

3.1 PROGRAMMING IN C

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Periods/week 4 4

RATIONALE

Computers play a vital role in present day life, more so, in the professional life of technician engineers. People working in the field of computer industry, use computers in solving problems more easily and effectively. In order to enable the students use the computers effectively in problem solving, this course offers the modern programming language C along with exposition to various applications of computers. The knowledge of C language will be reinforced by the practical exercises.

DETAILED CONTENTS

- 1. Algorithm and Programming Development (04 Periods)**
Steps in development of a program, Flow charts, Algorithm development, Debugging
- 2. Program Structure (06 Periods)**
I/O statements, assignment statements. Constants, variables and data types, Operators and Expressions, Use of Header files & Library functions, Key word, data Types and Identifiers
- 3. Control Structures (10 Periods)**
Introduction, Decision making with IF – statement, IF – Else and Nested IF, While and do-while, for loop, Break and switch statements
- 4. Functions (10 Periods)**
Introduction to functions, Function Declaration, Standard functions, Parameters and Parameter Passing, Call by value/reference, Global and Local Variables, Recursion
- 5. Arrays (08 Periods)**
Introduction to Arrays, Array Declaration and Initialization, Single and Multidimensional Array. Arrays of characters
- 6. Pointers (08 Periods)**
Introduction to Pointers, Address operator, pointer and functions, Declaring and Initializing pointers, Assignment through pointers, Pointers and Arrays
- 7. Structures and Unions (08 Periods)**
Declaration of structures, Accessing structure members, Structure Initialization, Arrays of structures, Unions, Memory allocation functions.
- 8. Strings (05 Periods)**
Introduction, Declaring and Initializing string variables, Reading and writing strings, String handling functions, Array of strings

9. Files

(05 Periods)

Introduction, File reading/writing in different modes, File manipulation using standard function types

LIST OF PRACTICALS

1. Programming exercises on executing and editing a C program.
2. Programming exercises on defining variables and assigning values to variables.
3. Programming exercises on arithmetic and relational operators.
4. Programming exercises on arithmetic expressions and their evaluation
5. Programming exercises on formatting input/output using printf and scanf
6. Programming exercises using if statement.
7. Programming exercises using if – Else.
8. Programming exercises on switch statement.
9. Programming exercises on do – while statements.
10. Programming exercises on for – statement.
11. Programs on one-dimensional array.
12. Programs on two-dimensional array.
13. (i) Programs for putting two strings together.
(ii) Programs for comparing two strings.
14. Simple programs using structures.
15. Simple programs using pointers.
16. Simple programs for reading from a file and writing into a file.

INSTRUCTIONAL STRATEGY

The subject is totally practical based. Students should be given clear idea about the basic concepts of programming. In practical session student should be asked to draw flow chart write algorithm and then write program for the algorithm and run on computer. It is required that students should maintain records (files with printouts).

RECOMMENDED BOOKS

1. Programming in ANSI C by E Balaguruswami, , Tata McGraw Hill Education Pvt Ltd , New Delhi
2. Application Programming in C by RS Salaria, Khanna Book Publishing Co(P) Ltd. New Delhi
3. Programming in C by Gottfried, Schaum Series, , Tata McGraw Hill Education Pvt Ltd , New Delhi
4. Exploring C by Yashwant Kanetkar – BPB Publications, New Delhi
5. Programming in C by Stefin G. Coachin
6. Programming in C by R Subburaj, Vikas Publishing House Pvt. Ltd., Jangpura, New Delhi
7. Elements of C by M.H. Lewin, Khanna Publishers, New Delhi
8. Programming in C by Stephen G Kochan
9. Programming in C by BP Mahapatra, Khanna Publishers, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Period)	Marks Allotted (%)
1	4	6
2	6	10
3	10	16
4	10	16
5	8	12
6	8	12
7	8	12
8	5	8
9	5	8
Total	64	100

3.2 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

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Periods/week	4	3

Rationale : The objective of this subject is to impart fundamental knowledge and skills regarding basic electrical and electronics engineering and digital electronics which diploma holders will come across in their professional life. This course will enable the students to understand the basic concepts and principles of d.c. and a.c. fundamentals, and batteries. The students will also learn basic electronics including diodes and transistors and their applications and digital electronics devices & systems.

DETAILED CONTENTS

- 1. Overview** (04 Period)
Basic concepts of electrical parameters, AC and DC, Use of Electrical Engineering. Ohm's law, Kirchhoff's Law. Concept of voltages & current sources and their conversion.
- 2. AC fundamentals** (04 Period)
Representation of sinusoidal quantity, Equation of sinusoidal wave form, Simple RLC circuits
- 3. Batteries** (06 Period)
Basic idea about primary and secondary cells, Construction, working and applications of Lead-Acid, Nickel-Cadmium and Silver oxide batteries, Charging methods used for lead-acid battery(accumulator), Care and maintenance of lead-acid battery, Series and parallel connections of batteries, General idea of solar cells, solar panels and their applications, Introduction to maintenance free batteries.
- 4. Semi Conductor Physics** (04 Period)
Conductors, Insulators, Semiconductors, Idea of Energy Level, Energy Band Diagrams of Insulators, Conductors and Semiconductors, Effect of Temperature, Recombination of holes and electrons, n-type semiconductor, p-type semiconductor, Majority and Minority Carriers.
- 5. Semi Conductor Diode & Transistor** (06 Period)
Mechanism of current conduction and characteristics of ordinary diode, zener diode, LED, Principle of operation characteristics and applications of BJT and concept of configurations.
- 6. Electrical & Electronics Measuring Instruments** (06 Period)
Operations methods and applications of induction type energy meter, Analog/Digital multimeter, CRO
- 7. Earthing & Discharge** (04 Period)
Concept of earthing and grounding, importance of Earthing, Mechanism and procedure of earthing provided in computer centre, checking of earthing, Static

Discharge, Methods to reduce discharge, Provision for the safety of computers from high electrical discharge, Magnetic effect etc.

- 8. Number System** (06 Period)
Distinction between analog and digital signal, Applications and advantages of digital signals, Binary, Octal and hexadecimal number system: conversion from decimal and hexadecimal to binary and vice-versa, binary addition, subtraction, multiplication and division including binary points. 1's and 2's complement method of addition/subtraction.
- 9. Codes and Parity** (04 Period)
Concept of code, weighted and non-weighted codes, examples of 8421, BCD, excess-3 and Gray code, Concept of parity, single and double entry and error detection, Alpha numeric codes : ASCII and EBCDIC
- 10. Logic Gates and Families** (04 Period)
Concept of negative and positive logic, Definition, Symbols and truth tables of NOT, AND, OR, NAND, NOR, EXOR Gates, NAND and NOR as universal gates, Logic family classification: Definition of SSI, MSI, LSI, VLSI, TTL and CMOS families.
- 11. Logic Simplification** (04 Period)
Postulates of Boolean algebra, De Morgan's Theorems . Various identities. Formulation of truth table and Boolean equation for simple problem. Implementation of Boolean (logic) equation with gates. Karnaugh map (upto 4variables) and simple applications in developing combinational logic circuits.
- 12. Arithmetic Circuits** (04 Period)
Half adder and Full adder circuit, design and implementation, Half and Full subtractor circuit, design and implementation, 4 bit adder/subtractor, Adder and Subtractor IC
- 13. Decoders, Multiplexers and De Multiplexers** (04 Period)
Four bit decoder circuits for 7 segment display and decoder/driver ICs, Multiplexers and De-Multiplexers, Basic function and block diagram of MUX and DEMUX. Different types and ICs.
- 14. Latches and flip flops** (04 Period)
Concept and types of latch with their working and applications, Operation using waveforms and truth tables of RS, T, D, Master/Slave JK flip flops, Difference between a latch and a flip flop.

LIST OF PRACTICALS

1. Verification of Kirchoff's current law and voltage law in a D.C. Circuit.
2. To test a lead – acid storage battery for charged & discharged condition (with hydrometer & to recharge it)
3. Use of analog & digital multimeter and measure resistance, voltage & current.
4. Use of CRO & measurement of frequency & voltage.

5. Verification & interpretation of truth tables for AND, OR, NOT NAND, NOR and Exclusive OR (EX-OR) gates.
6. To design a half adder & full adder using gates and verification of their operation construction of a full adder circuit using XOR and NAND gates and verify its operations.
7. To design a half subtractor & full subtractor circuit with the help of gates & verify their operations.
8. Verify of truth table for decoder ICs.
9. Verification of truth table of JK & JK Master slave flip flops.
10. Verification of MUX & DEMUX using ICs
11. To find the voltage & current relationship in single phase RLC circuit
12. Draw V.I. characteristics of ordinary semiconductor diode & LED.
13. Draw input & output characteristics of transistor in CB & CE configurations.
14. Demonstration of earthing, provided for computer center & testing of proper earthing.

INSTRUCTIONAL STRATEGY

The Electrical, Analog and digital systems have significant importance in the area of computer. Adequate competency needs to be developed by giving sufficient practical knowledge in Electrical, Electronics and digital circuit. Help may be taken in the form of charts, simulation packages to develop clear concepts of the subject.

LIST OF RECOMMENDED BOOKS

1. Digital Electronics: Principles and Integrated Circuits by A.K Maini, Wiley-India Pvt Ltd. Daryaganj, New Delhi
2. Digital Electronics and Applications by Malvino Leach, Tata McGraw Hill Education Pvt Ltd, New Delhi
3. Digital Logic Designs by Morris Mano, Prentice Hall of India, New Delhi
4. Digital Electronics by Soumitra Kumar Mandal, Tata McGraw Hill Education Pvt Ltd,
5. Digital Electronics by V K Sangar , Raj Publishers, Jalandhar

6. Digital Electronics by Tokheim, Tata McGraw Hill Education Pvt Ltd,
7. Digital Electronics by RP Jain, Tata McGraw Hill Education Pvt Ltd, New Delhi
8. Digital Electronics by KS Jamwal, Dhanpat Rai and Co., New Delhi
9. Digital Electronics by Rajiv Sapra, Ishan Publication, Ambala
10. Digital Electronics by BR Gupta, Dhanpat Rai & Co., New Delhi
11. Digital Systems: Principles and Applications by RJ Tocci, Prentice Hall of India, New Delhi
12. Digital Electronics by Rajaraman V., Prentice Hall of India, New Delhi
13. Fundamentals of Digital Electronics by Naresh Gupta, Jain Brothers, New Delhi
14. Principle of Electrical Engineering by V.K. Mehta, S Chand Publication.
15. Basic Electrical Engineering by J.B. Gupta, S.K. Kataria & sons
16. Basic Electrical Engineering by Sahdev & Sahdev, Uneek Publication
17. Fundamental of Elex for polytechnics by Subhadeep Chaudhary, Paragon international Publication
18. Electrical machines by S.K. Bhattacharya Tata McGraw Hill Education Private Limited.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Period)	Marks Allotted (%)
1	04	05
2	04	05
3	06	05
4	04	05
5	06	10
6	06	10
7	04	05
8	06	10
9	04	05
10	04	05
11	04	10
12	04	05
13	04	10
14	04	10
Total	64	100

3.3 OBJECT ORIENTED CONCEPTS

L T P

Periods/week 5 - 3

RATIONALE

Object orientation is a new approach to understand the complexities of the real world. In contrast to the earlier approaches like procedural etc, object orientation helps to formulate the problems in a better way giving high reliability, adaptability and extensibility to the applications. The students are already familiar with this concept of programming in C which is the basic for C++. This course offers the modern programming language C++ that shall help the students to implement the various concept of object orientation practically. The students will be able to programme in the object oriented technology with the usage of C++.

DETAILED CONTENTS

- 1. Introduction (06 Period)**
Algorithm, Flow charts, Debugging
- 2. Language Constructs (18 Period)**
Introduction C++ : variables, types and type declarations, user defined data types; increment and decrement operators, relational and logical operators; if then else clause; conditional expressions, input and output statement, loops, switch case, arrays, structure, unions, functions, pointers; preprocessor directives
- 3. Introduction OOP (06 Period)**
Fundamentals of object oriented programming – procedure oriented programming Vs. object oriented programming (OOP). Object oriented programming concepts – Classes, reusability, encapsulation, inheritance, polymorphism, dynamic binding, message passing, data hiding
- 4. Classes and Objects (06 Period)**
Creation, accessing class members, Private Vs Public, Constructor and Destructor Objects
- 5. Member Functions (06 Period)**
Method definition, Inline functions implementation, Constant member functions, Friend Functions and Friend Classes, Static functions
- 6. Overloading Member Functions (06 Period)**
Need of operator overloading, operator overloading, instream / ostream operator overloading, function overloading, constructor overloading
- 7. Inheritance (16 Period)**
Definition of inheritance, protected data, private data, public data, inheriting constructors and destructors, constructor for virtual base classes, constructors and destructors of derived classes, and virtual functions, size of a derived class, order

of invocation, types of inheritance, single inheritance, hierarchical inheritance, multiple inheritance, hybrid inheritance, multilevel inheritance

8. Polymorphism and Virtual Functions (06 Period)

Importance of virtual function, function call binding, virtual functions, implementing late binding, need for virtual functions, abstract base classes and pure virtual functions, virtual destructors

9. File and Streams (06 Period)

Components of a file, different operation of the file, communication in files, creation of file streams, stream classes, header files, updating of file, opening and closing a file, file pointers and their manipulations, functions manipulation of file pointers, detecting end-of-file.

LIST OF PRACTICALS

- 1 Programming exercises on control flow statements in C++
- 2 Programming exercises on arrays, strings, function and pointers in C++
- 3 Writing programs to construct classes and deriving objects
- 4 Writing programs for constructors, destructors, using public and private access specifies
- 5 Programming exercises on operator overloading, type conversions and inheritance
- 6 Programming exercises on functional overloading
- 7 Writing programs on stream computation.
- 8 Implementation of a mini project in C++
- 9 Introduction to latest ANSI C++ Compiler and elaboration of short comings of Turbo C++ Compiler

INSTRUCTIONAL STRATEGY

Since the entire course is totally practical oriented, it is strongly intended that after discussing the individual concepts in class, the students shall be asked to write the programs for the same in the practical class. The theory and practical shall go hand in hand. It is required that the students make a file of practical exercises which may include the problem definition, algorithms flow charts (wherever required) and the print outs for each listed practical

LIST OF RECOMMENDED BOOKS

- 1) Mastering C++ by K.R Venugopal and Rajkumar, T Ravishankar; Tata McGraw Hill Education Pvt Ltd , New Delhi
- 2) Object Oriented Programming in C++, W/CD by Rajesh K. Shukla, Wiley-India Pvt Ltd. Daryaganj, New Delhi
- 3) Object Oriented Programming in C++ by E. Balaguruswamy, Tata McGraw Hill Education Pvt Ltd , New Delhi
- 4) C++ by Robert Lafore, Galgotia Publications Pvt. Ltd., Daryaganj, New Delhi
- 5) Object Oriented Programming and C++ by R Rajaram; New Age International (P) Ltd., Publishers, New Delhi
- 6) Schaum's Outline of Programming with C++ by John R. Hubbard

- 7) Object Oriented Programming using C++ by Vipin Arora, Eagle Publication, Jalandhar
- 8) Object Oriented Programming using C++ by RS Salaria
- 9) Object Oriented Programming by D Ravi Chandran Tata McGraw Hill

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Period)	Marks Allotted (%)
1	6	08
2	18	22
3	8	08
4	6	08
5	6	08
6	6	08
7	16	20
8	6	8
9	8	10
Total	80	100

3.4 COMPUTER SYSTEM PERIPHERALS

Periods/week L T P
5 - 2

RATIONALE

A computer engineer should be able to interface and maintain key-board, printer, mouse, monitor etc along with the computer system. The course provides the necessary knowledge and skills regarding working construction and interfacing aspects of peripherals. The students will get to know how various peripherals communicate with central processing unit of the computer system. The student will be able to maintain keyboard, printer, monitors and Power Supplies (CVTs and UPSs) along with computer system. This subject provides the required background of computer installation, maintenance and testing of peripherals with microcomputers.

DETAILED CONETENTS

- 1. Video Display (10 Period)**
The basic principle of working of video monitors (CRT/TFT/LCD/LED), video display adapters, video modes, Video display EGA/VGA/SVGA/PCI adapters and their architecture
- 2. Key Board and Mouse (08 Period)**
Types and basic principle of working of wired /wireless key board and wired /optical/wireless mouse, scan codes.
- 3. Disk Drivers (14 Period)**
Features and working of hard disk drive, floppy disk drive, optical and DVD disk drives and CD writer, Pen Drive, Logical structure of disk and its organization and boot record
- 4. Peripheral Devices, Ports and Connectors (14 Period)**
Working principle of various input devices such as Scanner, Tablets, touch screen, light pen, digitizers and joystick, Serial, Parallel, PS/2, USB, RJ- 45, BNC
- 5. Printers (14 Period)**
Principle and working of deskjet, Inkjet, dot matrix and laser printers and plotters
- 6. Networks Peripherals (Features and Working) (12 Period)**
Hub, Switches, Gateway, Router, Bridge, Modem, Patch Panel, I/O Box, Patch Cord, Wireless access point, LAN card(wired/wireless access)
- 7. Power Supplies (Working Principle) (08 Period)**
SMPS, Constant voltage transformers, Uninterruptible Power Supplies : Classification of UPS, On the basis of their output power, on the basis of their working, ON line UPS, OFF line UPS, Line interactive UPS, Line Interaction UPS or Electronic Generator, Comparison Among Three Types of UPS Systems, and Selection of UPS, Important specifications of UPS.

LIST OF PRACTICALS

- 1) To identify various components and peripheral devices of computer.
- 2) Demonstration of different Peripherals of a computer system.
- 3) To study the operation of SMPS
- 4) To study the operation of CVT.
- 5) To study the operation of UPS.
- 6) To study the Video display Unit
- 7) To study the Network Connections

INSTRUCTIONAL STRATEGY

While teaching the subject the teacher may take the interfacing devices like disk drives, printers, key-boards, scanners, plotters etc. physically and explain its working. Additional practical exercise on maintenance and repair of peripheral devices will help the students to develop adequate skills.

LIST OF RECOMMENDED BOOKS

1. B. Govinda Rajalu, IBM PC and Clones. Hardware Trouble Shooting and Maintenance, Tata McGraw Hill 1991
2. Robert, S Lai: The waite group writing MS DOS Device, Drives, Addison, Wesley Publishing Co. 2nd Ed. 1992.
3. S.K Bose "Hardware and Software of Personal Computers" Wiley Eastern Limited, New Delhi.
4. Hall, Douglas "Microprocessors and Interfacing" McGraw Hill
5. Uffenbeck, Microprocessors and Interfacing
6. Sukhvir Singh, Fundamental of Computers, Khanna Publishers, New Delhi
7. Levis Hahenstau, Computer Peripherals for Micro Computers, Microprocessor and PC
8. Peter Norton, Inside the PC (Eight Edition), Tech media

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Period)	Marks Allotted (%)
1	10	12
2	08	10
3	14	18
4	14	18
5	14	18
6	12	14
7	08	10
Total	80	100

3.5 DIGITAL DATA COMMUNICATION

L T P
Periods/week 5 - -

RATIONALE

The course provides the student with:

- i) Principles of modulation, types of modulation and principle of digital data transmission
- ii) Communication methods and equipment used in data transmission
- iii) Errors in data communication and how to deal with them

DETAILED CONTENTS

- 1. Modulation (15 Period)**
Need for modulation in communication systems. Concepts of AM, FM, PM, PAM, FSK (Frequency Shift Keying), PSK (Phase Shift Key) and PCM (Pulse Code Modulation) (No mathematical treatment) Concepts of bandwidth, noise and channel capacity of different communication system such as radio, microwave, different types of electrical communication lines, optical fiber systems and issues like line characteristics and impedance matching
- 2. Transmission of Digital Data and Modems (25 Period)**
Transmission of binary data, concepts of simplex, half duplex and full duplex modes, two and four line systems. Bit level data transfer, rate of data transfer. Byte level data communication, synchronous communication, data transfer Efficiency. Asynchronous communication, start-stop bits, data transfer efficiency, relative advantages and disadvantages with synchronous communication.
Frame level communication, data packets, address encoding and decoding of data packets, data encryption and decryption
Serial and parallel data communications, comparison in terms of speed of data transfer.
Modems: Transmission rate, modem standards, traditional modems, 56 K Modems
- 3. Error Detection (25 Period)**
Sources of errors in data communication. Effect of errors, data error rate and its dependency on data transfer rates. Error detection through parity bit, block parity to detect double errors and correct single errors.
General principles of error detection and correction using cyclic redundancy checks. Encoding redundant bits and recovery of data
- 4. Communication Methods and Standards (15 Period)**
One-to-one connection, multidrop lines. Methods of implementation, channel capacities.
Types of multiplexing- TDM (Time Division Modulation), FDM (Frequency Division Modulation), WDM (Wave Length Division Modulation)
Direct mode of communication, need for handshake mode of communication, handshake modes

INSTRUCTIONAL STRATEGY

As the subject provides only theoretical concepts, the teacher must explain with reference to practical situations

LIST OF RECOMMENDED BOOKS

1. Data Communication and Networking 2nd edition by Forouzan; Tata McGraw Hill Publishing Co, New Delhi
2. Data and Computer Communications by William Stallings, Prentice Hall of India, New Delhi
3. Data Communication by Schwaber, William; McGraw Hills.
4. Digital, Analog and Data Communications by Willium, Sinnema and Tom; McGraw Hill
5. Data Communication by Tenanbaum, Prentice Hall of India, New Delhi
6. Data Communication by Fred Halsall Addison Wesley (Singapore) Pvt. Ltd., New Delhi
7. Data Communication by Keshav, Addison Wesley (Singapore) Pvt. Ltd., New Delhi
8. Understanding Data Communication, 4th Ed, Gilbert Held, Prentice Hall of India, New Delhi
9. Data Communication by Schweber
10. Data Communication and Network by Black

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Period)	Marks Allotted (%)
1	15	18
2	25	32
3	25	32
4	15	18
Total	80	100

3.6 OPERATING SYSTEMS

L T P
Periods/week 6 - 3

RATIONALE

The course provides the students with an understanding of human computer interface existing in computer system and the basic concepts of operating system and its working. The students will also get hand-on experience and good working knowledge to work in DOS and Windows environments. The aim is to gain proficiency in using various operating systems after undergoing this course.

DETAILED CONTENTS

1. **Brief Introduction to System Software (04 Period)**
Compiler, Assembler, Loader, Operating system, Linking, Loading and Executing a Program
2. **Overview of Operating Systems (08 Period)**
Definition of Operating Systems, Functions of Operating System, Types of Operating Systems – Batch Processing, Time Sharing, Multiprogramming, Multiprocessing and Real Time Systems, Distributed Systems, Importance of Operating System
3. **Process Management Functions (16 Period)**
Job Scheduler, Scheduling Criteria, Process Scheduler, Scheduling algorithms, Process synchronization, Critical section
4. **Dead Locks (16 Period)**
Introduction and necessary conditions of dead lock, Dead lock avoidance, Dead lock detection, Dead lock Recovery
5. **Memory Management Function (20 Period)**
Introduction, Logical and Physical address space, Virtual memory, Swapping, Single contiguous memory management, Fixed partition, Contiguous allocation, Paging, Segmentation, Demand paging, Page replacement algorithms, Thrashing
6. **I/O Management Functions (16 Period)**
Dedicated Devices, Shared Devices, Virtual Devices, Storage Devices, Buffering, Spooling
7. **File Management (16 Period)**
File concept, Access Methods, Directory Structure, Protection, File system structure, allocation methods, Directory implementation

LIST OF PRACTICALS

1. Demonstration of all the controls provided on Control Panel, and exercises using Windows
2. Practical exercises involving various internal and external DOS commands
3. Practical exercises involving various UNIX/LINUX commands

INSTRUCTIONAL STRATEGY

As per the above information, it is clear that the subject is both theory and practical oriented. Therefore, the stress must be given on both the theory and practical teaching. In the practical classes, the laboratory must be equipped with all the basic operating system software i.e DOS, UNIX, LINUX, WINDOWS etc. While imparting instructions, the teachers are expected to lay more emphasis on concepts and principles of operating systems, its features and practical utility.

LIST OF RECOMMENDED BOOKS

1. Operating systems by John J Donovan; Tata McGraw Hill, New Delhi
2. Operating System Concept by Ekta Walia, Khanna Publishers, New Delhi
3. System programming by Dhamdhare
4. Unix operating system by Vijay Mukhi
5. Operating system by C. Ritchie
6. MS DOS by Peter Norton, BPB Publications
7. Microsoft Windows Manual
8. First Course in Computers by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
9. Operating System by Galvin, silberchatz , Wiley Publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Period)	Marks Allotted (%)
1	04	04
2	08	08
3	16	16
4	16	18
5	20	22
6	16	16
7	16	16
Total	96	100