SEMESTER-I

Title of the course : **Elements of Computer Engineering**

Subject code : **ESCS-401**

Weekly load : **2 Hrs** **LTP 2-0-0**

Credits : **2**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Get acquainted with basics of computer system along with its various components
CO2	Know about various operating systems and memory
CO3	Study the C programming basics and learn the concept of operators
CO4	Understand the concept of decision statements and loops
CO5	Learn the use of functions, pointers, arrays, structures, union etc. for modular programming

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	1	3	0	0	0	3	1	3	2	3	3
CO2	3	1	3	3	3	0	0	0	3	2	3	2	3	3
CO3	3	2	3	1	3	3	0	0	2	2	3	2	3	3
CO4	3	2	3	3	3	3	0	0	3	3	3	3	3	3
CO5	3	3	3	3	3	3	0	0	3	3	3	3	3	3

Theory

Unit	**Main Topics**	**Course outlines**	**Lecture(s)**
Unit-1	1. Fundamentals of computer system	Introduction and characteristics of computer system, Generations, Classifications, Applications, Central Processing Unit, Memory, I/O devices, Introduction to operating system and its types, Algorithm, Flowchart.	04
	2. C Programming Basics	Basic program construction, Structure of a C program, Compilation process, preprocessor directives, Comments, Data types, Type conversions, Operators - Arithmetic, Relational, Logical, Conditional, Increment/decrement, Library functions, Header files.	04
	3. Loops and Decision Statements	*for* loop, *while* loop, *do* loop, Various forms of *if* statement,*switch* statement, *break* statement, *continue* state ment, *go to* statement.	04
	4. Functions	Defining functions, Passing arguments to functions, Returning values from functions, Reference arguments, Storage classes.	04
Unit-2	5. Pointers	Pointers, Pointers to pointers, Declaring and initializing pointers, Pointer expressions, Pointers and arrays, Pointers and strings.	04

	6. Arrays	Arrays and strings, Declaring an array, Initializing arrays, Accessing the array elements, Working with multidimensional arrays, Declaring and initializing string variables, String handling functions.	04
	7. Structures and Union	Declaring and initializing a structure, Accessing the members of a structure, Nested structures, Array of structures, Using structures in functions, Pointers and structures, Declaring and initializing a union.	04
	8. Files	Reading and writing to text and binary files, Character I/O, String I/O, File pointers, Error handling, Redirection, Command line arguments.	04

Total=32

Recommended Books:

1. Raja Raman V., Fundamentals of Computers, PHI.
2. Kernighan Brian W. and Ritchie, Dennis M., The C Programming language, Dorling Kingsley.
3. Balagurusamy E., Programming in ANSI C, TMH Publications

Title of the course : **Elements of Computer Engineering Lab**

Subject Code : **ESCS-402**

Weekly load : **4 Hrs** **LTP 0-0-4**

Credit : **2**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Solve basic mathematical problems using programming
CO2	Demonstrate the use of loop statements to solve iteration problems
CO3	Implement the concept of modular programming and recursion using functions
CO4	Implementation of decision statements and loops
CO5	Create a file and add, append or retrieve data using file handling

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	3	0	0	3	3	3	2	3	2
CO2	3	3	3	2	2	2	0	0	3	3	3	2	3	2
CO3	3	3	3	2	3	2	0	0	3	2	3	3	3	3
CO4	3	3	3	3	3	3	0	0	3	2	3	3	3	3
CO5	3	3	3	3	3	3	0	0	3	3	3	3	3	3

LIST OF PRACTICALS

1. Write down programs to implement various operators available in C.
2. Write down programs to implement the concept of conditional statements.
3. Write down programs to implement various loop statements.
4. WAP to implement the concept of break and continue statements.
5. Write down programs to implement functions using various parameter passing techniques.
6. WAP to implement the concept of recursion.
7. WAP to implement the concept of local and global variables.
8. Write down programs to implement array and its various operations.
9. Write down programs to implement strings and its various functions.
10. Write down programs to implement the concept of structure and union.
11. Write down programs to implement the concept of pointers.
12. Write down programs to implement the concept of file handling.

Note: The above mentioned list of experiments is suggested list. Teacher may add more programs/ experiments as per requirement.

SEMESTER-II

Title of the course : **Elements of Computer Engineering**

Subject code : **ESCS-401**

Weekly load : **2 Hrs** **LTP 2-0-0**

Credits : **2**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Get acquainted with basics of computer system along with its various components
CO2	Know about various operating systems and memory
CO3	Study the C programming basics and learn the concept of operators
CO4	Understand the concept of decision statements and loops
CO5	Learn the use of functions, pointers, arrays, structures, union etc. for modular programming

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	1	3	0	0	0	3	1	3	2	3	3
CO2	3	1	3	3	3	0	0	0	3	2	3	2	3	3
CO3	3	2	3	1	3	3	0	0	2	2	3	2	3	3
CO4	3	2	3	3	3	3	0	0	3	3	3	3	3	3
CO5	3	3	3	3	3	3	0	0	3	3	3	3	3	3

Theory

Unit	**Main Topics**	**Course outlines**	**Lecture(s)**
Unit-1	1. Fundamentals of computer system	Introduction and characteristics of computer system, Generations, Classifications, Applications, Central Processing Unit, Memory, I/O devices, Introduction to operating system and its types, Algorithm, Flowchart.	04
	2. C Programming Basics	Basic program construction, Structure of a C program, Compilation process, preprocessor directives, Comments, Data types, Type conversions, Operators - Arithmetic, Relational, Logical, Conditional, Increment/decrement, Library functions, Header files.	04
	3. Loops and Decision Statements	*for* loop, *while* loop, *do* loop, Various forms of *if* statement,*switch* statement, *break* statement, *continue* state ment, *go to* statement.	04
	4. Functions	Defining functions, Passing arguments to functions, Returning values from functions, Reference arguments, Storage classes.	04
Unit-2	5. Pointers	Pointers, Pointers to pointers, Declaring and initializing pointers, Pointer expressions, Pointers and arrays, Pointers and strings.	04

	6. Arrays	Arrays and strings, Declaring an array, Initializing arrays, Accessing the array elements, Working with multidimensional arrays, Declaring and initializing string variables, String handling functions.	04
	7. Structures and Union	Declaring and initializing a structure, Accessing the members of a structure, Nested structures, Array of structures, Using structures in functions, Pointers and structures, Declaring and initializing a union.	04
	8. Files	Reading and writing to text and binary files, Character I/O, String I/O, File pointers, Error handling, Redirection, Command line arguments.	04

Total=32

Recommended Books:

4. Raja Raman V., Fundamentals of Computers, PHI.
5. Kernighan Brian W. and Ritchie, Dennis M., The C Programming language, Dorling Kingsley.
6. Balagurusamy E., Programming in ANSI C, TMH Publications

Title of the course : **Elements of Computer Engineering Lab**

Subject Code : **ESCS-402**

Weekly load : **4 Hrs** **LTP 0-0-4**

Credit : **2**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Solve basic mathematical problems using programming
CO2	Demonstrate the use of loop statements to solve iteration problems
CO3	Implement the concept of modular programming and recursion using functions
CO4	Implementation of decision statements and loops
CO5	Create a file and add, append or retrieve data using file handling

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	3	0	0	3	3	3	2	3	2
CO2	3	3	3	2	2	2	0	0	3	3	3	2	3	2
CO3	3	3	3	2	3	2	0	0	3	2	3	3	3	3
CO4	3	3	3	3	3	3	0	0	3	2	3	3	3	3
CO5	3	3	3	3	3	3	0	0	3	3	3	3	3	3

LIST OF PRACTICALS

1. Write down programs to implement various operators available in C.
2. Write down programs to implement the concept of conditional statements.
3. Write down programs to implement various loop statements.
4. WAP to implement the concept of break and continue statements.
5. Write down programs to implement functions using various parameter passing techniques.
6. WAP to implement the concept of recursion.
7. WAP to implement the concept of local and global variables.
8. Write down programs to implement array and its various operations.
9. Write down programs to implement strings and its various functions.
10. Write down programs to implement the concept of structure and union.
11. Write down programs to implement the concept of pointers.
12. Write down programs to implement the concept of file handling.

Note: The above mentioned list of experiments is suggested list. Teacher may add more programs/ experiments as per requirement.

SEMESTER-III

Title of the course : **Digital Electronics**

Subject Code : **PCCS-511**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Perform conversions among different number systems, became familiar with basic logic gates and understand Boolean algebra.
CO2	Simplify Boolean functions by using basicBoolean properties &K-Map.
CO3	Design of combinational circuits such as MUX, DEMUX, Encoder, Decoder etc.
CO4	Understand the design of sequential Circuits such as Flip-Flops, Registers, and Counters.
CO5	Obtain a basic level of Digital Electronics knowledge and set the stage to perform the analysis and design of Complex Digital electronic Circuits.

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	2	1	0	0	2	0	0	2	2	2
CO2	3	2	3	2	2	2	0	0	2	0	0	2	2	2
CO3	3	3	3	2	2	2	0	0	3	3	3	2	2	2
CO4	3	3	3	2	2	3	0	0	3	3	3	3	3	3
CO5	3	3	3	2	2	3	0	0	3	3	3	3	3	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of Number Systems and codes	Introduction to the concept of Digital Electronics, Number systems, binary number system, octal number system, hexadecimal number system, signed and unsigned numbers, Arithmetic using Different Number Systems; Representation of Binary Number in Sign-Magnitude, Sign 1's & 2's Complement Notation; Rules for Addition and Subtraction with Complement.	07
	2. Various types of codes	BCD, ASCII, Gray and other Codes.	05
	3. Boolean Function and its Minimization	Simplification of Boolean Function using Boolean theorems; Canonical and Standard Forms(SOP and POS) for Boolean Functions; Objectives of the Minimization Procedures; Karnaugh Map Method; Don't Care Conditions, Realization of Boolean Functions Using Only NAND and NOR Gates.	07
	4. Combinational	Half & Full Adder; Half & Full Subtractor; Parity Generator	05

	Logic Circuits Using Discrete Logic Gates	and Checker; Code Converters; Carry look ahead generator; Binary Multiplier; Majority Circuits, Magnitude Comparator.	
Unit-2	5. Combinational Logic Using MSI Circuits	Binary Parallel; BCD Adder; Encoder, Priority Encoder, Decoder; Multiplexer and De-multiplexer Circuits; Implementation of Boolean Functions Using Decoder and Multiplexer; ALU; BCD to 7-Segment Decoder.	07
	6. Introduction to Flip-flop Circuits	Basic Concepts of Sequential Circuits; Cross Coupled SR Flip-Flop Using NAND or NOR Gates; D-Type and Toggle Flip-Flops JK Flip-Flop & race Condition; Clocked Flip-Flops; Truth Tables & Excitation Tables for Flip-Flops; Edge & Level Triggering; Master Slave Configuration; Edge triggered D flip-flop; Flip-Flops With Preset & Clear.	07
	7. Sequential Logic Circuit Design & Counters	Sequential circuit; state table and state diagram; Design procedure; Basic Concepts of Counters and Registers; Shift Left and Right Register; Registers With Parallel Load; SIPO and PISO	06
	8. Ripple (asynchronous) counters	Up Down and Mod-N ripple counters; Design of Synchronous Counter Using State Diagrams and Table; BCD Counters; Modulo-N Counter; Up Down Counter; Ring counter.	04

Total=48

Recommended Books:

1. Morris Mano: “Digital Logic and Computer Design”, PHI.
2. Bartee Thomas: “Digital Computer Fundamentals”, McGraw-Hill.
3. Richard Sandige: “Modern Digital Design”, McGraw-Hill.
4. Taub and Schilling: “Digital Integrated Electronics”, McGraw-Hill.
5. Fletcher W.I.: “Engineering Approach to Digital Design”, PHI.
6. Malvino & Leech: “Digital Principles & Applications”, TMH.
7. J. F. Wakerly: “Digital design: principles and practice package”, Pearson

Title of the course : **Object Oriented Programming**

Subject Code : **PCCS-512**

Weekly load : **3 Hrs** **LTP 2-1-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the difference between object oriented programming and procedural programming
CO2	Choose data types and structures to solve mathematical and scientific problems
CO3	Write programs using C++ features such as composition of objects, operator overloading, inheritance, polymorphism etc.
CO4	Simulate the real world problems into object-oriented programs
CO5	Illustrate the process of data file manipulations using C++

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
CO's	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	0	0	0	0	0	0	0	2	3	1
CO2	3	3	3	3	3	3	0	0	3	3	3	3	3	3
CO3	3	3	3	3	3	3	0	0	3	3	3	3	3	3
CO4	3	3	3	3	3	3	0	0	3	3	3	3	3	3
CO5	3	3	3	3	3	3	0	0	3	3	3	3	3	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of object-oriented programming	Basic concepts of object-oriented programming, Characteristics of object-oriented programming, Comparison between procedural programming paradigm and object-oriented programming paradigm.	06
	2. Classes and Objects	Specifying a class, Creating class objects, Accessing class members, Access specifiers – public, private, and protected, Static members variables and functions, Static class objects, The const keyword, Friend functions, Friend classes, Empty classes, Nested classes, Local classes, Abstract classes, Container classes.	06
	3. Constructors and Destructors	Need for constructors and destructors, Default constructor, Parameterized constructor, Copy constructor, Dynamic constructors, Destructors, Constructors and destructors with static members.	06
	4. Inheritance	Introduction, Defining derived classes, Forms of inheritance, Ambiguity in multiple and multipath inheritance, Virtual base class, Object slicing, Overriding member functions, Object composition and delegation, Order of execution of constructors and destructors.	06

Unit-2	5. Virtual Functions and Polymorphism	Concept of Binding - Early binding and late binding, Virtual functions, Pure virtual functions, Abstract classes, Virtual destructors & polymorphism.	06
	6. Operator Overloading and Type Conversion	Defining operator overloading, Rules for overloading operators, Overloading of unary operators and binary operators, Overloading of new and delete operators, Type conversion - Basic type to class type, Class type to basic type, Class type to another class type.	06
	7. Pointers and Dynamic Memory Management	Understanding pointers, Accessing address of a variable, Declaring & initializing pointers, Accessing a variable through its pointer, Pointer arithmetic, Pointer to a pointer, Pointer to a function, Dynamic memory management - new and *delete* Operators, Pointers and classes, Pointer to an object, Pointer to a member, *this* Pointer, Self-referential classes, Possible problems with the use of pointers - Dangling/wild pointers, Null pointer assignment, Memory leak and allocation failures.	06
	8. Exception Handling and Managing Data Files	Exception and its types, Exception handling mechanisms, File streams, Hierarchy of file stream classes, Error handling during file operations, Reading/Writing of files, Accessing records randomly, Updating files, Data formatting in memory buffers.	06

Total=48

Recommended Books:

1. Lippman, S.B. and Lajoie, J., C++Primer, Pearson Education.
2. Stroustrup, Bjarne, The C++ Programming Language, Pearson Education.
3. YashwantKanetkar, Let Us C++, BPB
4. Robert Lafore, Turbo C++, Pearson India

Title of the course : **Data Structures and Algorithms**

Subject Code : **PCCS-513**

Weekly load : **3Hrs** **LTP 2-1-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Introduce various techniques for representation of the data in the real world
CO2	To design and implement various data structure algorithms
CO3	Familiar with the utilization of the data structures in problem solving
CO4	Learn how to analyse the time and space requirements of a given algorithm
CO5	To develop application using various data structure algorithms.

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	0	0	0	2	0	0	0	1	0
CO2	3	3	3	3	3	2	0	0	3	3	3	2	3	2
CO3	3	3	3	3	3	2	0	0	3	3	3	3	3	3
CO4	3	3	3	3	3	2	0	0	3	3	2	2	3	3
CO5	3	3	3	3	3	3	0	0	3	3	2	3	3	3

Theory

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	1. Basics of data structures	Basic concepts and notations; Data structures and data structure operations; Mathematical notation and functions; Algorithmic complexity, time-space trade off and recursion.	04
	2. Arrays	Introduction of an array, Representation of an array, One-dimensional array, Multidimensional arrays, Address calculation, String processing, memory representation of a strings, operation on a string, Pattern matching.	08
	3. Linked List	Introduction; Basic concepts of linked list – memory representation, building a linked list, traversing, insertion, deletion, searching; Doubly linked list; Merging two lists; Header linked list; Circular linked list.	06
	4. Stacks & Queues	Stack, Representation of stack, Implementation of stack; Polish notation; Queues; Implementation of queues; Circular queues; Double ended queues; Priority queues.	06
	5. Trees	Binary trees; Complete binary trees; Extended binary tree; Representation of binary tree; Insertion and deletion from the binary tree; Tree traversals using in-order, pre-order and post-orders; Applications of binary tree; search tree; Heap tree, Balanced binary tree; B-trees.	06

Unit-2	6. Graphs	Basic concepts &definitions; Representation of graph – Adjacency list, Adjacency matrix; Path matrix, Graph traversal– BFS, DFS; Shortest path algorithms.	06
	7. Sorting & Searching	Linear search; Binary search; Bubble sort; Insertion sort; Quick sort; Selection sort; Merge sort; Heap sort; Selection sort, Hashing Techniques.	06
	8. File Handling	File streams, Hierarchy of file stream classes, Error handling during file operations, Reading/Writing of files, Accessing records randomly, Updating files,	06

Total=48

Recommended Books:

1. Lipschutz,Schaum Series, Data Structures ,TMH.
2. A.M. Tanenbaum, Data Structures using C and C++, Pearson Education.
3. Trembley Sorenson, Introduction to Data Structures with Applications, TMH.

Title of the course : **Digital Electronics Lab**

Subject Code : **PCCS-514**

Weekly load : **2 Hrs** **LTP 0-0-2**

Credit : **1**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Implement the various logic gates such as AND, OR, NOT, NAND, NOR, XOR
CO2	Simplify the given expression and realize it using basic gates and universal gates.
CO3	Design and implement the various combinational such as adder and subtractorusing logic gates
CO4	Design and implement the multiplexer and demultiplexer circuits using NAND gates
CO5	Design and implement the various sequential circuits such as flip-flops using logic gates.

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	2	2	0	0	2	2	2	2	2	2
CO2	3	2	2	2	2	2	0	0	2	2	2	2	2	2
CO3	3	2	2	1	2	2	0	0	3	2	2	3	3	2
CO4	3	3	3	2	2	2	0	0	3	3	3	3	3	3
CO5	3	3	3	2	2	2	0	0	3	3	3	3	3	3

LIST OF PRACTICALS

1. Study of Logic gates- AND, OR, NOT, NAND, NOR, XOR on different inputs.
2. To simplify the given expression and to realize it using Basic gates and Universal gates.
3. Design and realization of Half adder/ Substractor using NAND gates.
4. Design and realization of Full adder using Logic gates.
5. Realization of R-S Flip-flop.
6. Realization of J-K Flip-flop.
7. To design and set up the following circuit
    a. 4:1 Multiplexer (MUX) using only NAND gates.
    b. 1:4 Demultiplexer(DE-MUX) using only NAND gates.

Note: The above mentioned list of experiments is suggested list. Teacher may add more programs/ experiments as per requirement.

Title of the course : **Object Oriented Programming Lab**

Subject Code : **PCCS-515**

Weekly load : **4 Hrs** **LTP 0-0-4**

Credit : **2**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the basic concepts of writing a program in C++.
CO2	Apply various object-oriented features like classes, inheritance and polymorphism to solve various computing problems using C++ language.
CO3	Solve mathematical and scientific problems using object oriented concepts.
CO4	Understanding the concepts of pointers and dynamic memory managements.
CO5	Create a file and perform the operation like addition, deletion, append or retrieve data using file handling

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):

Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2	2	0	0	3	2	1	3	3	2
CO2	3	3	2	3	3	2	0	0	3	2	2	2	3	2
CO3	3	3	2	3	3	3	0	0	3	3	2	2	3	2
CO4	3	3	3	3	3	2	0	0	3	3	2	2	3	2
CO5	3	3	3	3	3	3	0	0	3	3	3	3	3	3

LIST OF PRACTICALS

1. Write down programs to implement the concept of class and object.
2. Write down programs to implement the concept of constructor and destructors.
3. Write down programs to implement the different types of inheritance.
4. WAP to implement the concept of function overloading.
5. Write down programs to overload the different types of operators.
6. WAP to implement the concept of Virtual function.
7. WAP to implement the concept of Friend Function.
8. Write down programs to implement different types of pointer.
9. Write a program to implement the concept of new and delete operator.
10. Write down programs to implement the concept of exception handling.
11. Write down programs to implement the concept of file handling.

Note: The above mentioned list of experiments is suggested list. Teacher may add more programs/ experiments as per requirement.

Title of the course : **Data Structures and Algorithms**

Subject Code : **PCCS-516**

Weekly load : **4Hrs** **LTP 0-0-4**

Credit : **2**

Course Outcomes: At the end of the course, the student will be able to:

CO1	To impart the basic concepts of data structures and algorithms
CO2	Design, implement, test, and debug programs using a variety of data structures including linked lists, stacks, queues, binary search trees, heaps and graphs
CO3	Familiar with the utilization of the data structures in problem solving
CO4	Implement and know when to apply standard algorithms for searching and sorting
CO5	Learn to choose the appropriate data structure and algorithm design method for a specified application

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	0	0	0	1	0	0	2	2	2
CO2	3	3	3	2	3	2	0	0	3	3	3	2	3	3
CO3	3	3	3	2	3	2	0	0	2	2	3	2	3	3
CO4	3	3	3	3	3	3	0	0	3	2	2	3	3	2
CO5	3	3	3	3	3	3	0	0	3	3	3	3	3	3

LIST OF PRACTICALS

1) Write down programs to implement the concept of array and its operations.
2) Write down programs to implement the concept of Linked List and its operations.
3) Write down programs to implement the concept of Stack and its operations.
4) Write down programs to implement the concept of Queue and its operations.
5) Write down programs to implement the concept of Tree and its operations.
6) Write down programs to implement the concept of Graph and its operations.
7) Write down programs to implement the various Sorting techniques.
8) Write down programs to implement the various Searching techniques.

Note: The above mentioned list of experiments is suggested list. Teacher may add more programs/ experiments as per requirement.

Subject Name : **Internet Technologies**

Subject Code : **MDCS-511**

Weekly load : **4Hrs** **LTP 3-1-0**

Credit : **4**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understanding of Web fundamentals and its working around the world
CO2	Understanding and Web Development skills using different flavours of HTML along with CSS technology and interactive validations of different elements using JavaScript/ vbscript
CO3	Understanding E-commerce market and being aware of prime security issues while developing applications
CO4	Understanding the programming skills using java as Internet programming tool, developing client-server applications, Swings & Events Exception Handling, Servletand JDBC applications
CO5	The Practicability of all above contents is covered in Lab-Sessions

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2	2	2	0	0	1	2	2	2	3	2
CO2	2	3	3	2	3	2	0	0	3	3	3	2	3	2
CO3	2	1	1	2	2	2	0	0	3	2	2	2	3	3
CO4	3	3	3	2	3	2	0	0	3	2	2	2	3	3
CO5	3	3	3	3	3	2	0	0	3	3	3	2	3	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Fundamentals of web technologies	Understanding Web fundamentals, URL, ISP, W3C – Architecture, Evolution, Website Designing strategies, major issues in Web Development, Web Browsers, Web-Servers, Search Engines.	08
	2. E-Commerce	Definition, Types of E-commerce, merits & demerits, Problems and issues related to Internet based E-commerce, M-Commerce, E-commerce laws & forms of agreements, E-governance & role of government.	08
	3. HTML5 & CSS3	Features of HTML5, Revisiting basic tags in HTML5, New markup elements of HTML5, New Forms, Tables, Images, List & Links, Audio & Video attributes of HTML5, Introduction to VB Script – variables, arrays, looping & conditional statements, printing text using Vbscript.	08

		Enhancing web page features using CSS3, Advanced Java script.	
Unit-2	4. Security	E-commerce & security, Web security schemes, Cryptography, VPN, Firewalls, IDS.	08
	5. Advanced JAVA	Core Java and advanced Java-AWT GUI components, Swings & Events Exception Handling JDBC.	08
	6. Server-side Programming	Introduction to XML, XML-DTD, JSP, Servlet technology, J2EE &RMI.	08

Total=48

Recommended Books:

1. Uttam K. Roy, Web technologies; Oxford.
2. Zak Ruvalcaba& Anne Boehm, Murach's HTML5 and CSS3; SPD.
3. FiruzaAibara, HTML5 for beginners; SPD.
4. Jim Farley and William Crawford, Java Enterprise in a nutshell; SPD-O'reilly.
5. Michael Morrison, Head First Java Script; SPD-O'reilly.

SEMESTER-IV

Title of the course : **Computer Organization and Architecture**

Subject Code : **PCCS-521**

Weekly load : **3Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the evolution and trends of Computer Architecture and Organization
CO2	Understand the micro-operations executed in the system and thereby construction of ALU
CO3	Understand the instruction format, classification and execution in the system
CO4	Understand the organization of CPU and Control Unit
CO5	Understand the process of input/output in the system which includes the interfacing of I/O devices

CO/PO Mapping : (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation):														
COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	2	0	0	2	2	2	2	2	2
CO2	2	2	2	2	2	2	0	0	2	2	2	2	3	2
CO3	1	2	2	2	2	2	0	0	2	2	2	2	2	2
CO4	3	2	2	2	3	2	0	0	2	3	2	2	2	3
CO5	2	2	2	2	2	2	0	0	2	3	2	2	2	2

Theory

Unit	Main Topics	Course outlines	Hour(s)
Unit-1	1. Basics of computer architecture	Computer architecture, organization and designing. Historical architectural trends, Data representation: Number system and conversion, compliments, Fixed point Representation, floating point representation, Computer arithmetic(addition, subtraction and multiplication),	06
	2. Register Transfer Language and Micro-Operations	Register transfer language, Register transfer language, Bus & memory transfer, arithmetic, logic and shift micro-operations, constructing an arithmetic logic shift unit.	06
	3. Computer Architecture and Design	Computer registers, Instructions, Instruction codes, Instruction formats, Instruction classifications, Memory reference instruction, Register reference instruction, Input/Output & Interrupts Instruction set completeness, Instruction Execution cycle, Interrupts, interrupt cycle, Timing & control unit, complete computer description & design of basic computer	07

	4. Central Processing Unit	General Register Organization. Stack Organized CPU. Addressing Modes. Data Transfer and Manipulation. RISC Vs CISC. Introduction to Parallel processing and Pipeline Processing	05
Unit-2	5. Control Organization	Hardwired and micro-programmed control organization. Horizontal and Vertical Microprogramming.	06
	6. Input Output Organization	I/O interfacing, Asynchronous data transfer, Modes of transfer, Priority interrupt, DMA, Input Output processor	06
	7. Memory Organization	Memory Systems: principle of locality, principles of memory hierarchy Caches, associative memory, main memory, Virtual memory, Paging and Segmentation	06
	8. Case Studies	Case studies of the contemporary architecture for processors of families like Intel and AMD	06

Total=48

Recommended Books:

1. Hamacher, Vranesic “Computer Organization”, McGraw Hill.
2. Stalling , “Computer Organization, TMH.
3. John. P. Hays, “Computer Architecture and Organization,McGraw Hill.
4. Carpirdli, “Computer Architecture & Organization, Pearson Education Asia
5. M. Mano, “Computer Architecture & Organization”, PHI

Title of the course : **Operating System**

Subject Code : **PCCS-522**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Learn basic concepts of Operating System along with implementation of scheduling algorithms in process management
CO2	Analyze critical section problem in Inter process communication and use of memory management techniques
CO3	Implement page replacement algorithms and use virtual memory concepts
CO4	Know about file structure, file management and disk management
CO5	Learn the concept of deadlock and implement various algorithms used for its detection and recovery

CO/PO Mapping : (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation):

COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1	3	2	0	0	2	2	2	2	2	2
CO2	3	2	2	2	2	2	0	0	2	3	3	2	3	3
CO3	3	3	2	2	0	3	0	0	3	2	2	2	3	2
CO4	3	2	2	2	2	2	0	0	3	3	2	2	2	2
CO5	3	2	1	2	0	2	0	0	3	2	2	2	3	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basic Concept of Operating System	Evolution of operating system, operating system classifications, structure of operating system, types of operating system (Batch, Multiprogramming, Multiprocessing, Time-sharing systems and real time systems etc.), concept of virtual machine, case study on UNIX and windows operating system.	06
	2. Process Management	Process overview, process states, PCB, levels of scheduler and CPU scheduling algorithms, multiple-processor scheduling, scheduling criteria, threads, process scheduling objects and techniques.	06
	3. Inter-process Communication	Concurrent processes - The Critical Section & Mutual Exclusion problem - Algorithms - Semaphores, Critical Region, Conditional Critical Region, Race condition, Monitors, Messages passing - Examples in Contemporary OS - Classical Process Co-ordination Problems	06

	4. Memory Management	Memory hierarchy, static and dynamic memory allocation, overview of swapping, multiple partitions, contiguous and non-contiguous memory allocation, internal and external fragmentation, concepts of paging, segmentation.	06
Unit-2	5. Virtual Memory	Virtual Memory Concepts - Demand paging - Performance - Fragmentation & Compaction. Concept of page fault and dirty page/ dirty bit, Page replacement and Allocation algorithms -Memory Protection - System Calls – Linux/Windows Virtual Memory Techniques.	08
	6. File Management	File concepts, Access methods, Directory structure, File protection, File System structure, Allocation methods, Secondary storage management - Disk structure, Disk scheduling algorithms, Disk management, Swap-space management, Disk reliability.	08
	7. Deadlock	Introduction to deadlock, necessary and sufficient conditions, deadlock prevention & avoidance, Bankers algorithm, deadlock detection & recovery.	08

Total=48

Recommended Books:

1. Silberschatz A & Galvin, Operating System Concepts, John Wiley & Sons
2. W. Stallings, Operating Systems: Internals and Design Principles, Pearson Pub.
3. Andrew S Tanenbaum, Operating Systems - Design and Implementation, PHI
4. Crawley, Operating Systems - An Object oriented Approach, McGraw Hill

Title of the course : **Database Management System**

Subject Code : **PCCS-523**

Weekly load : **3 Hrs** **LTP 2-1-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Gain a good understanding of the architecture and functioning of database management systems as well as associated tools and techniques
CO2	Understand principles of data modelling using entity relationship to develop a good database design and normalization techniques to normalize a database
CO3	Understand and use structured query language to query, update, and manage a database
CO4	Evaluate and optimize queries
CO5	Understand transaction processing, backup and recovery techniques

CO/PO Mapping : (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation):														
COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	0	0	2	2	2	3	3	2
CO2	3	2	2	2	2	2	0	0	2	2	2	2	2	2
CO3	2	2	3	2	2	2	0	0	2	2	2	2	3	2
CO4	2	3	2	3	2	2	0	0	2	2	2	2	2	3
CO5	3	2	2	2	3	3	0	0	3	3	3	2	3	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of data processing	Data, data processing requirement, desirable characteristics of an ideal data processing system, traditional file based system, its drawback, concept of data dependency, Def of database, database management system.	04
	2. Database concepts	3-schema architecture: external-conceptual-internal, database terminology, benefits of DBMS, Database development process - conceptual data modeling, logical database design, physical database design, database implementation, database maintenance.	06
	3. Database Analysis	Conceptual data modeling using E-R data model -entities, attributes, relationships, generalization, specialization, specifying constraints: total and partial participation. 5 – 6 practical problems based on E-R data model.	06
	4. Database Design	Logical database design and relational data model: Introduction to relational database theory: *def* of relation, relational model operators, relational model integrity rules, Normalization- 1NF, 2NF, 3NF, 4NF, BCNF & practical problems based on these forms. Denormalization	08

Unit-2	5. Database Implementation	Introduction to SQL, DDL aspect of SQL, DML aspect of SQL – update, insert, delete & various form of SELECT-simple, using special operators, aggregate functions, group by clause, sub query, joins, co-related sub query, union clause.	08
	6. Query optimization	Introduction, Query plan,ways of evaluating a given query, Overview of optimization process, expression transformation, database statistics, A divide and conquer strategy.	06
	7. Transaction processing	Transaction concept, transaction state, Implementation of atomicity and durability, concurrent execution, Serializability, recoverability, Implementation of isolation, transaction definition in SQL.	04
	8. Overview of backup and recovery process	Failure classification, Storage structure, recovery and atomicity, log based recover , shadow paging, recovery with concurrent transaction, buffer management, failure with loss of non- volatile storage, advance recovery techniques.	06

Total=48

Recommended Books:

1. A Silberschatz, H. F. Korth, and S Sudarshan, Database System Concepts, TMH.
2. McFadden, F.Hoffer, M. B Modern database management, Prescott.
3. C.J Date, An Introduction to Database Systems, Addison, Wesley.
4. Raghu Ramakrishnan and Gehrke,Database Management System, McGraw-Hill.
5. Margaret.H.Dunham , Data Mining. Introductory and advanced topics, Pearson.

Title of the course : Operating System Lab

Subject Code : PCCS-524

Weekly load : 4 Hrs LTP 0-0-4

Credit : 2

Course Outcomes: At the end of the course, the student will be able to:

CO1	Implement CPU scheduling algorithms
CO2	Implement Page replacement algorithms
CO3	Implement Deadlock handling algorithms
CO4	Implement various memory management techniques
CO5	Implement various file allocation strategies

CO/PO Mapping : (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation):														
COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	2	2	0	0	2	2	2	2	3	3
CO2	3	2	2	2	2	2	0	0	2	2	3	2	3	2
CO3	3	2	2	2	1	2	0	0	3	3	2	2	3	2
CO4	3	3	2	2	2	2	0	0	3	2	2	3	3	2
CO5	3	3	2	2	2	2	0	0	2	3	2	2	3	2

LIST OF PRACTICALS

1. WAP to implement following CPU scheduling algorithms:
    - FCFS
    - SJF
    - Priority
    - Round Robin
2. WAP to implement MVT and MFT.
3. WAP to implement Bankers algorithm for deadlock avoidance.
4. WAP to implement Bankers algorithm for deadlock prevention.
5. WAP to implement following page replacement algorithms:
    - FIFO
    - LRU
6. WAP to implement paging technique of memory management.
7. WAP to implement following file allocation strategies:
    - Sequential
    - Indexed
    - Linked

Note: The above mentioned list of experiments is suggested list. Teacher may add more programs/ experiments as per requirement.

Title of the course : **Database Management System Lab**

Subject Code : **PCCS-525**

Weekly load : **4Hrs** **LTP 0-0-4**

Credit : **2**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand, analyze and apply common SQL statements including DDL, DML and DCL statements to perform different operations.
CO2	Apply various constraints on database tables using different keys.
CO3	Implement relational algebra and relational calculus query.
CO4	Develop programs using PL/SQL.
CO5	Create views, forms and reports.

CO/PO Mapping : (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation):														
COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	2	3	0	0	2	2	2	2	3	3
CO2	3	2	3	3	3	3	0	0	3	3	2	3	3	3
CO3	2	2	3	3	2	3	0	0	3	2	2	2	2	2
CO4	3	3	2	2	2	2	0	0	2	2	1	2	2	2
CO5	2	2	2	3	3	3	0	0	3	3	2	2	2	2

LIST OF PRACTICALS

1. Introduction to various constraints such as Primary key, secondary key, Super key, etc.
2. To implement Data Definition Commands (create, drop).
3. To implement Data Manipulation Commands (insert, delete, update, select)
4. To implement Data Control Commands (Commit, revoke, rollback, connect, execute)
5. Create Table, SQL for Insertion, Deletion, Update and Retrieval using aggregating functions.
6. Write Programs in PL/SQL, Understanding the concept of Cursors.
7. Write Program for Join, Union & intersectionetc.
8. Creating Views, Writing Assertions, and Triggers.
9. Creating Forms, Reports etc.
10. WAP in PL/SQL for adding two numbers.
11. WAP in PL/SQL for reversing the number. For e.g. the number is 12345 and reverse number will be 54321)
12. WAP in PL/SQL to find the number is even or odd.
13. WAP in PL/SQL to count numbers from 1 to 100.
14. WAP to test MAX, MIN, GROUP BY and ORDER BY commands.

Note: The above mentioned list of experiments is suggested list. Teacher may add more programs/ experiments as per requirement.

Title of the course : **Operating System**

Subject Code : **MDCS-521**

Weekly load : **4Hrs** **LTP 3-1-0**

Credit : **4**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Learn basic concepts of Operating System along with implementation of scheduling algorithms in process management
CO2	Analyze critical section problem in Inter process communication and use of memory management techniques
CO3	Implement page replacement algorithms and use virtual memory concepts
CO4	Know about file structure, file management and disk management
CO5	Learn the concept of deadlock and implement various algorithms used for its detection and recovery

CO/PO Mapping : (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation):														
COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1	3	2	0	0	2	2	2	2	2	2
CO2	3	2	2	2	2	2	0	0	2	3	3	2	3	3
CO3	3	3	2	2	0	3	0	0	3	2	2	2	3	2
CO4	3	2	2	2	2	2	0	0	3	3	2	2	2	2
CO5	3	2	1	2	0	2	0	0	3	2	2	2	3	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basic Concept of Operating System	Evolution of operating system, operating system classifications, structure of operating system, types of operating system (Batch, Multiprogramming, Multiprocessing, Time-sharing systems and real time systems etc.), concept of virtual machine, case study on UNIX and windows operating system.	06
	2. Process Management	Process overview, process states, PCB, levels of scheduler and CPU scheduling algorithms, multiple-processor scheduling, scheduling criteria, threads, process scheduling objects and techniques.	06
	3. Inter-process Communication	Concurrent processes - The Critical Section & Mutual Exclusion problem - Algorithms - Semaphores, Critical Region, Conditional Critical Region, Race condition,	06

		Monitors, Messages passing - Examples in Contemporary OS - Classical Process Co-ordination Problems	
	4. Memory Management	Memory hierarchy, static and dynamic memory allocation, overview of swapping, multiple partitions, contiguous and non-contiguous memory allocation, internal and external fragmentation, concepts of paging, segmentation.	06
Unit-2	5. Virtual Memory	Virtual Memory Concepts - Demand paging - Performance - Fragmentation & Compaction. Concept of page fault and dirty page/ dirty bit, Page replacement and Allocation algorithms -Memory Protection - System Calls – Linux/Windows Virtual Memory Techniques.	08
	6. File Management	File concepts, Access methods, Directory structure, File protection, File System structure, Allocation methods, Secondary storage management - Disk structure, Disk scheduling algorithms, Disk management, Swap-space management, Disk reliability.	08
	7. Deadlock	Introduction to deadlock, necessary and sufficient conditions, deadlock prevention & avoidance, Bankers algorithm, deadlock detection & recovery.	08

Total=48

Recommended Books:

1. Silberschatz A & Galvin, Operating System Concepts, John Wiley & Sons
2. W. Stallings, Operating Systems: Internals and Design Principles, Pearson Pub.
3. Andrew S Tanenbaum, Operating Systems - Design and Implementation, PHI
4. Crawley, Operating Systems - An Object oriented Approach, McGraw Hill

SEMESTER-V

Title of the course : **Discrete Mathematics**

Subject Code : **PCCS- 611**

Weekly load : **3 Hrs** **LTP 2-1-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand sets, relations, functions and basic principles of counting and probability
CO2	Apply Propositional logic, Formulate and solve various graph problems
CO3	Understand the concept of Recurrence Relations and Recursive Algorithms and their Solutions by the method of generating functions and know about various Boolean algebra concepts
CO4	Understand the theoretical workings of Basic Probability and Probability Distribution
CO5	Demonstrate various real world scenarios using concepts of Basic Probability , sampling theory

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	2	0	0	2	0	2	3	2	2
CO2	3	2	3	2	3	2	0	0	2	0	2	3	2	2
CO3	3	3	3	3	3	2	0	0	2	0	2	3	3	2
CO4	3	3	2	2	2	2	0	0	2	0	2	3	3	2
CO5	3	3	2	2	2	2	0	0	2	0	2	3	2	2

Theory:

Unit	**Main Topics**	**Course outlines**	**Lecture(s)**
Unit-1	1. Sets and Propositions	Introduction, Combinations of sets, Finite and infinite sets, Mathematical induction, Principle of inclusion and exclusion, Multisets, Ordered sets, Propositions.	04
	2.Basic principles of counting	Counting Principles: Basics of counting, Pigeonhole Principle, Permutations, Combinations, Generation of permutations and combinations.	05
	3.Basic principles of probability	Discrete probability, Conditional probability, Information and mutual information.	03
	4.Relations and Functions	Introduction, A relational model for data bases, Properties of binary relations, Equivalence relations and partitions, Partial ordering relations and lattices, Definition & properties of Lattice, Sub lattice, Distributive & Boolean algebra, a job scheduling problem.	05
Unit-2	5. Mathematical logic	Propositions, logical operators & propositional algebra.	03
	6. Graphs and Planer graphs	Introduction, Basic terminology, Multigraphs and weighted graphs, Paths and Circuits, Shortest paths in weighted graphs, Eulerian paths and circuits.	04

	7. Recurrence Relations and Recursive Algorithms	Introduction, Linear recurrence relations with constant coefficients, Homogeneous solutions, Particular solutions, Total solutions, Solutions by the method of generating functions, Recursive definitions, Recursive algorithms.	04
	8. Groups, rings and Boolean algebra	Group rings and Boolean algebra: Binary operations, semi groups and monoids, integers, groups, subgroups, rings and fields, principle of duality, Boolean lattices.	04

Total=32

Recommended Books:

1. Liu C.L., "Elements of Discrete Mathematics", MGH.
2. Joshi , "Maths Foundation of Discrete Mathematics", Wiley Eastern
3. Kolman B., Busby R.C. & Ross S., "Discrete Mathematical Structure", 5/E, PHI.
4. DeoNarsingh., "Graph theory with applications to Engineering & Computer Science", PHI.

Title of the course : **Computer Networks**

Subject Code : **PCCS-612**

Weekly load : **3 Hrs** **LTP 2-1-0**

Credit : **3 (Lecture 3)**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand basics of computer networks
CO2	Learn use of physical and datalink layer in networking
CO3	Understand the concept of MAC and Network layer
CO4	Learn various protocols used in transport and application layer
CO5	Understand OSI and TCP/IP models

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	0	0	1	0	0	0	0	0	0	2	1	1
CO2	2	2	0	0	2	0	0	0	0	2	0	2	2	2
CO3	2	3	2	2	2	2	0	0	2	2	0	2	2	2
CO4	2	2	3	2	2	2	0	0	2	2	0	2	2	2
CO5	2	2	2	2	2	2	0	0	2	2	0	0	3	2

Theory

Unit	**Main Topics**	**Course outlines**	**Lecture(s)**
Unit-1	1. Basics of Computer Network	Need & Evolution of Computer Networks, Description of LAN, MAN, WAN and wireless Networks, OSI and TCP/IP models with description of Data Encapsulation & peer to peer communication, Comparison of OSI and TCP/IP.	06
	2. Network devices	Basic terminology of computer networks - bandwidth, physical and logical topologies, Media – 10 base Z, 10base S, 10base T, 100baseTX, 100base FX, 1000baseLX and wireless. LAN & WAN devices – Router, bridge, Ethernet switch HUB, Modem.	06
	3. Physical Layer	Representation, one bit on physical modem i.e. in wired network, optical Network and wireless N/W, Encoding / Modulation – Manchester Encoding, AM, FM and PM. Dispersion, Jitter, Latency and collision. Different types of Media – Shielded twisted pair, Unshielded twisted pair, Coaxial cable, Optical Fiber cable and wireless.	06

	4. Data link Layer	Framing, Error control and Flow control, Data link control and protocols – Simplex protocol, Sliding window protocol	06
Unit-2	5. Medium Access Sublayer	Channel Allocations, Multiple Access protocols- ALOHA, CSMA, CSMA/CD protocols, Collision free protocols, Token Ring, FDDI, Bridges and recent developments.	06
	6. Network Layer	Segmentation and autonomous system path determination, Network layer addressing, Network-layer data gram, IP addressed classes. Subnetting – Sub network, Subnet mask. Routing algorithm – optimality Principle, Shortest path routing, Hierarchical routing, Broadcast routing, Multicast routing, tunneling Fragmentation and DHCP. Routing Protocol – RIP, IGRP, OSPF and EIGRP.	06
	7. Transport Layer	Layer 4 Protocol TCP & UDP. Three-way handshakes open connection. Session Layer design issue, Presentation layer design issue, and Application layer design issue.	06
	8. Application Layer	Application Layer protocols: TELNET, FTP, HTTP,SNMP, DNS, SMTP, FTP, HTTP, WWW and recent development.	06

Total=48

Recommended Books:

1. Tanenbaum, Computer Network, Prentice Hall India
2. William Stalling, Data and Computer Communication, Prentice Hall
3. Douglas E. Comer, Internetworking with TCP/IP Volume – I, Prentice Hall India
4. W. Richard Stevens, TCP/IP Illustrated Volume-I, Pub. Addison Wesley
5. B. Forouzan, Data Communication And Networking, TMH

Title of the course : Computer Networks Lab
Subject Code : PCCS-613
Weekly load : 4 Hrs LTP 0-0-4
Credit : 2

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the concept of different network and its components
CO2	Configure cable connection and testing using various commands
CO3	Configure different wireless networks.
CO4	Implement the connection between different nodes by using different topologies
CO5	Understand how to share resources on the network.

CO/PO Mapping : (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation):

Cos	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	2	2	2	2	1	2	0	0	2	3	2	2	3	2
CO2	2	2	2	2	2	2	0	0	2	3	2	2	2	2
CO3	2	2	3	2	2	2	0	0	2	3	2	2	2	2
CO4	2	3	3	3	2	3	0	0	2	3	2	2	2	2
CO5	3	2	3	2	2	1	0	2	2	3	2	2	3	2

LIST OF PRACTICALS

1. Introduction to LAN with its cables, network connectors and topologies.
2. Making of a network cable (straight thru and cross over twisted pair) to connect two personnel computer.
3. Introduction to motherboard and installation of LAN card and Wi-fi dongle.
4. Case study of Ethernet (10 base 5,10 base 2,10 base T).
5. Create a simple network with two PCs using a hub.
    a. Identify the proper cable to connect the PCs to the hub
    b. Configure workstation IP address information.
    c. Test connectivity using the Ping command
    d. Installation and working of Telnet.
6. Configuration of Wireless Access point.
7. Punching of information outlet (I/O box) using punching tool.
8. Procedure to share hardware resources over network.
9. Various troubleshooting tools used in computer network.

Note: The above mentioned list of experiments is suggested list. Teacher may add more programs/ experiments as per requirement.

Title of the course : **Computer Graphics**

Subject Code : **PECS-611A**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Provide comprehensive introduction about computer graphics system and design algorithms
CO2	Familiar with two dimensional and three dimensional transformations
CO3	Familiar with techniques of clipping, hidden surface removal and shading
CO4	Provide information about Projections and shading techniques
CO5	To recognize the software utilized in constructing computer graphics applications.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):

Cos	Programme Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	0	2	0	2	0	0	0	0	0	0	2	3	2
CO2	2	0	2	2	1	0	0	0	0	0	0	2	3	2
CO3	2	3	2	2	2	0	0	0	2	0	2	2	3	3
CO4	2	3	2	2	2	0	0	0	2	0	2	2	3	2
CO5	2	3	2	2	2	0	0	0	2	0	2	2	3	2

Theory:

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Overview of graphics systems	Display devices, physical input and output devices: storage tube graphic displays, Raster Refresh, Plasma Panel Displays, Liquid Crystals	04
	2. Output Primitives	Point plotting, Line Drawing algorithms – Slope Line Method, DDA algorithms, Bresenham's Line algorithm	06
	3. Two-dimensional Transformations	Basic transformations-translation, scaling, rotation, Matrix representation and homogenous coordinates, composite transformations, Rotation about an arbitrary point, scaling relative to a fixed point	06
Unit 2	4. Windowing and Clipping Techniques	Windowing concepts, clipping algorithms-Line clipping– Cohen-Sutherland algorithm, Polygon Clipping algorithms, Text Clipping.	06
	5. Projections and Shading	Parallel projections, perspective projections, Polygon shading methods: Flat shading, Gouraud Shading, Phong Shading.	06
	6. Visible Surface Detection and Hidden-Surface Removal	Back face removal method, Depth-buffer method, Scan-line method	04

Total=32

Recommended Books:

1. Computer Graphics, Hearn & Baker, PHI
2. Principles of Interactive Graphics, Newman &Sproul, Mcgraw Hill
3. Computer Graphics-A Programming Approach, Steven Harrington, Mcgraw Hill
4. Computer Graphics, Sinha&Udai, Mcgraw Hill

Title of the course : **Data Mining**

Subject Code : **PECS-611B**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: On successful completion of this course, students will be able to:

CO1	Design a data mart for any organization
CO2	Develop skills to write queries using DMQL
CO3	Extract knowledge using data mining techniques
CO4	Adapt to new data mining tools
CO5	Explore recent trends in data mining such as web mining, spatial-temporal mining

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**
CO1	2	1	2	1	1	2	0	0	2	0	0	2	3	2
CO2	2	3	3	2	2	2	0	0	2	2	2	2	2	3
CO3	2	3	3	3	2	3	0	0	3	2	2	2	3	3
CO4	2	3	3	3	2	3	0	0	2	2	2	2	2	3
CO5	2	2	2	2	2	2	0	0	2	0	2	2	3	3

Theory

Unit	**Main Topics**	**Course outlines**	**Lecture(s)**
Unit-1	1. Basics of Data Mining	Data Mining Concepts, Input, Instances, Attributes and Output, Knowledge Representation & Review of Graph Theory, Lattices, Probability & Statistics	06
	2. Machine learning concepts and approaches	Supervised Learning Framework, concepts & hypothesis, Training & Learning, Boolean functions and formulae, Monomials, Disjunctive Normal Form & Conjunctive Normal Form, A learning algorithm for monomials	06
	3. Data Preparation	Data Cleaning, Data Integration & Transformation, Data Reduction	05
	4. Mining Association Rules	Associations, Maximal Frequent & Closed Frequent item sets, Covering Algorithms & Association Rules, Linear Models & Instance-Based Learning, and Mining Association Rules from Transactional databases, Mining Association Rules from Relational databases, Correlation analysis & Constraint-based Association Mining.	07
Unit-2	5. Classification and Prediction	Issues regarding Classification & Prediction, Classification by Decision Tree induction, Bayesian classification, Classification by Back Propagation, k-Nearest Neighbor	08

		Classifiers, Genetic algorithms, Rough Set & Fuzzy Set approaches	
	6. Cluster Analysis	Types of data in Clustering Analysis, Categorization of Major Clustering methods, Hierarchical methods, Density-based methods, Grid-based methods, Model-based Clustering methods	08
	7. Mining Complex Types of Data	Multidimensional analysis & Descriptive mining of Complex data objects, Mining Spatial Databases, Mining Multimedia Databases, Mining Time-series & Sequence data, Mining Text databases, Mining World -Wide Web	08

Total=48

Recommended Books:

1. Jiawei Han and MichelineKamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, 2000 (ISBN: 1-55860-489-8).
2. Ian H. Witten and Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques with Java implementations", Morgan Kaufmann Publishers, San Fransisco, CA (2000).
3. Dorian Pyle, "Data Preparation for Data Mining", Morgan Kaufmann, (1999)
4. Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill
5. Elmasri, Navathe, "Fundamentals Of Database Systems", Addision Wesley

Title of the course : **Cyber Security**

Subject code : **PECS-611C**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Gain knowledge of cyber threats and vulnerabilities.
CO2	Analyze and resolve security issues in networks to secure an IT infrastructure.
CO3	Learn about hijacking and its control measures.
CO4	Understand cyber crime and its related attacks.
C05	To understand the concept of intrusion and system hardening.

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	0	3	1	3	2	0	0	3	1	3	2	1	2
CO2	3	3	3	3	3	0	0	0	3	1	3	2	2	3
CO3	3	0	3	0	0	0	0	0	0	0	0	2	1	1
CO4	3	0	3	3	0	0	0	0	0	0	0	3	1	1
CO5	3	2	3	1	0	0	0	1	0	0	1	2	1	1

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Threats and Vulnerabilities in Cyber world	Overview of Computer and Web Technology, Need for Cyber Law, Cyber Jurisprudence at International and Indian Level, Jurisdictional Aspects in Cyber Law Issues of jurisdiction in cyberspace, Types of jurisdiction, Minimum Contacts Theory, Sliding Scale Theory, Effects Test and International targeting, Jurisdiction under IT Act, 2000.	06
	2. Network Vulnerabilities	Overview of vulnerability scanning, Open Port / Service Identification, Banner /Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning (Netcat, Socat), Network Sniffers and Injection tools Cyber Security Framework NIST	06
	3. Network Security Fundamentals	Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding. VPN: the basic of Virtual Private Networks, Firewall: Introduction, Linux Firewall, Windows Firewall, Snort:	06

		Introduction Detection System, Cyber Kill Chain model for identification and prevention of cyber intrusions activity.	
	4. Hijacking	Control Hijacking, More Control Hijacking attacks integer overflow, attacks format string vulnerabilities, Defense against Control Hijacking – Platform Defenses, Defense against Control Hijacking - Run-time Defenses, Advanced Control Hijacking attacks.	06
Unit-2	5. Cyber Crime	Introduction to cybercrime, Data diddling, Data leakage, Eavesdropping, E-mail forgery, E-mail threats, Internet misinformation, Internet terrorism, Password cracking, Scavenging/Corporate Espionage, Social Engineering, Spamming, Super zapping, Piggybacking, Trap door, Trojan Horse, Virus, Worm Impersonation, Time bomb, Logic bomb, DOS Attack Email Hacking & its security ,Social Media Hacking & its Security, Web Hacking& its Security, Mobile Hacking & its Security, Wi-Fi Network Hacking & its Security, Software Hacking, Email forgery and E-mail Tracing.	08
	6. Intrusion	Intrusion Analysis, Intrusion, Methods to Performing Intrusion Analysis, Passively, Discovering Activity in Historical Data and Logs, Detecting Future Threat Actions and Capabilities, Denying Access to Threats, Delaying and Degrading Adversary Tactics and Malware, Identifying Intrusion Patterns and Key Indicators	08
	7. System Hardening	Concepts and Processes of OS and NOS Hardening, File System, Updates, Hotfixes, Service Packs, Patches. Network Hardening, Updates (Firmware), Configuration, Enabling and Disabling Services and Protocols, Access Control Lists. Application Hardening, Web Servers, E-mail Servers, FTP Servers, DNS Servers, NNTP Servers, File and Print Servers, DHCP, Data Repositories, Directory Services, Databases.	08

Total=48

Recommended Books:

1. Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short, Cybersecurity essential, Sybex, Wiley Press
2. Anne Kohnke, Dan Shoemaker, Ken Sigler, The Complete Guide to Cybersecurity Risks and Controls, CRC press
3. Thomas J. Mowbray, Cybersecurity - Managing Systems, Conducting Testing, and Investigating Intrusions, Wiley press
4. Leslie F. Sikos, AI in Cybersecurity, Springer

Title of the course : **Software Engineering**

Subject Code : **PECS-611D**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Gain understanding of software development life cycle
CO2	Prepare SRS document for a software project
CO3	Apply software design and development techniques
CO4	Apply estimation techniques for software development
CO5	Implement testing at each phase of SDLC

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	1	0	0	2	0	3	3	1	1
CO2	3	3	3	2	2	1	0	0	2	0	2	2	2	2
CO3	3	0	3	2	2	1	0	0	2	0	2	2	2	3
CO4	2	0	2	2	2	2	0	0	2	0	3	2	2	3
CO5	3	0	2	3	2	2	0	0	2	0	2	2	2	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Evolving role of Software	Introduction to Software Engineering, importance of Software, The Software Evolution, Software Characteristics, Software Applications	06
	2.Software Development Life Cycle Models	Waterfall model, Prototyping Model, RAD Model, Incremental Model, Spiral Model, Selection of a life cycle model	06
	3. S/W scope	Resources, estimation, decomposition techniques, empirical estimation models. Project scheduling	06
	4. Software reliability	Software reliability models, Software quality, software quality ISO standards, Capability Maturity Model, requirement analysis, analysis principles	06
Unit-2	5. Software Testing	Software testing Fundamentals, Test Case design, White box testing, Basis path testing, Black box testing.	06
	6. Post implementation review	Review plan. S/W maintenance and enhancement procedure.	06
	7. Reverse Engineering	Scope, Levels of reverse engineering, tools, software re-engineering, documentation	06
	8.Control Measures	Threats & control measures, disaster/recovery planning, ethics in system development, ethics codes & standard of behavior.	06

Total=48

Recommended Books:

1. Roger S. Pressman, Software Engineering, A Practitioner's Approach, McGrawHill International Edition.
2. Ian Sommerville, Software Engineering, Addison-Wesley Publishing Company
3. James F. Peter, Software Engineering - An Engineering Approach, John Wiley
4. Pankaj Jalote, An integrated Approach to Software Engineering, Narosa.

Title of the course : **Enterprise Resource Planning**

Subject Code : **PECS-611E**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Learn fundamental concepts of ERP system and ERP related technologies.
CO2	Acquire knowledge of different ERP modules and manufacturing perspectives of ERP
CO3	Use ERP system in different business organizations by having knowledge of latest scenario of ERP market in e-business.
CO4	Understand the concept of ERP implementation strategies and use the ERP module in real time projects.
CO5	Develop skills necessary for building and managing relationships with customers, and stakeholders.

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	3	2	2	0	1	3	3	3	2	1	2
CO2	3	2	1	3	2	2	0	1	3	3	3	2	2	1
CO3	3	2	1	3	2	2	0	1	3	3	3	2	1	3
CO4	1	1	1	2	2	2	0	1	2	2	3	2	1	2
CO5	2	2	2	3	2	2	0	1	3	3	3	3	1	2

Theory

Unit	Main Topics	Course outlines	Hour(s)
Unit-1	1. Basics of ERP	Introduction and evolution of ERP, Reasons for the growth of the ERP market, Advantages of ERP, Introduction to ERP packages	04
	2. Enterprise- An overview	Integrated Management information, Business Modeling, Integrated Data Model.	04
	3. ERP and Related Technologies	BRP (Business Process Reengineering), MIS (Management Information System), DSS (Decision Support System), EIS (Executive Information system), Data Warehousing, Data Mining, OLAP (On-Line Analytical Processing), Supply Chain Management.	08
	4. ERP-A Manufacturing Perspective	ERP, CAD/CAM, MRP (Material Requirement Planning), BOM (Bill of Material), Closed loop MRP, MRP-II, DRP (Distributed Requirement Planning), PDM (Product Data Management) and its benefits, Data Management, MTO, MTS, ATO, ETO, CTO	08
	5. ERP Modules	Finance, Plant Maintenance, Quality Management, Material Management.	06

Unit-2	6. Benefits of ERP and ERP Market	Benefits of ERP, SAP, BAAN, Oracle Corporation, People Soft	06
	7. ERP Implementation	ERP Implementation Life Cycle, In-house Implementation – pros & cons, Vendors, Consultants, End-users.	06
	8. Future directions in ERP	Future Directions in ERP and ERP Case Studies	06

Total=48

Recommended Books:

1. Alexis Leon "Enterprise Resource Planning", TMH.

Title of the course : **Network Operating System**

Subject Code : **PECS-611F**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Study the basics of Linux based Operating System.
CO2	Learn the installation, configuring and setup of Linux Operating System.
CO3	Develop the skill of shell programming in Linux.
CO4	Access advanced configuration and system management features of Linux.
CO5	Learn GUI features including Applications Manager, Text Editor, printing

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	3	0	0	0	0	0	0	0	3	0	3	1	2
CO2	0	3	2	2	0	0	0	0	0	3	0	3	3	3
CO3	0	3	2	3	0	0	0	0	0	3	0	3	2	2
CO4	0	3	0	2	0	0	0	0	0	3	0	3	2	1
CO5	0	2	1	0	0	3	0	2	1	1	0	1	2	2

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of Linux Operating System	History of Linux and Unix, Linux overview, Linux releases, Open Linux	06
	2. Installing Linux	Hardware, software and information requirements; opening disk space for Linux partitions; creating the open Linux install disks; installing Linux;	06
	3. Installing Drivers	Installing and configuring X-windows; installing sound drivers.	06
	4. Linux Startup and Setup	User accounts; accessing the Linux system; Linux commands; online manual; online documentation; installing software packages	06
Unit-2	5. Shell	The command line: special characters and file arguments; standard input/ output and redirection; pipes; redirecting and piping with standard errors; shell scripts; jobs.	06

	6. Linux file Structure	Linux files; file structure; listing, displaying and printing files; managing directories; file and directory operations	06
	7. VI editor	vi editing commands; advanced vi editing commands; line editing commands; options in v i	06
	8. System Administration	System management, managing users; installing and managing devices	06

Total=48

Recommended Books:

1. Linux the Complete Reference, Richard Peterson TMH, New Delhi.
2. CISCO Network Design Handbook, Michal Salvagno IDG books, Delhi

Title of the course : **Software Engineering**

Subject Code : **OECS-611A**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Gain understanding of software development life cycle
CO2	Prepare SRS document for a software project
CO3	Apply software design and development techniques
CO4	Apply estimation techniques for software development
CO5	Implement testing at each phase of SDLC

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	1	0	0	2	0	3	3	1	1
CO2	3	3	3	2	2	1	0	0	2	0	2	2	2	2
CO3	3	0	3	2	2	1	0	0	2	0	2	2	2	3
CO4	2	0	2	2	2	2	0	0	2	0	3	2	2	3
CO5	3	0	2	3	2	2	0	0	2	0	2	2	2	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Evolving role of Software	Introduction to Software Engineering, importance of Software, The Software Evolution, Software Characteristics, Software Applications, Software Crisis: Problem and Causes.	05
	2.Software Development Life Cycle Models	Build and fix model, Waterfall model, Prototyping Model, RAD Model, Incremental Model, Spiral Model, Selection of a life cycle model	07
	3. S/W scope	Resources, estimation, decomposition techniques, empirical estimation models. Project scheduling, refinement of major tasks, scheduling project plan,	06
	4. Software reliability	Software reliability models, Software quality, software quality ISO standards, Capability Maturity Model, The system engineering hierarchy information engineering, information strategy planning, requirement analysis, analysis principles	06
Unit-2	5. Software Testing	Software testing Fundamentals, Test Case design, White box testing, Basis path testing, Control structure testing, Black box testing.	08
	6. Post	Review plan. S/W maintenance and enhancement	05

	implementation review	procedure. System security.	
	7. Reverse Engineering	Scope, Levels of reverse engineering, tools, software re-engineering, documentation	05
	8.Control Measures	Threats & control measures, disaster/recovery planning, ethics in system development, ethics codes & standard of behavior.	06

Total=48

Recommended Books:

1. Roger S. Pressman, Software Engineering, A Practitioner'sApproach, McGrawHill International Edition.
2. Ian Sommerville, Software Engineering, Addison-Wesley Publishing Company
3. James F. Peter, Software Engineering - An Engineering Approach, John Wiley
4. Pankaj Jalote, An integrated Approach to Software Engineering, Narosa.

Title of the course : **Enterprise Resource Planning**

Subject Code : **OECS-611B**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Learn fundamental concepts of ERP system and ERP related technologies.
CO2	Acquire knowledge of different ERP modules and manufacturing perspectives of ERP
CO3	Use ERP system in different business organizations by having knowledge of latest scenario of ERP market in e-business.
CO4	Understand the concept of ERP implementation strategies and use the ERP module in real time projects.
CO5	Develop skills necessary for building and managing relationships with customers, and stakeholders.

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	3	2	2	0	1	3	3	3	2	1	2
CO2	3	2	1	3	2	2	0	1	3	3	3	2	2	1
CO3	3	2	1	3	2	2	0	1	3	3	3	2	1	3
CO4	1	1	1	2	2	2	0	1	2	2	3	2	1	2
CO5	2	2	2	3	2	2	0	1	3	3	3	3	1	2

Theory

Unit	Main Topics	Course outlines	Hour(s)
Unit-1	1. Basics of ERP	Introduction and evolution of ERP, Reasons for the growth of the ERP market, Advantages of ERP, Introduction to ERP packages	04
	2. Enterprise- An overview	Integrated Management information, Business Modeling, Integrated Data Model.	04
	3. ERP and Related Technologies	BRP (Business Process Reengineering), MIS (Management Information System), DSS (Decision Support System), EIS (Executive Information system), Data Warehousing, Data Mining, OLAP (On-Line Analytical Processing), Supply Chain Management.	08
	4. ERP-A Manufacturing Perspective	ERP, CAD/CAM, MRP (Material Requirement Planning), BOM (Bill of Material), Closed loop MRP, MRP-II, DRP (Distributed Requirement Planning), PDM (Product Data Management) and its benefits, Data Management, MTO, MTS, ATO, ETO, CTO	08
Unit-2	5. ERP Modules	Finance, Plant Maintenance, Quality Management, Material Management.	06
	6. Benefits of ERP and ERP Market	Benefits of ERP, SAP, BAAN, Oracle Corporation, People Soft	06

	7. ERP Implementation	ERP Implementation Life Cycle, In-house Implementation – pros & cons, Vendors, Consultants, End-users.	06
	8. Future directions in ERP	Future Directions in ERP and ERP Case Studies	06

Total=48

Recommended Books:

1. Alexis Leon “Enterprise Resource Planning”, TMH.

Title of the course : **Cyber Laws and Ethics**

Subject code : **OECS-611C**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credits : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	To identify and analyze statutory, regulatory, constitutional, and organizational laws that affects the information technology professional.
CO2	To locate and apply case law and common law to current legal dilemmas in the technology field.
CO3	To understand the basics of the four primary forms of intellectual property rights.
CO4	To compare and contrast the different forms of intellectual property protection in terms of their key differences and similarities.
CO5	To understand the basics of Copyright & Related Rights and protection from copyright.

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	0	3	1	3	2	0	0	3	1	3	2	1	2
CO2	3	3	3	3	3	0	0	0	3	1	3	2	2	3
CO3	3	0	3	0	0	0	0	0	0	0	0	2	1	1
CO4	3	0	3	3	0	0	0	0	0	0	0	3	1	1
CO5	3	2	3	1	0	0	0	1	0	0	1	2	1	1

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of Cyber system	Overview of Computer and Web Technology, Need for Cyber Law, Cyber Jurisprudence at International and Indian Level, Jurisdictional Aspects in Cyber Law Issues of jurisdiction in cyberspace, Types of jurisdiction, Minimum Contacts Theory, Sliding Scale Theory, Effects Test and International targeting, Jurisdiction under IT Act, 2000.	06
	2. Jurisdiction	Jurisdictional Aspects in Cyber Law Issues of jurisdiction in cyberspace, Types of jurisdiction, Minimum Contacts Theory, Sliding Scale Theory, Effects Test and International targeting, Jurisdiction under IT Act, 2000.	06
	3. Cyber Crimes	Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Ethics and Etiquettes of Cyber World, Cyber Pornography, Identity Theft & Fraud, Cyber Terrorism, Cyber Defamation.	06
	4. Legal Framework	Right to Privacy and Data Protection on Internet, Concept of privacy, Threat to privacy on internet, Self-regulation approach	06

		to privacy.	
Unit-2	5. Intellectual Property	Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development IPR in abroad.	06
	6. Patents	Macro-economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document How to protect your inventions?, Granting of patent, Rights of a patent.	06
	7. Copyright & Related Rights	Copyright, latest editions, duration of copyright last, how to protect copyright. Related rights and its distinction with copyright.	06
	8. Trademarks	Trademark and rights of trademark, kind of signs can be used as trademarks, types of trademark, trademark protection and registration process.	06

Total=48

Recommended Books:

1. AnirudhRastogi. Cyber Law-Law Of Information Technology And Internet, LexisNexis.
2. Vakul Sharma. Information Technology Law and Practice Cyber Laws and LawsRelating to E-Commerce, Universal Law Publishing.
3. Dr. S.K. Singh. Intellectual Property Rights, Central Law Agency.

Title of the course : **Programming Methodology**

Subject Code : **OECS-611D**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the different problem representation, flow chart, algorithm etc.
CO2	Choose data types and operators to solve mathematical and scientific problems
CO3	Understand the flow control of program
CO4	Basic knowledge of object-oriented programs and file handling in c
CO5	To understand the use of pointer in real time problems.

CO/PO Mapping: (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	1	0	0	0	0	0	0	0	2	1	1
CO2	3	3	3	2	2	0	0	0	0	0	0	3	1	1
CO3	3	3	3	3	2	0	0	0	1	0	0	3	1	1
CO4	3	3	3	3	3	1	1	0	1	0	0	3	2	1
CO5	3	2	3	2	2	1	0	0	0	0	0	3	2	1

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	**1. Programming Techniques**	Steps in development of a program, Brief discussion of Flow chart, algorithm development & program debugging. Procedural Programming, Functional Programming, Structured programming, Object oriented Programming	06
	2. Program Structure	Character set, comments, data types, logical, relational & binary operators, variables, constants, Standard I/O statements, Expressions, Automatic conversion & casting in data types.	06
	3. Flow control	If, If-Else, Nested if, Go-to, Switch, Break, continue, while, do-while, for loop.	06
	4. Functions & Arrays	Void functions, function declaration, parameter passing, call by value, call by reference, return statement Function Overloading. Friend Functions, Virtual functions, Declaration& Initialization of arrays, Accessing array elements, Array of structures, two dimensional & multi-dimensional arrays.	06
Unit-2	**5. Structures & Scope**	Declaration of a structure, Initialization, accessing structure members, nested structures, structures as function arguments, Typedef, unions Enumerated data, Block Local & Global variables, Auto Static & External Variables	06

	6. Objects & Classes	Classes & objects in C++, Accessing data & member functions, private & public qualifiers, # include, #define & #undef directives, Base & derived classes ,multiple inheritance, constructors in derived classes, constructors in multiple inheritance, operator overloading.	06
	7. Pointers in C++	Pointers, Pointers as function argument, Pointer as a structure member, Pointer arithmetic in objects and classes, pointers and strings, pointers to objects.	06
	8. File I/O	Opening & closing a file, Reading & writing a file. Random access files. Updating data in random access files, Exception handling, Throwing of a function or an object as an exception, Multiple catch statements.	06

Total=48

Recommended Books:

1. Turbo C++ Robert Lafore Pearson India
2. Let Us C++ YashwantKanetkar BPB
3. Thinking In C++ P B Mahapatra PHI

Title of the course : **Data Preparation and Analysis**

Subject Code : **OECS-611E**

Weekly load : **3Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: On successful completion of this course, students will be able to:

CO1	Learn how to prepare data for analysis.
CO2	Gain knowledge to identify data parsing and transformation.
CO3	Learn how to apply cleaning and reformatting of data.
CO4	Perform a variety of data exploration techniques.
CO5	Perform exploratory data analysis, and develop meaningful data visualization.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	0	0	0	0	0	0	1	0	1	1	1	2
CO2	1	1	1	0	2	0	0	0	1	1	1	1	1	2
CO3	2	1	1	0	3	0	0	2	2	2	2	1	2	3
CO4	1	1	1	0	2	0	0	0	1	1	1	1	1	2
CO5	2	1	1	0	3	0	0	2	2	2	2	1	2	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1.Defining Data Analysis Problems	Knowing the client, Understanding the question	02
	2. Data Gathering and Preparation	Data formats, parsing and transformation, Scalability and real-time issues.	07
	3. Data Cleaning	Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation	11
Unit-2	4. Exploratory Analysis	Descriptive and comparative statistics, Clustering and association, Hypothesis generation	13
	5. Visualization	Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity.	15

Total=48

Recommended Books:

1. Making sense of Data: A practical Guide to Exploratory Data Analysis and Data mining, by Glenn J. myatt

Title of the course : **Software Project Management**

Subject Code : **OECS-612A**

Weekly load : **3 Hrs** **L T P 3 0 0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Comprehend software project management activities
CO2	Understand various steps required for project planning
CO3	Create an estimation and effective cost benefit evaluation techniques
CO4	Design framework for risk management
CO5	Comprehend resource management

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):

COs	Programme Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	2	3	2	3	0	0	0	0	0	1	1
CO2	3	3	2	2	2	2	3	0	0	2	0	0	1	2
CO3	3	2	2	2	3	2	3	2	0	2	0	0	1	2
CO4	2	2	2	3	3	2	3	2	0	0	0	0	1	2
CO5	3	3	2	2	3	2	2	0	0	0	2	0	1	1

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of software project management	Introduction to software project management, types of project, project attributes, project constraints, importance of management, problems with software projects, management control, role of project manager, steps in project planning, Programme management, managing resources within Programme.	12
	2. Software Cost and Time Estimation	A system view of project management, stakeholder management Assessment of projects, Cost-benefit Analysis, Cash flow forecasting, Cost-benefit evaluation techniques, Selection of an appropriate project technology, Choice of process model, developing the project schedule, Estimation Techniques, Problem with over and under estimates, COCOMO Model	12
	3. Planning	Objective of Planning, Project Schedule, Activities – Sequencing and Scheduling, Development of Project	12

Unit-2		Network, Time Estimation, Forward and backward Pass, Critical Path and Activities. Introduction to project risk management, Risk categories, identification, assessment, planning, management, Software Configuration Management Process: Version Control, Change Control management, PERT and CPM Models, project implementation	
	4. Software Project Management	Resources, Nature of Resources, developing the project budget, monitoring and controlling the project, project metrics, Project targets, Management Spectrum, associating human resource with job, Motivation, Oldham- job Characteristics Model, Decision Making, Leadership, Stress Management, Health and Safety	12

Total=48

Recommended Books:

1. Bob Hughes, Mike Cotterell, "Software Project Management", Tata McGraw Hill.
2. Prasanna Chandra, "Projects: Panning, Analysis, Selection, Financing, Implementation and Review", Tata McGraw Hill Publication.
3. Jeffrey K. Pinto, "Project Management", Pearson Publications.

Title of the course : Decision Support System
Subject Code : OECS-612B
Weekly load : 3 Hrs LTP 3-0-0
Credit : 3

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand fundamental concepts associated with DSS
CO2	Develop skill in the system analysis, design and implementation of computerized DSS
CO3	Learn various knowledge representation techniques
CO4	Learn different types of Data warehouse, different framework of datamining
CO5	To understand the concept of Business Analytics,Knowledge Discovery in Databases

Theory

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	2	3	1	0	2	3	3	3	2	1	1
CO2	3	2	2	2	3	1	0	2	3	3	3	2	1	1
CO3	3	2	2	2	3	1	0	2	3	3	3	2	1	2
CO4	3	2	1	2	2	1	0	1	1	1	2	2	1	2
CO5	3	2	1	2	2	1	0	1	1	1	2	2	1	2

Unit	**Main Topics**	**Course outlines**	**Hour(s)**
Unit-1	1. Basics of DSS	Concepts of Data, Information, Information Systems & End Users, Systems Concepts: Open System, Closed System; Information Systems and Systems Concept	06
	2. Building Information System	System Analysis and Design – Systems Development Cycle (Identification of Requirements, Feasibility Study, System Analysis, Design And Implementation), Prototyping	06
	3. Decision Making	Introduction and Definitions, Simons Decision Making Model, How Decisions are Supported, DSS Configurations, DSS Characteristics and Capabilities	06
	4. Components of DSS	DSS Classifications DSS Modeling-Static and Dynamic Models, Certainty, Uncertainty, and Risk, Sensitivity Analysis, What-IF, and Goal Seeking	06
Unit-2	5. Knowledge Management System	Definition and types of Knowledge, Frame work for Knowledge Management, Knowledge Representation Techniques: Rules, Frames, Semantic Networks	06
	6. Data Warehouse and Data Mining	Data Warehousing Definitions and Concepts, Types of Data warehouse, Data Mining Concepts and Applications, Framework of datamining, Text Mining, Web Mining Usage, Benefits, and Success of Business Analytics	06
	7. Business Analytics	Online Analytical Processing (OLAP), Reporting and Queries, Multidimensionality, Knowledge Discovery in Databases(KDD), framework of KDD	06
	8. Future directions	Future Directions in DSS and DSS Case Studies	06

Total=48

Recommended Books:

1. Turban, Efrain : Decision Support & Business Intelligent Systems(8e)- Pearson Education
2. Marakas, George.M. : Decision Support Systems in the 21st century – Pearson Education
3. Mallach, EfremG. : Decision Support & data Warehouse Systems – Tata McGraw-Hill

Title of the course : **Computer Networks**

Subject Code : **OECS-612 C**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand basics of computer networks
CO2	Learn use of physical and datalink layer in networking
CO3	Understand the concept of MAC and Network layer
CO4	Learn various protocols used in transport and application layer
CO5	Understand OSI and TCP/IP models

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	0	0	1	0	0	0	0	0	0	2	1	1
CO2	2	2	0	0	2	0	0	0	0	2	0	2	2	2
CO3	2	3	2	2	2	2	0	0	2	2	0	2	2	2
CO4	2	2	3	2	2	2	0	0	2	2	0	2	2	2
CO5	2	2	2	2	2	2	0	0	2	2	0	0	3	2

Theory

Unit	**Main Topics**	**Course outlines**	**Lecture(s)**
Unit-1	1. Basics of Computer Networks	Need & Evolution of Computer Networks, Description of LAN, MAN, WAN and wireless Networks, OSI and TCP/IP models with description of Data Encapsulation & peer to peer communication, Comparison of OSI and TCP/IP.	06
	2. Media and network devices	Basic terminology of computer networks - bandwidth, physical and logical topologies, Media – 10 base Z, 10base S, 10base T, 100baseTX, 100base FX, 1000baseLX and wireless. LAN & WAN devices – Router, bridge, Ethernet switch HUB, Modem.	06
	3. Physical Layer	Representation, one bit on physical modem i.e. in wired network, optical Network and wireless N/W, Encoding / Modulation – Manchester Encoding, AM, FM and PM. Dispersion, Jitter, Latency and collision. Different types of Media – Shielded twisted pair, Unshielded twisted pair, Coaxial cable, Optical Fiber cable and wireless.	06

	4. Data link Layer	Framing, Error control and Flow control, Data link control and protocols – Simplex protocol, Sliding window protocol	06
Unit-2	5. Medium Access Sublayer	Channel Allocations, Multiple Access protocols- ALOHA, CSMA, CSMA/CD protocols, Collision free protocols, Token Ring, FDDI, Bridges and recent developments.	06
	6. Network Layer	Segmentation and autonomous system path determination, Network layer addressing, Network-layer data gram, IP addressed classes. Subnetting – Sub network, Subnet mask. Routing algorithm – optimality Principle, Shortest path routing, Hierarchical routing, Broadcast routing, Multicast routing, tunneling Fragmentation and DHCP. Routing Protocol – RIP, IGRP, OSPF and EIGRP.	06
	7. Transport Layer	Layer 4 Protocol TCP & UDP. Three-way handshakes open connection. Session Layer design issue, Presentation layer design issue, and Application layer design issue.	06
	8. Application Layer	Application Layer protocols: TELNET, FTP, HTTP, SNMP, DNS, SMTP, FTP, HTTP, WWW and recent development.	06

Total=48

Recommended Books:

1. Tanenbaum, Computer Network, Prentice Hall India
2. William Stalling, Data and Computer Communication, Prentice Hall
3. Douglas E. Comer, Internetworking with TCP/IP Volume – I, Prentice Hall India
4. W. Richard Stevens, TCP/IP Illustrated Volume-I, Pub. Addison Wesley
5. B. Forouzan, Data Communication And Networking, TMH

Title of the course : **Object Oriented Programming**

Subject Code : **OECS-612D**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the difference between object oriented programming and procedural programming
CO2	Choose data types and structures to solve mathematical and scientific problems
CO3	Write programs using C++ features such as composition of objects, operator overloading, inheritance, polymorphism etc.
CO4	Simulate the real world problems into object-oriented programs
CO5	Illustrate the process of data file manipulations using C++

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
CO's	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	0	0	0	0	0	0	0	2	3	1
CO2	3	3	3	3	3	3	0	0	3	3	3	3	3	3
CO3	3	3	3	3	3	3	0	0	3	3	3	3	3	3
CO4	3	3	3	3	3	3	0	0	3	3	3	3	3	3
CO5	3	3	3	3	3	3	0	0	3	3	3	3	3	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of object oriented programming	Basic concepts of object-oriented programming, Characteristics of object-oriented programming, Comparison between procedural programming paradigm and object-oriented programming paradigm.	06
	2. Classes and Objects	Specifying a class, Creating class objects, Accessing class members, Access specifiers – public, private, and protected, Static members variables and functions, Static class objects, The const keyword, Friend functions, Friend classes, Empty classes, Nested classes, Local classes, Abstract classes, Container classes.	06
	3. Constructors and Destructors	Need for constructors and destructors, Default constructor, Parameterized constructor, Copy constructor, Dynamic constructors, Destructors, Constructors and destructors with static members.	06
	4. Inheritance	Introduction, Defining derived classes, Forms of inheritance, Ambiguity in multiple and multipath inheritance, Virtual base class, Object slicing, Overriding member functions, Object composition and delegation, Order of execution of constructors and destructors.	06

Unit-2	5. Virtual Functions and Polymorphism	Concept of Binding - Early binding and late binding, Virtual functions, Pure virtual functions, Abstract classes, Virtual destructors & polymorphism.	06
	6. Operator Overloading and Type Conversion	Defining operator overloading, Rules for overloading operators, Overloading of unary operators and binary operators, Overloading of new and delete operators, Type conversion - Basic type to class type, Class type to basic type, Class type to another class type.	06
	7. Pointers and Dynamic Memory Management	Understanding pointers, Accessing address of a variable, Declaring & initializing pointers, Accessing a variable through its pointer, Pointer arithmetic, Pointer to a pointer, Pointer to a function, Dynamic memory management - new and *delete* Operators, Pointers and classes, Pointer to an object, Pointer to a member, *this* Pointer, Self-referential classes, Possible problems with the use of pointers - Dangling/wild pointers, Null pointer assignment, Memory leak and allocation failures.	06
	8. Exception Handling and Managing Data Files	Exception and its types, Exception handling mechanisms, File streams, Hierarchy of file stream classes, Error handling during file operations, Reading/Writing of files, Accessing records randomly, Updating files, Data formatting in memory buffers.	06

Total=48

Recommended Books:

1. Lippman, S.B. and Lajoie, J., C++Primer, Pearson Education.
2. Stroustrup, Bjarne, The C++ Programming Language, Pearson Education.
3. YashwantKanetkar, Let Us C++, BPB
4. Robert Lafore, Turbo C++, Pearson India

Title of the course : **Database Management System**

Subject Code : **OECS-612E**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Gain a good understanding of the architecture and functioning of database management systems as well as associated tools and techniques
CO2	Understand principles of data modeling using entity relationship to develop a good database design and normalization techniques to normalize a database
CO3	Understand and use structured query language to query, update, and manage a database
CO4	Evaluate and optimize queries
CO5	Understand transaction processing, backup and recovery techniques

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):

COs	Programme Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	2	2	0	0	0	0	0	0	3	2	3
CO2	3	2	2	2	2	0	0	0	2	0	2	2	2	2
CO3	2	2	3	2	2	2	0	0	3	2	2	2	2	2
CO4	2	2	2	2	2	2	0	0	2	0	2	2	2	3
CO5	3	3	2	2	3	2	0	0	2	2	2	2	2	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of data processing	Data, data processing requirement, desirable characteristics of an ideal data processing system, traditional file based system, its drawback, concept of data dependency, Def of database, database management system.	04
	2. Database concepts	3-schema architecture: external-conceptual-internal, database terminology, benefits of DBMS, Database development process - conceptual data modeling, logical database design, physical database design, database implementation, database maintenance.	06
	3. Database Analysis	Conceptual data modeling using E-R data model -entities, attributes, relationships, generalization, specialization, specifying constraints: total and partial participation. 5 – 6 practical problems based on E-R data model.	06
	4. Database Design	Logical database design and relational data model: Introduction to relational database theory: *def* of relation, relational model operators, relational model integrity rules, Normalization- 1NF, 2NF, 3NF, 4NF, BCNF & practical problems based on these forms. Denormalization.	08

Unit-2	5. Database Implementation	Introduction to SQL, DDL aspect of SQL, DML aspect of SQL – update, insert, delete & various form of SELECT- simple, using special operators, aggregate functions, group by clause, sub query, joins, co-related sub query, union clause.	08
	6. Query optimization	Introduction, Query plan,ways of evaluating a given query, Overview of optimization process, expression transformation, database statistics, A divide and conquer strategy.	06
	7. Transaction processing	Transaction concept, transaction state, Implementation of atomicity and durability, concurrent execution, Serializability, recoverability, Implementation of isolation, transaction definition in SQL.	04
	8. Overview of backup and recovery process	Failure classification, Storage structure, recovery and atomicity, log based recover , shadow paging, recovery with concurrent transaction, buffer management, failure with loss of non-volatile storage, advance recovery techniques.	06

Total=48

Recommended Books:

1. A Silberschatz, H. F. Korth, and S Sudarshan, Database System Concepts, TMH.
2. McFadden, F.Hoffer, M. B Modern database management, Prescott.
3. C.J Date, An Introduction to Database Systems, Addison, Wesley.
4. Raghu Ramakrishnan and Gehrke,Database Management System, McGraw-Hill.
5. Margaret.H.Dunham , Data Mining. Introductory and advanced topics, Pearson.

Title of the course : **Application Development using Python**

Subject code : **MDCS-611**

Weekly load : **4 Hrs** **LTP 3-1-0**

Credits : **4**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand why Python is a useful scripting language for developers.
CO2	Learn how to design and program Python applications.
CO3	Learn how to use lists, tuples, and dictionaries in Python programs.
CO4	Learn how to design object-oriented programs with Python classes.
CO5	Learn how to use exception handling in Python applications for error handling.

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	3	3	3	1	0	0	1	0	2	3	1	3
CO2	1	2	3	3	3	1	0	0	1	0	3	3	2	2
CO3	0	1	3	2	3	0	0	0	0	0	0	2	3	2
CO4	0	1	3	3	3	0	0	0	0	0	0	2	3	2
CO5	0	1	3	2	3	0	0	0	0	0	0	2	3	2

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit -1	**1.** Fundamental concepts of the programming	Concept of an algorithm, program, programming languages, need of programming, scenario, development of code from an algorithm, concept, need and use of pseudo code, variables, datatypes, operators, implicit/explicit type conversion, functions in programs.	09
	2. Control statements	Selection and iteration control statements: if, else, nested if else, for while and nested loops; break, continue, pass	09
	3. Testing and debugging	Unit testing (path coverage and boundary value analysis), introduction of debugging, introduction of Eclipse: basic, tip to handle infinite loop	05
Unit -2	**4.** Collections	Introduction to collections, list, array, tuple, string, set, dictionary, basic operations and built-in method/function of: list, array, tuple, string, set, dictionary	09
	5. Function	Definition of function, arguments, argument behavior, types of argument, variables and its scope, function calling, types of function, recursive function, revisiting function	09
	6. Exception handling	Introduction and need of Exception handling in code	02
	7. Modules and Libraries	Introduction to modules, package, libraries, introduction to math, random, combination, itertools, Numpy library	05

Total=48

Recommended Books:

1. Mark Lutz, Learning Python, O'Reilly.
2. David Beazley and Brian K. Jones, Python Cookbook, O'Reilly.
3. David Beazley, Python Essential Reference, Developer's Library.
4. John V. Guttag, Introduction to Computation and Programming Using Python, The MIT Press.
5. Zed Shaw, Learn Python the Hard Way, Pearson.

Title of the course : **Big Data Analytics**

Subject Code : **HDCS-611**

Weekly load : **4 Hrs** **LTP 3-1-0**

Credit : **4**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Summarize the workflow of analytics process model, its requirements and applications.
CO2	Apply suitable data pre-processing techniques for the given dataset.
CO3	Demonstrate different predictive, Descriptive and text analytic models.
CO4	Examine Survival Analysis model and learn through Social Network Analytics.
CO5	Define the Text Analytics method, Text Analytics Metrics and their applications

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	0	0	0	0	0	0	1	0	0	0	1	1
CO2	1	1	1	0	2	0	0	0	1	1	0	0	3	2
CO3	2	1	1	0	3	0	0	2	2	2	0	0	1	2
CO4	3	2	2	1	3	1	0	1	2	2	0	0	2	1
CO5	1	1	1	0	2	0	0	2	1	1	0	0	1	2

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of Big data	What is big data, why big data, convergence of key trends, unstructured data,industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics	08
	2. NoSQL	Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer peer replication, sharding and replication, consistency, relaxing consistency ,version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.	08
	3. Hadoop	Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures	08

Unit-2	4. MapReduce	MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats	08
	5. Hbase and Cassandra	Hbase, data model and implementations,Hbase clients, Hbase examples, praxis Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration	08
	6. High Level utilities(Pig, Grunt, Hive)	Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts.Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.	08

Total=48

Recommended Books:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
4. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
5. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
6. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
7. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
8. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
9. Alan Gates, "Programming Pig", O'Reilley, 2011.

Title of the course : **Internet of Things**

Subject Code : **HDCS-612**

Weekly load : **4** **L T P 3 1 0**

Credit : **4**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Effective usage of IoT deployment for different sectors.
CO2	Developing and modifying code for various sensor based applications using wireless sensor modules and working with variety of modules like environmental and security module.
CO3	Exploring the features of predictive data analytics for IoT applications.
CO4	Modular hands on training will enable participants to conduct IoT related activities in academic environment and initiate new projects in Industrial sectors.
CO5	Design a simple IoT system comprising sensors, edge devices and wireless network connections involving prototyping, programming and data analysis.

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	0	0	0	0	0	0	2	0	1	2
CO2	3	3	3	3	2	0	0	0	0	0	0	0	3	1
CO3	3	2	2	2	2	2	1	0	0	0	0	0	1	2
CO4	3	3	2	3	3	1	2	0	0	0	2	0	3	1
CO5	2	2	3	1	3	2	1	0	0	0	1	1	3	2

	Main Topics	**Course outlines**	**Lecture(s)**
Unit-1	Basics of IoT	Introduction to IoT Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & API's	08
	IoT& M2M	Machine to Machine, Difference between IoT and M2M, Software define network	08
	Network and communication aspects	Wireless medium access issues, MAC protocol survey, Survey routing protocols, sensor deployment & Node Discovery, Data aggregation & dissemination	08
Unit-2	Domain specific applications of IoT	Home automation, Industry applications, Surveillance applications, other IOT applications	08
	Challenges in IOT	Design challenges, Development challenges, security challenges, other challenges	08
	Developing IOT's	Introduction to Python, Introduction to different IOT tools, Developing applications through IOT tools, Developing Sensor based application through embedded system platform, Implementing IOT concepts with Python	08

Total=48

Recommended Books:

1. SAMuel Greengard, “the Internet of Things”.
2. Klaus Schweb, “The Fourth Industrial revolution”.
3. CunoPfister, “Getting Started with Internet of Things”
4. Peter Wahel, “Learning Internet of Things.

SEMESTER-VI

Title of the course : **Design and Analysis of Algorithms**

Subject code : **PCCS-621**

Weekly load : **3 Hrs** **LTP 2-1-0**

Credits : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand about algorithm complexities
CO2	Have an understanding of elementary and advanced data structures
CO3	Acquire knowledge about various advanced design and analysis techniques such as divide-and-conquer, greedy algorithms, dynamic programming, branch-and-bound
CO4	Know the concept of tractable and intractable problems and the P, NP, NP-complete problems
CO5	Utilize data structures and/or algorithmic design techniques for developing efficient computer algorithm for solving real-world problems

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2	2	0	0	2	0	2	2	2	2
CO2	3	3	3	2	2	2	0	0	2	0	2	2	2	2
CO3	3	2	2	2	3	2	0	0	3	3	3	3	3	2
CO4	3	3	3	3	3	3	0	0	3	2	3	3	2	2
CO5	3	3	3	2	3	2	0	0	3	3	3	3	3	3

Theory

Unit	Main Topics	Course Outline	Lecture(s)
Unit-1	1. Fundamentals of algorithms	Notion of an algorithm; Fundamentals of algorithmic problem solving; Performance analysis: space complexity, time complexity; Asymptotic notations: big-oh notation (O), omega notation (Ω), theta notation (Θ);Mathematical analysis of non-recursive algorithms; Mathematical analysis of recursive algorithmsthrough recurrence relations (substitution method, iteration method, recursion tree method,Master's theorem)	06
	2. Searching and Sorting	Searching: linear search, binary search; Sorting: insertion sort, selection sort, quick sort, merge sort; priority queues; heaps	02
	3. Graphs and Search Trees	**Graphs:**Introduction; Graph exploration: BFS, DFS; Applications of BFS: shortest path for unweighted graph, cycle detection in undirected graph, finding all nodes within one connected component; Applications of DFS: cycle detection in a graph, finding strongly connected components of a graph; Directed acyclic graphs; Network flow algorithm; **Search trees:** Introduction; Traversals; Insertions; Deletions; Balancing (AVL trees)	06

	4. Divide and Conquer	Introduction; Median of two sorted arrays; Counting inversions; Nearest pair of points; Quick sort vs. merge sort	02
Unit-2	5. Greedy Method	Introduction; Finding minimum number of coins; Knapsack problem; Job sequencing problem; Minimum cost spanning trees: Prim's algorithm, Kruskal's algorithm; Single source shortest paths: Dijkstra's algorithm; Optimal tree problem: Huffman coding	04
	6. Dynamic Programming	Memorization; General method with examples; Coin change problem; Edit distance; Longest ascending subsequence; Matrix multiplication; All-pairs shortest paths: Floyd's algorithm; Knapsack problem; Bellman-Ford algorithm	06
	7. Backtracking and Branch and Bound	**Backtracking:**General method; N-queens problem; Sum of subsets problem; Graph coloring; Hamiltonian cycles; **Branch and bound:**Job assignment problem;Travelling salesperson problem; 0/1 knapsack problem	04
	8. Tractable and Intractable Problems	Computability of algorithms; Computability classes – P,NP, NP-complete and NP-hard; Cook's theorem; Standard NP-complete problems and reduction techniques.	02

Total=32

Recommended Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms, The MIT Press.
2. Alfred V. Aho, John E. Hopcroft, and Jeffrey D. Ullman, The Design and Analysis of Computer Algorithms, Addison-Wesley Pub. Co.
3. Jon Kleinberg, and EvaTardos, Algorithm Design, Pearson Education.
4. Ellis Horowitz, and Sartaj Sahni, Fundamentals of Computer Algorithms, Galgotia Publications.
5. Robert Sedgewick, and Kevin Wayne, Algorithms, Addison-Wesley Pub. Co.
6. S. Dasgupta, C. H. Papadimitriou, and U. V. Vazirani, Algorithms, McGraw-Hill Education.

Title of the course : **Automata Theory and Formal Languages**

Subject Code : **PCCS-622**

Weekly load : **3 Hrs** **LTP 2-1-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand basic properties of deterministic and nondeterministic finite automata
CO2	Understand the relation between types of languages and types of finite automata
CO3	Design grammars and recognizers for different formal languages
CO4	Prove or disprove theorems in automata theory using its properties
CO5	Determine the decidability and intractability of computational problems

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	2	1	2	0	0	2	2	2	2	2	2
CO2	2	3	3	2	1	2	0	0	2	2	2	3	3	2
CO3	2	3	3	2	2	3	0	0	3	2	2	3	3	2
CO4	2	3	3	3	3	2	0	0	2	2	2	3	3	3
CO5	2	3	3	3	3	3	0	0	2	2	2	3	2	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Finite Automata	Finite state systems, Deterministic, non deterministic finite automata, equivalence of deterministic and non-deterministic finite automata, Finite automates with & without Ɛ-moves, 2 way finite automata with output, equivalence of Mealy and Moore machines.	08
	2. Regular Languages	Identification of Regular expressions, Finite Automata and Regular expression	04
	3. Properties of Regular Sets:	The pumping lemma for regular sets, closure properties of regular sets, decision algorithms of regular sets, The Myhill-Nerode Theorem & minimization of finite Automata.	05
	4. Context free grammars	Introduction to context free grammars, derivation trees, top-down & bottom up parsing methods, ambiguous context free grammars, Chomsky and Greibach normal forms.	05
Unit-2	5. Pushdown Automata:	Deterministic and Non-deterministic pushdown automata, Equivalence of context free languages and sets accepted by pushdown automata, Deterministic context free languages.	04

	6. Properties of Context free Languages	The pumping Lemma for context free languages, closure properties of context free languages, decision algorithms for context free languages, Coke-Kasmi-Young algorithm.	06
	7. Turning Machines:	Introduction to Turing Machines, Deterministic, non-deterministic, two way infinite tape, multi tape, Constructions of Turing Machines for n!, n*n.	08
	8. Turning Machines	Post Correspondence problem, Unsolvability of the halting problems.	08

Total=48

Recommended Books:

1. Daniel A. Cohen, Introduction to Computer Theory, John Wiley and Sons (1996)
2. Hopcroft John E., Ullman Jeffrey D. and Motwani R., Introduction to Automata Theory, Languages and Computation, Pearson Education (2006).
3. Michael Sipser, Introduction to the Theory of Computation, Thomson (2007).
4. Lewis Harry R., Elements of Theory of Computation, PHI (1997).
5. K.L.P. Mishra, N. Chandrasekaran, "Theory of Computer Science: Automata.

Title of the course : **Design and Analysis of Algorithms Lab**

Subject Code : **PCCS-623**

Weekly load : **4 Hrs** **LTP 0-0-4**

Credit : **2**

Course Outcomes: At the end of the course, the students will be able to:

CO1	Learn how to analyse a problem and design a solution for the problem
CO2	Acquire hands-on skills to implement various advanced algorithm design such as divide-and-conquer, greedy algorithms
CO3	implement Quick sort ,Merge sort algorithm, BFS and DFS algorithms
CO4	Implement Dynamic Programming algorithm for the 0/1 Knapsack problem
CO5	Utilize data structures and/or algorithmic design techniques for developing efficient computer algorithm for solving real-world problems

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	0	0	0	0	0	0	2	1	2
CO2	3	3	3	2	2	0	0	0	0	0	0	0	2	2
CO3	3	3	2	2	0	2	2	0	0	0	0	0	3	3
CO4	0	0	1	1	0	1	0	2	1	2	0	1	2	3
CO5	3	3	3	2	2	0	0	0	0	0	0	0	2	2

LIST OF PRACTICALS

1. Implement various searching techniques.
2. Implement various sorting techniques.
3. Implement different techniques for traversal of tree.
4. Implement different techniques for traversal of graph.
5. For a given set of elements, construct an AVL Tree and also display balance factor for each node.
6. Given a value V, if we want to make change for V Rs., and we have infinite supply of each of the denominations in Indian currency, i.e., we have infinite supply of {1, 2, 5, 10, 20, 50, 100, 200, 2000} valued coins/notes, what is the minimum number of coins and/or notes needed to make the change? Implement the greedy algorithm to find minimum number of coins.
7. Find the minimum cost spanning tree of a given undirected graph using:

a) Kruskal's algorithm
b) Prim's algorithm

8. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstras's algorithm.
9. Implement the longest ascending subsequence problem using dynamic programming.
10. Implement matrix chain multiplication problem using dynamic programming.
11. Implement 0/1 Knapsack problem using dynamic programming.
12. Write a program to find the shortest path using Bellman-Ford algorithm.
13. Implement branch and bound scheme to find the optimal solution for:
    a) Job assignment problem
    b) Traveling salesperson problem.

Note: The above mentioned list of experiments is suggested list. Teacher may add more programs/ experiments as per requirement.

Title of the course : **Multimedia and Animation**

Subject Code : **PECS- 621A**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand all the basic in the multimedia technologies.
CO2	with all phases like digital images, digital audio & video, compression & standards etc.
CO3	Use and apply tools for image processing, video, sound and animation.
CO4	Apply methodology to develop a multimedia system.
CO5	Understand the fundamental principles of animation in addition to an invaluable appreciation for observational techniques & the art of planning.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):

COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	1	0	0	0	0	1	3	1	2
CO2	3	2	3	2	3	1	0	0	0	0	1	3	2	3
CO3	3	3	3	3	3	0	0	0	0	0	1	3	2	3
CO4	2	1	0	0	0	2	1	0	0	2	0	0	2	2
CO5	3	2	3	2	3	1	0	0	0	0	1	3	2	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	**1.** Basics of Multimedia	Introduction to Multimedia, Design Processes, Hypertext, Links, Frames, Files, HTML, HGML, Morphing, and Media Control interfaces. Multimedia Tools, Elements of Multimedia, Sound Input, Video Input, Data Automation, General Devices.	08
	2. Text and Image	Types of text, Font, insertion, compression, File formats. Types of images, color models, Basic steps for image processing, principle and working of scanner and digital camera, Gamma and gamma correction.	08
	3. Audio and Video technology	Fundamental characteristics of sound, sensors for TV cameras, color fundamentals, additive and subtractive color mixing, Liquid crystal display (LCD), Plasma Display Panel (PDP), file formats , Video for Window, QuickTime	08
Unit-2	**4.** Multimedia presentation and authoring	Overview, multimedia authoring metaphor, multimedia production, presentation and automatic authoring, Design paradigms and user interface, overview of tools like adobe premiere, director, flash and Dreamweaver.	08

	5. Animation	Introduction and examples of Animation. Types of Animation Cel Animation, Stop Motion Animation, Computer Animation, 2-D Animation, 3-D Animation.	08
	6. Basic Principles of Animation	Illusion of Life, straight action and pose to pose Timing, Exaggeration, Drama and Psychological Effect, Fade in and Fade out, Squash and Stretch, Anticipation, staging, follow through and overlapping action, Arcs, Solid Drawing ,Appeal, slow in and slow out, Secondary Action.	08

Total=48

Recommended Books:

1.Principles of Multimedia by Ranjan Parekh. Tata McGraw-Hill

2.Multimedia technologies by Ashok banerji

3.Prabhat K. Andleigh and Kiran Thakrar, "Multimedia Systems Design", PHI publication

4.John F. Koegal Buford, "Multimedia systems", Pearson Education.

5.The complete animation course by Chris Patmore Pub.-Baron's Educational Series.(New York)
Animation Unleashed by Ellen Bessen, Michael Weise Productions,2008(U.S.A)

Title of the course : **Artificial Intelligence**

Subject code : **PECS-621B**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Solve a problem as a state space problem.
CO2	Apply suitable search technique for a random search problem.
CO3	Understand probabilistic reasoning.
CO4	Understand optimization and inference algorithms for model learning
CO5	Design and develop programs for an agent to learn and act in a structured environment.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	1	0	0	0	0	0	2	2	1
CO2	2	3	2	3	2	2	0	0	0	2	2	2	3	2
CO3	2	2	2	3	3	3	0	0	2	2	2	3	3	2
CO4	2	2	2	3	3	3	0	0	2	3	3	3	3	2
CO5	2	2	2	2	3	2	0	0	2	2	2	2	2	3

Theory

Unit	Main Topics	Course Outline	Lecture(s)
Unit-1	1. Basics of AI	Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree.	08
	2. Search Algorithms	Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search.	08
	3. Probabilistic Reasoning	Probability, conditional probability, Bayes Rule, Bayesian Networks-representation, construction and inference, temporal model, hidden Markov model.	08
Unit-2	4. Markov Decision process	MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.	12
	5. Reinforcement Learning	Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning-Q learning.	12

Total=48

Recommended Books:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rdEdition, Prentice Hall.
2. Elaine Richand Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill.
3. Trivedi, M.C., “A Classical Approach to Artificial Intelligence”, Khanna Publishing House, Delhi.
4. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2011.
5. David Poole and Alan Mackworth, “Artificial Intelligence: Foundations for Computational Agents”, Cambridge University Press 2010.

Title of the course : **Mobile Communication**

Subject Code : **PECS-621C**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Make students familiar with fundamentals of mobile communication systems.
CO2	Identify the requirements of mobile communication as compared to static communication.
CO3	Identify the limitations of 2G and 3G wireless mobile communication and use design of 4G and beyond mobile communication systems.
CO4	Outline cellular mobile communication standards.
CO5	Analyze various methodologies to improve the cellular capacity

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	2	2	2	3	2
CO2	2	2	2	0	0	2	0	0	2	3	2	2	2	2
CO3	2	2	2	2	2	2	0	0	2	3	3	2	2	2
CO4	3	2	2	2	2	2	0	0	2	3	2	3	2	3
CO5	2	2	2	2	2	2	0	0	2	3	2	2	3	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of wireless communication	History of wireless communication, Need of mobility, Application of wireless communication, Cellular concept	06
	2.First Generation (1G) Mobile Systems	Advanced Mobile Phone System (AMPS) and Nordic Mobile Telephony (NMT), frequency allocation, channels, modulation, multiple access scheme, network operation.	08
	3.Second Generation (2G) Mobile Systems	Network architecture, channels and operation of GSM, CDMAOne (IS-95), and IS-41, mobility management, Network operations of GPRS, CDMATwo (IS-95B), CDPD, and HCSD.	10
Unit-2	4.Third Generation (3G) Mobile Systems	3G spectrum requirements, enabling technologies, service classes, applications and radio access standards (WCDMA and CDMA2000), Introduction to EDGE and WLAN. Introduction to 4G.	12

	5.Network Layer Mobility	Mobile IP, Goals, Assumptions and requirements, Entities and terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunnelling and Encapsulation , Optimisation , Reserve Tunnelling, ipv6 Protocol, Dynamic Host configuration Protocol(DHCP), Micro-mobility.	12

Total=48

Recommended Books:

1. J.Schiller, Mobile Communications, Pearson Education.
2. Pomportsis, Wireless Networks, John Wiley and Sons.

Title of the course : **Software Project Management**

Subject Code : **PECS-621D**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Comprehend software project management activities
CO2	Understand various steps required for project planning
CO3	Create an estimation and effective cost benefit evaluation techniques
CO4	Design framework for risk management
CO5	Comprehend resource management

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
COs	**Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	2	2	3	2	3	0	0	0	0	1	1
CO2	3	3	2	2	2	2	3	0	0	2	0	2	2
CO3	3	2	2	2	3	2	3	2	0	2	0	2	3
CO4	2	2	2	3	3	2	3	2	0	0	0	1	3
CO5	3	3	2	2	3	2	2	0	0	0	2	2	2

Theory

Unit	**Main Topics**	**Course outlines**	**Lecture(s)**
Unit-1	1. Basics of software project management	Introduction to software project management, types of project, project attributes, project constraints, importance of management, problems with software projects, management control, role of project manager, steps in project planning, Programme management	12
	2. Software Cost and Time Estimation	A system view of project management, stakeholder management Assessment of projects, Cost-benefit Analysis, Cash flow forecasting, Cost-benefit evaluation techniques, Choice of process model, developing the project schedule, Estimation Techniques, COCOMO Model	12
Unit-2	3. Planning	Objective of Planning, Project Schedule, Activities – Sequencing and Scheduling, Development of Project Network, Time Estimation, Critical Path and Activities. Introduction to project risk management, Risk categories, identification, assessment, planning, management, Software	12

		Configuration Management Process: Version Control, Change Control management	
	4. Software Project Management	Resources, Nature of Resources, developing the project budget, monitoring and controlling the project, project metrics, Project targets, associating human resource with job, Motivation, Oldham- job Characteristics Model, Decision Making, Leadership, Stress Management, Health and Safety	12

Total=48

Recommended Books:

1. Bob Hughes, Mike Cotterell, "Software Project Management", Tata McGraw Hill.
2. Prasanna Chandra, "Projects: Panning, Analysis, Selection, Financing, Implementation and Review", Tata McGraw Hill Publication.
3. Jeffrey K. Pinto, "Project Management", Pearson Publications.

Title of the course : Decision Support System
Subject Code : PECS-621E
Weekly load : 3 Hrs LTP 3-0-0
Credit : 3

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand fundamental concepts associated with DSS
CO2	Develop skill in the system analysis, design and implementation of computerized DSS
CO3	Learn various knowledge representation techniques
CO4	Identify decision support tools that can aid decision making.
CO5	Develop a functional prototype of a decision support system for a given case.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):

COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	3	1	0	2	3	3	3	2	1	1
CO2	3	2	2	2	3	1	0	2	3	3	3	2	2	2
CO3	3	2	2	2	3	1	0	2	3	3	3	2	2	3
CO4	3	2	2	2	3	1	0	2	3	3	3	2	2	2
CO5	3	2	2	1	3	2	0	2	3	3	2	1	2	2

Theory

Unit	Main Topics	Course outlines	Hour(s)
Unit-1	1. Introduction to DSS	Concepts of Data, Information, Information Systems & End Users, Systems Concepts: Open System, Closed System; Information Systems and Systems Concept	06
	2. Building Information System	System Analysis and Design – Systems Development Cycle (Identification of Requirements, Feasibility Study, System Analysis, Design And Implementation), Prototyping	06
	3. Decision Making	Introduction and Definitions, Simons Decision Making Model, How Decisions are Supported, DSS Configurations, DSS Characteristics and Capabilities	06
	4. Components of DSS	DSS Classifications DSS Modeling-Static and Dynamic Models, Certainty, Uncertainty, and Risk, Sensitivity Analysis, What-IF, and Goal Seeking	06
Unit-2	5. Knowledge Management System	Definition and types of Knowledge, Frame work for Knowledge Management, Knowledge Representation Techniques: Rules, Frames, Semantic Networks	06
	6. Data Warehouse and Data Mining	Data Warehousing Definitions and Concepts, Types of Data warehouse, Data Mining Concepts and Applications, Framework of datamining, Text Mining, Web Mining Usage, Benefits, and Success of Business Analytics	06
	7. Business Analytics	Online Analytical Processing (OLAP), Reporting and Queries, Multidimensionality, Knowledge Discovery in Databases(KDD), framework of KDD	06
	8. Future directions	Future Directions in DSS and DSS Case Studies	06

Total=48

Recommended Books:

1. Turban, Efrain : Decision Support & Business Intelligent Systems(8e)- Pearson Education
2. Marakas, George.M. : Decision Support Systems in the 21st century – Pearson Education
3. Mallach, Efrem G. : Decision Support & data Warehouse Systems – Tata McGraw-Hill

Title of the course : **Advance Computer Architecture**

Subject Code : **PECS-621F**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand uniprocessor and multiprocessor system
CO2	Design issues of vector and pipeline computers
CO3	Learn SIMD computer design and its effects on computation
CO4	Understand inter-processing element communication
CO5	Interpret performance of different pipelined processors.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	2	2	0	0	0	0	2	2	1	1
CO2	2	2	2	2	2	2	0	0	0	0	2	2	2	2
CO3	2	2	2	2	2	2	0	0	0	2	2	2	2	2
CO4	2	2	2	2	2	2	0	0	0	2	2	2	2	2
CO5	2	1	2	0	2	2	0	0	0	2	2	0	3	2

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of Parallel Processing	Evolution of Computer Architecture, Parallelism in Uniprocessor systems, Parallel Computer Structures, Architectural Classifications schemes, Multiprocessors and Multicomputers, Multivector and SIMD Computers, Parallel processing applications	06
	2. Memory and Input-Output Subsystems	Hierarchical Memory structure, Virtual memory system, Memory Allocation and Management, Cache Memories and Management, Input-Output Subsystems.	06
	3. Pipelining and Vector Processing	Pipelining, Instruction and Arithmetic Pipelines, Principles of Designing Pipelined Processors, Vector Processing Requirements.	06
	4. Pipeline Computers and Vectorization Methods	Vector Super Computers, Scientific attached Processors, Architecture of Cray-I, Pipeline Chaining and Vector Loops, Vectorization and Optimization Methods.	06

Unit-2	5. Array Processors and Interconnection networks	SIMD Array Processors, SIMD Interconnection Networks Static & Dynamic Networks, Mesh Connected Network, Cube interconnection networks	08
	6. Parallel Algorithms for Array Processors	SIMD matrix multiplication, Parallel sorting for array processors, Associative Array Processing	08
	7. Multi-processor Architecture	Functional Structures, Multi stage networks for multiprocessors, Parallel Memory Organization	08

Total - 48

Recommended Books

1. Hawang Kai, Briggs F.A, "Computer Architectures and Parallel Processing", McGraw-Hill.
2. Kain Richard Y, "Advanced Computer Architecture", PHI
3. Hwang Kai, "Advanced Computer Architecture", McGraw-Hill
4. Mano M. "Computer System Architecture", PHI

Title of the course : **Requirement Engineering**

Subject Code : **OECS-621A**

Weekly load : **3 Hrs** **L T P 3 0 0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Comprehend software engineering knowledge and principles
CO2	Understand requirement engineering and requirement elicitation
CO3	Comprehend requirement analysis and specifications
CO4	Design framework for software engineering projects
CO5	Make a reasoned choice about the best approach for requirements modelling given the context of a project

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	0	0	0	0	0	2	0	3	3	2	1
CO2	3	3	3	2	2	0	0	0	0	0	2	2	2	2
CO3	3	0	3	1	1	0	0	0	0	0	1	2	2	2
CO4	2	0	1	0	0	0	0	0	0	0	3	1	3	3
CO5	0	0	0	0	2	0	2	0	1	0	2	0	2	2

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Principles of communication	Software engineering knowledge, process guidance principles, practice guiding principles, framework guiding principles, communication principles, planning principles, modelling principles, construction principles, deployment principles	12
	2. Requirement engineering and requirements elicitation	Introduction to requirement engineering, steps of requirement engineering, present state of practice, types of requirements, identifying stakeholders, recognizing multiple viewpoints, working toward collaboration, requirements elicitation, interviews, brainstorming sessions, facilitated application specific technique, quality function deployment	12
	3. Requirement	Requirements analysis, data flow diagrams, data dictionaries,	12

Unit-2	analysis & specifications	Entity relationship diagrams, software prototyping, Software requirement specifications, nature of SRS, characteristics, organization of SRS, introduction, overall description, specific requirements, change management process, approvals, supporting information.	
	4. Design concepts	Conceptual design and technical design, modularity, design strategy, bottom up design, top down design, hybrid design, function-oriented design, object-oriented design, steps to analyze object-oriented design	12

Total=48

Recommended Books:

1. Software Engineering, Roger S. Pressman, McGraw Hill publication.
2. Ian Sommerville, Software Engineering, Addison-Wesley Publishing Company
3. James F. Peter, Software Engineering - An Engineering Approach, John Wiley
4. Pankaj Jalote, An integrated Approach to Software Engineering, Narosa.

Title of the course : **Management Information System**

Subject Code : **OECS-621B**

Weekly load : **3Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Describe relationship between concept of information system, organization, management and strategies
CO2	Evaluate the role of information system in today's competitive business environment
CO3	Effectively communicate strategic alternatives to facilitate decision making
CO4	Explain how enterprise systems and industrial networks create new efficiencies for businesses.
CO5	Analyze the principal causes of information system failure.

CO/PO Mapping : (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation):														
COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	0	3	0	0	2	3	3	3	2	1	3
CO2	2	3	3	0	3	1	1	2	3	3	3	2	2	3
CO3	2	3	3	2	3	1	0	2	3	3	3	2	2	3
CO4	0	0	0	3	0	0	2	1	0	0	2	1	2	2
CO5	0	0	1	0	0	3	2	0	0	1	0	0	3	2

Theory

Unit	Main Topics	Course outlines	Hour(s)
Unit-1	1. Understanding MIS	Introduction to Management Information Systems, History of MIS, Impact of MIS, Role and Importance, MIS Categories, Managers and Activities in IS, Types of Computers Used by Organizations in Setting up MIS, Hardware support for MIS	06
	2. Conceptual Foundations	Introduction, The Decision Making Process, System Approach to Problem Solving, The Structure of Management Information System, Types of Management Systems Concepts of Management Organization	06
	3. MIS Planning, Control and Development	Introduction, Differences between planning and control information, Systems Analysis, Systems Design, Development	06
	4. MIS and BPR	Introduction, Business Process Re – Engineering, Improving a process in BPR, Object Oriented methodology, BPR – Current Focus	06
	5. MIS Organization Structure	Introduction, MIS at Management levels, Strategic Level Planning, Operational Level Planning, Economic and Behavior Theories	06

Unit-2	6. MIS – Support Models and Knowledge Management	Introduction, Philosophy of Modeling, DSS: Deterministic Systems, Market Research Methods, Ratio Analysis for Financial Assessment, Management Science Models	06
	7. Strategic Management Information System	Introduction, Background, Performance, Product differentiation and Value Chain, How IT influences Organizations' goals, The five levels, Governance Modes in the use of IT	06
	8. Security, Ethical Issues and Case Studies	Introduction, Control Issues in Management Information Systems, Security Hazards, Ethical Issues, Technical solutions for Privacy Protection and MIS Case Studies	06

Total=48

Recommended Books:

1. Kenneth C. Laudon : Management Information Systems- Pearson Education
2. Kenneth C. Laudon : Essentials of Management Information System – Pearson Education

Title of the course : **System Installation and Troubleshooting**

Subject Code : **OECS-621C**

Weekly load : **3Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the functioning of various hardware components of computer and the installation procedure of operating systems & drives required for functioning of the devices.
CO2	Understand the installation procedure of the latest software, peripheral devices and the modems.
CO3	Understand about computer hardware and the installation procedure of system software and application software.
CO4	A hands-on approach will be used to provide the student with a basic skill level to work on a computer
CO5	Recognition and solution of common hardware-software problems including the replacement or upgrading of components will be addressed

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):												
COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	0	3	2	2	0	0	0	0	0	3	2	3
CO2	0	3	2	2	0	0	0	0	0	3	1	3
CO3	0	3	2	2	0	0	0	0	0	3	2	2
CO4	2	0	0	1	0	2	2	3	3	0	2	1
CO5	1	0	0	0	1	0	1	0	0	0	1	2

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1.Hardware components	Functioning of various hardware components i.e. CPU, RAM, ROM, Mother Board (AT, ATX, NLX), power supply	06
	2. Ports and cards	Ports (serial, parallel, USB etc), CD-ROM drive, sound card , LAN card	06
	3. Installation of various operating systems	The necessary steps for loading of various operating systems to a new computer system: a) DOS / Linux / Unix b) Windows XP c) Window NT-Workstation / Server d) Windows Vista / 7	06
	4. Installation procedure for	Installation procedure for various drives required for the functioning of various devices, i.e. CD-ROM, MOUSE and	06

	various drives	VGA or (Graphics Acceleration Card).	
Unit-2	5. Installation of various software packages	Installation of MS-Office 2003/2007/2010, Flash Player, Photoshop, Antivirus in the system	06
	6. Installation of peripheral device	Installing of Digital Camera / Web Camera	06
	7. Installation of Printer	Installing various printers and activating them to print text pages.	06
	8. Installation of Modem	Installing an internal and external modem to a system including configuring the port to which the modem is connected.	06

Total=48

Recommended Books:

1. W. L. Rosch, Hardware Bible, Que
2. Muller &Zacker, Upgrading and Repairing PC's, PHI

Title of the course : **Internet Programming**

Subject Code : **OECS-621D**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3 (Lecture 3)**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the concept of object oriented programming
CO2	Learn data type and variables of Java
CO3	Write programs using various features of Java
CO4	Understand the concept of applet and multi-threading
CO5	Learn the concept of AWT and event handling

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	1	0	0	0	0	0	0	0	2	2	1
CO2	3	3	3	2	2	0	0	0	0	0	0	3	1	1
CO3	3	3	3	3	2	0	0	0	1	0	0	3	3	2
CO4	3	3	3	3	3	1	1	0	1	0	0	3	3	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of Programming	Programming; Need of Programming; Representation of Algorithms; Need for OOP; Class and Objects; Abstraction; Association; Composition; Aggregation; Inheritance: simple inheritance, hierarchical inheritance, multilevel inheritance, hybrid inheritance; Encapsulation; Polymorphism: static polymorphism, dynamic polymorphism;	8
	2. Java and its variables	Introduction to Java; Environment variables; JAVA-Home directory; Steps to develop a Java Program; Command line arguments, Variables: value type, reference type; Identifiers; Data Types: primitive data types, abstract data types; Instance variables and Local Variables; Access Specifiers; Access Modifiers; Keywords.	8
	3. Operators, Classes and Methods	Unary Operators; Binary Operators; Types of Operators: arithmetic operator, relational operator, logical operator, assignment operator, increment operator, decrement operator, negation operator, bitwise operator, shift operator, concatenation operator, new operator, instance operator; Type Casting: implicit type casting, explicit type casting; Methods and Parameters; Constructors; Overloading Constructors; Overloading member functions; Abstract class; Final class; Variables, Interfaces, Object;	8

		Constructors: default constructor, parameterized constructor; Wrapper classes; Adapter Classes; Anonymous Classes; Utility Classes; Generics.	
Unit-2	4. Programming using Java	Selection control Structures; Iteration control Structure; Arrays: array initialization, array creation, multidimensional array; Strings; Recursion; Regular Expression; Packages; Exception Handling: errors in software engineering, exception classes, keywords used in exception handling, hierarchy of run time exception; Multithreading: life cycle of a thread, creation of child thread, working with multiple child thread, thread priorities, thread synchronization, and monitors; Abstract Window Toolkit; Event Handling; Window listener; Working With Menus; Dialog box; Card Layout; Applets; Collections; Framework; Loading an Image onto the Frame and Applet; Insets.	12
	5. Debugging, Code Analysis and Unit Testing	Debugging; Code Analysis using Programming Mistake Detector (PMD); Unit Testing using JUnit and Code coverage	12

Total=48

Recommended Books:

1. Bert bates, Kathy Sierra, Head First Java, O'Reilly Media.
2. Steven Holzer, Java 8 programming, Dreamtech Press.

Title of the course : **Database Integrity and Security**

Subject Code : **OECS-621E**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: On successful completion of this course, students will be able to:

CO1	Describe the three schema architecture of DBMS.
CO2	Explain the join dependency and its types with an example.
CO3	Illustrate the role of different components in Data Base system environment.
CO4	Discuss the categories classified for data base management systems.
CO5	Review where and how the database users and passwords are maintained.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	0	0	0	0	0	0	3	2	3
CO2	3	2	2	2	2	0	0	0	2	0	2	2	2	2
CO3	2	2	3	2	2	2	0	0	3	2	2	2	2	2
CO4	2	2	2	2	2	2	0	0	2	0	2	2	2	3
CO5	3	3	2	2	3	2	0	0	2	2	2	2	2	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Database System Concepts and Architecture	DBMS characteristics and advantages Data Model DBMS system environment and architecture	04
	2. Database Design Theory and Methodology	E-R Diagram , Relational Constraints, Algebra, Normal Forms and Decompositions	06
	3. SQL - The Relational Database Standard	Basic Integrity constraints and queries , Indexes and Views , Database connectivity	08
	4.Transaction processing	Transaction concept, transaction state, Implementation of atomicity and durability, concurrent execution, Serializability, recoverability, Implementation of isolation, transaction definition in SQL.	06
	5. Database Security and	Database Security within the General Security Landscape and a Defense in-Depth Strategy, Application Security,	09

Unit-2	Authorization	Securing database-to-database communications, Authentication and Password Security	
	6. Granular Access Control and Encryption	Advances in Access Control - Managing and Querying Encrypted Data –Database Watermarking - Copyright Protection, Regulations and Compliance	08
	7. Trust Management and Auditing	Trust Negotiation - Auditing Categories - Auditing Architectures	07

Total=48

Recommended Books:

1. Elamsri, Navathe, Somayajulu and Gupta, Database Concepts, Pearson Edu, 2006.
2. Michael Gertz, Sushil Jajodia, Handbook of Database Security: Applications and Trends, Springer,2008.
3. Nilesh Shah, "Database Systems using Oracle", 2nd edition, Prentice Hall of India Pvt Ltd,2007.
4. Ron Ben Natan, "Implementing Database Security and Auditing", Elsevier, 2005.
5. Alfred Basta, Melissa Zgola, Dana Bullaboy, Thomas L.Whitlock Sr.," Database Security",Cencage Learning, 2012.
6. Bhavani Thuraisingham, "Database and Applications security – Integrating Information security and Data Management", Taylor & Francis Group, 2005.

Title of the course : **Object Oriented Analysis and Design**

Subject Code : **OECS-622A**

Weekly load : **3 Hrs** **L T P 3 0 0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the concept of object-oriented development and create a static object model and a dynamic behavioural model and a functional model of the system.
CO2	Understand the approaches to system design and object design, and the techniques of translating design to implementation.
CO3	Implement the object-oriented modelling and design patterns to provide solutions to the real-world software design problems.
CO4	Become familiar with the Unified modelling Language.
CO5	Understand the difference between writing programs for the software and doing analysis and design.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	0	0	0	0	0	2	0	3	3	2	1
CO2	3	3	3	2	2	0	0	0	0	0	2	2	3	1
CO3	3	0	3	1	1	0	0	0	0	0	1	2	3	2
CO4	0	0	0	3	0	2	2	0	1	1	0	1	2	2
CO5	0	0	0	2	2	1	0	0	2	2	1	0	2	3

Theory

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	1. Basics	Object orientation; Development; Modeling; Object modeling technique.	04
	2. Object Modeling	Objects and classes; Links and associations; Generalization and inheritance; Grouping constructs; Aggregation; Abstract classes; Generalization as extension and restriction; Multiple inheritance; Meta data; Candidate keys; Constraints.	04
	3. Dynamic Modeling and Functional Modeling	Events and states; Nesting; Concurrency; Advanced dynamic modeling concepts. Functional models; Data flow diagrams; Specifying operations; Constraints; Relation of functional model to object and dynamic models.	06
	4. Design Methodology and Analysis	Object modeling; Dynamic modeling; Functional modeling; Adding operations; Iterating the analysis.	04

	5. System Design and Object Design	Subsystems concurrency; Allocating subsystems to processors and tasks; Management of data stores; Handling global resources; Handling boundary conditions; Setting trade-off priorities; Overview of object design; Combining the three models; Designing algorithms; Design optimization; Implementation of control; Adjustment of inheritance; Design of associations; Object representation; Physical packaging; Document design decisions.	06
Unit-2	6. Comparison of Methodologies	Structured Analysis/Structured Design (SA/SD); Jackson Structured Development (JSD).	04
	7. Implementation and Programming Style	Implementation using a programming language; Implementation using a database system; Implementation outside a computer. Object-oriented programming style; Reusability; Extensibility; Robustness; Programming-in-the-large.	06
	8. UML	Basics; Emergence of UML; Types of diagrams.	04
	9. Use Case	Actors; Use Case Diagram; Relationships between Use Cases.	04
	10. Classes	Class diagram; Classes; Objects; Attributes; Operations; Methods; Interfaces; Constraints; Generalization; Specialization; Association; Aggregation.	06

Total=48

Recommended Books:

1. James E. Rumbaugh, "Object Oriented Modeling and Design", Pearson Education.
2. Bernd Oestereich, "Developing Software With UML", Pearson Education.
3. Grady Booch, "Object Oriented Analysis and Design", Addison Wesley.
4. Pierre-Alain, Muller, "Instant UML", Shroff Publishers.
5. Grady Booch, James Rumbaugh, Lvar Jacobson, "The Unified Modeling Language User Guide", Addison Wesley.
6. Grady Booch, James Rumbaugh, Lvar Jacobson, "The Unified Modeling Language Reference Manual", Addison Wesley.
7. Rebecca Wirfs-Brock, "Design Object Oriented Software", PHI.
8. E. Charnaik, D. McDermott, "Introduction to Artificial Intelligence", Addison-Wesley Publishing Company.
9. Nils J. Nilsson, "Principles of Artificial Intelligence", Narosa Publishing Co.

Title of the course : **E-Commerce**

Subject Code : **OECS-622B**

Weekly load : **3Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the concept of evolution of E-commerce
CO2	Analyze various E-commerce process models
CO3	Identify current issues and case studies in E-commerce
CO4	Categorize advantages and disadvantages of different online payment options
CO5	Assess e-commerce strategies and applications, including online marketing, e-government, e-learning and global e-commerce

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):

COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	0	3	0	0	2	3	3	3	2	1	2
CO2	2	3	3	0	3	1	1	2	3	3	3	2	2	2
CO3	2	3	3	2	3	1	0	2	3	3	3	2	1	3
CO4	0	0	0	1	1	2	1	0	0	0	1	3	2	2
CO5	0	0	1	0	0	2	2	1	0	1	0	0	3	2

Theory

Unit	Main Topics	Course outlines	Hour(s)
Unit-1	1. Basics of E-commerce	Introduction, E-commerce or Electronic Commerce- An Overview, Electronic Commerce– Cutting edge, Electronic Commerce Framework	06
	2. Evolution of E-commerce	Introduction, History of Electronic Commerce, Advantages and Disadvantage of E-commerce, Roadmap of e-commerce in India	06
	3. E-commerce Infrastructure	Introduction, E-commerce Infrastructure-An Overview, Hardware, Server Operating System, Software, Network Website	06
	4. Managing the e-Enterprise	Introduction, e-Enterprise, Managing the e-Enterprise, E-business Enterprise, Comparison between Conventional Design and E-organization, Organisation of Business in an e-Enterprise	06
Unit-2	5. e-Commerce Process Models	Introduction, Business Models, E-business Models Based on the Relationship of Transaction Parties, e-commerce Sales Life Cycle (ESLC) Model	06
	6. Electronic Payment Systems	Electronic Payment Systems, Electronic Cash, Smart Cards and Electronic Payment Systems, Credit Card Based Electronic Payment Systems, Risks and Electronic Payment Systems	06

	7. Electronic Data Interchange	The Meaning of EDI, History of EDI, EDI Working Concept, Implementation difficulties of EDI, Financial EDI, EDI and Internet	06
	8. E-Marketing, Current issues and Case Studies	The scope of E-Marketing, Internet Marketing Techniques, Current issues in E-commerce and Case studies on E-commerce	06

Total=48

Recommended Books:

1. Kenneth C. Laudon: E-Commerce: Business, Technology, Society, 4th Edition, Pearson
2. S. J. Joseph, E-Commerce: An Indian perspective, PHI

Title of the course : **Computer Network Security**

Subject Code : **OECS-622C**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Comprehend and implement various cryptographic algorithms to protect the confidential data.
CO2	Identify network vulnerabilities and apply various security mechanisms to protect networks from security attacks.
CO3	Apply security tools to locate and fix security leaks in a computer network/software.
CO4	Secure a web server and web application.
CO5	Configure firewalls and Intrusion Detection System

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	3	3	0	0	3	2	2	3	2	1
CO2	2	3	3	2	3	3	0	0	3	2	2	3	2	2
CO3	2	3	3	3	3	3	0	0	3	2	2	3	1	1
CO4	0	3	3	2	3	3	0	0	2	0	2	3	2	2
CO5	0	3	3	0	3	3	0	0	0	0	0	3	2	2

Theory

Unit	**Main Topics**	**Course outlines**	**Lecture(s)**
Unit-1	1. Security principles and attacks	Security Attacks, Security Services, Security Mechanisms and Principles, Security goals, Malicious software, Worms, Viruses, Trojans, Spyware, Botnets	06
	2. Basics of Cryptography:	Symmetric and asymmetric cryptography, cryptographic hash functions, authentication and key establishment, Message Authentication Codes (MACs), digital signatures, PKI.	06
	3. Security Vulnerabilities:	DoS attacks, Buffer Overflow, Race Conditions, Access Control Problems, Spoofing and Sniffing attacks, ARP Poisoning, Social Engineering and countermeasures.	06
	4. Internet Security:	TCP/IP Security, Secure Sockets Layer (SSL), Transport Layer Security (TLS), HTTPS, Secure Shell (SSH), IPsec, Email Security, DNS Security, DNSSEC, Authentication Protocols	06

Unit-2	5. Web Security:	Phishing attack, SQL Injection, Securing databases and database access, Cross Site Scripting Attacks, Cookies, Session Hijacking, E-commerce security	08
	6. System Security:	Firewalls, Types: Packet filter (stateless, stateful), Application layer proxies, Firewall Location and Configurations, Intruders, Intrusion Detection System, Anomaly and misuse detection.	08
	7. Wireless Network Security:	IEEE 802.11i Wireless LAN Security, Wireless Application Protocol Overview, Wireless Transport Layer Security, WAP End-to-End Security	08

Total=48

Recommended Books:

1. Stallings, W., Network Security Essentials, Prentice Hall (2017) 6th Edition.
2. Cheswick, R., W., Bellovin, M., S., and Rubin, D., A., Firewalls and Internet Security, AddisonWesley Professional (2003) 2nd Edition.
3. Graves, K., Certified Ethical Hacking Study Guide,Sybex (2010) 1st Edition.
4. Stallings, W., Cryptography and Network Security, Prentice Hall (2013), 6th Edition.

Title of the course : **Computer Graphics**

Subject Code : **OECS-622D**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3 (Lecture 3)**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Provide comprehensive introduction about computer graphics system and design algorithms
CO2	Familiar with two dimensional and three dimensional transformations
CO3	Familiar with techniques of clipping, hidden surface removal and shading
CO4	Provide information about Projections and shading techniques
CO5	Render projected objects to naturalize the scene in 2D view and use of illumination models for this

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	2	0	2	0	0	0	0	0	0	2	3	2
CO2	2	0	2	2	1	0	0	0	0	0	0	2	3	2
CO3	2	3	2	2	2	0	0	0	2	0	2	2	3	3
CO4	2	3	2	2	2	0	0	0	2	0	2	2	3	2
CO5	2	3	2	2	2	0	0	0	2	0	2	2	3	2

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Overview of graphics systems	Display devices, physical input and output devices: storage tube graphic displays, Raster Refresh, Plasma Panel Displays, Liquid Crystals	06
	2. Output Primitives	Point plotting, Line Drawing algorithms – Slope Line Method, DDA algorithms, Bresenham's Line algorithm	06
	3. Two-dimensional Transformations	Basic transformations-translation, scaling, rotation, Matrix representation and homogenous coordinates, composite transformations, Rotation about an arbitrary point, scaling relative to a fixed point	06
	4. Windowing and Clipping Techniques	Windowing concepts, clipping algorithms-Line clipping– Cohen-Sutherland algorithm, Polygon Clipping algorithms, Text Clipping.	06
	5.Three- dimensional Transformations	Scaling, Rotation, Translation, Rotation about arbitrary axis.	06

Unit 2	6. Projections	Parallel projections, perspective projections	06
	7. Surface Detection and Hidden-Surface Removal	Back face removal method, Depth-buffer method, Scan-line method	06
	8. Shading Overview	Polygon shading methods: Flat shading, Gouraud Shading, Phong Shading.	06

Total=48

Recommended Books:

1. Computer Graphics, Hearn & Baker, PHI
2. Principles of Interactive Graphics, Newman & Sproul, Mcgraw Hill
3. Computer Graphics-A Programming Approach, Steven Harrington, Mcgraw Hill
4. Computer Graphics, Sinha & Udai, Mcgraw Hill

Title of the course : **Data Analytics**

Subject Code : **OECS-622E**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Summarize the workflow of analytics process model, its requirements and applications.
CO2	Apply suitable data pre-processing techniques for the given dataset.
CO3	Demonstrate different predictive, Descriptive and text analytic models.
CO4	Examine Survival Analysis model and learn through Social Network Analytics.
CO5	Acquire fundamental enabling techniques and scalable algorithms data analytics.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	0	0	0	0	0	0	1	0	0	0	2	1
CO2	1	1	1	0	2	0	0	0	1	1	0	0	2	1
CO3	2	1	1	0	3	0	0	2	2	2	0	0	3	2
CO4	3	2	2	1	3	1	0	1	2	2	0	0	2	3
CO5	0	0	0	2	0	2	2	0	0	0	2	0	2	2

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Data Analytics an Overview	Analytics Process Model – Analytics – Analytical Model Requirements.	04
	2. Data Collection, Sampling and Preprocessing	Types of Data Sources and Data Elements– Sampling – Visual Data Exploration – Missing Values –Classification-Clustering and Outlier detection – Standardizing data – Categorization.	09
	3. Predictive Analytics	Linear Regression – Logistic Regression – Ensemble Methods – Multiclass Classification Techniques – Evaluating Predictive Models.	09
	4. Descriptive Analytics	Association rules – sequence rules –segmentation.	02
	5. Survival Analytics	Kaplan Meier Analysis –Parametric Survival Analysis – Evaluating Survival Analysis Models.	06

Unit-2	6. Text Analytics	Overview, key terms used – Text Analytics Methods – Text Analytics Metrics – Applications.	06
	7. Social Network Analytics	Social network definitions – Social network metrics –Social network learning Relational Neighbor classifier -Probabilistic relational Neighbor classifier– Case Study on Real-Time Applications like Twitter data , dataset from Kaggle website, Data analytics for security applications and deep learning applications.	12

Total=48

Recommended Books:

1. Bart Baesens, "Analytics in a Big Data World", The Essential Guide to Data Science and its Applications, Wiley, First edition, 2014.
2. Jesus Rogel- Salazar, "Data Science and Analytics with Python ", CRC Press, First Edition, 2017.
3. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, Second edition, 2007.
4. Thomas H. Davenport, Jeanne G. Harris, "Competing on Analytics: The New Science of Winning", Harvard Business Review Press ,First edition,2007
5. Paul C. Zikopoulos, Chris Eaton, "Understanding Big Data", McGraw-Hill, 2012 (eBook from IBM)
6. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw-Hill Publishing, 2012.

Title of the course : **Artificial Intelligence**

Subject code : **MDCS-621**

Weekly load : **4 Hrs** **LTP 3-1-0**

Credits : **4**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Solve a problem as a state space problem.
CO2	Apply suitable search technique for a random search problem.
CO3	Understand probabilistic reasoning.
CO4	Understand optimization and inference algorithms for model learning
CO5	Design and develop programs for an agent to learn and act in a structured environment.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	1	0	0	0	0	0	2	2	1
CO2	2	3	2	3	2	2	0	0	0	2	2	2	3	2
CO3	2	2	2	3	3	3	0	0	2	2	2	3	3	2
CO4	2	2	2	3	3	3	0	0	2	3	3	3	3	2
CO5	2	2	2	2	3	2	0	0	2	2	2	2	2	3

Theory

Unit	Main Topics	Course Outline	Lecture(s)
Unit-1	1. Basics of AI	Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree.	03
	2. Search Algorithms	Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search.	09
	3. Probabilistic Reasoning	Probability, conditional probability, Bayes Rule, Bayesian Networks-representation, construction and inference, temporal model, hidden Markov model.	12
Unit-2	4. Markov Decision process	MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.	12
	5. Reinforcement Learning	Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning-Q learning.	12

Total=48

Recommended Books:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rdEdition, Prentice Hall.
2. Elaine Richand Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill.
3. Trivedi, M.C., “A Classical Approach to Artificial Intelligence”, Khanna Publishing House, Delhi.
4. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2011.
5. David Poole and Alan Mackworth, “Artificial Intelligence: Foundations for Computational Agents”, Cambridge University Press 2010.

Title of the course : **Optimization Techniques**

Subject code : **HDCS-621**

Weekly load : **4 Hrs** **LTP 3-1-0**

Credits : **4**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Describe clearly a problem, identify its parts and analyze the individual functions. Feasibility study for solving an optimization problem.
CO2	Becoming a mathematical translation of the verbal formulation of an optimizationproblem.
CO3	To design algorithms, the repetitive use of which will lead reliably to finding an approximate solution.
CO4	Evaluate and measure the performance of an algorithm. Discovery, study and solve optimization problems.
CO5	Understand optimization techniques using algorithms. Investigate, study, develop, organize and promote innovative solutions for various applications.

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	0	0	0	0	0	1	0	2	2
CO2	3	3	3	3	0	0	0	0	2	0	0	1	3	2
CO3	2	2	3	2	0	0	2	0	0	0	0	0	3	3
CO4	2	2	2	2	2	0	0	0	0	1	0	0	2	3
CO5	0	0	2	1	0	2	0	0	3	1	1	0	2	1

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basic Concepts	Historical Development; Engineering applications of Optimization; Art of ModelingObjective function; Constraints and Constraint surface; Formulation of design problems as mathematical programming problems Classification of optimization problems. Optimization techniques – classical and advanced techniques	08
	2. Optimization using Calculus	Stationary points; Functions of single and two variables; Global OptimumConvexity and concavity of functions of one and two variablesOptimization of function of one variable and multiple variables; Gradient vectors;	08

		Examples Optimization of function of multiple variables subject to equality constraints; Lagrangian functionOptimization of function of 1 multiple variables subject to equality constraints; Hessian matrix formulation; Eigen values Kuhn-Tucker Conditions; Examples	
	3.Linear Programming	Standard form of linear programming (LP) problem; Canonical form of LP problem; Assumptions in LP Models; Elementary operationsGraphical method for two variable optimization problem; Examples Motivation of simplex method, Simplex algorithm and construction of simplex tableau; Simplex criterion; Minimization versus maximization problems	08
	4. Linear Programming Applications	Use of software for solving linear optimization problems using graphical and simplex methodsExamples for transportation, assignment, water resources, structural and other optimization problems	
Unit-2	5. Dynamic Programming	Sequential optimization; Representation of multistage decision process; Types of multistage decision problems; Concept of sub optimization and the principle of optimality Recursive equations – Forward and backward recursions; 2 Computational procedure in dynamic programming (DP) D	12
	6. Dynamic Programming Applications	Problem formulation and application in Design of continuous beam and Optimal geometric layout of a truss Water allocation as a sequential process.	06
	7. Integer Programming	Integer linear programming; Concept of cutting plane methodMixed integer programming; Solution algorithms; Examples	06

Total=48

Recommended Books:

1. Kapoor, V.K.: Operation Research, Sultan Chand & Co., New Delhi.
2. Manmohan Gupta, P.K.: Operation Research, Sultan Chand & Co., New Delhi.
3. Pronsen, Richard: Theory and Problems of Operation Research, McGraw Hill, 1983.
4. Hiller, F.S. & Liberman, G.J., 1974: Introduction to Operations Research, 2nd Edn. Holden
5. Rao, S. S., 1978: Introduction to Optimization: Theory & Applications, Wiley Eastern.
6. Srinath, L.S.: Linear Programming, East-West, New Delhi.

SEMESTER-VII

Title of the course : **Internet Programming**

Subject code : **PCCS-711**

Weekly load : **3 Hrs** **LTP 2-1-0**

Credits : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the concept of object oriented programming
CO2	Learn data type and variables of Java
CO3	Write programs using various features of Java
CO4	Understand the concept of applet and multi-threading
CO5	Learn the concept of AWT and event handling

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	1	0	0	0	0	0	0	0	2	2	1
CO2	3	3	3	2	2	0	0	0	0	0	0	3	1	1
CO3	3	3	3	3	2	0	0	0	1	0	0	3	3	2
CO4	3	3	3	3	3	1	1	0	1	0	0	3	3	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of Programming	Programming; Need of Programming; Representation of Algorithms; Need for OOP; Class and Objects; Abstraction; Association; Composition; Aggregation; Inheritance: simple inheritance, hierarchical inheritance, multilevel inheritance, hybrid inheritance; Encapsulation; Polymorphism: static polymorphism, dynamic polymorphism;	8
	2. Java and its variables	Introduction to Java; Environment variables; JAVA-Home directory; Steps to develop a Java Program; Command line arguments, Variables: value type, reference type; Identifiers; Data Types: primitive data types, abstract data types; Instance variables and Local Variables; Access Specifiers; Access Modifiers; Keywords.	8
	3. Operators, Classes and Methods	Unary Operators; Binary Operators; Types of Operators: arithmetic operator, relational operator, logical operator, assignment operator, increment operator, decrement operator, negation operator, bitwise operator, shift operator, concatenation operator, new operator, instance operator; Type Casting: implicit type casting, explicit type casting; Methods and Parameters; Constructors; Overloading Constructors; Overloading member functions; Abstract	8

		class; Final class; Variables, Interfaces, Object; Constructors: default constructor, parameterized constructor; Wrapper classes; Adapter Classes; Anonymous Classes; Utility Classes; Generics.	
Unit-2	4. Programming using Java	Selection control Structures; Iteration control Structure; Arrays: array initialization, array creation, multidimensional array; Strings; Recursion; Regular Expression; Packages; Exception Handling: errors in software engineering, exception classes, keywords used in exception handling, hierarchy of run time exception; Multithreading: life cycle of a thread, creation of child thread, working with multiple child thread, thread priorities, thread synchronization, and monitors; Abstract Window Toolkit; Event Handling; Window listener; Working With Menus; Dialog box; Card Layout; Applets; Collections; Framework; Loading an Image onto the Frame and Applet; Insets.	12
	5. Debugging, Code Analysis and Unit Testing	Debugging; Code Analysis using Programming Mistake Detector (PMD); Unit Testing using JUnit and Code coverage	12

Total=48

Recommended Books:

1. Bert bates, Kathy Sierra, Head First Java, O'Reilly Media.
2. Steven Holzer, Java 8 programming, Dreamtech Press.

Title of the course : **Compiler Design**

Subject Code : **PCCS-712**

Weekly load : **3Hrs** **LTP 2-1-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Introduce the major concept areas of language translation and compiler design
CO2	Enrich the knowledge in various phases of compiler ant its use, code optimization techniques, machine code generation, and use of symbol table
CO3	Extend the knowledge of parser by parsing LL parser and LR parser
CO4	Provide practical programming skills necessary for constructing a compiler
CO5	Understands Intermediate Code Generation and Code Optimization

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	0	2	2	0	0	1	0	1	2	3	3
CO2	2	2	2	2	2	2	0	0	2	0	2	2	2	2
CO3	3	2	2	2	2	2	0	0	2	2	2	3	2	2
CO4	3	2	2	2	2	3	0	0	2	2	2	2	2	2
CO5	3	2	2	2	2	2	0	0	3	0	1	2	2	2

Theory

Unit	**Main Topics**	**Course outlines**	**Lecture(s)**
Unit-1	1. Basics of translators	Introduction to translators (assemblers, compilers, interpreters)	06
	2. Phases of compiler	Lexical & Syntax analysis, Intermediatecode generation optimization, bookkeeping, error handling, regular expressions, finite automata.	06
	3. Parsing:	Context free grammar, Derivation & Parse Trees, parsers: shift reduce, operatorprecedence, top down predictive, efficient parsers; LR parser, LR(O), SLR, LALR, implementation of parsers.	06
	4. Syntax Directed Translation:	Different schemes & implementation, immediate code, Parsetrees, syntax-trees.	06
Unit-2	5. Intermediate code generation	Three address code, quadruples triple, translation of assignment statements, Boolean expressions, postfix notation any parser.	06

	6. Error Detection & Recovery:	Errors, Lexical-phase errors, syntactic-phase errors,semantic errors.	06
	7. Code Optimization:	Sources of optimization, loop optimization DAG representation of basicblocks, Value number & algebraic laws, Global data-flow analysis, Dominators, Reducible flow graphs, loop invariant computations, Induction variables eliminations, Backward flow problems.	06
	8. Code Generation:	Object programs, problems in code generation, Register allocation &assignment code generation from DAG‘s.	06

Total=48

Recommended Books:

1. Aho A. V., Ullman J. D., Sethi R., Compilers Principles, Techniques and Tools, Pearson Education.
2. John Levine, Tony Mason, Doug Brown, Lex and Yacc, O’REILLY.
3. Kenneth C. Louden, Compiler Construction and Practice, Thomson Publication.
4. Dhamdhere, Compiler Construction, Macmillan Publication.

Title of the course : **Internet Programming Lab**

Subject Code : **PCCS-713**

Weekly load : **4 Hrs** **LTP 0-0-4**

Credit : **2**

Course Outcomes: At the end of the course, the students will be able to:

CO1	Implement programs using various control structure
CO2	Implement command line argument and various input methods
CO3	Write programs using various features of Java like vector, string, string buffer class
CO4	Implement programs using applet and multi-threading
CO5	Develop applications using applet, AWT and event handling

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3	3	2	3	1	0	0	1	0	1	3	2	1
CO2	1	3	3	2	3	1	0	0	1	0	1	3	2	1
CO3	1	3	3	2	3	1	0	0	1	0	1	3	3	2
CO4	1	3	3	2	3	1	0	0	1	0	1	3	3	2
CO5	1	3	3	2	3	1	0	0	1	0	1	3	3	2

LIST OF PRACTICALS

1. Write a Java program to find a number of command line Arguments and to display them.
2. Write Java programs to implement the concept of operators.
3. Write a Java program to implement the concept of typecasting.
4. Write Java programs to show the concept of class, objects and constructors.
5. Write a Java program to show the concept of constructor overloading.
6. Write a Java program to show the concept of function overloading.
7. Implement the concept of final class, variable and method.
8. Write Java programs to implement the concept of wrapper classes.
9. Write Java programs to implement the concept of array and string classes.
10. Write Java programs to implement the concept of various types of inheritance.
11. Write Java programs to implement the concept of vector classes.
12. Write Java program to implement the concept of applet and its methods.
13. Write Java program to implement the concept of exception handling.

14. Write Java program to implement the concept of multithreading and its methods.
15. Write Java program to implement the concept of event handling.
16. Write a Java program to show working of user defined Generic classes.
17. Implement abstract window toolkit (awt) GridLayout, button, checkbox, ItemListener, choice, list, combo box, drop down list box, scrollbar, working with menus, dialog, file dialog, card layout, text listener, event Mouse Listener, Mouse Motion Listener, and Mouse Wheel Listener.
18. Implement collection framework (list, set, Map, sorted set, and sorted map) and utility classes (date, string tokenizer,, stack, arrays, Random, currency, properties, timer and timer task, vector, enumeration, iterator, hash table).

Note: The above mentioned list of experiments is suggested list. Teacher may add more programs/ experiments as per requirement.

Title of the course : **Image Processing**

Subject Code : **PECS-711A**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Learn the fundamental concepts and applications of image processing
CO2	Cover the basic theory and algorithms that are widely used in image processing
CO3	Provide mathematical foundations for digital manipulation of images such as image acquisition, segmentation, Fourier transformation and compression
CO4	Understand the basic concepts of performing Image restoration, Image compression, Color image processing, Image segmentation and Object Recognition
CO5	Understand and review image transforms

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):

Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	0	0	0	0	0	0	0	0	0	2	2	2
CO2	2	3	2	2	2	2	0	0	2	2	2	2	3	2
CO3	3	3	3	3	2	2	0	0	2	2	2	3	3	2
CO4	2	2	2	3	2	2	0	0	2	2	2	2	3	2
CO5	2	0	0	0	0	0	0	0	0	0	0	2	3	2

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	**1. Basics of image processing**	Image model, human vision, digital images representation, image acquisition, storage, processing, communication and display, Image Geometry, Image transformations,	06
	2. Fourier Transformation	Discrete Fourier transformation, Fast Fourier Transformation, other represent able image transformation.	06
	3. Image Enhancement	Image enhancement, special domain and frequency domain methods, enhancement by point frequency,	06
	4. Filters	Special filtering, enhancement in frequency domain, color image frequency.	06
Unit-2	**5. Image Restoration**	Image restoration, degradation model, algebraic approval to restoration, constrained least square restoration, Interactive restoration, restoration in special domain.	06
	6. Image Compression	Image compression, image compression models, loss less and glossy image compressions methods.	06
	7. Image Segmentation	Image segmentation, detection of discontinuities, Region oriented segmentation.	06

	8. Image Detection	edge detection and boundary detection, shareholding,	06

Total=48

Recommended Books:

1. Rafacl C. Gonzalez, Digital image processing, Addison Wesley.
2. Jain Tenber, Digital Image Processing, PHI

Title of the course : **Soft Computing**

Subject code : **PECS-711 B**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credits : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand fuzzy logic and its applications.
CO2	Acquire knowledge of artificial neural networks and their applications.
CO3	Solve single-objective optimization problems using genetic algorithms.
CO4	Apply soft computing to solve problems in varieties of application domains.
CO5	To familiarize with soft computing concepts.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	0	0	2	2	2	3	2	2
CO2	3	3	3	3	3	2	0	0	3	2	2	3	2	3
CO3	3	3	3	2	2	2	0	0	3	3	3	3	3	2
CO4	3	3	3	2	2	3	0	0	3	3	3	3	3	3
CO5	2	3	2	2	2	3	0	0	3	3	3	2	3	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of Soft Computing	Concept of computing systems; "Soft" computing versus "Hard" computing; Characteristics of soft computing; Some applications of soft computing techniques	02
	2. Fuzzy Logic	Introduction to fuzzy logic; Fuzzy sets and membership functions; Operations on fuzzy sets; Fuzzy relations, rules, propositions, implications and inferences; Defuzzification techniques; Fuzzy logic controller design; Some applications of fuzzy logic	10
	3. Genetic Algorithms (GAs)	Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques; Basic GA framework and different GA architectures; GA operators: encoding, crossover, selection, mutation, etc.; Solving single-objective optimization problems using GAs	12
Unit-II	4. Artificial Neural Networks	Biological neurons and their working; Simulation of biological neurons to problem solving; Different ANN architectures; Training techniques for ANNs; Applications of ANNs to solve some real-life problems	12

	5. Unsupervised Learning	Competitive learning networks;Kohonen self-organizing networks; Hebbian learning; The Hopfield network	12

Total=48

Recommended Books:

1. F. Martin McNeill, and Ellen Thro, Fuzzy Logic: A Practical Approach, Morgan Kaufmann Pub.
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley.
3. Nikola K. Kasabov, Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering, MIT Press.
4. Melanie Mitchell, An Introduction to Genetic Algorithms, MIT Press.
5. David E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Pearson Education.
6. S. Rajasekaran, and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis, and Applications, Prentice Hall of India.
7. D. K. Pratihar, Soft Computing, Narosa, 2008.

Title of the course : **Computer Network and Security**

Subject Code : **PECS-711C**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	To understand the basics of computer networks and wireless networks.
CO2	To understand the cryptographic techniques and Internet security protocols.
CO3	To learn how to implement biometric security and software security techniques.
CO4	Describe the functions of each layer in OSI and TCP/IP model.
CO5	Explain the functions of Application layer and Presentation layer paradigms and Protocols.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	2	2	0	0	1	0	0	0	0	0	0	2	1	1
CO2	2	2	0	0	2	0	0	0	0	2	0	2	2	2
CO3	2	3	2	2	2	2	0	0	2	2	0	2	2	2
CO4	2	2	3	2	2	2	0	0	2	2	0	2	2	2
CO5	2	2	2	2	2	2	0	0	2	2	0	0	3	2

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of Computer Networks	Computer Network & Security: Data and Computer Communication Networks, Data Communication, Transmission Methodologies, Data Link Layer, Multiple Access & Local Area Networks.	06
	2. Connecting Devices	Connecting Devices and Backbone Networks, Network Layer and Transport Layer, Application Layer.	04
	3. Wireless Networks	Wireless networking, wireless LANS & PANS, ad-hoc wireless networks & security, wireless sensor networks.	06
	4. Cellular Networks	Cellular Mobile Wireless Networks, Evolution of Modern Mobile Wireless Communication System.	06
Unit-2	5. Cryptography and Network Security	Introduction to the Concept of Security, Cryptographic Techniques, Computer-based Symmetric and Asymmetric Key Cryptographic Algorithms, Public Key Infrastructure (PKI), Internet Security Protocols, Network Security.	06

	6. Database Security:	Data management technologies, Information security, Information Management Technologies, Security policies, Policy enforcement & related issues, Design principles, Multilevel relational data models, Security impact on database function, inference problem.	06
	7. Software Security:	Defining a discipline, A Risk Management Framework, Code review with a tools, Architectural risk analysis, Software penetrating testing, Risk Based security Testing, An Enterprise S/W security program, Security knowledge.	06
	8. Biometric Security:	Biometric Fundamentals, Types of Biometrics, Fingerprints and Hand Geometry, Facial and Voice Recognition, Iris and Retina scanning, Signature Recognition and Keystroke Dynamics, Behavioral and Esoteric Biometric Technologies, Issues Involving Biometrics, Privacy, Policy and Legal Concerns Raised by Biometrics.	08

Total=48

Recommended Books:

1. Tanenbaum, Computer Network, Prentice Hall India
2. William Stalling, Data and Computer Communication, Prentice Hall
3. Douglas E. Comer, Internetworking with TCP/IP Volume – I, Prentice Hall India
4. W. Richard Stevens, TCP/IP Illustrated Volume-I, Pub. Addison Wesley
5. B. Forouzan, Data Communication And Networking, TMH

Title of the course : **Requirement Engineering**

Subject Code : **PECS-711D**

Weekly load : **3 Hrs** **L T P 3 0 0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Comprehend software engineering knowledge and principles
CO2	Understand requirement engineering and requirement elicitation
CO3	Comprehend requirement analysis and specifications
CO4	Design framework for software engineering projects
CO5	Convert the requirements model into the design model and demonstrate use of software and user interface design principles

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO12	PSO1	PSO2
CO1	3	3	3	2	1	1	0	0	2	0	3	3	1	1
CO2	3	3	3	2	2	1	0	0	2	0	2	2	2	2
CO3	3	0	3	2	2	1	0	0	2	0	2	2	2	3
CO4	2	0	2	2	2	2	0	0	2	0	3	2	2	3
CO5	3	0	2	3	2	2	0	0	2	0	2	2	2	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Principles of communication	Software engineering knowledge, process guidance principles, practice guiding principles, framework guiding principles, communication principles, planning principles, modelling principles, construction principles, deployment principles	12
	2. Requirement engineering and requirements elictation	Introduction to requirement engineering, steps of requirement engineering, present state of practice, types of requirements, identifying stakeholders, recognizing multiple viewpoints, working toward collaboration, requirements elicitation, interviews, brainstorming sessions, facilitated application specific technique, quality function deployment,	12

Unit-2	3. Requirement analysis & specifications	Requirements analysis, data flow diagrams, data dictionaries, Entity relationship diagrams, software prototyping, Software requirement specifications, nature of SRS, characteristics, organization of SRS, introduction, overall description, specific requirements, change management process, approvals, supporting information.	12
	4. Design concepts	Conceptual design and technical design, modularity, design strategy, bottom up design, top down design, hybrid design, function-oriented design, object-oriented design, steps to analyze object-oriented design	12

Total=48

Recommended Books:

1. Software Engineering, Roger S. Pressman, McGraw Hill publication.
2. Ian Sommerville, Software Engineering, Addison-Wesley Publishing Company
3. James F. Peter, Software Engineering - An Engineering Approach, John Wiley
4. Pankaj Jalote, An integrated Approach to Software Engineering, Narosa.

Title of the course : **Management Information System**

Subject Code : **PECS-711E**

Weekly load : **3Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Describe relationship between concept of information system, organization, management and strategies
CO2	Evaluate the role of information system in today's competitive business environment
CO3	Effectively communicate strategic alternatives to facilitate decision making
CO4	Understand the leadership role of Management Information Systems in achieving business competitive advantage through informed decision making.
CO5	Effectively communicate strategic alternatives to facilitate decision making.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):

Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	3	1	0	2	3	3	3	2	1	1
CO2	3	2	2	2	3	1	0	2	3	3	3	2	2	2
CO3	3	2	2	2	3	1	0	2	3	3	3	2	2	3
CO4	3	2	2	2	3	1	0	2	3	3	3	2	2	2
CO5	3	2	2	1	3	2	0	2	3	3	2	1	2	2

Theory

Unit	Main Topics	Course outlines	Hour(s)
Unit-1	1. Understanding MIS	Introduction to Management Information Systems, History of MIS, Impact of MIS, Role and Importance, MIS Categories, Managers and Activities in IS, Types of Computers Used by Organizations in Setting up MIS, Hardware support for MIS	06
	2. Conceptual Foundations	Introduction, The Decision Making Process, System Approach to Problem Solving, The Structure of Management Information System, Types of Management Systems Concepts of Management Organization	06
	3. MIS Planning, Control and Development	Introduction, Differences between planning and control information, Systems Analysis, Systems Design, Development	06
	4. MIS and BPR	Introduction, Business Process Re – Engineering, Improving a process in BPR, Object Oriented methodology, BPR – Current Focus	06
	5. MIS Organization Structure	Introduction, MIS at Management levels, Strategic Level Planning, Operational Level Planning, Economic and Behavior Theories	06

Unit-2	6. MIS – Support Models and Knowledge Management	Introduction, Philosophy of Modeling, DSS: Deterministic Systems, Market Research Methods, Ratio Analysis for Financial Assessment, Management Science Models	06
	7. Strategic Management Information System	Introduction, Background, Performance, Product differentiation and Value Chain, How IT influences Organizations' goals, The five levels, Governance Modes in the use of IT	06
	8. Security, Ethical Issues and Case Studies	Introduction, Control Issues in Management Information Systems, Security Hazards, Ethical Issues, Technical solutions for Privacy Protection and MIS Case Studies	06

Total=48

Recommended Books:

1. Kenneth C. Laudon : Management Information Systems- Pearson Education
2. Kenneth C. Laudon : Essentials of Management Information System – Pearson Education

Title of the course : **Distributed Systems**

Subject Code : **PECS-711F**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the components of distributed computing, its networks, protocols, communication and interconnection architecture
CO2	Recognize the inherent difficulties that arise due to distributed-ness of computing resources
CO3	Learn and explore mobile & wireless computing and their applications to real world problems
CO4	Understand the basics of distributed object & file based system. Also familiarize with the design, implementation and security issues of distributed system
CO5	To develop a simple distributed system.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	2	0	0	2	3	2	2	3	2
CO2	2	2	2	2	2	2	0	2	2	3	2	2	2	2
CO3	3	2	2	2	2	2	0	2	2	3	2	3	3	2
CO4	3	2	3	2	2	2	0	2	2	3	2	3	2	2
CO5	3	3	2	2	3	3	0	2	2	2	2	3	1	2

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of Distributed Systems	Definition of distributed systems, their objectives, types, hardware and software concepts, architecture.	06
	2. Web Services Concepts	Introduction to XML, SOAP, Web and Grid services concepts.	06
	3. Communication	Inter process communication, Remote Procedure Call (RPC), Remote Method Invocation (RMI), Remote Object Invocation, and Message Oriented Communication.	08
	4. Processes	Introduction to threads, Threads in distributed and non distributed systems, Client side software, Design issues for Servers, Software agents.	06
Unit-2	5. Naming	General issues with respect to naming, Name resolution, implementation of a name space, Domain name Systems, X.500 name space.	06

	6. Security	Introduction to security in distributed systems, General issues in authentication and access control, Security management: Key management, secure group management, authorization management; examples: Kerberos, x.509 certificates.	08
	7. Distributed Object-based Systems	Introduction to distributed object based systems, Overview of CORBA and DCOM and their comparison.	04
	8. Distributed File System and Document Based Systems	Introduction to distributed file system, distributed document-based systems, their examples.	04

Total=48

Recommended Books:

1. Andrew S Tanenbaum, Principles and Paradigms of Distributed Sytsems, Pearson Education.
2. George Coulouris, Distributed Systems, Addison Wesley.

Title of the course : **Simulation and Modelling**

Subject Code : **PECS-712A**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Analyze the system and its behavior so that the physical behavior of a system can transform into a mathematical model that can in turn transform into an efficient algorithm for simulation purpose.
CO2	Understand the methodology for modeling & simulation of continuous, discrete and combined systems using simulation languages.
CO3	Have basic knowledge on simulation software and use it in solving of engineering problems, analysis and validation of the results.
CO4	Understand how simulation modeling can aid in effective decision-making.
CO5	Knowledge about a system and develop the capability to apply the same to study systems through available software.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	2	0	0	2	1	2	2	2	2
CO2	2	2	2	3	2	3	0	0	3	2	2	3	3	2
CO3	2	2	2	2	2	2	0	0	3	2	2	3	2	2
CO4	2	2	2	2	2	3	0	0	2	2	2	3	2	2
CO5	1	2	2	2	2	2	0	0	3	3	2	2	3	2

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of modeling	Concept of a system, stochastic activities, continue and discrete system, system modeling, mathematical modeling, principle used in modeling.	08
	2. Simulation of Systems	Concepts of simulation of continuous systems with the help of two examples; use of integration formulas; concepts of discrete system simulation with the help of two examples, Generation of random numbers, Generation of non-uniformly distributed numbers.	08
	3. Simulation of Queuing Systems	Rudiments of queuing theory, Simulation of Single-Server queue, two-server queue, general queues.	08
Unit-2	4. Simulation in Inventory Control and Forecasting:	Elements of inventory theory, inventory models, Generation of Poisson and Erlang variants, forecasting and regression analysis.	08

	5. Design and Evaluation of Simulation Experiments:	Experimental layout and validation. Simulation Languages: Continuous and discrete simulation languages, Block-Structured continuous simulation languages, expression based languages,	08
	6. Discrete simulation languages	Discrete system simulation languages, simscript, GPSS, SIMULA, Simpack, GASP IV, CSIM, factors in selection of a discrete system simulation languages.	08

Total=48

Recommended Books:

1. Narsingh Deo, System Simulation with Digital Computer, Prentice-Hall of India.
2. Gordon, System Simulation, Prentice Hall of India.

Title of the course : **Machine Learning**

Subject code : **PECS-712 B**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credits : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand about machine learning algorithms.
CO2	Learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
CO3	Explore supervised and unsupervised learning paradigms of machine learning.
CO4	Explore Deep learning technique and various feature extraction strategies.
CO5	To mathematically analyze various machine learning approaches and paradigms.

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	0	0	0	0	0	1	0	2	2
CO2	3	3	3	3	0	0	0	0	2	0	0	1	3	2
CO3	2	2	3	2	0	0	2	0	0	0	0	0	3	3
CO4	2	2	2	2	2	0	0	0	0	1	0	0	2	3
CO5	0	0	2	1	0	2	0	0	3	1	1	0	2	1

Theory

Unit	Main Topics	Course Outline	Lecture(3)
Unit-l	1. Supervised Learning (Regression/Classification)	Basic Methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naïve Bayes. Linear models: Linear Regression, Logistic Regression, Generalized Linear models. support Vector machines, Nonlinearity and Kernel methods. Beyond Binary Classification: multi-class/structured Outputs, Ranking.	l0
	2. Unsupervised Learning	Clustering: K-means/Kernel K-means. Dimensionality Reduction: PCA and kernel PCA. matrix Factorization and matrix Completion. Generative models (mixture models and latent factor models).	07
	3. Evaluations of machine learning techniques	Evaluating machine Learning algorithms and model selection, Introduction to statistical Learning Theory, Ensemble methods (Boosting, Bagging, Random Forests)	07

Unit-2	4. modeling & deep learning	sparse modeling and Estimation, modeling sequence/Time-series Data, Deep Learning and Feature Representation Learning	09
	5. Other machine Learning Techniques	scalable machine Learning (Online and Distributed Learning). A selection from some other advanced topics, e.g., semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical models, Introduction to Bayesian Learning and Inference	09
	6. Recent Trends in learning techniques	Recent trends in various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT applications.	06

Total=48

Recommended Books:

1. Kevin murphy, machine Learning: A Probabilistic Perspective, IT Press.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of statistical Learning, springer (freely availableonline)
3. Christopher Bishop, Pattern Recognition and machine Learning, springer.

Title of the course : **Cyber Forensics**

Subject Code : **PECS-712C**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Learn the fundamentals of computer forensics.
CO2	Understand the role and responsibilities of forensic investigator.
CO3	Learn, analyze and validate forensic data.
CO4	Gain knowledge of digital evidence and its policies, ethics.
CO5	Study the tools and tactics related to digital forensics.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	0	0	1	0	0	0	0	0	0	2	1	1
CO2	2	2	0	0	2	0	0	0	0	2	0	2	2	2
CO3	2	3	2	2	2	2	0	0	2	2	0	2	2	2
CO4	2	2	3	2	2	2	0	0	2	2	0	2	2	2
CO5	2	2	2	2	2	2	0	0	2	2	0	0	3	2

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Concept of Computer Forensics	Need for Computer Forensics, Why and When Do You Use Computer Forensics, Forensic Readiness, Forensic Readiness and Business Continuity, Forensics Readiness Planning, Incident Response, Computer Forensics as part of Incident Response Plan, Overview of Incident Response Process Flow, Role of SOC in Computer Forensics.	06
	2. Forensic investigator	Need for Forensic Investigator, Roles and Responsibilities of Forensics Investigator, What makes a Good Computer Forensics Investigator, Code of Ethics, Accessing Computer Forensics Resources, Other Factors That Influence Forensic Investigations Introduction to Web Application Forensics, Introduction to Network Forensics, Postmortem and Real-Time Analysis	08
	3. Data Acquisition	Data acquisition concepts, rules & fundamental concepts, Understanding Data Acquisition, Live Acquisition, Order of Volatility, Dead Acquisition, Rules of Thumb for Data Acquisition, Types of Data Acquisition, Determine the Data Acquisition Format, Understanding Dark Web, How TOR Browser works, TOR Bridge Node, Internal architecture of	06

		MySQL, Structure of data directory.	
	4. Cloud computing	Introduction to Cloud Computing, Types of Cloud Computing Services, Cloud Deployment Models, Cloud Computing Threats, Cloud Computing Attacks, Introduction to an email system, Components involved in email communication, How email communication works, Understanding parts of an email message	06
Unit-2	5. Digital Evidence	Introduction to Digital Evidence, Types of Digital Evidence, Characteristics of Digital Evidence, Role of Digital Evidence, Sources of Potential Evidence, Understanding Hard Disk, Understanding Solid State Drive (SSD), RAID Storage System, NAS/SAN Storage, Disk Interfaces, Logical Structure of Disks	06
	6. Regulations, policies and ethics	Rules of Evidence, Principles of Digital Evidence, Seeking Consent, Obtaining Witness Signatures, Computer Forensics: Legal Issues, Computer Forensics: Privacy Issues, Computer Forensics and Legal Compliance, Other Laws that May Influence Computer Forensics, Laws Against Email Crime.	06
	7. Digital Forensics	Anti-Forensics Technique: Data/File Deletion, Anti-Forensics Techniques: Password Protection, Bypassing Passwords on Powered-off Computer, Anti-Forensics Technique: Steganography, Anti-Forensics Technique: Alternate Data Streams, Anti-Forensics Techniques: Trail Obfuscation, Anti-Forensics Technique: Artifact Wiping, Anti-Forensics Technique: Overwriting Data/Metadata, Anti-Forensics Technique: Encryption, Anti-Forensics Technique: Program Packers, Anti-Forensics Techniques that Minimize Footprint, Anti-Forensics Technique: Exploiting Forensics Tools Bugs, Anti-Forensics Technique: Detecting Forensic Tool Activities, Anti-Forensics Countermeasures, Anti-Forensics Tools	06
	8. Forensic tools	Perform Static and Dynamic Malware Analysis in a Sandboxed Environment using Cuckoo Sanbox for automated malware analysis, Using Rainbow Tables to Crack Hashed Passwords, Intro to Wireshark as network capture and analyser tool and to investigate network related incident, HashMyFiles to calculate the MD5 and SHA1 hashes, Autopsy open source graphical interface to The Sleuth Kit and other digital forensics tools.	04

Total=48

Recommended Books:

1. Albert J. Marcella Jr., Frederic Guilloson, Cyber Forensic from data to digital evidence, Wiley Press
2. Dejey Murugan, Cyber forensics, Oxford Press
3. Andre Arnes, Digital forensics, Wiley Press
4. Nilakshi Jain, Dhananjay R. Kallande, Digital Forensics: the fascinating world to digital evidences, Wiley Press

Title of the course : **Object Oriented Analysis and Design**

Subject Code : **PECS-712D**

Weekly load : **3 Hrs** **L T P 3 0 0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the concept of object-oriented development and create a static object model and a dynamic behavioural model and a functional model of the system.
CO2	Understand the approaches to system design and object design, and the techniques of translating design to implementation.
CO3	Implement the object-oriented modelling and design patterns to provide solutions to the real-world software design problems.
CO4	To develop robust object-based models for Systems
CO5	To inculcate necessary skills to handle complexity in software design

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	0	0	0	0	0	2	0	3	3	2	1
CO2	3	3	3	2	2	0	0	0	0	0	2	2	3	1
CO3	3	0	3	1	1	0	0	0	0	0	1	2	3	2
CO4	0	0	0	3	0	2	2	0	1	1	0	1	2	2
CO5	0	0	0	2	2	1	0	0	2	2	1	0	2	3

Theory

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	1. Basics of modeling	Object orientation; Development; Modeling; Object modeling technique.	04
	2. Object Modeling	Objects and classes; Links and associations; Generalization and inheritance; Grouping constructs; Aggregation; Abstract classes; Generalization as extension and restriction; Multiple inheritance; Meta data; Candidate keys; Constraints.	04
	3. Dynamic Modeling and Functional Modeling	Events and states; Nesting; Concurrency; Advanced dynamic modeling concepts. Functional models; Data flow diagrams; Specifying operations; Constraints; Relation of functional model to object and dynamic models.	06
	4. Design Methodology and	Object modeling; Dynamic modeling; Functional modeling; Adding operations; Iterating the analysis.	04

	Analysis		
	5. System Design and Object Design	Subsystems concurrency; Allocating subsystems to processors and tasks; Management of data stores; Handling global resources; Handling boundary conditions; Setting trade-off priorities; Overview of object design; Combining the three models; Designing algorithms; Design optimization; Implementation of control; Adjustment of inheritance; Design of associations; Object representation; Physical packaging; Document design decisions.	06
Unit-2	6. Comparison of Methodologies	Structured Analysis/Structured Design (SA/SD); Jackson Structured Development (JSD).	04
	7. Implementation and Programming Style	Implementation using a programming language; Implementation using a database system; Implementation outside a computer. Object-oriented programming style; Reusability; Extensibility; Robustness; Programming-in-the-large.	06
	8. UML	Basics; Emergence of UML; Types of diagrams.	04
	9. Use Case	Actors; Use Case Diagram; Relationships between Use Cases.	04
	10. Classes	Class diagram; Classes; Objects; Attributes; Operations; Methods; Interfaces; Constraints; Generalization; Specialization; Association; Aggregation.	06

Total=48

Recommended Books:

1. James E. Rumbaugh, "Object Oriented Modeling and Design", Pearson Education.
2. Bernd Oestereich, "Developing Software With UML", Pearson Education.
3. Grady Booch, "Object Oriented Analysis and Design", Addison Wesley.
4. Pierre-Alain, Muller, "Instant UML", Shroff Publishers.
5. Grady Booch, James Rumbaugh, Lvar Jacobson, "The Unified Modeling Language User Guide", Addison Wesley.
6. Grady Booch, James Rumbaugh, Lvar Jacobson, "The Unified Modeling Language Reference Manual", Addison Wesley.
7. Rebecca Wirfs-Brock, "Design Object Oriented Software", PHI.
8. E. Charnaik, D. McDermott, "Introduction to Artificial Intelligence", Addison-Wesley Publishing Company.
9. Nils J. Nilsson, "Principles of Artificial Intelligence", Narosa Publishing Co.

Title of the course : **E-Commerce**

Subject Code : **PECS-712E**

Weekly load : **3Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the concept of evolution of E-commerce
CO2	Analyze various E-commerce process models
CO3	Identify current issues and case studies in E-commerce
CO4	Understand the processes of developing and implementing information systems
CO5	Be aware of the ethical, social, and security issues of information systems.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):

Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO 2
CO1	3	2	2	2	3	1	0	2	3	3	3	2	1	1
CO2	3	2	2	2	3	1	0	2	3	3	3	2	2	2
CO3	3	2	2	2	3	1	0	2	3	3	3	2	2	3
CO4	3	2	2	2	3	1	0	2	3	3	3	2	2	2
CO5	3	2	2	1	3	2	0	2	3	3	2	1	2	2

Theory

Unit	Main Topics	Course outlines	Hour(s)
Unit-1	1. Basics of E-commerce	Introduction, E-commerce or Electronic Commerce- An Overview, Electronic Commerce– Cutting edge, Electronic Commerce Framework	06
	2. Evolution of E-commerce	Introduction, History of Electronic Commerce, Advantages and Disadvantage of E-commerce, Roadmap of e-commerce in India	06
	3. E-commerce Infrastructure	Introduction, E-commerce Infrastructure-An Overview, Hardware, Server Operating System, Software, Network Website	06
	4. Managing the e-Enterprise	Introduction, e-Enterprise, Managing the e-Enterprise, E-business Enterprise, Comparison between Conventional Design and E-organization, Organisation of Business in an e-Enterprise	06
	5. e-Commerce Process Models	Introduction, Business Models, E-business Models Based on the Relationship of Transaction Parties, e-commerce Sales Life Cycle (ESLC) Model	06

Unit-2	6. Electronic Payment Systems	Electronic Payment Systems, Electronic Cash, Smart Cards and Electronic Payment Systems, Credit Card Based Electronic Payment Systems, Risks and Electronic Payment Systems	06
	7. Electronic Data Interchange	The Meaning of EDI, History of EDI, EDI Working Concept, Implementation difficulties of EDI, Financial EDI, EDI and Internet	06
	8. E-Marketing, Current issues and Case Studies	The scope of E-Marketing, Internet Marketing Techniques, Current issues in E-commerce and Case studies on E-commerce	06

Total=48

Recommended Books:

1. Kenneth C. Laudon:E-Commerce: Business, Technology, Society, 4th Edition, Pearson
2. S. J. Joseph, E-Commerce: An Indian perspective, PHI

Title of the course : **Parallel Computing**

Subject Code : **PECS-712F**

Weekly load : **3 Hrs** **LTP 3 0 0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the concepts related to parallel computing
CO2	Learn how to measure the performance of parallel computers
CO3	Understand the advanced processor technology and memory hierarchy
CO4	Learn the concepts behind multithreaded architecture and multicore programming
CO5	Analyse the efficiency of a parallel processing system and evaluate the types of application for which parallel programming is useful.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
COs	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2	2	0	0	0	0	0	0	0	1	1
CO2	2	2	3	3	2	2	0	0	2	2	0	2	2
CO3	2	2	3	2	2	2	0	0	2	2	2	3	2
CO4	3	2	2	2	2	2	0	0	2	2	2	2	2
CO5	3	3	2	3	3	2	0	0	2	3	2	3	3

Theory

Unit	**Main Topics**	**Course outlines**	**Lecture(s)**
Unit-1	1. Parallel Computer Models	The State of Computing, Multiprocessors and Multicomputers, Multivector and SIMD Computers, Architectural Development Tracks.	06
	2. Program and Network Properties	Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architecture.	06
	3. Metrics and Scalability	Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.	06
	4. Processor Hierarchy	Advanced Processor Technology, Superscalar and Vector Processors.	06
Unit-2	5. Memory Hierarchy	Memory Hierarchy Technology, Virtual Memory Technology.	06
	6. Bus, Cache, and Shared Memory	Bus Systems, Cache Memory Organizations, Shared-Memory Organizations, Sequential and Weak Consistency Models, Cache Coherence and Synchronization Mechanisms, Message-Passing Mechanisms.	

	7. Pipelining and Superscalar Techniques and Multivector Computers	Linear Pipeline Processors, Nonlinear Pipeline Processors, Instruction Pipeline Design, Arithmetic Pipeline Design, Superscalar Pipeline Design, Vector Processing Principles, Compound Vector Processing, Latency-Hiding Techniques.	06
	8. Principles of Multithreading	Threads Versus Processes, Types of Thread-Level Parallelism: Chip-Level Multiprocessing, Interleaved Multithreading, Simultaneous Multithreading, Hyperthreading.	06

Total=48

Recommended Books:

1. Kai Hwang, Advanced Computer Architecture, McGraw-Hill.
2. Kai Hwang, F Briggs, Computer Architecture and Parallel Processing, McGraw Hill.
3. M Flynn, Computer Architecture: Pipelined and Parallel Processor Design, 1/E, Jones and Bartlett.
4. Harry F Jordan, Fundamentals of Parallel Processing, Prentice Hall.
5. Hesham El-Rewini, Mostafa Abd-El-Barr, Advanced Computer Architecture and Parallel Processing, Wiley-Interscience.
6. Shameem Akhter, Jason Roberts, Multi-Core Programming, Intel Press.

Title of the course : **Software Reliability & Testing**

Subject Code : **OECS-711A**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the concept of reliability and access the difference between H/W & S/W reliability and evaluate different S/W engineering technologies
CO2	Understand and anticipate the possible causes of failure and knowledge of how to prevent them and know about various parameter determination methods
CO3	Analyze and test a S/W system, when it is evolved to accommodate a set of change requirements such as adding new functionalities, bug fixing etc
CO4	How to test software appropriately and effectively and have hands-on experience with test generation and test automation.
CO5	Design reliability models for software systems.

CO/PO Mapping: (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	1	0	0	2	0	3	3	1	1
CO2	3	3	3	2	2	1	0	0	2	0	2	2	2	2
CO3	3	0	3	2	2	1	0	0	2	0	2	2	2	3
CO4	2	0	2	2	2	2	0	0	2	0	3	2	2	3
CO5	3	0	2	3	2	2	0	0	2	0	2	2	2	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of Reliability	Software Reliability & Hardware Reliability, Basic Concepts, Availability, Modeling.	08
	2. Selected Models	Execution Time Component, Calendar Time Component, Model Choice.	08
	3. Applications:	System Engineering, Project Management, Management of Operational Phase, Evaluation of S/W Engineering Technologies.	08
Unit-2	4. System Definition	Failure definition, System Configuration, Text Run Selection.	08
	5. Parameter Determination	Execution Time Component, Calendar Time Component.	08

	6. Project Specific Techniques	Unobserved Failures, Failure Time Measurement, Evolving Programs, Changes in Environment, Other Consideration.	08

Total=48

Recommended Books:

1. Pressman, Software Engineering concepts, TMH.

Title of the course : **Human Resource Management**

Subject Code : **OECS-711B**

Weekly load : **3Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Identify scope and importance of human resource management in industry.
CO2	Facilitate and support effective employee and labour relations in both non-union and union environments.
CO3	Define strategic HR planning and the HRM process to the organization's strategic management and decision-making process
CO4	Research and support the development and communication of the organization's total compensation plan.
CO5	List training and development processes as well as future trends for HRM globalization

CO/PO Mapping : (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation):														
COS	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	0	3	0	0	2	3	3	3	2	1	2
CO2	2	3	3	0	3	1	1	2	1	2	3	2	3	2
CO3	3	0	0	2	3	3	0	2	2	1	2	1	2	1
CO4	3	1	1	2	3	3	3	1	1	0	2	0	2	3
CO5	2	3	3	2	3	1	0	2	3	3	3	2	1	2

Theory

Unit	Main Topics	Course outlines	Hour(s)
Unit-1	1. Basics of HRM	Introduction to Human Resource Management and its definition, functions of Human Resource Management & its relation to other managerial functions. Nature, Scope and Importance of Human Resource Management in Industry, Role & position of Personnel function in the organization.	06
	2. Procurement and Placement	Need for Human Resource Planning; Process of Human Resource Planning; Methods of Recruitment; Psychological tests and interviewing; Meaning and Importance of Placement and Induction, Employment Exchanges (Compulsory Notification of vacancies) Act 1959, The Contract Labour (Regulation & Abolition) Act 1970.	06
	3. Training & Development	Difference between training and Development; Principles of Training; Employee Development; Promotion-Merit v/s seniority Performance Appraisal, Career Development & Planning.	06

	4. Job analysis & Design	Job Analysis: Job Description & Job Description, Job Specification.	06
Unit-2	5. Job Satisfaction	Job satisfaction and its importance; Motivation, Factors affecting motivation, introduction to Motivation Theory; Workers ' Participation, Quality of work life.	06
	6. The Compensation Function	Basic concepts in wage administration, company's wage policy, Job Evaluation, Issues in wage administration, Bonus & Incentives, Payment of Wages Act-1936, Minimum Wages Act-1961	06
	7. Integration	Human Relations and Industrial Relations; Difference between Human Relations and Industrial Relations, Factors required for good Human Relation Policy in Industry; Employee Employer relationship Causes and Effects of Industrial disputes; Employees Grievances & their Redressal.	06
	8. Maintenance	Fringe & retirement terminal benefits, administration of welfare amenities, Meaning and Importance of Employee Safety, Accidents-Causes & their Prevention, Future challenges for Human Resource Management.	06

Total=48

Recommended Books:

1. T.N.Chhabra- Human Resource Management (Dhanpat Rai & Co.)
2. Lowin B. Flippo - Principles of personnel Management (McGraw-Hill)

Title of the course : **Client Server Architecture**

Subject Code : **OECS-711C**

Weekly load : **3Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand distributed computing and client-server architecture
CO2	Analyze the need of distributed computing and remote-method invocation
CO3	Understand Java IDL technology for distributed objects
CO4	Understand fundamental concepts of Web Services
CO5	Analyze the contents the packet contents of different protocols.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	2	2	0	0	0	0	2	2	1	1
CO2	2	2	2	2	2	2	0	0	0	0	2	2	2	2
CO3	2	2	2	2	2	2	0	0	0	2	2	2	2	2
CO4	2	2	2	2	2	2	0	0	0	2	2	2	2	2
CO5	2	1	2	0	2	2	0	0	0	2	2	0	3	2

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Fundamental of Distributed Systems:	Client/Server technology an introduction, Classification – Mainframe, File sharing, Client/Server, Distributed/Collaborative architecture, Distributed Computing Environment–DCE architecture, Type of Client/Server Architecture – Two- tier architecture, Three-tier architecture, Distributed/Collaborative enterprise architecture.	06
	2. Technologies	Complementary Technologies to 3-tier – Object – oriented Design, Database Two Phase Commit Processing, Remote Procedure Call, Message Oriented Middleware.	06
	3. Distributed Computing Environment: Remote Method Invocation:	Structure – Client/Server Model, Defining distributed Environment, Motivation for Distributed Computing, Developing the Distributed Computing Architecture Framework, Fundamental Technologies & Design Mechanism.	08
	4. Remote Method Invocation	Distributed Object Model, RMI System Overview, Client interfaces, Registry interfaces, Remote object interface, Stub interface, Exception in RMI.	06

Unit-2	5. Distributed Component Object Model	The DCOM Architecture, Component & Reuse, Location Independence, Language Neutrality, Connection Management, Scalability, Performance, Bandwidth & Latency, Security, Local Balancing, Fault Tolerance, Ease of Deployment, Protocol Neutrality, Platform Neutrality,	06
	6. Integration	Seamless Integration with other Internet Protocols.	04
	7. The Common Object Request Broker	Overview of CORBA, The object request Broker, OMG Interface Definition Language, Language Mapping, Interface Repository, Stubs & Skeletons, Dynamic Invocation & Dispatch, Object Adapters	08
	8. Case study	Java IDL (Interface Definition Language).	04

Total=48

Recommended Books:

1. P.M. Heinchieus, Object-oriented Design Architecture and Implementation, Addison Wesley .

Title of the course : **Multimedia and Animation**

Subject Code : **OECS-711D**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand all the basic in the multimedia technologies.
CO2	with all phases like digital images, digital audio & video, compression & standards etc.
CO3	Understand the fundamental principles of animation in addition to an invaluable appreciation for observational techniques & the art of planning.
CO4	To learn and understand technical aspect of Multimedia Systems.
CO5	To develop multimedia application and analyze the performance of the same

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	2	0	2	0	2	0	0	0	0	0	0	2	3	2
CO2	2	0	2	2	1	0	0	0	0	0	0	2	3	2
CO3	2	3	2	2	2	0	0	0	2	0	2	2	3	3
CO4	2	3	2	2	2	0	0	0	2	0	2	2	3	2
CO5	2	3	2	2	2	0	0	0	2	0	2	2	3	2

Theory

Unit	Main Topics	Course outlines	Lectures
Unit-1	**1.** Basics of Multimedia	Introduction to Multimedia, Design Processes, Hypertext, Links, Frames, Files, HTML, HGML, Morphing, and Media Control interfaces. Multimedia Tools, Elements of Multimedia, Sound Input, Video Input, Data Automation, General Devices.	06
	2. Text and Image	Types of text, Font, insertion, compression, File formats. Types of images, color models, Basic steps for image processing, principle and working of scanner and digital camera, Gamma and gamma correction.	06
	3. Audio and Video technology	Fundamental characteristics of sound, sensors for TV cameras, color fundamentals, additive and subtractive color mixing, Liquid crystal display (LCD), Plasma Display	06

		Panel (PDP), file formats , Video for Window, QuickTime	
	4. Image fundamentals and representations	Image fundamentals and representations 10 Hrs. Colour Science , Colour, Colour Models, Colour palettes, Dithering, 2D Graphics, Image Compression and File Formats :GIF, JPEG, JPEG 2000, PNG, TIFF, EXIF, PS, PDF, Basic Image Processing, Use of image editing software, White balance correction, Dynamic range correction, Gamma correction, Photo Retouching.	06
Unit-2	**5.** Multimedia presentation and authoring	Overview, multimedia authoring metaphor, multimedia production, presentation and automatic authoring, Design paradigms and user interface, overview of tools like adobe premiere, director, flash and Dreamweaver.	06
	6. Animation	Introduction and examples of Animation. Types of Animation Cel Animation, Stop Motion Animation, Computer Animation, 2-D Animation, 3-D Animation.	06
	7. Basic Principles of Animation	Illusion of Life, straight action and pose to pose Timing, Exaggeration, Drama and Psychological Effect, Fade in and Fade out, Squash and Stretch, Anticipation, staging, follow through and overlapping action, Arcs, Solid Drawing ,Appeal, slow in and slow out, Secondary Action.	06
	8. Various Terms	Animation Drawings/Cels, Rough Drawings , Clean ups, Color reference drawings, Layout, Model Sheet, Key Drawings and in Betweens, Master Background, Concept Piece, Character drawing , Story Board.	06

Total=48

Recommended Books:

1.Principles of Multimedia by Ranjan Parekh. Tata McGraw-Hill
2.Multimedia technologies by Ashok banerji
3.Prabhat K. Andleigh and Kiran Thakrar, “Multimedia Systems Design”, PHI publication
4.John F. Koegal Buford, “Multimedia systems”, Pearson Education.

Title of the course : **Data Mining**

Subject Code : **OECS-711E**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: On successful completion of this course, students will be able to:

CO1	Design a data mart for any organization
CO2	Develop skills to write queries using DMQL
CO3	Extract knowledge using data mining techniques
CO4	Adapt to new data mining tools
CO5	Explore recent trends in data mining such as web mining, spatial-temporal mining

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	1	1	2	0	0	2	0	0	2	3	2
CO2	2	3	3	2	2	2	0	0	2	2	2	2	2	3
CO3	2	3	3	3	2	3	0	0	3	2	2	2	3	3
CO4	2	3	3	3	2	3	0	0	2	2	2	2	2	3
CO5	2	2	2	2	2	2	0	0	2	0	2	2	3	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of Data Mining	Data Mining Concepts, Input, Instances, Attributes and Output, Knowledge Representation & Review of Graph Theory, Lattices, Probability & Statistics	06
	2. Machine learning concepts and approaches	Supervised Learning Framework, concepts & hypothesis, Training & Learning, Boolean functions and formulae, Monomials, Disjunctive Normal Form & Conjunctive Normal Form, A learning algorithm for monomials	06
	3. Data Preparation	Data Cleaning, Data Integration & Transformation, Data Reduction	05
	4. Mining Association Rules	Associations, Maximal Frequent & Closed Frequent item sets, Covering Algorithms & Association Rules, Linear Models & Instance-Based Learning, Mining Association Rules from Transactional databases, Mining Association Rules from Relational databases & Warehouses, Correlation analysis & Constraint-based Association Mining.	07
Unit-2	5. Classification and Prediction	Issues regarding Classification & Prediction, Classification by Decision Tree induction, Bayesian classification, Classification	06

		by Back Propagation, k-Nearest Neighbor Classifiers, Genetic algorithms, Rough Set & Fuzzy Set approaches	
	6. Cluster Analysis	Types of data in Clustering Analysis, Categorization of Major Clustering methods, Hierarchical methods, Density-based methods, Grid-based methods, Model-based Clustering methods	06
	7. Mining Complex Types of Data	Multidimensional analysis & Descriptive mining of Complex data objects, Mining Spatial Databases, Mining Multimedia Databases, Mining Time-series & Sequence data, Mining Text databases, Mining World -Wide Web	06
	8. Data Mining Applications and Trends in Data Mining	Massive Datasets/Text mining, Agent-Based Mining	06

Total=48

Recommended Books:

1. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, 2000 (ISBN: 1-55860-489-8).
2. Ian H. Witten and Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques with Java implementations", Morgan Kaufmann Publishers, San Fransisco, CA (2000).
3. Dorian Pyle, "Data Preparation for Data Mining", Morgan Kaufmann, (1999)
4. Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill
5. Elmasri, Navathe, "Fundamentals Of Database Systems", Addision Wesley

Title of the course : **Project Stage I and Seminar**

Subject code : **PRCS-711**

Weekly load : **4 Hrs** **LTP 0-0-4**

Credits : **2**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Evaluate social impact of technology.
CO2	Evaluate environmental impact of technology.
CO3	Design system for real-life applications.
CO4	To understand need of project management.
CO5	To understand project scheduling concept and risk.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	0	0	2	2	2	2	2	2
CO2	3	3	2	2	2	2	0	0	2	2	2	2	2	2
CO3	3	2	2	2	2	2	0	0	1	2	2	3	2	2
CO4	2	2	3	2	2	0	0	0	2	2	3	2	3	2
CO5	3	2	2	3	2	0	0	0	2	0	2	2	3	3

Project Stage I and Seminar Evaluation: In this, the student must select an area from emerging technologies and specify the objectives to be achieved. Evaluation criteria will be based on objective stated and achieved.

Title of the course : **Soft Computing**

Subject code : **MDCS-711**

Weekly load : **4 Hrs** **LTP 3-1-0**

Credits : **4**

Course Outcomes: At the end of the course, the student will be able to understand:

CO1	Understand fuzzy logic and its applications.
CO2	Acquire knowledge of artificial neural networks and their applications.
CO3	Solve single-objective optimization problems using genetic algorithms.
CO4	Apply soft computing to solve problems in varieties of application domains.
CO5	Introduce students to artificial neural networks and fuzzy theory from an engineering perspective.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	0	0	2	2	2	3	2	2
CO2	3	3	3	3	3	2	0	0	3	2	2	3	2	3
CO3	3	3	3	2	2	2	0	0	3	3	3	3	3	2
CO4	3	3	3	2	2	3	0	0	3	3	3	3	3	3
CO5	2	3	2	2	2	3	0	0	3	3	3	2	3	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of Soft Computing	Concept of computing systems; "Soft" computing versus "Hard" computing; Characteristics of soft computing; Some applications of soft computing techniques	02
	2. Fuzzy Logic	Introduction to fuzzy logic; Fuzzy sets and membership functions; Operations on fuzzy sets; Fuzzy relations, rules, propositions, implications and inferences; Defuzzification techniques; Fuzzy logic controller design; Some applications of fuzzy logic	10
	3. Genetic Algorithms (GAs)	Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques; Basic GA framework and different GA architectures; GA operators: encoding, crossover, selection, mutation, etc.; Solving single-objective optimization problems using GAs	12
Unit-II	4. Artificial Neural Networks	Biological neurons and their working; Simulation of biological neurons to problem solving; Different ANN architectures; Training techniques for ANNs; Applications of ANNs to solve some real-life problems	12

	5. Unsupervised Learning	Competitive learning networks; Kohonen self-organising networks; Hebbian learning; The Hopfield network	12

Total=48

Recommended Books:

1. F. Martin McNeill, and Ellen Thro, Fuzzy Logic: A Practical Approach, Morgan Kaufmann Pub.
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley.
3. Nikola K. Kasabov, Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering, MIT Press.
4. Melanie Mitchell, An Introduction to Genetic Algorithms, MIT Press.
5. David E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Pearson Education.
6. S. Rajasekaran, and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis, and Applications, Prentice Hall of India.
7. D. K. Pratihar, Soft Computing, Narosa, 2008.

Title of the course : **Cryptography and Network Security**

Subject Code : **HDCS-711**

Weekly load : **4 Hrs** **LTP 3-1-0**

Credit : **4**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Know about information security, which includes an overview of public and secret key Cryptosystems
CO2	Comprehend and apply authentication services and mechanisms
CO3	Identify system vulnerabilities of communication protocols
CO4	Apply the knowledge and skills obtained to study further concepts in information security
CO5	To learn about how to maintain the Confidentiality, Integrity and Availability of a data.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):

Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	3	2	0	0	0	0	2	0	1	2	2	2
CO2	2	2	2	2	1	2	0	0	2	2	2	2	2	3
CO3	2	2	2	2	1	2	0	0	2	2	2	2	2	3
CO4	2	2	2	2	2	2	0	0	1	2	2	2	3	2
CO5	2	3	2	2	1	0	0	0	1	2	2	2	3	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit1	1. Basics of Security and attacks	Terminology: Security, Security Attacks, Security Services, Security Mechanisms, OSI Security Architecture, A Model for Internetwork Security, Internet Standards.	06
	2. Symmetric Ciphers	Symmetric Cipher model, substitution techniques, Transposition techniques, Rotor machines, Steganography, Block Cipher principles,	06
	3. Data Encryption	Data Encryption standard, Strength of DES, Differential and Linear Cryptoanalysis, Block Cipher Design principles	05
	4. Advanced Encryption Standard	Evaluation Criteria for AES, The AES Cipher, Multiple Encryption, Triple DES, Block Cipher modes of Operation.	05
Unit2	5. Key Encryption and Hash functions:	Public Key Cryptography Principles, PublicKey Cryptography Algorithms, Key Management, DiffieHellman Key exchange, Digital Signatures, Digital signature standard, Authentication protocols, Cryptography and Message Authentication, Approaches to Message Authentication,	12
	6. Hash Functions	Secure Hash Functions and HMAC.	04

	7. Network Security Applications	Authentication Applications, Kerberos, X.509 Directory Authentication Service, Public Key Infrastructure, Kerberos Encryption Techniques Electronic Mail Security, Pretty Good Privacy (PGP), S/MIME, Introduction to Firewalls.	08
	8. Firewalls	Introduction to Firewalls, Various types of Firewall	02

Total=48

Recommended Books:

1. William Stallings, Cryptography and Network Security, Principles and practices, PHI.
2. William Stallings, Network Security Essentials ,PHI

SEMESTER-VIII

Title of the course : Digital Signal Processing
Subject Code : PECS-721A
Weekly load : 3 Hrs LTP 3-0-0
Credit : 3
Course Outcomes: At the end of the course, the student will be able to:

CO1	To understand the basics of discrete time signals, systems and their classifications.
CO2	To analyze the discrete time signals in both time and frequency domain.
CO3	To design lowpass digital IIR filters according to predefined specifications based on analog filter theory and analog-to-digital filter transformation.
CO4	To design Linear phase digital FIR filters using fourier method, window technique
CO5	To Understanding of spectral analysis of the signals

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
COS	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	1	0	0	0	0	0	0	0	2	2	3
CO2	3	3	3	2	2	0	0	0	0	0	0	3	2	1
CO3	3	3	3	3	2	0	0	0	1	0	0	3	1	1
CO4	3	3	3	3	3	1	1	0	1	0	0	3	1	1
CO5	2	1	3	2	0	0	1	2	0	0	1	2	1	2

Unit	Main Topics	Course outlines	Lecture(s)
Unit -1	**1.** Basics of Signal processing	Overview: Signals, systems and signal processing, classification of signals, elements of digital signal processing system, concept of frequency in continuous and discrete time signals, Periodic Sampling, Frequency domain representation of sampling, Reconstructions of band limited signals from its samples	06
	2. Discrete-Time Signals and Systems (Frequency Domain analysis)	Z-transform & Inverse z-transform, Linear convolution and its properties, Linear Constant Coefficient Difference equations, Frequency domain representation of Discrete-Time Signals & Systems, Representation of sequences by discrete time Fourier Transform, (DTFT), Properties of discrete time Fourier Transform, and correlation of signals, Fourier Transform Theorems.	06
	3. Analysis of Linear Time Invariant System	Analysis of LTI systems in time domain and stability considerations. 8 15 Frequency response of LTI system, System functions for systems with linear constant-coefficient Difference equations, Freq. response of rational system functions relationship between magnitude & phase, All pass systems, inverse systems, Minimum/Maximum phase systems, systems with linear phase.	06
	4. Structures for Discrete Time Systems:	Block Diagram and signal flow diagram representations of Linear Constant-Coefficient Difference equations, Basic Structures of IIR Systems, lattice and lattice-ladder structures, Transposed forms, Direct and cascade form Structures for FIR Systems,	06

		Linear Phase FIR structure, Effects of Co-efficient quantization.	
Unit -2	**5.** Filter Design Techniques	Design of Discrete-Time IIR filters from Continuous-Time filters Approximation by derivatives, Impulse invariance and Bilinear Transformation methods; Design of FIR filters by windowing techniques.	06
	6. Finite Impulse Response Filters	Linear Phase FIR filter–Phase delay–Group delay–Realization of FIR filter–Design of Causal and Non-causal FIR filters (LPF, HPF, BPF and BRF) using Window method (Rectangular, Hamming window, Hanning window) –Frequency Sampling Technique.	06
	7. Applications Of DSP	Multirate Signal Processing: Decimation, Interpolation, Spectrum of the sampled signal –Processing of Audio and Radar signal.	06
	8. Architecture of DSP Processors & applications	Hardwired architecture, pipelining, Multiplier-accumulator (MAC) hardware, architectures of fixed and floating point (TMSC6000) DSP processors. Applications	06

Total=48

Recommended Books:

1. "Digital Signal Processing: Principles, Algorithm & Application", 4th edition, Proakis, Manolakis, Pearson
2. "Discrete Time Signal Processing":Oppeheim, Schafer, Buck Pearson education publication, 2nd Edition, 2003.
3. Digital Signal Processing fundamentals and Applications,Li Tan , Jean Jiang, Academic Press,2nd edition,2013
4. Digital Signal Processing – A computer based Approach, S.K.Mitra, Tata McGraw Hill,3rd edition,2006 5. Fundamentals of digital Signal Processing –Lonnie c.Ludeman, Wiley

Title of the course : **Neural Networks and Deep Learning**

Subject code : **PECS-721 B**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credits : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
CO2	Implement deep learning algorithms and solve real-world problems.
CO3	Implement, train and evaluate neural network using existing software libraries.
CO4	Explain different network architecture and how these are used in current applications.
CO5	Present and critically assess current research on neural network and their applications.

CO/PO Mapping: (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation):

Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	0	0	0	0	0	2	0	3	3	3	3
CO2	3	3	3	2	2	0	0	0	0	0	2	2	3	3
CO3	3	3	3	0	0	0	0	0	2	0	3	3	2	1
CO4	3	3	3	2	2	0	0	0	0	0	2	2	3	2
CO5	3	1	2	0	0	0	1	2	3	0	2	2	1	1

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of deep learning	Various paradigms of earning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques.	4
	2. Feed forward neural network	Artificial Neural Network, activation function, multilayer Perceptron, Gradient descent, Back propagation, empirical risk minimization, regularization, auto encoders.	6
	3. Training Neural Network	Risk minimization, loss function, back propagation, regularization, model selection, and optimization. Greedy layer wise training.	6
	4. Conditional Random Fields	Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.	8

	5. Deep Learning	Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network.	8
	6. Probabilistic Neural Network	Hopfield Net, Boltzman machine, RBMs, Sigmoid net, Auto encoders	6
	7. Deep Learning research	Object recognition, sparse coding, computer vision, natural language processing	6
	8. Deep Learning Tools	Caffe, Theano, Torch	4

Total=48

Recommended Books:

1. Yegnananrayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
2. Golub, G.,H., and Van Loan, C.,F., Matrix Computations, JHU Press, 2013.
3. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

Title of the course : **Cyber Threat Intelligence**

Subject Code : **PECS-721C**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Familiar with cyber threat intelligence lifecycle.
CO2	Gain knowledge of framework of cyber threat intelligence.
CO3	Learn threat analytics using machine learning and data mining tools.
CO4	Understand various technologies related to cyber threat intelligence.
CO5	Learn different categories of cyber threat intelligence.

CO/PO Mapping : (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation):														
Cos	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	0	0	0	0	0	0	0	0	0	2	3	3
CO2	1	2	1	0	1	0	0	0	0	1	1	2	2	1
CO3	2	2	1	0	2	0	0	0	0	2	2	2	3	3
CO4	2	0	1	3	3	2	2	2	1	1	0	2	1	2
CO5	0	1	2	0	1	3	1	3	2	0	0	1	2	1

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of cyber threat intelligence	Introduction, concepts and vocabulary, Intelligence lifecycles, Threat trending, Critical asset identification, Indicators of compromise (IoC's), Modeling threat scenarios for an organization (diamond modelling)	12
	2. Intelligence Sources	Identifying intelligence sources and feeds, Collecting and aggregating open source intelligence using web mining techniques, Collecting and aggregating internal intelligence, intelligence formats, Setting up collective intelligence framework, Security information and event management (SIEM), Artificial intelligence and SIEM	12
Unit-2	3. Threat Analysis	Threat Analytics and Reporting: Lockheed Martin cyber kill chain, Internal and external hacker profiling and tracking, Fundamental CTI analytics: summary statistics, event correlation, reputation, malware analysis, anomaly detection, forensics, Threat analytics utilizing machine learning and text mining Approaches, Network science applications for	12

		cyber threat intelligence applications.	
	4. Intelligence categories	Operational Intelligence: Actionable intelligence, Courses of action, Proactive defense, Threat dissemination and intelligence sharing, Intelligence strategy, process, and systems review	12

Total=48

Recommended Books:

1. Ali Dehghantanha, Mauro Conti TooskaDargahi, Cyber Threat Intelligence, Springer
2. Florian Skopik, Collaborative Cyber Threat Intelligence, CRC Press
3. Aaron Roberts, Cyber Threat Intelligence: The No-Nonsense Guide for CISOs and Security Managers, APress, O'Reilly Press.
4. Zane Pokorny, The Threat Intelligence Handbook, CyberEdge Press.

Title of the course : **Software Reliability & Testing**

Subject Code : **PECS-721D**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the concept of reliability and access the difference between H/W & S/W reliability and evaluate different S/W engineering technologies
CO2	Understand and anticipate the possible causes of failure and knowledge of how to prevent them and know about various parameter determination methods
CO3	Analyze and test a S/W system, when it is evolved to accommodate a set of change requirements such as adding new functionalities, bug fixing etc
CO4	Understand different time dependent and time independent software reliability models.
CO5	Design reliability models for software systems.

CO/PO Mapping: (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	0	0	0	0	3	2	0	3	3	3	3
CO2	3	3	3	2	2	1	0	0	0	1	2	2	2	2
CO3	3	0	3	1	1	0	2	0	0	0	1	2	3	3
CO4	1	2	3	0	0	1	1	2	2	0	2	2	1	2
CO5	1	1	2	2	0	0	3	2	1	3	0	1	2	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of Reliability	Software Reliability & Hardware Reliability, Basic Concepts, Availability, Modeling.	08
	2. Selected Models	Execution Time Component, Calendar Time Component, Model Choice.	08
	3. Applications:	System Engineering, Project Management, Management of Operational Phase, Evaluation of S/W Engineering Technologies.	08
Unit-2	4. System Definition	Failure definition, System Configuration, Text Run Selection.	08
	5. Parameter Determination	Execution Time Component, Calendar Time Component.	08

	6. Project Specific Techniques	Unobserved Failures, Failure Time Measurement, Evolving Programs, Changes in Environment, Other Consideration.	08

Total=48

Recommended Books:

1. Pressman, Software Engineering concepts, TMH.

Title of the course : **Business Management System**

Subject Code : **PECS-721E**

Weekly load : **3Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the concepts related to Business.
CO2	Recognize the various roles of managers and types of business management
CO3	Understand methods to plan, incorporate innovation and build strategies for global management
CO4	Identify the fundamentals of managing and organizing environments
CO5	Understand the complexities associated with management of human resources in the organizations and integrate the learning in handling these complexities.

CO/PO Mapping : (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation):

COS	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2
CO1	2	3	3	0	3	0	0	2	0	3	3	2	1	2
CO2	2	3	3	0	3	1	1	2	3	3	3	2	1	3
CO3	2	3	3	2	3	1	0	2	3	3	3	2	1	2
CO4	1	1	2	2	0	0	1	2	1	2	2	0	2	3
CO5	2	1	3	2	1	1	0	0	1	2	1	2	3	1

Theory

Unit	Main Topics	Course outlines	Hour(s)
Unit-1	1. Basics of Business management system	Introduction, Management roles, Management functions, Managerial levels, Managerial types, Managerial knowledge, Managerial abilities and skills	06
	2. The Planning Function	Value of planning cycle, Mission and Vision Statements, Assessing the environment, Operational and Short term plans, SWOT Analysis, Determining organization goals	06
	3. The Organizing Function	Job design, Departmentalization, Managerial concerns, completing the organization structure, structural configuration, Organization goals in structure design	06
	4. The Staffing Function	Nature of Staffing, Legal aspects of staffing, Strategic human resource management, Job design and human resource planning, Employee placement, Employee development and Employee environment	06
	5. The Leading Function	Leading vs Managing, Leadership theories, Leadership and Power, Leadership and Motivation, Process theories of Motivation, Content theories of Motivation	06

Unit-2	6. Group, Teams and Communication	Types of Groups and Teams, Stages of team development, Leading and Effective Teamwork, Leading and individual communication, Overcoming interpersonal communication barriers	06
	7. The controlling Function	Constant controls, Periodic controls, Functional area controls, Accounting and Financial controls, Ratio Analysis, Ratio Budgeting Process	06
	8. Case studies and Future trends	Future Directions in business management system and related Case Studies	06

Total=48

Recommended Books:

1. Donald Baack,The five function of Effective Management, 2th Edition, Bridgepoint Education.
2. R.C. Bhatia, Business Organization and Management, Atlantic Publishers.

Title of the course : **Cloud Computing**

Subject Code : **PECS-721F**

Weekly load : **3** **L T P 3 0 0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	To create a brief understanding of cloud computing and other related technologies (Grid/cluster etc.).
CO2	To understand cloud service models, deployment models and service inception through virtualization in cloud.
CO3	To understand various security issues in cloud as well as an overview of the basic architectures of cloud computing.
CO4	To understand the basic architecture of cloud computing
CO5	To understand the advanced cloud architecture

CO/PO Mapping: (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation)													
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	2	2	3	3	2	2	0	2	0	1	3	3
CO2	2	2	3	2	3	0	2	0	0	1	0	2	3
CO3	3	2	2	1	3	0	0	0	0	3	0	2	3
CO4	3	2	2	3	3	1	2	0	3	0	0	3	3
CO5	3	3	3	3	3	2	1	1	2	2	0	2	1

Theory

Unit	**Main Topics**	**Course outlines**	**Lecture(s)**
Unit-1	1. Understanding Cloud Computing	Background of cloud computing, enabling technologies and technology innovations, introduction to cloud computing including benefits, challengers and risks. Reference Architecture: cloud consumer, cloud service provider, cloud broker, cloud Auditor, cloud carrier. Boundaries of cloud computing.	08
	2. Service deployment Models and Virtualization	Cloud Characteristics, Cloud service model, cloud deployment models. Virtualization concepts: types of virtualization, benefits of virtualization, introduction to various virtualization operating systems.	08
	3. Cloud Security	Security concepts: Confidentiality, privacy, integrity, authenticity, availability, access control, non-repudiation,	08

		Threat, Vulnerability, Risk, Security Controls, Virtualization Attack: Guest hopping, attacks on the VM, VM migration attack. Legal and compliance issues: responsibility, ownership of data, right to penetration test, compliance for cloud provider vs. compliance for the customer.	
Unit-2	4. Cloud Computing Architecture	Fundamental Cloud Architectures: Architecture of Workload Distribution, Resource Pooling, Dynamic Scalability, Capacity, Service Load Balancing.	08
	5. Advance cloud computing architecture	Hypervisor Clustering, Load Balanced Virtual Server Instances, Zero Downtime, Cloud Balancing, Resource Reservation, Dynamic Failure Detection and Recovery, Storage Workload Management	08
	6. Case study	Public cloud environment: Understanding and exploring Amazon web services, managing and creating EC2 instances.	08

Total=48

Recommended Books:

1. Thomas Erl, Zaigham Mahmood, Ricardo Puttini, "Cloud Computing: Concepts, Technology and Architecture", Prentice Hall.
2. John W. Rittinghouse, James F. Ransome, "Cloud Computing Implementation, Management and Security", CRC Press.
3. Alfredo Mendoza, "Utility Computing Technologies, Standards, and Strategies", Artech House INC.
4. Bunker, Darren Thomson, "Delivering Utility Computing",John Wiley and Sons Ltd.
5. George Reese, "Cloud Application Architectures", O'reilly Publications.
6. Ronald L. Krutz, Russell Dean Vines, "cloud Security: A Comprehensive Guide to Secure Cloud Computing" Wiley

Title of the course : **Parallel Algorithms**

Subject Code : **PECS-722A**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Gain basic understanding of fundamental concepts in parallel algorithms.
CO2	Know about various models of parallel algorithms.
CO3	Analyze the computational complexity of parallel algorithms.
CO4	Understand various parallel sorting algorithms.
CO5	Learn different parallel searching algorithms.

	CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):													
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	3	3	3	1	0	0	1	0	2	3	1	3
CO2	1	2	3	3	3	1	0	0	1	0	3	3	2	2
CO3	0	1	3	2	3	0	0	0	0	0	0	2	3	2
CO4	0	1	3	3	3	0	0	0	0	0	0	2	3	2
CO5	0	1	3	2	3	0	0	0	0	0	0	2	3	2

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit -1	**1.** Parallel computing models	Sequential model, need of alternative model, parallel computational models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.	12
	2. Complexity analysis	Performance Measures of Parallel Algorithms, speed-up and efficiency of parallel algorithms, Cost-optimality, An example of illustrate Cost-optimal algorithms- such as summation, Min/Max on various models.	12
Unit -2	**3.** Parallel sorting algorithms	Parallel Sorting Networks, Parallel Merging Algorithms on CREW/EREW/MCC/, Parallel Sorting Networks on CREW/EREW/MCC/, linear array	12
	4. Parallel searching algorithms	Parallel Searching Algorithm, Kth element, Kth element in X+Y on PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding.	12

		Graph Algorithms - Connected Graphs, search and traversal, Combinatorial Algorithm, Permutation, Combinations, Derangements.	

Total=48

Recommended Books:

1. M.J. Quinn, Designing Efficient Algorithms for Parallel Computer, Mc Graw Hill.
2. S.G. Akl, Design and Analysis of Parallel Algorithms, Prentice-Hall
3. SanguthevarRajasekaran, Handbook of Parallel Computing Models, Algorithms and Applications, CRC Press
4. Fayez Gebali, Algorithms and Parallel Computing, Wiley Press
5. S.G. Akl, Parallel Sorting Algorithm, Academic Press

Title of the course : **Computer Vision**

Subject code : **PECS-722 B**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credits : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Identify basic concepts, terminology, theories, models and methods in the field of computer vision,
CO2	Describe known principles of human visual system
CO3	Understand and implement Image representation and modeling
CO4	Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition,
CO5	Design of face detection and recognition algorithms

CO/PO Mapping: (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation):

Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	3	2	2	0	3	3	1	3	3	2
CO2	3	2	3	1	2	0	0	0	3	3	0	3	2	2
CO3	2	2	2	0	1	2	2	3	1	2	1	2	1	3
CO4	1	2	2	2	0	1	3	0	0	1	2	3	2	1
CO5	2	1	2	3	0	2	3	1	2	0	0	2	1	1

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Digital Image Formation and low level processing	Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration Histogram Processing	6
	2. Depth Estimation and Multi Camera Views	Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration. apparel	6
	3. Feature Extraction	Edges-Canny, LOG, DOG; Line Detectors (Hough Transform), Corners-Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-space Analysis-image Pyramids and Gaussian Derivative filters, Gabor Filters and DWT.	8

	4. Image Segmentation	Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.	6
	5. Pattern Analysis	Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods	8
	6. Motion Analysis	Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.	8
	7. Shape from X	Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges	6

Total=48

Recommended Books:

1. D. A. Forsyth, J. Ponce, *Computer Vision: A Modern Approach*, PHI Learning 2009.
2. Milan Soanka, Vaclav Hlavac and Roger Boyle, *Digital Image Processing and Computer Vision*, Cengage Learning.
3. R.C. Gonzalez and R.E. Woods, *Digital Image Processing*, Pearson Education.
4. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003

Title of the course : **High Speed Communication Network**

Subject Code : **PECS-722C**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the latest high speed communication technologies.
CO2	Analyse the need of Fibre, ISDN and B-ISDN.
CO3	Analyse and Set up protocol designing issues for Communication networks.
CO4	Apply various network layer techniques for designing subnets and supernets and analyse packet
CO5	Understand the routing algorithm for high speed networks.

CO/PO Mapping : (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PS02
CO1	1	2	0	1	3	2	1	2	0	0	1	2	2	3
CO2	1	2	1	0	1	0	0	0	0	0	1	2	1	3
CO3	2	1	0	0	1	2	1	3	2	3	2	1	1	2
CO4	2	1	0	3	2	1	0	1	2	3	1	2	3	2
CO5	2	2	1	0	2	0	0	0	0	0	2	2	2	2

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Gigabit Ethernet	High Speed LAN Overview of fast Ethernet, Gigabit Ethernet – overview, specifications, layered protocol architecture, network design using Gigabit Ethernet, applications, 10GB Ethernet – overview, layered protocol architecture, applications.	08
	2. Wireless Networks	Existing and emerging standards, Wireless LAN(802.11), Broadband Wireless(802.16), Bluetooth(802.15) their layered protocol architecture and security. Mobile Networks – GSM, CDMA and GPRS	08
	3. Fibre Channel	Fibre channel physical characteristics – topologies & ports, layered protocol architecture, class of service, technology comparison, SAN overview and architecture.	06

	4. Frame Relay	High Speed WAN	06
		Protocol architecture, frame format, routing, congestion control.	
Unit-2	5. ISDN & B-ISDN	Channels, interfaces, addressing, protocol architecture, services and B-ISDN	08
	6. ATM	Virtual circuits, cell switching, reference model, traffic management.	06
	7. Routing Protocols	OSPF, BGP, internet multicasting, mobile IP, Introduction to	06

Total=48

Recommended Books:

1. William stalling, "High Speed Networks and Internets", Pearson Education.
2. Tere Parnell, "Building high speed Networks", TMH.

Title of the course : **Software Quality Assurance**

Subject Code : **PECS 722D**

Weekly load : **3 Hrs** **L T P 3 0 0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Comprehend software engineering knowledge and principles.
CO2	propose and defend innovative solutions to software quality assurance and measurement problems in the context of various software development environments;
CO3	evaluate leading edge approaches in software development and attendant quality assurance methodologies, presenting the research using Harvard referencing
CO4	Comprehend requirement analysis and specifications for quality control
CO5	Design framework for software engineering projects with good quality constraints

CO/PO Mapping: (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	0	0	0	1	2	2	0	3	3	1	2
CO2	3	3	3	2	2	0	2	1	0	0	2	2	1	2
CO3	2	1	0	1	2	3	2	1	0	2	3	1	2	1
CO4	1	0	3	1	1	0	0	0	0	0	1	2	1	1
CO5	2	0	1	0	0	0	0	0	0	0	3	1	2	3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Principle of software engineering	Introduction of Software Engineering - Evolution of Software Engineering, Goals of software engineering, Software Development vs. Software Engineering. Software Process - Software Process, Models Waterfall, Spiral, Prototyping, Software Requirements Analysis - Analysis Principles, SRS, Components of SRS.	12
	2. Software design concepts	Introduction of Software Design - Design Objectives, Principles & Concepts, Design Process, Design Strategies and Methods, Architectural Design-Architectural Styles, Modular Design, Object oriented design, User-interface design, Principles of structured Analysis and Design Tools i.e. DFD, Decision Tables and Decision Trees etc for	12

		quality of Project Management, Software Project Planning and its characteristics, Types of metrics, Effort Estimation- FP, LOC, FP vs. LOC, Schedule & Cost Estimation ModelsActivity Networks- PERT/CPM, COCOMO-I, COCOMO-II Model.	
Unit-2	3. Quality Assurance- Quality concepts	Software Metrics- Scope of software metrics, classifying software measures, Measurement basics – representational theory, scales, meaningfulness, What to measure – GOM technique, Control flow structure, product quality metrics – MTTF, customer problems, customer satisfaction, function point. Quality Assurance- Quality concepts – quality, quality control, quality assurance, cost of quality Software quality assurance – SQA activities, software reviews, inspections, audits, Software reviews, inspections, audits,	12
	4. Software Quality Assurance & Reliability	Quality Assurance - Overview of Software Quality, Software Quality Attributes, Factors Affecting Software Quality, Building, Software Quality Assurance Plan, Quality management Principles, Capability Maturity Model, Risk Assessment. Software reliability Quality Attributes: correctness, reliability, usability, integrity, portability, maintainability, interoperability, Quality Standards- Basic concept of – ISO 9000 & 9001 and case study.	12

Total=48

Recommended Books:

1. Kshirasagar Naik and Priyadarshi Tripathy, 'Software Testing and Quality Assurance: Theory and Practice', 1st Edn., Wiley, 2008.
2. Jeff Tian, 'Software Quality Engineering: Testing, Quality Assurance, and Quantifiable, Improvement', 1st Edn., Wiley, 2005.
3.Roger S. Pressman, Software Engineering, A Practitioner's Approach, McGrawHill International Edition.
4. Ian Sommerville, Software Engineering, Addison-Wesley Publishing Company

Title of the course : **Human Resource Management**

Subject Code : **PECS-722E**

Weekly load : **3Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Identify scope and importance of human resource management in industry.
CO2	Facilitate and support effective employee and labour relations in both non-union and union environments.
CO3	Define strategic HR planning and the HRM process to the organization's strategic management and decision-making process
CO4	Research and support the development and communication of the organization's total compensation plan.
CO5	List training and development processes as well as future trends for HRM globalization

CO/PO Mapping : (Strong(S)/Medium(M)/Weak(W) indicates strength of correlation):														
COS	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	0	3	0	0	2	3	3	3	2	1	2
CO2	2	3	3	0	3	1	1	2	1	2	3	2	3	2
CO3	3	0	0	2	3	3	0	2	2	1	2	1	2	1
CO4	3	1	1	2	3	3	3	1	1	0	2	0	2	3
CO5	2	3	3	2	3	1	0	2	3	3	3	2	1	2

Theory

Unit	Main Topics	Course outlines	Hour(s)
Unit-1	1. Basics of HRM	Introduction to Human Resource Management and its definition, functions of Human Resource Management & its relation to other managerial functions. Nature, Scope and Importance of Human Resource Management in Industry, Role & position of Personnel function in the organization.	06
	2. Procurement and Placement	Need for Human Resource Planning; Process of Human Resource Planning; Methods of Recruitment; Psychological tests and interviewing; Meaning and Importance of Placement and Induction, Employment Exchanges (Compulsory Notification of vacancies) Act 1959, The Contract Labour (Regulation & Abolition) Act 1970.	06
	3. Training & Development	Difference between training and Development; Principles of Training; Employee Development; Promotion-Merit v/s seniority Performance Appraisal, Career Development & Planning.	06
	4. Job analysis & Design	Job Analysis: Job Description & Job Description, Job Specification.	06

Unit-2	5. Job Satisfaction	Job satisfaction and its importance; Motivation, Factors affecting motivation, introduction to Motivation Theory; Workers ' Participation, Quality of work life.	06
	6. The Compensation Function	Basic concepts in wage administration, company's wage policy, Job Evaluation, Issues in wage administration, Bonus & Incentives, Payment of Wages Act-1936, Minimum Wages Act-1961	06
	7. Integration	Human Relations and Industrial Relations; Difference between Human Relations and Industrial Relations, Factors required for good Human Relation Policy in Industry; Employee Employer relationship Causes and Effects of Industrial disputes; Employees Grievances & their Redressal.	06
	8. Maintenance	Fringe & retirement terminal benefits, administration of welfare amenities, Meaning and Importance of Employee Safety, Accidents-Causes & their Prevention, Future challenges for Human Resource Management.	06

Total=48

Recommended Books:

1. T.N.Chhabra- Human Resource Management (Dhanpat Rai & Co.)
2. Lowin B. Flippo - Principles of personnel Management (McGraw-Hill)

Title of the course : **Embedded Systems**

Subject Code : **PECS-722F**

Weekly load : **3 Hrs** **LTP 3-0-0**

Credit : **3**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Identify embedded hardware
CO2	Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems..
CO3	Understand microprocessor architecture, interrupts and interface
CO4	Understand software development and tools for embedded systems
CO5	Understand use of RTOS in designing of embedded systems

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	0	0	0	0	2	0	0	0	0	0	2	1	2
CO2	3	2	2	2	0	2	0	0	2	2	2	2	2	3
CO3	2	2	2	2	2	2	0	0	1	0	0	2	2	3
CO4	2	2	3	2	3	2	0	0	2	2	2	2	2	2
CO5	2	2	3	2	3	2	0	0	2	2	2	2	2	2

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Basics of Embedded Hardware	Terminology, Gates, Timing Diagram, Memory, Microprocessor Buses, Direct Memory Access, Interrupts, Built instructions on the Microprocessor.	06
	2. Interrupts	Conventions used on Schematic, Interrupts, Microprocessor Architecture, Interrupt Basic, Shared Data Problem, Interrupt Latency.	05
	3. PIC Micro controller	Introduction, CPU Architecture, Registers, Instruction Sets, Addressing Modes, Programs, Interfacing Methods, Parallel I/O Interface, Parallel Port Interface,	08
	4. Interfacing	Memory Interfacing, High Speed I/O Interfacing, Interrupts – Interrupt Service Routine – features of Interrupts – Interrupt vector & Priority, Timing Generation & Measurements, Input Capture, Output Compare, Frequency Measurement, Serial I/O Device RS232, RS845, Analog Interfacing, Applications.	08
	5. Software Development & Tools	Embedded System Evolution Trends, Round – Robin, Robin with Interrupts, Function Scheduling architecture, Algorithms, Introduction to assembler, Compiler and Cross compilers and Integrated Development Environment IDE,	08

Unit-2	6. Concepts of OOI and Simulator	Object Oriented Interfacing, Recursion, Debugging Strategies, and Simulators.	05
	7. Real Time Operating Systems	Task And Task States, Tasks and Data, Semaphores and shared data, operating system services, Message queues, Timer Function, Events, Memory Management, Interrupt Routines in an RTOS Environment, Basic Design Using RTOS.	08

Total=48

Recommended Books:

1. D.D. Gajski, F. Vahid, J. Gong, S. Narayan, Specification and Design of embedded Systems, Prentice Hall.
2. Steve Heath, Newnes, Embedded Systems Design.

Title of the course : **Project Stage II**

Subject code : **PRCS-721**

Weekly load : **12 Hrs** **LTP 0-0-12**

Credits : **6**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Demonstrate a sound technical knowledge of their selected project topic.
CO2	Undertake problem identification, formulation and solution.
CO3	Design engineering solutions to complex problems utilizing a system approach.
CO4	Communicate with engineers and the community at large in written and oral forms.
CO5	Demonstrate the knowledge, skills and attitudes of a professional engineer.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	0	0	2	2	2	2	2	2
CO2	3	3	2	2	2	2	0	0	2	2	2	2	2	2
CO3	3	2	2	2	2	2	0	0	1	2	2	3	2	2
CO4	2	2	3	2	2	0	0	0	2	2	3	2	3	2
CO5	3	2	2	3	2	0	0	0	2	0	2	2	3	3

Project stage II Evaluation: In this, the student must select an area from emerging technologies and specify the objectives to be achieved. Evaluation criteria will be based on objectives stated and achieved.

Title of the course : **Project Hon's**

Subject code : **PHCS-721**

Weekly load : **8 Hrs** **LTP 0-0-8**

Credits : **4**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Demonstrate a sound technical knowledge of their selected project topic.
CO2	Undertake problem identification, formulation and solution.
CO3	Design engineering solutions to complex problems utilizing a system approach.
CO4	Communicate with engineers and the community at large in written and oral forms.
CO5	Demonstrate the knowledge, skills and attitudes of a professional engineer.

CO/PO Mapping : (Strong(3)/Medium(2)/Weak(1) indicates strength of correlation):														
Cos	Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	0	0	2	2	2	2	2	2
CO2	3	3	2	2	2	2	0	0	2	2	2	2	2	2
CO3	3	2	2	2	2	2	0	0	1	2	2	3	2	2
CO4	2	2	3	2	2	0	0	0	2	2	3	2	3	2
CO5	3	2	2	3	2	0	0	0	2	0	2	2	3	3

Project Hon's Evaluation: In this, the student must select an area from emerging technologies and specify the objectives to be achieved. Evaluation criteria will be based on objectives stated and achieved.