Theorem, Simplification of Boolean Expressions, Minimization Techniques for Boolean Expressions using Karnaugh Map and Quine McCluskey Tabular method.introduction of TTL and CMOS Logic and their characteristics, Tristate gates.

UNIT II COMBINATIONAL CIRCUITS

Introduction to combinational Circuits, Adders-Half-Adder and Full-Adder, Subtractors- Half and Full Subtractor; Parallel adder and Subtractor; Look-Ahead Carry Adders. BCD adder, BCD subtractor, Parity Checker/Generator, Multiplexer, Demultiplexer, Encoder, Priority Encoder; Decoder ,BCD to Seven segment Display Decoder/Driver, LCD Display, and Comparators.

UNIT III SEQUENTIAL CIRCUITS

Introduction to Sequential Circuits, Flip-Flops: Types of Flip Flops -RS, T, D, JK; Edge triggering, Level Triggering; Flip Flop conversions; Master-Salve JK.

Introduction to shift registers, Basic Shift Register Operations, types of shift registers, Bidirectional Shift Registers, Shift Register Counters. Introduction to counters, Types of Counters-Asynchronous and synchronous counters, Up/Down Synchronous Counters, Modulo-n Counter , State table, excitation table concepts, Design of asynchronous and synchronous counters, Ring Counter, Applications of counters.

UNIT IV CONVERTER and MEMORY DEVICES

Digital to Analog Converter, Weighed Register: R-2R Ladder Network: Analog to Digital Conversion, Successive Approximation Type, Dual Slope Type.

Classification of memories - ROM: ROM organization, PROM, EPROM, EEPROM, EAPROM, RAM: - RAM organization - Write operation, Read operation, Memory cycle, Timing wave forms, memory expansion, Static RAM Cell, MOSFET RAM cell structure, Dynamic RAM cell structure, Programmable Logic Devices - Programmable Logic Array (PLA), Programmable Array Logic (PAL), Implementation of PLA, PAL using ROM.

Suggested Books:

Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH, 2003.M. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.

ALI, Digital Switching Systems, , TMH

A.K. Maini, Digital Electronics, Wiley India

John F. Wakerly, Digital Design, Fourth Edition, Pearson/PHI, 2006

John. M Yarbrough, Digital Logic Applications and Design, Thomson Learning, 2002.

S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 3rd Edition., Vikas Publishing House Pvt. Ltd, New Delhi, 2006
William H. Gothmann, Digital Electronics, 2nd Edition, PHI, 1982.
Thomas L. Floyd, Digital Fundamentals, 8th Edition, Pearson Education Inc, New Delhi, 2003
Donald D. Givone, Digital Principles and Design, TMH, 2003.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

Lecture Plan (ES-207)

Lectures	TOPICS
L1	Binary Digitas , Logic levels, and digital waveforms , logic system positive and negative
L2	Logic operations, logical operators, logic Gates, AND , Or NOT ,
L3	NAND ,NOR
L4	Exclusive –OR and Exclusive –NOR,
L5	Active high and active low concepts
L6	Universal gates and realization of other gates using universal gates,
L7	Gate Performance Characteristics and Parameters,
L8	Boolean Algebra: rules and laws of Boolean Algebra
L9	Demorgan's Theorems, Boolean Expressions and Truth Tables
L10	Standard SOP and POS forms
L11	Minterm and Mazterms,
L12	Canaonical representation of Boolean expression,
L13	Duality Theorem , Simplification of Boolean Expressions,
L14	Minimization Techniques for Boolean Expressions using Karnaugh Map
L15	Quine McCluskey Tabular method
L16	Introduction of TTL and CMOS logic and their characterisitics,
L17	Tristate gates
L18	Introduction to combinational Circuits,
L19	Adders –Half Adder and Full Adder,
L20	Subtractors Half and full subtractor ;
L21	parallel adder and subtractor
L22	Look –Ahead Carry adders , BCD adder, BCD subtractor,
L23	Parity Checker/ Generator
L24	Multiplexer, Demultiplexer, Enocder, Priority Encoder, Decoder ,
L25	BCD to Seven Segment Display Decoder/ Driver, LCD Display and Comparators
L26	Introduction to sequential Circuits, Flip-Flop:
L27	Typesof Flip Flop RS, T,D, JK; Edge triggering
L28	Level Triggering Flip Flop conversions: Master Salve JK
L29	Introduction to shift registers, Basic Shift Register Operations,
L30	types of shift registers, , Bidirectional shift Registers,
L31	Shift Register Counters, Introduction to counters,
L32	Types of Counters Asynchronous and synchronous counters,
L33	Up/ Down Synchronous Counters, Modulo-n Counter, State table,
L34	excitation table concepts Design of asynchronous and synchronous counters,
L35	reing counter , Application of counters,
L36	Digital to Analog Converter,
L37	Weighed Register : R-2R ladder Network
L38	Analog to digital Conversion, Successive Approximation type ,
L39	Dual Slope type
L40	Classification of memories –Rom: ROM organization, PROM, EPROM
L41	EEPROM , EAPROM , RAM: RAM organization write operation,
L42	Read operation, Memory cycle, Timing wave forms, memory expansion

L43	Static RAM Cell, MOSFET RAM cell structure, Dynamic RAM Cell structure
L44	Programmable logic Devices Programmable logic array (PLA)
L45	Programmable array logic (PAL) , Implementation of PLA, PAL using ROM

TUTORIAL SHEET -1

Q.1 Discuss the number systems,
Q.2 Write a note on : BCD codes, Excess-3 , Gray Codes; Error detection and correction codes .
Q.3 Draw the symbols and truth tables of the logic gates.
Q.4 What do you understand by the standard form of SOP and POS form of Boolean function .
Q.5 Explain the K-Map with an example.
Q.6 Explain Q-M method with the help of an example.

TUTORIAL SHEET -2

Q.1 Compare the performance of TTC & CMOS families.
Q.2 Explain RTL and DTL logic families.
Q.3 What is CMOS ? Compare the performance of CMOS & TTL.
Q.4 Draw RTL-NOR gate.
Q.5 Describe the basic operation of Encoder and Decoders.
Q.6 Design a 2- bit parity checker and magnitude comparator .

TUTORIAL SHEET -3

Q.1 State the characteristic equations and excitation tables for (a) D-type , and (b) JK flip-flops.
Q.2 Show that the following circuits operate as RS latches .
Q.3 A flip –flop may be described as edge-triggered' with 'asynchronous set and reset input'. What do these terms mean ?
Q.4 Explain the term 'Propagation delay'. Setup time ', hold time ' in relation to flip-flops.
Q.5 Show the circuits diagram and explain the operation of each of the following types of shift register (a) SIPO (b) PISO
Q.6 Show a circuit diagram and explain the operation of a bidirectional shift register with paralled load

TUTORIAL SHEET -4

Q.1 Show the circuit diagram and explain the operation of each of the following types of counter (a) ring counter (b) Johnson/Twisted-ring counter (c) LFSR
Q.2 Explain the difference between the "Mealy" and "Moore" models of sequential circuits.
Q.3 (a) Design a 4-bit BCD synchronous counter suing D-type flip-flops
(b) Explain how the counter may be reset to zero at any time .
(c) What happens if the counter has a value greater than 9 when the power is switched on ?
Q.4 Design a simple traffic –light sequencer using JK flip-flops. The Red output should be active for 3 clock periods, RED and AMBER for 1 clock period , GREEN for 2, and AMBER for 1, before repeating.
Q.5 Design a digital monostable' circuit which will generate a pulse, one clock cycle long, whenever the input goes high. The input signal will remain high for at least the length of one clock period.
Q.6 Design a synchronous sequential circuit suing JK bistables to implement the function shown in the state diagram, the circuit has one primary input and one primary output. Note that the transitions are marked with both input and output values, eg., in state D, the output is 1if the input is 0

TUTORIAL SHEET -5

Q.1 Discuss in brief the classification of Memory.
Q.2 Write a brief note on ROM, PLA, and PAL
Q.3 Discuss the basic architecture of FPGA and CPLD.
Q.4 Design a 2-bit parity checker and Magnitude comparator .
Q.5 Write short note on sample and hold circuit .

Roll No. ..... Total Pages : 03

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DIGITAL ELECTRONICS

CSE-207N

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. **1** is compulsory. All questions carry equal marks.

1. (a) Differentiate between Minterm and Maxterm. **3**

(b) Discuss fast adder design procedure. **4**

(c) Differentiate between D-type and T-type flip-flop. **4**

(d) Explain EAROM. **4**

Unit I

2. Explain Quine Mc-Clusky (QM) method of minimization ? Simplify the following expression using QM method, also verify the results by K map method :

$F = \Sigma A, B, C, D\ m(1, 3, 7, 11, 15) + \Sigma d(0, 2, 5)$ **15**

3. (a) Realize the following logic equation using only NOR gates :

$(A + B).(C + D) = (A + B) + (C + D)$ **5**

(b) Explain principle of duality. **5**

(c) Tristate outputs. **5**

Unit II

4. (a) Describe encoder using logic circuit. Explain encoder with decoder can be used as coder converter. **10**

(b) Explain magnitude comparator. **5**

5. (a) Design a 40 : 1 multiplexer using 8 : 1 multiplexers. **5**

(b) Write brief note on adder with look ahead carry. **5**

(c) Design a BCD to Gray code convertor using NAND gates only.

Unit III

6. (a) What is the difference between race around condition and undefined state ? Explain, how the race around condition is removed in J-K flip-flop ? **9**

(b) Draw and discuss master slave flip-flop. **6**

7. Write short notes on the following :
   (a) Sequence generator
   (b) Modulo-*n* counter
   (c) Universal shift registers. **15**

Unit IV

8. Explain the following in brief :
   (a) MOSFET RAM cell structure
   (b) Bipolar RAM cell
   (c) Differentiate between PLA and PAL. **15**

9. Write short notes on the following :
   (a) Memory expansion
   (b) PROM
   (c) FPGA. **15**

PC-CS203			Object Oriented Programming				
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**75**	**25**	**100**	**3 Hour**
Purpose	To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System.						

Course Outcomes (CO)	
CO1	To understand the differences between procedural design and object- oriented design.
CO2	To understand the Concept of inheritance, polymorphism, dynamic binding and Generic structures
CO3	Object-oriented program design based on template model of C++.
CO4	for creating efficient codes, exception handling Mechanisms use in C++
CO5	Perform object oriented programming to develop solutions to problems demonstrating usage of control structures, modularity, I/O. and other standard language constructs.
CO6	To learn how to design C++ classes for code reuse.

Unit–1

Introduction to C++, C++ Standard Library, Illustrative Simple C++ Programs. Header Files, Namespaces, Application of object oriented programming.

Object Oriented Concepts, Introduction to Objects and Object Oriented Programming, Encapsulation, Polymorphism, Overloading, Inheritance, Abstract Classes, Accessifier (public/ protected/ private), Class Scope and Accessing Class Members, Controlling Access Function, Constant, Class Member, Structure and Class

Unit-2

Friend Function and Friend Classes, This Pointer, Dynamic Memory Allocation and Deallocation (New and Delete), Static Class Members, Constructors, parameter Constructors and Copy Constructors, Deconstructors,
Introduction of inheritance, Types of Inheritance, Overriding Base Class Members in a Derived Class, Public, Protected and Private Inheritance, Effect of Constructors and Deconstructors of Base Class in Derived Classes.

Unit-3

Polymorphism, Pointer to Derived class, Virtual Functions, Pure Virtual Function, Abstract Base Classes, Static and Dynamic Binding, Virtual Deconstructors.

Fundamentals of Operator Overloading, Rules for Operators Overloading, Implementation of Operator Overloading Like <<,>> Unary Operators, Binary Operators.

Unit-4

Text Streams and binary stream, Sequential and Random Access File, Stream Input/ Output Classes, Stream Manipulators.

Basics of C++ Exception Handling, Try, Throw, Catch, multiple catch, Re-throwing an Exception, Exception specifications.
Templates: Function Templates, Overloading Template Functions, Class Template, Class Templates and Non- Type Template arguments.

Suggested Books:

The complete reference C ++ by Herbert shieldt Tata McGraw Hill.
Object Oriented Programming in Turbo C++ by Robert Lafore, 1994, The WAITE Group Press.
Shukla, Object Oriented Programming in c++, Wiley India.
C++ How to Program by H M Deitel and P J Deitel, 1998, Prentice Hall.
Programming with C++ By D Ravichandran, 2003, T.M.H.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

Lecture Plan (PC-CS-203)

Lectures	TOPICS
L1	Introduction to C++ , C++ standard Library , IIlustrative simple C++ Programs
L2	Header files , Namespaces,
L3	Application of object oriented programming
L4	Object oriented concepts,
L5	Introduction to objects and object oriented programming
L6	Introduction to objects and object oriented programming
L7	Encapsulation ,
L8	Polymorphism
L9	Overloading,
L10	Inheritance,
L11	Abstract Classes
L12	Accessifier (public/protected/private,) Class scope and accessing class member
L13	Controlling access function, constant
L14	class member
L15	structure and class
L16	Friends function and
L17	friend classes
L18	this pointer
L19	Dynamic Memory Allocation and Deallocation (New and Delete)
L20	Static Class members ,
L21	Constructors,
L22	parameter Constructors ,
L23	copy constructors
L24	Deconstructors
L25	Introduction of inheritance,
L26	Types of Inheritance,
L27	Types of Inheritance
L28	Public , Protected and Private Inheritance,
L29	Effect of constructors and deconstructors of Base Class in Derived Classes
L30	Polymorphism, Pointer to Derived Class,
L31	Virtual Functions Pure Virtual Function
L32	Abstract Base Classes, Static and Dynamic Binding,
L33	Virtual Deconstructors
L34	Fundamentals of Operator Overloading, rule for Operators Overloading
L35	Implementation of Operator Overloading Like <<>> Unary Operators, Binary Operators
L36	Text streams and binary stream ,
L37	Sequential and Random access file
L38	Stream input / Output classes, stream manipulators .
L39	Basics of C++ Exception Handing
L40	Try , Throw , Catch, Multiple Catch
L41	Re-throwing an exception, Exception Specifications
L42	Templates : Function Templates,
L43	Overloading Template Function
L44	Class Template , Class Templates
L45	Non –type template arguments

TUTORIAL SHEET -1

Q.1 How C++ is Differ from C?
Q.2 Why do we need object –oriented programming ?
Q.3 What is object, its behavior and description ?
Q.4 Explain Encapsulation, Polymorphism, Abstraction and Inheritance.

Q.5 What is Class, How it is used and how it differ from structure ?

TUTORIAL SHEET -2

Q.1 What is a friend function and friends class ?
Q.2 Explain Dynamic memory allocation .
Q.3 Explain Constructor and Deconstructor .
Q.4 Define this Pointer .
Q.5 Explain the types of inheritance

TUTORIAL SHEET -3

Q.1 Explain different types of polymorphism .
Q.2 Explain operator overloading in detail.
Q.3 Write difference between overriding and overloading ?
Q.4 What do you mean by virtual and pure virtual function ?
Q.5 Explain virtual deconstructors .

TUTORIAL SHEET -4

Q.1 Explain Exception Handling ?
Q.2 Explain method to access a file .
Q.3 What do you mean by Re-throwing an exception .
Q.4 Explain Templates in detail .
Q.5 Explain Function and class templates.

TUTORIAL SHEET -5

Q.1 What are pointer and their use ?
Q.2 How C++ objects acts as physical objects ?
Q.3 What is the purpose of a class specifier C Declaration ?
Q.4 Define major library function ?
Q.5 What is Non –Type template arguments .

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OBJECT ORIENTED PROGRAMMING

PC-CS-203-A

Time : Three Hours]

[Maximum Marks : 75

Note : All questions in Part A and B are compulsory. Attempt any *four* questions from Part C, selecting at least *one* question from each Unit.

Part A

1. (a) Explain controlling access function and utility function with example.

   (b) What is the use of new operator ?

   (c) What does polymorphism mean in C++ language ?

   (d) What is throwing an exception ?

   (e) Under what circumstances overloading using friend function becomes necessary. 5×3=15

Part B

2. What is the object oriented programming ? How is it different from procedure oriented programming ? Explain. 5

3. Why is the "Assignment" operator function not inherited ? Explain. 5

P.T.O.

4. Differentiate between structure and class. 5

5. Create a template for bubble sort function. 5

Part C

Unit I

6. (a) What is the application of the scope resolution operator :: in C++ ? 5

   (b) Which operator is used to access a class member with respect to pointer ? 5

7. (a) What is data abstraction ? How is it implemented in C++ ? 5

   (b) What is the difference between early binding and late binding in C++ ? 5

Unit II

8. What is inheritance ? How does inheritance influence the size and functionality of derived class objects ? 10

9. (a) Under what conditions does the dynamic memory allocation become mandatory. 5

   (b) What are destructors ? When they are called and what is their utility ? 5

Unit III

10. When do we make a virtual function "pure" ? What are the implications of making a function a pure virutual function ? Explain. **10**

11. Overload the "addition" operator for the string so that it adds two strings and return the result. **10**

BS-205					Mathematics-III			
Lecture	**Tutorial**		**Practical**	**Credit**	**Theory**	**Sessional**	**Total**	**Time**
3	**0**		**0**	**3**	**75**	**25**	**100**	**3 Hour**
Purpose	To familiarize the prospective engineers with techniques in sequence and series, multivariable							
	Calculus and ordinary differential equations.							
Course Outcomes (CO)								
CO1	Sequence and series used to organize & create logical process to create flow diagram.							
CO2	Fourier series is used in transmission and processing of digital signals,mp3 encoding.							
CO3	Differential equation play important role in modeling virtually every physical, technical process.							
CO4	Multivariable calculus is used in problems in the field with extra polating based on data to minimize error in some way							
CO5	Multivariable calculus is used in probability and statistics which are prerequisites for machine learning and theoretical computer science.							
CO6	Vector calculus is required to work with graphics, visualization, flight simulation etc.							

UNIT-I

Sequence and Series: Convergence of sequence and series, tests for convergence (Comparison test, D'Alembert's Ratio test, Logarithmic test, Cauchy root test, Raabe's test).

Fourier series: Introduction, Fourier-Euler Formula, Dirichlet's conditions, Change of intervals, Fourier series for even and odd functions, Half range sine and cosine series.

UNIT-II

First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Differential equations of higher orders:

Second order linear differential equations with constant coefficients, method of variation of parameters, Cauchy and Legendre's linear differential equations.

UNIT-III

Multivariable Calculus (Integration): Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar) Applications: areas and volumes; Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

UNIT-IV

Vector Calculus: Introduction, Scalar and Vector point functions, Gradient, divergence and Curl and their properties, Directional derivative. Line integrals, surface integrals, volume integrals, Theorems of Green, Gauss and Stokes (without proof).

Suggested Books:

G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley and Sons, 2006.

W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.

S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.

E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.

G.F. Simmons and S.G. Krantz, Differential Equations, Tata McGraw Hill, 2007.

Erwin Kreyszig and Sanjeev Ahuja, Applied Mathematics-I, reprint 2015, Wiley India Publication.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

Lecture Plan (BS-205)

S. No.	TOPIC	No. of Lectures
1.	**IST ORDER ORDINARY DIFF. EQNS (Unit II)** L1- Exact, linear and Bernoulli's equations L2- ----------do---------- L3- Euler's equations L4-Equations not of first degree equations solvable for p L5- Equations solvable for y, equations solvable for x and Clairaut's type. L6- ----------do---------- L7- Second order linear differential equations with constant coefficients L8- ----------do---------- L9-Method of variation of parameters L10- Cauchy and Legendre's linear differential equations	**10**
2.	**SEQUENCES AND SERIES (Unit I)** L1- Convergence of sequence and series L2- Tests for convergence (Comparison test) L3-D'Alembert's Ratio test, Logarithmic test L4----------do---------- L5- Cauchy root test, Raabe's test L6- ----------do---------- L7- Power series. L8-Fourier series: Introduction, Fourier-Euler Formula, Dirichlet's conditions L9----------do---------- L10 Change of intervals L11- Fourier series for even and odd functions L12- Half range sine and cosine series.	**12**
3.	**MULTIVARIABLE CALCULUS (Unit III)** L1- Multiple Integration:Double integrals (Cartesian) L2- ----------do---------- L3-Change of order of integration in double integrals L4----------do---------- L5- Change of variables (Cartesian to polar) L6-Applications: areas and volumes L7- ----------do---------- L8-Triple integrals (Cartesian),orthogonal curvilinear coordinates L9- Simple applications involving cubes, sphere and rectangular parallelepipeds. L10----------do----------	**10**
4.	**VECTOR CALCULUS (Unit IV)** L1- Introduction, Scalar and Vector point functions L2- Gradient , Directional derivative. L3- Divergence & Curl and their properties L4- ----------do---------- L5-Line integrals L6-Surface integrals L7-Volume integrals L8-Green's Theorem (without proof). L9-Gauss Theorem (without proof). L10- Stokes Theorem (without proof). **TOTAL LECTURES**	**10** **10**
		42

Tutorial sheet (Unit I)

1. Show that the following sequence
   (i) $\{a_n\}= (-1)^n /n$ converges
   (ii) $\{a_n\}= 2n$ diverges
   (iii) $\{a_n\}= 1 +(-1)^n$ oscillates

2. Test the convergence of the series $\frac{1}{1*2*3}+\frac{1}{2*3*4}+\frac{1}{3*4*5}+\ldots\ldots\ldots-$

3. Test the convergence of the series $\Sigma(n^3+a)/(2^n+a)$

4. Find the Half Range Cosine series for the function $f(x)=(x-1)^2$ in the interval $0<x<1$. Hence show that

1) $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+\ldots\ldots\ldots=\frac{\pi^2}{6}$

2) $\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+\ldots\ldots\ldots=\frac{\pi^2}{12}$

3) $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\frac{1}{7^2}+\ldots\ldots\ldots=\frac{\pi^2}{8}$

6. Expand $f(x) = e^{-x}$ as a Fourier series in the interval $(-\pi,+\pi)$

7. Find a Fourier series to represent x^2 in the interval (-c,+c)

8. If $f(x) = |\cos x|$, expand f(x) as a fourier series in the interval $(-\Pi,+\Pi)$

9. Define Power series with examples.

Tutorial Sheet (Unit II)

1.Solve the following equation

(a) $(3x^2+6xy^2)dx + (6x^2y+4y^3)dy = 0$

(b) $(y^2+2x^2y)dx + (2x^3-xy)dy = 0$

(c) $2ydx+x(2\log x-y)dy = 0$

2. Solve the initial value problem $\cos x\, dy/dx + y = \sin x$, $y(0)=2$

3. Solve $dy/dx + y/x = 3x^2y^2$

4. Solve $y=xy' - (y')^2$

5.Solve by the method of variation of parameters

$y'' - 2y' + 2y = e^x \tan x$

6. Solve $x^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} - 4y = x^2 + 2\log x$

7.Solve $(1+x)^2\frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = 4\cos\log(1+x)$

8. Solve the differential equation : $(D^2+2D+1)Y = \cosh x - \cos^2 x$

Tutorial Sheet (Unit III)

1. Evaluate the following integral by changing the order of integration:

$$\int_0^1 \int_x^{\sqrt{2-x^2}} \frac{x}{\sqrt{x^2+y^2}} dydx$$

2. Find by double integration, the area of lemniscate $r^2 = a^2 \cos 2\theta$.

3. Evaluate the integral:

$\iint (x+y)^2 dxdy$ over the area bounded by ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$.

4. Evaluate the integral:

$$\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z} dzdydx.$$

5. Find by double integration, the area lying between the parabola $y=4x-x^2$ and the line y=x.

6. Find the area lying inside the cardiods r=1+cosθ and outside the parabola r(1+cosθ)=1

7. Evaluate $\iiint dxdydz/\sqrt{(a^2-x^2-y^2-z^2)}$ (i) Over the positive octant of the sphere $x^2+y^2+z^2=a^2$
   (ii) Taken throughout the volume of the sphere $x^2+y^2+z^2=a^2$

8. Evaluate $\iint_D \exp\{-(x^2+y^2)\}dydx$, where D is the region bounded by $x^2+y^2= a^2$

Tutorial Sheet (Unit-Iv)

1. In what direction from (3,1,-2) is the directional derivative of $\phi = x^2 y^2 z^4$ maximum? Find also the magnitude of this maximum.

2. Give geometrical interpretation of gradient, curl, divergence.

3. For a solenoidal vector **F,** show that curlcurlcurl**F**= $\nabla^4 F$

4. Calculate (a) curl(grad f), given $f(x,y,z)= x^2+y^2-z$.

   (b) curlcurl**A**, given that **A**= x^2 y**I**+y^2 z**J**+z^2 y**K**

5. Find the values of λ and μ so that the surfaces $\lambda x^2 y+ \mu z^3 =4$ may cut the surface $5x^2 =2yz+9x$ orthogonally at (1,-1,2)

6. The acceleration of a particle at any time $t \geq 0$ is given by 12cos2t**I**-8sin2t**J**+16t**k,** the velocity and acceleration are initially zero. Find the velocity and displacement at any time.

7. Compute the line integral $\int_C (y^2 dx - x^2 dy)$ about the triangle whose vertices are (1,0), (0,1) and (-1,0).

8. Evaluate by Stoke's theorem $\oint_C (yzdx + zxdy + xydz)$ where C is the curve $x^2+y^2=1$, z=1.5.

9. If S is any closed surface enclosing a volume V and **F**= ax**I**+by**J**+cz**K,** prove that $\int_S F.Nds = (a+b+c)V$

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MATHEMATICS-3

BS-205A

Time : Three Hours] [Maximum Marks : 75

Note : All questions in Part A and Part B are compulsory. Attempt any *four* questions from Part C selecting at least *one* from each Unit.

Part A

1. (a) Determine the following series converges or diverges :

$$\sum_{n=1}^{\infty} \frac{1}{n^2 - 1}.$$

(b) Solve $3y' + xy = xy^{-2}$.

(c) Find the solution of $(D^2 + 2D + 1)y = 2e^x$.

(d) Evaluate the integral $\int_0^1 \int_0^x \int_0^{1+x+y} f(x, y, z)\, dx\, dy\, dz$ where $f(x, y, z) = 1$.

(e) Evaluate divergence of $2x^2zi - xy^2zj + 3yz^2k$ at the point (1, 1, 1). 5×3=15

Part B

2. Determine whether the series converge :

   (a) $\sum_{n=1}^{\infty} \frac{n!}{n^n}$.

   (b) $\sum_{n=1}^{\infty} \frac{n^5}{n^n}$. 5

3. Solve $\left(2x^2+3y^2-7\right)xdx=\left(3x^2+2y^2-8\right)ydy$. 5

4. Evaluate $\int_0^1\int_0^{1-x}\int_0^{1-x-y} xyz\,dz\,dy\,dx$. 5

5. Prove that $\nabla.\left(\nabla\times\bar{A}\right)=0$ for any vector function $\bar{A}$. 5

Part C

Unit I

6. (a) Define Cauchy first root test for sequence.Also check the convergence of $<a_n>$ where $a_n=\left(\frac{n^2+1}{n+3}\right)^{\frac{1}{n}}$. 5

   (b) Series $\sum\frac{1}{n}$ converges or diverges ? Justify. 5

7. Find the Fourier series expansion of $f(x)=\frac{1}{4}(\pi-x)^2,\ 0<x<2\pi$. 10

Unit II

8. (a) Find the general solution and singular solution of $y=px+p^3$. 5

(b) Solve $\left(2y^2+4x^2y\right)dx+\left(4xy+3x^3\right)dy$ using exact differential equation. 5

9. (a) Solve $(D^2 - 2D + 1)y = xe^x \sin x$. 5

(b) Solve the following differential equation using method of variation of parameter $\left(D^2+1\right)y=\operatorname{cosec} x.\cot x$. 5

Unit III

10. Change the order of integration and hence evaluate : $\int_0^a \int_{\sqrt{ax}}^{a} \frac{y^2}{\sqrt{y^4-a^2x^2}}\,dy\,dx$ 10

11. Find the volume of the portion of the sphere $x^2 + y^2 + z^2 = a^2$ lying inside the cylinder $x^2 + y^2 = ay$. 10

Unit IV

12. Show that $\nabla\times\left(\nabla\times\bar{A}\right)=\nabla\left(\nabla.\bar{A}\right)-\nabla^2\bar{A}$. For any vector function $\bar{A}$. **10**

13. Using Green's theorem find the area of the region in the first quadrant bounded by the curve $y = x,\ y=\frac{1}{x}, y=\frac{x}{4}$. **10**

HM-902A	Business Intelligence & Entrepreneurship					
Lecture	**Tutorial**	**Practical**	**Major Test**	**Minor Test**	**Total**	**Time**
4	**-**	**-**	**75**	**25**	**100**	**3**
Course Outcomes						
CO1	Students will be able understand who the entrepreneurs are and what competences needed to become an Entrepreneur					
CO2	Students will be able understand insights into the management, opportunity search, identification of a Product;					
CO3	Students can be able to write a report and do oral presentation on the topics such as product identification, business idea, export marketing etc.					
CO4	Students be able to know the different financial and other assistance available for the establishing small industrial units.					
CO5	Students will be able understand market feasibility studies; project finalization etc. required for small business enterprises.					
CO6	To understand the perspectives of business intelligence using marketing and business ideas					

Unit –I

Entrepreneurship : Concept and Definitions; Entrepreneurship and Economic Development; Classification and Types of Entrepreneurs; Entrepreneurial Competencies; Factor Affecting Entrepreneurial Growth – Economic, Non-Economic Factors; EDP Programmes; Entrepreneurial Training; Traits/Qualities of an Entrepreneurs; Manager Vs. Entrepreneur, Entrepreneurial challenges.

Unit -II

Opportunity / Identification and Product Selection: Entrepreneurial Opportunity Search and Identification; Criteria to Select a Product; Conducting Feasibility Studies; Sources of business ideas, Marketing Plan : Conducting of Marketing Research, Industry Analysis, Competitor analysis, market segmentation and positioning, building a marketing plan, marketing mix, launching a new product; export marketing, Methods of Project Appraisal, Project Report Preparation; Specimen of Project Report; Project Planning and Scheduling using Networking Techniques of PERT / CPM.

Unit –III

Small Enterprises and Enterprise Launching Formalities : Definition of Small Scale; Rationale; Objective; Scope; SSI; Registration; NOC from Pollution Board; Machinery and Equipment Selection , Role of SSI in Economic Development of India; major problem faced by SSI,MSMEs – Definition and Significance in Indian Economy; MSME Schemes, Challenges and Difficulties in availing MSME Schemes.

Unit –IV

Role of Support Institutions and Management of Small Business : DIC; SIDO; SIDBI; Small Industries Development Corporation (SIDC); SISI; NSIC; NISBUD; State Financial Corporation SIC; Venture Capital : Concept, venture capital financing schemes offered by various financial institutions in India.

Special Issues for Entrepreneurs: Legal issues – Forming business entity, requirements for formation of a Private/Public Limited Company, Entrepreneurship and Intellectual Property Rights: IPR and their importance. (Patent, Copy Right, Trademarks) , Case Studies-At least one in whole course.

Note:

• Case studies of Entrepreneurs – successful, failed, turnaround ventures should be discussed in the class.
• Exercises / activities should be conducted on 'generating business ideas' and identifying problems and opportunities.
• Interactive sessions with Entrepreneurs, authorities of financial institutions, Government officials should be organized

Suggested Readings:

- "Entrepreneurship development small business enterprises", Pearson, Poornima M Charantimath,2013.
- Roy Rajiv, "Entrepreneurship", Oxford University Press, 2011.
- "Innovation and Entrepreneurship",Harper business- Drucker.F, Peter, 2006.
- "Entrepreneurship", Tata Mc-graw Hill Publishing Co.ltd new Delhi- Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, 8th Edition, 2012
- Enterpreneurship Development- S.Chand and Co.,Delhi- S.S.Khanka 1999
- Small-Scale Industries and Entrepreneurship. Himalaya Publishing House, Delhi –Vasant Desai 2003.
- Entrepreneurship Management -Cynthia, Kaulgud, Aruna, Vikas Publishing House, Delhi, 2003.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus

Lecture Plan (HM-902)

Week	Lecture Day	Class	Topic/Chapter Covered	Academic Activity	Test/ Assignment
1st	L1	B.Tech CSE- 3rd Semester	Concepts & Definitions of Entrepreneurship	Lecture	
	L2	B.Tech CSE- 3rd Semester	Entrepreneurship & Economic Development	Lecture	
	L3	B.Tech CSE- 3rd Semester	Classification of Entrepreneurs	Lecture	
2nd	L4	B.Tech CSE- 3rd Semester	Types of Entrepreneurs	Lecture	
	L5	B.Tech CSE- 3rd Semester	Types of Entrepreneurship	Lecture	
	L6	B.Tech CSE- 3rd Semester	Entrepreneurial Competencies	Lecture	
3rd	L7	B.Tech CSE- 3rd Semester	Factors affecting Entrepreneurial Growth (economic & Non Economic)	Lecture	
	L8	B.Tech CSE- 3rd Semester	EDP Programms	Lecture	
	L9	B.Tech CSE- 3rd Semester	EDP Programms	Lecture	
4th	L10	B.Tech CSE- 3rd Semester	Entrepreneurial Training	Lecture	
	L11	B.Tech CSE- 3rd Semester	Traits & Qualities of an Entrepreneur	Lecture	
	L12	B.Tech CSE- 3rd Semester	Manager vs. Entrepreneurs	Lecture	
5th	L13	B.Tech CSE- 3rd Semester	Entrepreneurs vs. entrepreneurship	Lecture	
	L14	B.Tech CSE- 3rd Semester	Entrepreneurial Challenges	Lecture	Assignment from 1st Unit
	L15	B.Tech CSE- 3rd Semester	Entrepreneurial Opportunity Search & Identification	Lecture	
6th	L16	B.Tech CSE- 3rd Semester	Entrepreneurial Opportunity Search & Identification	Lecture	
	L17	B.Tech CSE- 3rd Semester	Criteria to Select a Product	Lecture	
	L18	B.Tech CSE- 3rd Semester	Conducting Feasibility Studies	Lecture	
7th	L19	B.Tech CSE- 3rd Semester	Conducting Feasibility Studies	Lecture	
	L20	B.Tech CSE- 3rd Semester	Sources of business ideas	Lecture	
	L21	B.Tech CSE- 3rd Semester	-- do --	Lecture	
8th	L2	B.Tech CSE- 3rd Semester	Marketing plan: Conducting of marketing research	Lecture	

	L22	B.Tech CSE- 3rd Semester	Industry analysis, competitor analysis	Lecture	
	L23	B.Tech CSE- 3rd Semester	Marketing segmentation and positioning	Lecture	
9th	L24	B.Tech CSE- 3rd Semester	Building a marketing plan	Lecture	
	L25	B.Tech CSE- 3rd Semester	Marketing mix.	Lecture	
	L26	B.Tech CSE- 3rd Semester	Launching a new product	Lecture	
10th	L27	B.Tech CSE- 3rd Semester	Export marketing	Lecture	
	L28	B.Tech CSE- 3rd Semester	Methods of Project Appraisal	Lecture	
	L29	B.Tech CSE- 3rd Semester	-- do --	Lecture	
11th	L30	B.Tech CSE- 3rd Semester	Project Report Preparation	Lecture	
	L31	B.Tech CSE- 3rd Semester	Specimen of Project Report	Lecture	
	L32	B.Tech CSE- 3rd Semester	Project, Planning & Scheduling using Networking Techniques of PERT/CPM	Lecture	
12th	L33	B.Tech CSE- 3rd Semester	-- do --	Lecture	Assignment from 2nd Unit
	L34	B.Tech CSE- 3rd Semester	Definitions of Small Scale, , Objective, Scope,	Lecture	
	L35	B.Tech CSE- 3rd Semester	Rationale of SSI	Lecture	
13th	L36	B.Tech CSE- 3rd Semester	SSI Registration	Lecture	
	L37 Add On's	B.Tech CSE- 3rd Semester	NOC from Pollution Board Machinery & Equipment Selection	Lecture	
	L38 Add On's	B.Tech CSE- 3rd Semester	Role of SSI in Economic Development in India	Lecture	
14th	L39 Add On's	B.Tech CSE- 3rd Semester	Major problem faced by SSI, MSMEs	Lecture	
	L40 Add On's	B.Tech CSE- 3rd Semester	Definition and significance of Indian Economy	Lecture	
	L41 Add On's	B.Tech CSE- 3rd Semester	MSME Schemes	Lecture	
15th	L42	B.Tech CSE- 3rd Semester	Challenges and difficulties in availing MSME Schemes	Lecture	Assignment from 3rd unit
	L43	B.Tech CSE- 3rd Semester	Director of Industries DIC, SIDO, SIDBI, SIDC, SISI, NSIC, NISBUD, State financial Corporation's.	Lecture	

	L44	B.Tech CSE- 3rd Semester	Venture capital: financing schemes offered by various financial institutions in India.	Lecture	
16th	L45	B.Tech CSE- 3rd Semester	Legal issues: forming business entity , requirements for formation of a private / public limited company.	Lecture	
	L46	B.Tech CSE- 3rd Semester	Entrepreneurship & intellectual property rights & their importance.	Lecture	
	L47	B.Tech CSE- 3rd Semester	Case study	Lecture	
	L48	B.Tech CSE- 3rd Semester	Revision Unit –I	Lecture	Assignment from 4th Unit
	L49	B.Tech CSE- 3rd Semester	Revision Unit - II	Lecture	
	L50	B.Tech CSE- 3rd Semester	Revision Unit – III	Lecture	
	L51	B.Tech CSE- 3rd Semester	Revision Unit – IV	Lecture	

Tutorial Sheet 1

1. Define Entrepreneurship and types of Entrepreneurs.
2. What are the factors affecting entrepreneurial growth.
3. Difference between Managers and Entrepreneurs.
4. Explain EDP Programmes.

Tutorial Sheet 2

1. Write briefly on “Identification of business opportunity”.
2. Detailed note on Feasibility study.
3. What is Marketing mix and how marketing help business to grow.
4. Difference between PERT and CPM.

Tutorial Sheet 3

1. What is SSI and problems faced by SSI.
2. How MSME are responsible for the growth of Indian Economy.
3. Explain the schemes launched under MSME in the current budget.
4. What are the objectives and scope of SSI.

Tutorial Sheet 4

1. Explain the following institutions:
   DIC, SIDO, SIDBI, SIDC, SISI, NSIC
2. What are the requirements for formation of a Private and Public limited company.
3. Briefly explain Intellectual Property Right.
4. Difference between Patent, Copyright and Trademarks.

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BT-3/D-19 33136

BUSINESS INTELLIGENCE AND ENTREPRENEURSHIP

HM-902A (G-I)

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. **1** is compulsory. Each question carries equal marks.

1. Answer the following questions :

(i) (i) The limit of investment in plant and machinery in small scale manufacturing units is.....lakhs.

(ii) Which Schedule of Items is not open for Private manufacture ?

(iii) Write full form of PERT and CPM.

(ii) What are objectives of the MSME Registration ?

(iii) Discuss the function of District Industry Centre ?

(iv) Write salient features of Micro, Small and Medium Enterprises Development Act, 2006 ?

(v) Describe ZED certification scheme. **15**

Unit I

2. Explain the characteristics of successful entrepreneurs. Also explain, how does an Entrepreneur contribute to the economy and society ? Explain with illustrations ? 15

3. Discuss Entrepreneurial competencies on the basis of three clusters. 15

Unit II

4. What are the various criteria an entrepreneur must follow for the selection of a product for the launch of a enterprise ? 15

5. Describe the opportunity search and identifications methods in detail. 15

Unit III

6. Describe PERT/CPM project planning and scheduling techniques. 15

7. (a) Explain net present value (NPV) project evaluation method. 8

   (b) Write merit of discounted cash flow techniques with example. 7

Unit IV

8. (a) Discuss function of SIDO. 7

   (b) Discuss function of NISBUD. 8

9. Describe issue in Human Resource Management in SMEs. 15

PC-CS205L	Data Structure and Algorithms Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	
0	**0**	**4**	**2.0**	**40**	**60**	**100**	
Purpose	To introduce the principles and paradigms of Data Structures for design and implement the software systems logically and physically.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of Data structure, basic data types, searching and sorting based on array data types.						
CO2	To introduce the structured data types like Stacks and Queue and its basic operation's implementation.						
CO3	To introduce dynamic implementation of linked list.						
CO4	To introduce the concepts of Tree and graph and implementation of traversal algorithms.						
CO5	To introduce the concepts of Tree and implementation of traversal algorithms.						
CO6	To introduce the concepts of Graphs.						

1. Write a program for Binary search methods.
2. Write a program for insertion sort, selection sort and bubble sort.
3. Write a program to implement Stack and its operation.
4. Write a program for quick sort.
5. Write a program for merge sort.
6. Write a program to implement Queue and its operation.
7. Write a program to implement Circular Queue and its operation.
8. Write a program to implement singly linked list for the following operations: Create, Display, searching, traversing and deletion.
9. Write a program to implement doubly linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.
10. Write a program to implement circular linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.
11. Write a program to implement insertion, deletion and traversing in B tree

NOTE:

At least seven experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining eight.

ES-209L	Digital Electronics Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2.0**	**40**	**60**	**100**	**3**
Purpose	To learn the basic methods for the design of digital circuits and systems.						
Course Outcomes (CO)							
CO1	To Familiarization with Digital Trainer Kit and associated equipment.						
CO2	To Study and design of TTL gates						
CO3	To learn the formal procedures for the analysis and design of combinational circuits.						
CO4	To learn the formal procedures for the analysis and design of sequential circuits						
CO5	Students may also design State M/Cs circuits using combinational circuits						
CO6	Students will be able to understand the basics memories and PLDs.						

LIST OF EXPERIMENTS:

1. Familiarization with Digital Trainer Kit and associated equipment.
2. Study of TTL gates AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
3. Design and realize a given function using K-Maps and verify its performance.
4. To verify the operation of Multiplexer and De-multiplexer.
5. To verify the operation of Comparator.
6. To verify the truth table of S-R, J-K, T, D Flip-flops.
7. To verify the operation of Bi-directional shift register.
8. To design and verify the operation of 3-bit asynchronous counter.
9. To design and verify the operation of asynchronous Up/down counter using J-K FFs.
10. To design and verify the operation of asynchronous Decade counter.
11. Study of TTL logic family characteristics.
12. Study of Encoder and Decoder.
13. Study of BCD to 7 segment Decoder.

NOTE:

At least ten experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining five.

PC-CS205 L	Object Oriented Programming Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2.0**	**40**	**60**	**100**	**3 Hour**
Purpose	To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of object oriented programming language and the its representation.						
CO2	To allocate dynamic memory, access private members of class and the behavior of inheritance and its implementation.						
CO3	To introduce polymorphism, interface design and overloading of operator.						
CO4	To handle backup system using file, general purpose template and handling of raised exception during programming.						
CO5	Perform object oriented programming to develop solutions to problems demonstrating usage of control structures, modularity, I/O. and other standard language constructs.						
CO6	To learn how to design C++ classes for code reuse.						

Q1. Raising a number n to a power p is the same as multiplying n by itself p times. Write a function called power ( ) that takes a double value for n and an int value for p, and returns the result as double value. Use a default argument of 2 for p, so that if this argument is omitted, the number will be squared. Write a main ( ) function that gets values from the user to test this function.

Q2. A point on the two dimensional plane can be represented by two numbers: an X coordinate and a Y coordinate. For example, (4,5) represents a point 4 units to the right of the origin along the X axis and 5 units up the Y axis. The sum of two points can be defined as a new point whose X coordinate is the sum of the X coordinates of the points and whose Y coordinate is the sum of their Y coordinates. Write a program that uses a structure called point to model a point. Define three points, and have the user input values to two of them. Then set the third point equal to the sum of the other two, and display the value of the new point. Interaction with the program might look like this:

Enter coordinates for P1: 3 4
Enter coordinates for P2: 5 7
Coordinates of P1 + P2 are : 8, 11

Q3. Create the equivalent of a four function calculator. The program should request the user to enter a number, an operator, and another number. It should then carry out the specified arithmetical operation: adding, subtracting, multiplying, or dividing the two numbers. (It should use a switch statement to select the operation). Finally it should display the result. When it finishes the calculation, the program should ask if the user wants to do another calculation. The response can be 'Y' or 'N'. Some sample interaction with the program might look like this. Enter first number, operator, and second number: 10/ 3

Answer = 3.333333
Do another (Y/ N)? Y
Enter first number, operator, second number 12 + 100
Answer = 112
Do another (Y/ N) ? N

Q4. A phone number, such as (212) 767-8900, can be thought of as having three parts: the area code (212), the exchange (767) and the number (8900). Write a program that uses a structure to store these three parts of a phone number separately. Call the structure phone. Create two structure variables of type phone. Initialize one, and have the user input a number for the other one. Then display both numbers. The interchange might look like this:

Enter your area code, exchange, and number: 415 555 1212
My number is (212) 767-8900
Your number is (415) 555-1212

Q5. Create two classes DM and DB which store the value of distances. DM stores distances in metres and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use a friend function to carry out the addition operation. The object that stores the results maybe a DM object or DB objects, depending on the units in which the results are required. The display should be in the format of feet and inches or metres and cenitmetres depending on the object on display.

Q6. Create a class rational which represents a numerical value by two double values- NUMERATOR and DENOMINATOR. Include the following public member Functions:

- constructor with no arguments (default).
- constructor with two arguments.
- void reduce( ) that reduces the rational number by eliminating the highest common factor between the numerator and denominator.
- Overload + operator to add two rational number.

• Overload >> operator to enable input through cin.

• Overload << operator to enable output through cout.

Write a main ( ) to test all the functions in the class.

Q7. Consider the following class

definition class father {
protected : int age;
public;
father (int x) {age = x;}
virtual void iam ( )
{ cout < < "I AM THE FATHER, my age is : "<< age<<
end1:} };

Derive the two classes son and daughter from the above class and for each, define iam ( ) to write our similar but appropriate messages. You should also define suitable constructors for these classes. Now, write a main ( ) that creates objects of the three classes and then calls iam ( ) for them. Declare pointer to father. Successively, assign addresses of objects of the two derived classes to this pointer and in each case, call iam ( ) through the pointer to demonstrate polymorphism in action.

Q8. Write a program that creates a binary file by reading the data for the students from the terminal. The data of each student consist of roll no., name (a string of 30 or lesser no. of characters) and marks.

Q9. A hospital wants to create a database regarding its indoor patients. The information to store

include a) Name of the patient
b) Date of admission
c) Disease
d) Date of discharge

Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about all the to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).

Q10. Make a class **Employee** with a name and salary. Make a class **Manager** inherit from **Employee**. Add an instance variable, named department, of type string. Supply a method to **to String** that prints the manager's name, department and salary. Make a class **Executive** inherits from **Manager**. Supply a method **to String** that prints the string **"Executive"** followed by the information stored in the **Manager** superclass object. Supply a test program that tests these classes and methods.

Q11. Imagine a tollbooth with a class called toll Booth. The two data items are a type unsigned int to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes both these to 0. A member function called payingCar ( ) increments the car total and adds 0.50 to the cash total. Another function, called nopayCar ( ), increments the car total but adds nothing to the cash total. Finally, a member function called displays the two totals. Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a nonpaying car. Pushing the ESC kay should cause the program to print out the total cars and total cash and then exit.

Q12. Write a function called reversit ( ) that reverses a string (an array of char). Use a for loop that swaps the first and last characters, then the second and next to last characters and so on. The string should be passed to reversit ( ) as an argument. Write a program to exercise reversit ( ). The program should get a string from the user, call reversit ( ), and print out the result. Use an input method that allows embedded blanks. Test the program with Napoleon's famous phrase, "Able was I ere I saw Elba)".

Q13. Create some objects of the string class, and put them in a Deque-some at the head of the Deque and some at the tail. Display the contents of the Deque using the forEach ( ) function and a user written display function. Then search the Deque for a particular string, using the first That ( ) function and display any strings that match. Finally remove all the items from the Deque using the getLeft ( ) function and display each item. Notice the order in which the items are displayed: Using getLeft ( ), those inserted on the left (head) of the Deque are removed in "last in first out" order while those put on the right side are removed in "first in first out" order. The opposite would be true if getRight ( ) were used.

Q14. Assume that a bank maintains two kinds of accounts for customers, one called as savings account and the other as current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed.

Create a class account that stores customer name, account number and type of account. From this derive the classes

cur_acct and sav_acct to make them more specific to their requirements. Include necessary member functions in order to achieve the following tasks:

a) Accept deposit from a customer and update the balance.

b) Display the balance.

c) Compute and deposit interest.

d) Permit withdrawal and update the balance.

e) Check for the minimum balance, impose penalty, necessary and update the balance.

f) Do not use any constructors. Use member functions to initialize the class members.

Q15. Create a base class called shape. Use this class to store two double type values that could be used to compute the area of figures. Derive two specific classes called triangle and rectangle from the base shape. Add to the base class, a member function get_data( ) to initialize baseclass data members and another member function display_area( ) to compute and display the area of figures. Make display_area ( ) as a virtual function and redefine this function in the derived classes to suit their requirements. Using these three classes, design a program that will accept dimensions of a triangle or a rectangle interactively and display the area.

Remember the two values given as input will be treated as lengths of two sides in the case of rectangles and as base and height in the case of triangles and used as follows:

Area of rectangle = x * y

Area of triangle = ½ * x * y

NOTE:

At least ten experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining five.