

## 5.1 EMPLOYABILITY SKILLS – I

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### RATIONALE

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. Our diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject is to prepare students for employability in job market and survive in cut throat competition among professionals.

### DETAILED CONTENTS

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|----|--|----------|
| 1. | Writing skills                                   | (08 hrs) |
|    | i) Official and business correspondence          |          |
|    | ii) Job application - covering letter and resume |          |
|    | iii) Report writing - key features and kinds     |          |
| 2. | Oral Communication Skills                        | (20 hrs) |
|    | i) Giving advice                                 |          |
|    | ii) Making comparisons                           |          |
|    | iii) Agreeing and disagreeing                    |          |
|    | iv) Taking turns in conversation                 |          |
|    | v) Fixing and cancelling appointments            |          |
| 3. | Generic Skills                                   | (04 hrs) |
|    | i) Stress management                             |          |
|    | ii) Time management                              |          |
|    | iii) Negotiations and conflict resolution        |          |
|    | iv) Team work and leadership qualities           |          |

## 5.2 ELECTRICAL MACHINES-II

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### RATIONALE

Electrical machines is a subject where a student will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc. After studying this subject, an electrical diploma holder must be competent to repair and maintain these machines and give suggestions to improve their performance. Explanation of practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications

### DETAILED CONTENTS

- |      |   |          |
|------|---|----------|
| 1.   | Synchronous Machines  | (24 hrs) |
| 1.1  | Main constructional features of synchronous machine including commutator and brushless excitation system                                  |          |
| 1.2  | Generation of three phase emf   |          |
| 1.3  | Production of rotating magnetic field in a three phase winding  |          |
| 1.4  | Concept of distribution factor and coil span factor and emf equation<br>Armature reaction at unity, lag and lead power factor             |          |
| 1.5  | Operation of single synchronous machine independently supplying a load - Voltage regulation by synchronous impedance method               |          |
| 1.6  | Need and necessary conditions of parallel operation of alternators<br>Synchronizing an alternator (Synchroscope method) with the bus bars |          |
| 1.7  | Operation of synchronous machine as a motor –its starting methods   |          |
| 1.8  | Effect of change in excitation of a synchronous motor   |          |
| 1.9  | Concept and Cause of hunting and its prevention   |          |
| 1.10 | Rating and cooling of synchronous machines  |          |
| 1.11 | Applications of synchronous machines (as an alternator, as a synchronous condenser)   |          |
| 2.   | Induction Motors  | (16 hrs) |
| 2.1  | Salient constructional features of squirrel cage and slip ring 3-phase induction motors   |          |
| 2.2  | Principle of operation, slip and its significance   |          |
| 2.3  | Locking of rotor and stator fields  |          |
| 2.4  | Rotor resistance, inductance, emf and current   |          |
| 2.5  | Relationship between copper loss and the motor slip   |          |

- 2.6 Power flow diagram of an induction motor
  - 2.7 Factors determining the torque
  - 2.8 Torque-slip curve, stable and unstable zones
  - 2.9 Effect of rotor resistance upon the torque slip relationship
  - 2.10 Double cage rotor motor and its applications
  - 2.11 Starting of 3-phase induction motors, DOL, star-delta, auto transformer
  - 2.12 Causes of low power factor of induction motors
  - 2.13 Testing of 3-phase motor on no load and blocked rotor test and to find efficiency
  - 2.14 Speed control of induction motor
  - 2.15 Harmonics and its effects, cogging and crawling in Induction Motors.
3. Fractional Kilo Watt (FKW) Motors (16 hrs)
- 3.1 Single phase induction motors; Construction characteristics and applications
  - 3.2 Nature of field produced in single phase induction motor
  - 3.3 Split phase induction motor
    - 3.3.1 Capacitors start and run motor
    - 3.3.2 Shaded pole motor
    - 3.3.3 Reluctance start motor
  - 3.4 Alternating current series motor and universal motors
  - 3.5 Single phase synchronous motor
    - 3.5.1 Reluctance motor
    - 3.5.2 Hysteresis motor
4. Special Purpose Machines (8 hrs)
- Construction and working principle of linear induction motor, stepper motor, servomotor, submersible motor, introduction to energy efficient motors.

### LIST OF PRACTICALS

1. Demonstration of revolving field set up by a 3-phase wound stator
2. To plot relationship between no load terminal voltage and excitation current in a synchronous generator at constant speed
3. Determination of the relationship between the voltage and load current of an alternator, keeping excitation and speed constant
4. Determination of the regulation and efficiency of alternator from the open circuit and short circuit test

5. Synchronization of polyphase alternators and load sharing
6. Determination of the effect of variation of excitation on performance of a synchronous motor
7. Study of ISI/BIS code for 3-phase induction motors
8. Perform at least two tests on a 3- phase induction motor as per BIS code
9. Determination of efficiency by (a) no load test and blocked rotor test on an induction motor (b) direct loading of an induction motor (refer BIS code)
10. Determination of effect of rotor resistance on torque speed curve of an induction motor
11. To study the effect of a capacitor on the starting and running of a single-phase induction motor by changing value of capacitor and also to reverse the direction of rotation of a single phase induction motor

### INSTRUCTIONAL STRATEGY

Teacher should lay-emphasis on development of understanding amongst students about basic principles of operation and control of electrical machines. This may be achieved by conducting quiz tests and by giving home assignments. The teachers should also conduct laboratories classes themselves encouraging each should to perform with his/her own hands and draw conclusions.

### RECOMMENDED BOOKS

1. Electrical Machines by SK Bhattacharya, Tata Mc Graw Hill, New Delhi
2. Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar
3. Electrical Machines by Nagrath and Kothari, Tata Mc Graw Hill, New Delhi  
Electrical Engineering by JB Gupta, SK Kataria and sons, New Delhi
4. Electrical Machines by Samarjit Ghosh, Pearson Education (Singapore) Pte, Ltd.  
482, FIE Patparganj, Delhi 110092
5. Electrical Machines by DR Arora, Ishan Publications, Ambala City.

### SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1	Synchronous Machines	24	40
2	Induction Motors	16	25
3	Fractional Kilo Watt Motors	16	25
4	Special Purpose Machines	8	10
	<b>Total</b>	<b>64</b>	<b>100</b>

## 5.3 ELECTRICAL POWER STATIONS

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### RATIONALE

The majority of the polytechnic passouts who get employment in State Electricity Boards / Power Corporations have to perform various activities in the field of generation, transmission and distribution of electrical power. The range of these activities vary from simple operation and maintenance of equipment, lines, fault location, planning and designing of simple distribution schemes, executive and supervisory control in power stations, transmission and distribution networks in addition to administrative jobs including public relations. They should also be made aware of recent developments, current practices in the electricity departments, corporations and boards to keep them abreast with modern techniques in transmission and distribution of electrical power.

### DETAILED CONTENTS

1. Introduction ( 06 hrs)
  - Main resources of energy, conventional and non-conventional
  - Different types of power stations, thermal, hydro, gas, diesel and nuclear power stations. Flow diagrams and brief details of their operation, comparison of the generating stations on the basis of capital cost, running cost, site, starting, operations and maintenance etc.
  - General terminology of power plant like peak load, base load, loads factor, power etc.
  
2. Hydro Power Plants ( 25 hrs)
  - Selection of site, features of hydro power plant, plant layout
  - Classifications of hydro power plants
  - Hydraulic Turbines and their classifications
  - Elements of hydropower plants such as diversion structure – (Dams, Barrages, Trench Weir, Trash Rack, Intake Gates, HRT, Penstock Gates, Penstock, Filling Valve, MIVs, Turbine Parts, Scroll Case, Draft Tube, Tail Race, Gates, De-silting System, Surge Tank, Turbine casing, Distributor piping, alternators, Excitation System.
  - Thrust bearing, guide bearings, governors, servo motor for oil control of guide vanes, Types of Runners.
  - Advantages and disadvantages of hydro power plant. Challenges faced by hydropower plant. (silt, seepage, environment) : Silt Preventive Techniques
  - Introduction to micro hydro power plant and mini hydro power plant
  - Concept of Multipurpose Projects like Bhakra Dam, Surface Power Plants, Under - Ground Power Plants
  - Concept in Brief of: Hydro- Turbine and its auxiliaries, generator and its auxiliaries, L.T. system, d.c. system, scada system, switchyard and yard equipment, cables, generator, lighting (a.c and emergency) etc.

3. Thermal Power Plant ( 22 hrs)
- Selection of site for thermal power plant
  - Block diagram of thermal power plant
  - Concept of Sub – Critical and Super Critical Thermal and Power Plants
  - Types of fuels, solid, liquid and gaseous. Fuel handling layout and its methods, stages in coal handling storage, Concept of Gross Calorific Value (GCV) and Ultimate Heat Rate Value (UHV)
  - Elements of thermal power plant such as alternator and its excitation boiler (fire tube and water tube) turbines, condensers, cooling tower, water treatment chambers, conveyers for fuel.
  - Study of important topics related to thermal power plant such as: super heater economizer, ash precipitators, water pre-heater, air pre heater
  - Fuel burning; Coal - its grading, pulverization, coal pulverizers, pulverized fuel burning
  - Coal Handling and Ash Handling Systems: introduction, ash disposal management and its utilization
  - Pit Head Thermal Plant - Concept
  - Advantages and disadvantages of thermal power plants
- 4 Nuclear Power Plants (15 hrs)
- Nuclear fuel - Fission and Fusion process
  - Relation between energy and mass
  - Controlled Chain reaction
  - Nuclear Reactors and its elements such as Fuel Rods, coolants, biological values of reactors, moderators etc.
  - Classification of nuclear reactors
  - Site selection, safety measures
  - Nuclear Power Plant in India
  - Future of nuclear power plant
  - Steam generation in nuclear power
  - Plants (block diagram)
  - Advantages and disadvantages
  - Concept of Synchronization and Auto-Synchronization
5. Comparison of Hydro, Thermal and Nuclear Power Plants: (06 hrs)
- Comparing power stations on the basis of site,
  - Capital cost, running cost, starting, operations and maintenance, fuel cost etc.
  - Idea of daily, weekly, monthly, quarterly, ½ yearly, yearly, major rehauling, maintenance – schedules of power plants

6 Economics of Generations (06 hrs)

- Fixed and running cost, load estimation, load curves, demand factor, load factor, diversity factor, power factor and their effect on cost of generation, simple problems there on.
- Base load and peak load power stations, inter-connection of power stations and its advantages, concept of regional and national grid.
- Tariff : concept of tariffs, types of tariffs – block rate, flat rate maximum demand and two part tariff, simple problems

**Note:** Visit to:

- 1) Thermal Power Plant – (Preferably in Haryana)
- 2) Hydro Power Plant – (Preferably in Punjab, UK, HP) (Surface and Underground)
- 3) Nuclear Power Plant – (Wherever possible)

### **INSTRUCTIONAL STRATEGY**

Since this is a descriptive and practice oriented subject, it is suggested that visits to different types of power generating stations and substations including grid stations be arranged and explained various equipment, accessories and components to the students before the actual class room teaching and make them familiar with the equipment and accessories installed there. There should be at least 3 visits during the semester. The students may be asked to prepare notes while on visit, submit the report and give seminar. In addition, viva-voce be conducted to evaluate the knowledge gained during the field visit.

### **RECOMMENDED BOOKS**

1. Power Plant Engineering by Dr. PC Sharma, SK Kataria & Sons, Darya Ganj, N. Delhi.
2. Electrical Power System and Analysis by CL Wadhwa, 3<sup>rd</sup> edition, New Age International Publishers, New Delhi
3. Substation Design and Equipment by P.S. Satnam and PV Gupta, Dhanpat Rai & Sons, New Delhi
4. Electrical Power –I by SK Sahdev, Uneek Publications, Jalandhar
5. Electrical Power System by VK Mehta, S Chand and Co., New Delhi
6. Electrical Power System by JB Gupta, SK Kataria and Sons, New Delhi
7. Electrical Power Distribution System by AS Pabla, Tata McGraw Hill, New Delhi
8. Electrical Power System by S Channi Singh, Tata McGraw Publishing Co. New Delhi

**SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER**

<b>Sr. No</b>	<b>Topic</b>	<b>Time Allotted (hrs)</b>	<b>Marks Allocation (%)</b>
1	Introduction	06	10
2	Hydro Power Plants	25	30
3	Thermal Power Plant	22	25
4	Nuclear Power Plants	15	15
5	Comparison of Hydro, Thermal and Nuclear Power Plants	06	10
6	Economics of Generations	06	10
	<b>Total</b>	<b>80</b>	<b>100</b>



## 5.4 INDUSTRIAL ELECTRONICS AND CONTROL OF DRIVES

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### RATIONALE

Industrial electronics plays a very vital role in the field of control engineering specifically in the modern industries as they mostly use electronic controls, which are more efficient, effective and precise as compare to the conventional methods. The old magnetic and electrical control schemes have all become obsolete. Electrical diploma holder many times has to maintain the panels used in the modern control process. Therefore, the knowledge of components like thyristors and other semiconductor devices used in such control panels is must for them in order to supervise the work efficiently and effectively. Looking in to usefulness and importance of the subject this has been incorporated in the curriculum.

### DETAILED CONTENTS

1. Introduction to SCR (16 hrs)
  - 1.1. Construction and working principles of an SCR, two transistor analogy and characteristics of SCR
  - 1.2. SCR specifications and rating
  - 1.3. Construction, working principles and V-I characteristics of DIAC, TRIAC and Quadriac
  - 1.4. Basic idea about the selection of heat sinks for SCR and TRIACS
  - 1.5. Methods of triggering a Thyristor. Study of triggering circuits
  - 1.6. UJT, its Construction, working principles and V-I characteristics, UJT relaxation oscillator
  - 1.7. Commutation of Thyristors (Concept)
  - 1.8. Series and parallel operation of Thyristors
  - 1.9. Applications of SCR, TRIACS and Quadriac such as light intensity control, speed control of DC and universal motor, fan regulator, battery charger etc.
  - 1.10.  $dv/dt$  and  $di/dt$  protection of SCR.
  
2. Controlled Rectifiers (10 hrs)
  - 2.1 Single phase half wave controlled rectifier with resistive load and inductive load, concept of free wheeling diode.
  - 2.2 Single phase half controlled full wave rectifier (No mathematical derivation)
  - 2.3 Single phase fully controlled full wave rectifier bridge (Workshops only)
  - 2.4 Single phase full wave centre tapped rectifier (Workshops only)
  - 2.5 Three phase full wave half controlled bridge rectifier (Workshops only)
  - 2.6 Three phase full wave fully controlled bridge rectifier (Workshops only)

3. Inverters, Choppers, Dual Converters and Cyclo Converters (18 hrs)
  - 3.1 Inverter-introduction, working principles, voltage and current driven series and parallel inverters and applications
  - 3.2 Choppers-introduction, types of choppers and their working principles and applications
  - 3.3 Dual converters-introduction, working principles and applications
  - 3.4 Cyclo-converters- introduction, types, working principles and applications
  
4. Thyristor Control of Electric Drives (15 hrs)
  - 4.1 DC drives control (Basic Concept)
  - 4.2 Half wave drives
  - 4.3 Full wave drives
  - 4.4 Chopper drives
  - 4.5 AC drives control
  - 4.6 Phase control
  - 4.7 Variable frequency a.c. drives
  - 4.8 Constant V/F application
  - 4.9 Voltage controlled inverter drives
  - 4.10 Constant current inverter drives
  - 4.11 Cyclo convertors controlled AC drives
  - 4.12 Slip control AC drives
  
5. Uninterrupted Power Supplies (5 hrs)
  - 5.1 UPS, Stabilizers, SMPS
  - 5.2 UPS online, off line
  - 5.3 Storage devices (batteries) and their maintenance

### LIST OF PRACTICALS

1. To draw V-I characteristics of an SCR
2. To draw V-I characteristics of a TRIAC
3. To draw V-I characteristics of a DIAC
4. To draw uni-junction transistor characteristics
5. Observe the output wave of an UJT relaxation oscillator
6. Observe the wave shape across SCR and load of an illumination control circuit
7. Fan speed regulator using TRIAC Quadriac (fabrication of this circuit)
8. Speed-control of a DC shunt motor or universal motor
9. To observe the output wave shape on CRO of a Single phase half controlled full wave rectifier
10. Single phase controlled rectifier
11. Use of Variable Frequency Drive for running a 3 phase Induction motor

## INSTRUCTIONAL STRATEGY

The teachers may encourage students to perform practical simultaneously for better understanding of the subjects and verification of theoretical concepts. The various components must be shown to the students for identification and also tested. Practical applications of the various circuits and devices should be discussed in the class. The available video films on the subject must be shown to the students.

## BOOKS RECOMMENDED

1. Industrial Control Electronics. John Webb, Kevin Greshock, Maxwell, Macmillan International editions.
2. Fundamentals of Power Electronics by S Rama Reddi, Narosa Publishing House Pvt. Ltd, New Delhi
3. Power Electronics, Circuits Devices and Applications by Mohammad H. Rashid
4. Power Electronics by PC Sen
5. Power Electronics by Dr. PS Bhimbra, Khanna Publishers, New Delhi
6. Industrial Electronics & Control by SK Bhattacharya & S Chatterji, New Age international Publications(P) Ltd, New Delhi
7. Industrial Electronics and Control of Drives by SK Sahdev, Uneek Publication, Jalandhar
8. Industrial Power Electronics by JC Karhava, King India Publication,
9. Fundamentals of Electrical Drives by Gopal K Dubey, Narosa Publishing House Pvt. Ltd, New Delhi
10. Power Electronics and Controls by Samir K Datta, Prentice Hall of India, New Delhi

## SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1	Introduction of SCR	16	25
2	Controlled Rectifiers	10	15
3	Inverters, Choppers, Dual Converters and cyclo converters	18	30
4	Thyristor Control of Electric Drives	15	20
5	Uninterrupted power supplies	5	10
	<b>Total</b>	<b>64</b>	<b>100</b>

## 5.5 DIGITAL ELECTRONICS AND MICROPROCESSORS

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### RATIONALE

Digital electronics has made extremely rapid advances in the last five decades. It has important applications in communication entertainment, instrumentation, control, automation etc. Thus it appears that there is no end to its usefulness. In fact, the light and the new world belongs to it. So it is necessary to give the knowledge of digital electronics to the electrical students. Microprocessor is one of the most exciting technological advancement among the semiconductor devices in recent times. It has a tremendous impact on the Industrial processes due to its high reliability, flexibility and control capacity both at the design and the Implementation stages. The decreasing cost with increasing facilities act as catalysts in widening their scope of applications.

### DETAILED CONTENTS

**Note:** Question paper will be set 70% from Part-A and 30% from Part-B.

#### (Part-A)

1. Number Systems (8 hrs)
  - 1.1 Decimal, binary, octal, hexa-decimal BCD and ASCII code number systems and their inter-conversion
  - 1.2 Binary and Hexadecimal addition, subtraction and multiplication
  - 1.3 1's and 2's complement methods of addition/subtraction
  
2. Gates (6 hrs)
 

Definition, symbol and truth tables for inverter, OR, AND, NAND, NOR and X-OR exclusive-AND gates
  
3. Boolean Algebra (8 hrs)
  - 3.1 Boolean Relations and their applications
  - 3.2 DeMorgan's Theorems
  - 3.3 K-Map upto four variables
  
4. Combinational Circuits (8 hrs)
  - 4.1 Half adder, Full adder
  - 4.2 Encoder, Decoder
  - 4.3 Multiplexer/Demultiplexer
  - 4.4 Display Devices (LED, LCD and 7-segment display)
  
5. Flip-Flops (8 hrs)
  - 5.1 J-K Flip-Flop
  - 5.2 R-S Flip-Flop
  - 5.3 D-Type Flip-Flop
  - 5.4 T-Type Flip-Flop
  - 5.5 Applications of Flip-Flops

6. Introduction to Shift Registers and Counters (6 hrs)
7. A/D and D/A Converters (6 hrs)
  - 7.1 A/D converter (Counter ramp, successive approximation method of A/D Conversion)
  - 7.2 D/A converters (Binary weighted, R-2R D/A Converter)
8. Semi-conductor Memories (6 hrs)  
Types, merits, demerits, and applications

### (PART-B)

9. Microprocessor (24 hrs)
  - 9.1 Study of 8085 microprocessor architecture, pin configuration, bus organisation, registers flags, interrupts
  - 9.2 Instruction set of 8085 microprocessor, addressing modes, instruction format. Writing some simple assembly language programmes including debugging. Use of stacks and sub-routines in programming
  - 9.3 Interfacing and data transfer between peripheral, I/O and microprocessor
  - 9.4 Study of peripheral chips – 8251, 8155, 8051, 8257, 8259
  - 9.5 Introduction of 16-bit, 32-bit microprocessor, their advantages over 8-bit microprocessor

### LIST OF PRACTICALS

1. Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, X-OR gates
2. Construction of Half Adder/Full Adder using gates
3. To verify the truth table for R-S and JK flipflop
4. Construction and testing of any counter
5. Verification of operation of a 8-bit D/A Converter
6. Writing assembly language programme using numemoanics and test them on  $\mu$ P Kit (any three)
  - a) Addition of two 8-bit numbers
  - b) Subtraction of two 8-bit numbers
  - c) Multiplication of two 8-bit numbers
  - d) Division of two 8-bit numbers
  - e) Finding average of N given integer
  - f) Finding maximum number out of three given numeric
7. Assembly language programming for different applications on 8051 microcontroller

## INSTRUCTIONAL STRATEGY

The digital systems in microprocessors have significant importance in the area of electronics. Adequate competency needs to be developed by giving sufficient practical knowledge in microprocessors (programming as well as interfacing), A/D, D/A converters and other Topics. Help may be taken in the form of charts, simulation packages to develop clear concepts of the subject. More emphasis while teaching this subject should be given on practical aspects along with the theory input. Lots of programming exercises may be given to the students. Mini projects based on microprocessor operations may be identified and given to students as assignments.

## RECOMMENDED BOOKS

1. Modern Digital Electronics by RP Jain, Tata McGraw Hill, Education Pvt. Ltd. New Delhi
2. Digital Principles and Electronics by Malvino and Leach, Tata McGraw Hill, New Delhi
3. Digital Electronics by SN Ali
4. Digital Electronics by Rajive Sapra, Eshan Publications, Ambala City
5. Digital Fundamentals by Floyd and Jain, Pearsons Education (Singapore) Pte Ltd Patparganj, Delhi 110092
6. Digital Electronics by Jamwal, Dhanpat Rai and Co. New Delhi
7. Microprocessors Architecture, Programming and Application with 8085/8080A, Ramesh S Gaonkar, Wiley Eastern Ltd. New Delhi
8. Introduction to Microprocessors by Aditya Mathur, TMH Publishing Co., New Delhi
9. Microprocessors and Microcontrollers by BP Singh, Galgotia Publications, New Delhi
10. Digital Systems by Sanjay K Bose, Wiley Eastern(P) Ltd. New Delhi
11. Digital Systems : principles and Applications by RJ Tocci, Prentice Hall of India, New Delhi
12. Digital Integrated Circuits by AK Gautam, SK Kataria and Sons, New Delhi
13. Microprocessors(The 8086 and 8088) by AK Gautam and A Jaiswal; SK Kataria and Sons, New Delhi

## SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1	Number Systems	8	10
2	Gates	6	7
3	Boolean Algebra	8	10
4	Combinational Circuits	8	10
5	Flip-Flops	8	10
6	Shift Registers and Counters	6	8
7	A/D and D/A Converters	6	7
8	Semi-conductor Memories	6	8
9	Microprocessor	24	30
	<b>Total</b>	<b>80</b>	<b>100</b>

## 5.6 MINOR PROJECT WORK

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Minor project work aims at exposing the students to industrial/field practices so as to have an appreciation of size, scale and type of operations; and work culture in the industries. Also the students will be able to comprehend concepts, principles and practices taught in the classroom and their application in solving field/industrial problems.

Depending upon the interests of the students, location of the organization the student may be sent to:

- 1) Study various types of generation and generating plants
- 2) Learn about various operations/processes being carried out at power generating station
- 3) Know about various measuring instruments and test equipment
- 4) Study the plant layout and material handling in power plants
- 5) Know about various quality control techniques and safety measures adopted
- 6) Disassembly and assembly of motors, transformers available in the laboratory
- 7) Study the wiring in the control panels
- 8) Study various types of materials being used
- 9) Handling of wastes at power stations

For effective planning and implementation of this practical training, it is suggested that polytechnic should:

- a) Identify power generating plants where students will be sent for visits.
- b) Prepare a workbook (which can be used by students) for guiding students to perform definite study/task during the practical training.
- c) Identify teachers who would supervise the students and provide guidance during practical training.

This practical training of 3-4 weeks duration will carry 100 marks. 50 marks will be given by industrial/field supervisors and 50 marks by the teacher supervising this training. The components of evaluation will include the following:

The components of evaluation will include the following:

- |    |                                   |     |
|----|-----------------------------------|-----|
| a) | Punctuality and regularity        | 15% |
| b) | Initiative in learning new things | 15% |
| c) | Relationship with others          | 15% |
| d) | Project report                    | 40% |
| e) | Seminar and Viva Voce             | 15% |

## 5.7 ENVIRONMENTAL EDUCATION

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### RATIONALE

Education about environment protection is a must for all the citizens. In addition, a diploma holder must have knowledge of different types of pollution caused by industries and construction activities so that he may help in balancing the eco system and controlling pollution by adopting pollution control measures. He should also be aware of environmental laws related to the control of pollution.

### DETAILED CONTENTS

1. Definition, Scope and Importance of Environmental Education (02 hrs)
2. Basics of ecology, biodiversity, eco system and sustainable development (03 hrs)
3. Sources of pollution - natural and manmade, causes, effects and control measures of pollution (air, water, noise, soil, radioactive and nuclear) and their units of measurement (12 hrs)
4. Solid waste management – Causes, effects and control measures of urban and industrial waste (06 hrs)
5. Mining and deforestation – Causes, effects and control measures (04 hrs)
6. Environmental Legislation - Water (prevention and control of pollution) Act 1974, Air (Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986, Role and Function of State Pollution Control Board, Environmental Impact Assessment (EIA) (10 hrs)
7. Role of Non-conventional Energy Resources (Solar Energy, Wind Energy, Bio Energy, Hydro Energy) (04 hrs)
8. Current Issues in Environmental Pollution – Global Warming, Green House Effect, Depletion of Ozone Layer, Recycling of Material, Environmental Ethics, Rain Water Harvesting, Maintenance of Groundwater, Acid Rain, Carbon Credits. (07 hrs)

### INSTRUCTIONAL STRATEGY

The contents will be covered through lecture cum discussion sessions. In addition, in order to have more appreciation of need for protection of environment, it is suggested that different activities pertaining to Environmental Education like video films, seminars, environmental awareness camps and expert lectures may also be organized.



**RECOMMENDED BOOKS**

1. Environmental Engineering and Management by Suresh K Dhameja; SK Kataria and Sons, New Delhi.
2. Environmental Science by Dr. Suresh K Dhameja; SK Kataria and Sons, New Delhi.
3. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
4. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.
5. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.
6. Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.
7. Environmental Studies by Erach Bharucha; UGC University Press.

**SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted for Lectures (Periods)</b>	<b>Marks Allotted (%)</b>
1	02	04
2	03	06
3	12	24
4	06	12
5	04	10
6	10	20
7	04	10
8	07	14
<b>Total</b>	<b>48</b>	<b>100</b>

## PERSONALITY DEVELOPMENT CAMP

This is to be organized at a stretch for two to three days during fifth or sixth semester. Extension Lectures by experts or teachers from the polytechnic will be delivered on the following broad topics. There will be no examination for this subject.

1. Communication Skills
2. Correspondence and job finding/applying/thanks and follow-up
3. Resume Writing
4. Interview Techniques: In-Person interviews; telephonic interviews, panel interviews; group interviews and video conferencing etc.
5. Presentation Techniques
6. Group Discussions Techniques
7. Aspects of Personality Development
8. Motivation
9. Leadership
10. Stress Management
11. Time Management
12. Interpersonal Relationship
13. Health and Hygiene