



**UTTARAKHAND BOARD OF TECHNICAL EDUCATION**  
**JOINT ENTRANCE EXAMINATION AND TRAINING, RESEARCH DEVELOPMENT CELL, DEHRADUN**  
**STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME**

**BRANCH NAME– INSTRUMENTATION CONTROL ENGINEERING**

**SEMESTER – III**

Subject Code	Subject	L	T	P	T O T	EVALUATION SCHEME						Total Marks	Credit Point
						Internal		External					
		Period/Weeks		Theory	Practical	Theory		Practical					
		Max Marks	Max Marks	Max Marks	Hrs.	Max Marks	Hrs.						
093004	Basics of Electrical Engineering and Machinery	3	1	4	8	35	30	75	2.5	50	3.0	190	6
093001	Analog Electronics	4	1	4	9	35	30	75	2.5	50	3.0	190	6
323001	Transducer and Application	6	2	4	12	35	30	100	2.5	65	3.0	230	6
083001	Electrical and Electronics Engineering Materials	4	-	2	6	20	30	50	2.5	50	3.0	150	5
093003	Basic of C Programming	4	1	4	9	35	30	75	2.5	50	3.0	190	5
323052	Industrial Exposure (assessment at Inst. Level)+	-	-	-	-	-	25	-	-	-	-	25	1
013054	General Proficiency #	-	-	4	4	-	25	-	-	-	-	25	1
	<b>Total</b>	<b>21</b>	<b>5</b>	<b>22</b>	<b>48</b>	<b>160</b>	<b>200</b>	<b>375</b>	<b>-</b>	<b>265</b>		<b>1000</b>	<b>30</b>

# General Proficiency will comprise of various co-curricular activities like games, hobby clubs, seminars, declamation contests, extension lectures, NCC, NSS and cultural activities, elementary mathematics, G.S. & G.K. etc.

+ Industrial visit compulsory at minimum 2 Industries or Department.

**Note:** 1- Each period will be 50 minutes. 2- Each session will be of 16 weeks. 3- Effective teaching will be at least 12.5 weeks.

**Branch Code - 32**



**THIRD SEMESTER  
INSTRUMENTATION & CONTROL ENGINEERING**





# BASICS OF ELECTRICAL ENGINEERING AND MACHINERY

Subject Code : 093004

L	T	P
3	1	4

## RATIONALE

This subject provides a proper understanding of working principles, construction operation and applications of various electrical equipment and machines.

For a diploma holder, it becomes imperative to know the fundamentals of the electrical engg. in order to grasp the knowledge of the field. So, while completing diploma programme, student have to understand working principle, construction, operations and application of various electrical equipments, machines and instruments. Learning of this course will help students to understand basics of electrical engg. and by the completion of the course, student will be able to fully acquaint with various terms, knowledge of fundamental concepts of electricity and various motors and machines.

### 1. Over view of DC Circuits

(08 period)

- Applications of Kirchoff's Laws in solving electrical network problems.
- Networks theorem such as: Superposition, Thevenin theorem, Norton theorem and maximum power transfer theorem.

### 2. AC fundamentals

(10 period)

- Concept of alternating current, and voltage, equation of instantaneous values.
- Representation of alternating sinusoidal quantities by phasors
- Power in pure Resistance, Inductance, Capacitance. RL, RC, RLC circuits
- Active and reactive components of current and their significance
- Power factor and its practical significance
- Resonance in series and parallel circuits
- Active power, reactive power, apparent power

### 3. Three phase supply

(10period)

- Advantage of three phase system over single phase system
- Star-delta connection and transformation.
- Relation between phase voltage and line voltage, also between phase current and line current in a 3 phase system
- Power and power factor in 3 phase system

#### 4. Transformer

(10 period)

Working principle of a Transformer, constructional features, voltage and current transformation, auto transformer and its uses, instruments transformer, voltage regulation and its significance, need for isolation, Losses in a transformer, cooling of transformer

#### 5. Electrical Machines

(16 Period)

##### Construction & Working Principle of:

- DC Machines: DC motor.
- Single Phase Induction Motor.
- Three Phase Induction Motor.
- Three Phase Synchronous Machines: Alternator and synchronous motor.

#### 6. Batteries

(10Period)

##### Basic idea about primary and secondary cells,

- Construction, working and application of Lead-Acid, Nickel-Cadmium Battery.
- Capacity and efficiency of lead acid battery.
- Charging methods used for lead-acid battery(accumulator).
- Care and maintenance of lead-acid battery.
- Series and parallel connections of batteries.

#### LIST OF PRACTICALS

1. Familiarization of measuring instruments viz. voltmeter, ammeter, wattmeter.
2. To verify KVL in DC circuits.
3. To verify KCL in DC circuits.
4. To verify Thevenin's theorem in D.C. circuits.
5. To verify Norton's theorem in D.C. circuits.
6. To verify Super position theorem in D.C. circuits.
7. To verify Maximum power transfer theorem in D.C. circuits.
8. To determine effect of a single phase transformer from the data obtained through open circuit and short circuit test.
9. To test a lead – acid storage battery for charged & discharged condition.

## RECOMMENDED BOOKS

1. Basic Electrical and Electronics Engineering by SK Sahdev ,Dhanpat Rai and CO, New Delhi.
2. Electrical Science by Choudhury S.; Narosa Publishing House Pvt. Ltd. Daryaganj New Delhi.
3. Basic Electrical and Electronics Engineering by Kumar KM , Vikas Publishing House Pvt Ltd. Jangpura, New Delhi.
4. Basic Electrical Engineering by Mool Singh, Galgotia Publication Pvt. Ltd. New Delhi.
5. Electrical Technology by B.L. Theraja, S. Chand and Co, New Delhi.
6. Principles of Electrical Engineering by B.R. Gupta , S Chand and Co, New delhi.
7. Basic Electrical Engineering by P.S. Dhogal , Tata McGraw Hill , New Delhi.
5. Electrical Technology by B.L. Theraja, S. Chand and Co, New Delhi.
6. Principles of Electrical Engineering by B.R. Gupta , S Chand and Co, New delhi.
7. Basic Electrical Engineering by P.S. Dhogal , Tata McGraw Hill , New Delhi.
8. Basic Electrical Engineering by JB Gupta ; SK Kataria and Sons , New Delhi.
9. Electrical Machine by SK Bhattacharya , Tata McGraw Hill, New Delhi.
10. Electrical Machine by SK Sahdev , Unique International Publications, Jalandhar.
11. Electrical Machine by Nagrath and Kothari, Tata McGraw Hill, New Delhi.
12. Electrical Engineering by JB Gupta , SK Kataria & Sons , New Delhi.
13. Electrical Machines by P. S. Bhimbra.

## SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (period)	Marks Allocation(%)
1	8	12
2	10	16
3	10	16
4	10	16
5	16	24
6	10	16
<b>Total</b>	<b>64</b>	<b>100</b>

Subject Code : 093001

**DETAILED CONTENTS****Unit:- I (16 periods)****Semi Conductor Diode**

P and N type semiconductors and their conductivity. Effect of temperature on conductivity of intrinsic semi conductor. PN junction diode, mechanism of current flow in PN junction, Drift and diffusion current, depletion layer, forward and reverse biased PN junction, potential barrier, concept of junction capacitance in forward and reverse bias condition. V-I characteristics, static and dynamic resistance . Diode as half wave, full wave and bridge rectifier. PIV, rectification efficiencies and ripple factor. Zener and avalanche breakdown, Working of Zener diode, Zener diode as a voltage regulator

**Unit:- II (16 periods)****Introduction to Bipolar Transistor**

Concept of bipolar transistor, structure. PNP and NPN transistor, their symbols and mechanism of current flow. Current relations in transistor; concept of leakage current. CB, CE, CC configuration of the transistor. Input and output characteristics in CB and CE configurations. Transistor as a switch.

**Unit:- III (08 periods)****Transistor Biasing Circuits**

Concept of transistor biasing and selection of operating point. Need for stabilization of operating point. Different types of biasing circuits.

**Unit:- IV (08 periods)****Single Stage Transistor Amplifier**

Classification of Amplifier. Single stage transistor amplifier circuits.

**Unit:- V (16 periods)****FET, MOSFET & UJT**

Construction, operation and characteristics of JFET and its application. Construction, operation and characteristics of MOSFET in depletion and enhancement modes and its applications. C-MOS advantages and applications

## LIST OF PRACTICALS

1. Familiarization, identification and testing of active and passive components.
2. Familiarization with operations of different Electronics instruments like analog & digital Multi-meter, CRO, Signal generator, Regulated Power Supply
3. To plot V-I characteristics of PN Junction diode
4. To plot V-I characteristics of a Zener diode & observe its use as voltage regulator
5. To observe the wave shape of following rectifier circuit
  - Half wave rectifier
  - Full wave rectifier
  - Bridge rectifier
6. To plot the wave shape of full wave rectifier with
  - Shunt capacitor filter
  - Series capacitor filter
7. To plot input and output characteristics and calculate parameter of transistor in CE configuration
8. To plot input and output characteristics and calculate parameter of transistor in CB configuration
9. To plot V-I characteristics of FET Transistor

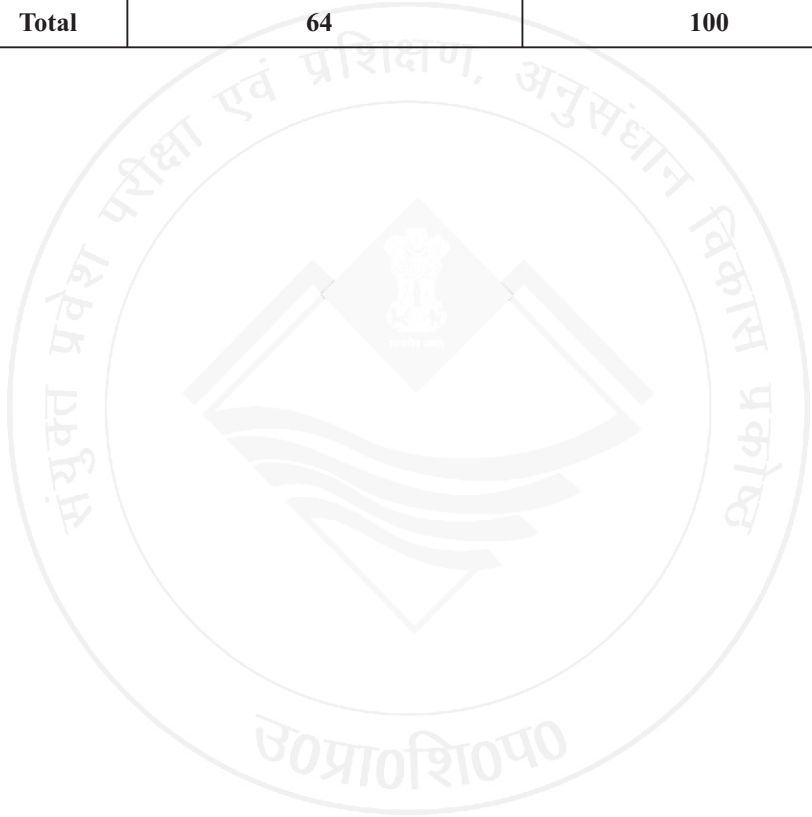
## RECOMMENDED BOOKS

1. Basic Electronics and Linear circuit by NN Bhargava and Kulshreshtha, Tata McGraw Hill, New Delhi.
2. Electronics Devices and circuits by D.C. Kulshreshtha; New Age Publishers, New Delhi.
3. Principle of Electrical and Electronics Engineering by VK Mehta; S Chand and Co. New Delhi.
4. Electronics Components and Materials by SM Dhi, Tata McGraw Hill, New Delhi.
5. Electronics Device and circuits by Millman and Halkias; McGraw Hill.
6. Principle of Electronics by Albert Paul Malvino; Tata McGraw Hill.
7. Electronics Devices and circuits-I by Naresh Gupta, Jyotesh Malhotra and Harish C. Saini, Eagle Prakashan, Jalandhar.
8. Electronics Devices .and circuits by Rama Reddy, Narosa Publishing House Pvt.Ltd. New Delhi.



## SUGGESTED DISTRIBUTION OF MARKS

Unit	Time Allotted (period)	Marks Allocation (%)
I	16	25
II	16	25
III	8	12
IV	8	13
V	16	25
<b>Total</b>	<b>64</b>	<b>100</b>



L	T	P
6	2	4

**Subject Code : 323001**

## **RATIONALE**

Sensing elements play a vital role in instrumentation. The type of sensing element needed depends upon the nature of instrumentation system used in the industry. Various types of transducers are available. The student is required to be familiar with the construction working principle and mounting procedure of different types of transducers.

## **DETAILED CONTENTS**

### **1. INTRODUCTION: (05 Periods)**

Definition of transducers.

Classification of Transducers:

- 1.1 Primary and secondary, mechanical devices as primary detectors.
- 1.2 Electrical transducer: Advantages, classification of electrical transducer, active and passive, analog and digital, Electrical phenomena used in transducers.

### **2. VARIABLE RESISTANCE TRANSDUCERS: (06 Periods)**

- 2.1 Principle of variable resistance transducers.
- 2.2 Potentiometers - Principle of working, construction, Linearity and sensitivity, Types, advantages and disadvantages of potentiometers, its applications.
- 2.3 Strain Gauges - Theory of strain gauges, gauge factor, types of strain gauges, material for strain gauges, temperature compensation in strain gauge, applications.
- 2.4 Thermistors - Construction, characteristics and applications of Thermistors.

### **3. VARIABLE INDUCTANCE TYPE TRANSDUCERS: (06 Periods)**

- 3.1 Principle of variable inductive transducers by variation of self inductance, mutual inductance and eddy current. Different types of transducers, working on above principles.
- 3.2 L.V.D.T.: Construction, theory, linearity and sensitivity advantages, disadvantages and uses.

**4. CAPACITIVE TRANSDUCERS:****(06 Periods)**

Principle of capacitive transducers, Capacitive transducers using change in distance between plates, differential arrangement for improving sensitivity, capacitive transducers constant, application fo capacitive transducers. Level measurement with calibration using suitable formula.

**5. OPTICAL TRANSDUCERS:****(07 Periods)**

Theory of photo emission, classification of photo electric devices, vacuum photo tube, Gas photo tube, Photo multiplier tube, photo conductive cell, photo diode, photo transistor and their applications. Optical Fibre sensors.

**6. PIEZO ELECTRIC TRANSDUCERS:****(07 Periods)**

Theory of piezoelectric effect, mode of operation and properties of piezoelectric crystal, Equivalent circuit of piezoelectric transducer and applications of piezo electric transducers.

**7. VISCOSITY MEASUREMENTS:****(07 Periods)**

Definition of viscosity, measurement of viscosity by capillary type and rotational type, cone and plata viscometer, two float viscometer, rheometers.

**8. PH ANALYSER:****(10 Periods)**

Definition and importance of PH value, better solution, reference and standard electrodes for PH measurement Hydrogen calomel and Glass electrode PH-meter-direct reading type and indirect reading type.

**9. CONDUCTIVITY ANALYSER:****(10 Periods)**

Definition of conductivity, conductance, Sp-conductance and equivalent conductance-Alternating current conduction. Measurement of conductivity-conductivity cell, cell constant applications.

**TRANSDUCERS AND APPLICATION LAB**

1. To draw the input output characteristics of linear variable differential transducers and also study its details.
2. To fabricate a circuit using linear variable differential transducer for the measurement of non-electrical quantity.

3. To draw I/o characteristics of the following photo transducers.
  - A. LDR
  - B. Photo diode
  - C. Photo Transistor
  - D. Opto copler

and fabricate an application circuit using photo transducers as a switch and as a light intensity meter.
4. To fabricate an application circuit using given temperature transducer like thermistors and I. C. sensors.
5. To fabricate an application circuit using capacitive transducers for measurement of level.
6. To draw I/o characteristics of strain gauge and study working of weighing M/c using strain gauge load cell.
7. To measure conductivity of a given solution using conductivity meter and calibrate it.
8. To measure PH of given acetic and alkaline solution using a PH meter and standardize it, using buffer solutions.
9. To measure density of given solution using simple hydrometer

#### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (period)	Marks Allocation (%)
1	5	5
2	6	10
3	6	10
4	6	10
5	7	10
6	7	10
7	7	10
8	10	15
9	10	20
<b>Total</b>	<b>64</b>	<b>100</b>

# ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS

L	T	P
4	-	2

**Subject Code : 083001**

## **RATIONALE**

A diploma holder in Instrumentation control Engineering will be involved in maintenance, repair and production of equipments and systems. In addition, he may be required to procure, inspect and test electrical and electronic engineering materials. Knowledge of various types of materials will be needed in order to execute the above mentioned functions. He may also have to decide for an alternative when a particular material is either not readily available in the market or its cost becomes prohibitive.

## **DETAILED CONTENTS**

### **Unit:- I (03 periods)**

Classification of materials into conducting, semi conducting and insulating materials through a brief reference to their atomic structure and energy bands.

### **Unit:- II (12 periods)**

Conducting Materials and their application: Introduction, Resistance and factors affecting it such as alloying and temperature etc. Classification of conducting material as low resistivity and high resistivity materials, Low resistance materials  
Copper- General properties as conductor: Resistivity, temperature coefficient, density, mechanical properties of hard-drawn and annealed copper, corrosion, contact resistance. Application in the field of electrical engineering Aluminum - General properties as conductor: Resistivity, temperature coefficient, density, mechanical properties of hard and annealed aluminum, solder ability, contact resistance. Applications of aluminum in the field of electrical engineering Steel - General properties as conductor: Resistivity, corrosion, temperature coefficient, density, mechanical properties, solder ability, Applications in the field of electrical engineering Introduction to bundle conductors and its applications Low resistivity copper alloys: Brass, Bronze (cadmium and Beryllium), and their practical applications with reasons for the same Applications of special metals e.g. Silver, Gold, and Platinum etc. High resistivity materials and their applications e.g., manganin, constantin, nichrome, mercury, platinum, carbon and tungsten, Tantalum. Superconductors and their applications.

### **Unit:- III (05 periods)**

Semi-conducting Materials and their applications: Semi conducting material such as Germanium, Silicon, Carbon-their atomic structure/application/against, pure and

impure semi conductors and their use for making electronic devices. Material used for special purpose semiconductor, diode, contacts, power transistor, substrate, integrated circuits and power handling devices.

#### **Unit:- IV**

**(12 periods)**

Insulating materials; General Properties and their applications: Electrical Properties Volume resistivity, surface resistance, dielectric loss, dielectric strength (breakdown voltage) dielectric constant. Physical Properties Hygroscopicity, tensile and compressive strength, abrasion resistance, brittleness. Thermal Properties Heat resistance, classification according to permissible temperature rise. Effect of overloading on the life of an electrical appliance, increase in rating with the use of insulating materials having higher thermal stability, Thermal conductivity, Electro-thermal breakdown in solid dielectrics. Chemical Properties Solubility, chemical resistance, weather ability. Mechanical properties, mechanical structure, tensile structure

#### **Unit:- V**

**(13 periods)**

Insulating Materials and their applications. Plastics a. Definition and classification b. Thermosetting materials: Phenol-formaldehyde resins (i.e. Bakelite) amino resins (urea formaldehyde and melamine - formaldehyde), epoxy resins - their important properties and applications c. Procedure of preparation of plastic (PVC) d. Thermoplastic materials: Polyvinyl chloride (PVC), polyethylene, silicones, their important properties and applications.

Natural insulating materials, properties and their applications.

- a. Mica and Mica products
- b. Asbestos and asbestos products
- c. Ceramic materials (porcelain and steatite)
- d. Glass and glass products
- e. Cotton
- f. Silk
- g. Paper (dry and impregnated)
- h. Rubber, Bitumen
- i. Mineral and insulating oil for transformers switchgear capacitors, high voltage insulated cables, insulating varnishes for coating and impregnation
- j. Enamels for winding wires
- k. Glass fibre sleeves

Gaseous materials; Air, Hydrogen, Nitrogen, SF<sub>6</sub> their properties and applications

#### **Unit:- VI**

**(19 periods)**

Magnetic Materials: Introduction - ferromagnetic materials, permeability, B-H

curve, magnetic saturation, hysteresis loop including coercive force and residual magnetism, concept of eddy current and hysteresis loss, curie temperature, magnetostriction effect, method of reduction of eddy current loss and hysteresis loss

### Soft Magnetic Materials

- a) Alloyed steels with silicon: High silicon, alloy steel for transformers, low silicon alloy steel for electric rotating machines
- b) Cold rolled grain oriented steels for transformer, Non-oriented steels for rotating machine
- c) Nickel-iron alloys
- d) Soft Ferrites

Hard magnetic materials - Tungsten steel, chrome steel, hard ferrites and cobalt steel, their applications Special Materials, Thermocouple, bimetals, leads soldering and fuses material, mention their applications. Introduction of various engineering materials necessary for fabrication of electrical machines such as motors, generators, transformers etc

### LIST OF PRACTICALS

1. A market survey of different Electrical and Electronics materials available in market will be conducted by students. They will submit a report, which will include names, types, specifications, identification, testing of components, manufacturing details and related cost.
2. Case study/data manuals of different wires/cables/fuses/sockets etc. A report will be submitted by the students.

### INSTRUCTIONAL STRATEGY

The teacher should bring different materials, electronic components and devices in the class while taking lectures and explain and make students familiar with them. Also he may give emphasis on practical applications of these devices and components in the field. In addition, the students should be given exercises on identification of materials used in various electronic gadgets etc .and be encouraged to do practical work independently and confidently

### RECOMMENDED BOOKS

1. Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi Electronic
2. Components and Materials by Grover and Jamwal, Dhanpat Rai and Co., New Delhi Electrical
3. Engineering Materials by Sahdev, Uneek International Publications

4. Electronic Components and Materials by SM Dhir, Tata Mc Graw Hill, New Delhi
5. Electrical Engineering Materials by PL Kapoor, Khanna Publishers, New Delhi
6. Electrical and Electronics Engineering Materials BR Sharma and Others, Satya Parkashan, New Delhi
7. Electrical and Electronics Engineering Materials DR Arora, Ishan Publications, Ambala City Electrical Engineering Materials by Rakesh Dogra, SK Kataria and Sons, NEW Delhi.

### SUGGESTED DISTRIBUTION OF MARKS

Unit	Time Allotted (period)	Marks Allocation (%)
I	03	5
II	12	18
III	05	09
IV	12	18
V	13	20
VI	19	30
<b>Total</b>	<b>64</b>	<b>100</b>



<b>L</b>	<b>T</b>	<b>P</b>
<b>4</b>	<b>1</b>	<b>4</b>

**Subject Code : 093003****RATIONALE**

Computer plays a very vital role in present day life, more so, in the professional life of Diploma engineers. In order to enable the students to use the computers effectively in problem solving, this course offers the modern programming language C along with exposure to various engineering applications of computers. The knowledge of C language will be reinforced by the practical exercises and demonstration of application software in the field of Electrical Engineering during the course of study. Introduction to data base management system is also a very significant field with vast employment potential.

**DETAILED CONTENTS****1. Algorithm and Program Development (12 period) + (04 T)**

- Steps in development of a program.
- Flow-charts, algorithm development.
- Introduction to various computer languages.
- Concept of interpreter, compiler, high level language(HLL), machine language (ML) and Assembly Language.

**2. Program Structure (C Programming) (40 period) + (24 T)**

- History of 'C', data types, input output statements, arithmetic and logical operations, data assignments, precedence and associativity.
- I/O statements - Assignment, Variables, arithmetic operation- their precedence, data types standard I/O function, formulated I/O.
- Control Statements - Logical and relational operators; if-else, while, do-while, for loops, breaks, switch statements.
- Functions - Function declaration, parameter passing- by value, storage classes (Local, Global and Static variables), standard library functions.
- Arrays - Single and multi dimensional arrays, character arrays.
- Pointers - To various data types, pointers in parameters passing, pointers to function.
- Structures - Definition of a structure, pointer to structure, union and array of structure.

- Strings - String processing, functions and standard library function
- Data files - File handling and manipulation, file reading and writing, Binary and ASCII files, file records using standard function type mouse

## **LIST OF PRACTICALS**

1. Programming exercise on executing a C Program.
2. Programming exercise on editing a C program.
3. Programming exercise on defining variables and assigning values to variables.
4. Programming exercise on arithmetic and relation operators.
5. Programming exercise on arithmetic expressions and their evaluation.
6. Programming exercise on reading a character.
7. Programming exercise on writing a character.
8. Programming exercise on formatting input using print.
9. Programming exercise on formatting output using scan.
10. Programming exercise on simple IF statement.
11. Programming exercise on IF... ELSE statement.
12. Programming exercise on SWITCH statement.
13. Programming exercise on GOTO statement.
14. Programming exercise on DO-WHILE statement.
15. Programming exercise on FOR statement.
16. Programming exercise on one dimensional arrays.
17. Programming exercise on two dimensional arrays.

## **RECOMMENDED BOOKS**

1. Programming in C by Balagurusamy, Tata McGraw Hill Education Pvt Ltd, New Delhi
2. Programming in C by Gottfried, Tata McGraw Hill Education Pvt Ltd, New Delhi
3. Programming in C by Kerning Lan and Richie; Prentice Hall of India, New Delhi
4. Let us C- YashwantKanetkar, BPB Publications, New Delhi
5. Vijay Mukhi Series for C and C++
6. Programming in C by R Subburaj, VikasPublishing House Pvt. Ltd., Jangpura, New Delhi
7. Programming in C by Kris A Jansa, Galgotia Publications Pvt. Ltd., Daryaganj, New Delhi
8. Programming in C by BP Mahapatra, Khanna Publishers, New Delhi
9. Elements of C by MH Lewin, Khanna Publishers, New Delhi

10. The Complete Reference to Visual Basic 6, by Noel Jerke, Tata McGraw Hill Education Pvt Ltd, New Delhi
11. Web site [www.Beyondlogic.org](http://www.Beyondlogic.org)
12. Pointers in C by YashwantKanetkar, BPB Publishers New Delhi
13. Programming in Applications by Chandershekhar, Unique International Publications, Jalandhar
14. The essentials of Computer Organizing and Architecture by Linda Null and Julia Labur, Narosa Publishing House Pvt. Ltd., New

### SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (period) + Tutorial	Marks Allocation (%)
1	16	25
2	64	75
<b>Total</b>	<b>80</b>	<b>100</b>