

## 4.1 NETWORK FILTERS AND TRANSMISSION LINES

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### RATIONALE

The Study of networks, filters and transmission lines leads to understanding of line communication, audio and video communication, and microwave communication. Particularly the study of networks takes off from principles of a.c. theory and introduces the student to parameters and characteristics of various networks, including filters. Also the study of transmission lines becomes important as its analogy is used in study of transmission of plane electromagnetic waves in bounded media.

### DETAILED CONTENTS

1. Networks (14 hrs)
  - a) Two port (four terminals) network: Basic concepts of the following terms:
    - Symmetrical and asymmetrical networks: Balanced and unbalanced network; T-network,  $\Pi$  network, Ladder network; Lattice network; L-network and Bridge T-network
  - b) Symmetrical Network:
    - Concept and significance of the terms characteristic impedance, propagation constant, attenuation constant, phase shift constant and insertion loss.
    - T-network and  $\Pi$  Network
  - c) Asymmetrical Network
    - Concept and significance of iterative impedance, image impedance, image transfer constant and insertion loss.
    - The half section (L-section); symmetrical T and  $\Pi$  sections into half sections
  
2. Attenuators (05 hrs)
  - a) Units of attenuation (Decibels and Nepers): General characteristics of attenuators
  - b) Analysis and design of simple attenuator of following types; Symmetrical T and  $\Pi$  type, L type.
  
3. Filters (13 hrs)
  - a) Brief idea of the use of filter networks in different communication systems, concept of low pass, high pass, band pass and band stop filters.
  - b) Prototype Filter Section:
    - Impedance characteristics vs frequency characteristics of a low and high pass filter and their significance

- Attenuation Vs frequency; Phase shift Vs frequency, characteristics impedance vs frequency of T and  $\Pi$  filters and their significance
  - Simple design problems of prototype low pass section.
- c) M-Derived Filter Sections  
Limitation of prototype filters, need of m-derived filters
- d) Crystal Filters  
Crystal and its equivalent circuits, special properties of piezoelectric filters and their use
- e) Active Filters  
Basic concept of active filters and their comparison with passive filters.
4. Transmission Lines (16 hrs)
- a) Transmission Lines, their types and applications.
  - b) Distributed constants, T and  $\Pi$  representation of transmission line section.
  - c) Definition of characteristic impedance, propagation constant, attenuation constant and phase shift constant.
  - d) Concept of infinite line
  - e) Condition for minimum distortion and minimum attenuation of signal on-the-line and introduction to loading methods.
  - f) Concept of reflection and standing waves, definition of reflection coefficient, SWR & VSWR and their relation (no derivation).
  - g) Transmission line equation, expression for voltage, current and impedance at a point on the line.
  - h) Concept of transmission lines at high frequencies.
  - i) Introduction to stubs. (single, open and short stubs).

### LIST OF PRACTICALS

1. To measure the characteristic impedance of symmetrical T and  $\Pi$  networks
2. To measure the image impedance of a given asymmetrical T and  $\Pi$  networks
3. For a prototype low pass filter:
  - a) Determine the characteristic impedance experimentally
  - b) Plot the attenuation characteristic

4. To design and measure the attenuation of a symmetrical T/  $\Pi$  type attenuator
5. For a prototype high pass filter:
  - a) Determine the characteristic impedance experimentally
  - b) To plot the attenuation characteristic
6.
  - a) To plot the Impedance characteristic of a prototype band-pass filter
  - b) To plot the attenuation characteristic of a prototype band pass filter
7.
  - a) To plot the impedance characteristic of m- derived low pass filter
  - b) To plot the attenuation characteristics of m-derived high pass filter
8. To observe the information of standing waves on a transmission line and measurement of SWR and characteristic impedance of the line
9. Draw the attenuation characteristics of a crystal filter

### **INSTRUCTIONAL STRATEGY**

Stress should be laid on problems in networks/ filter and transmission lines. Practical must be carried out after completion of topic to gain a good know how on the subject students should be given home assignments on various topics, stress on making own circuit models to calculate input/output impedance, characteristic impedance, losses etc. should be carried out by the students.

### **RECOMMENDED BOOKS**

1. Network Lines and Fields by John D Ryder; Prentice Hall of India, New Delhi
2. Network Filters and Transmission Lines by AK Chakarvorty; Dhanpat Rai and Co. Publication, New Delhi
3. Network Analysis by Van Valkenburg; Prentice Hall of India, New Delhi
4. Network Analysis by Soni and Gupta; Dhanpat Rai and Co. Publication, New Delhi
5. Network Theory and Filter Design by Vasudev K. Aatre
6. Network Filters and Transmission line by Umesh Sinha
7. Electrical and Electronics Measuring instrumentation , A.K Sawhney, Dhanpat Rai and Co. Publication, New Delhi
8. Network Analysis by G.K. Mithal

9. Network Filters and Transmission line by Nardeep Goyal, Rajneesh Kumari, Tech. Max Publication, Pune.

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

<b>Sr No</b>	<b>Topic</b>	<b>Time Allotted (hrs)</b>	<b>Marks Allocation%</b>
1	Networks	14	25
2	Attenuators	5	10
3	Filters	13	30
4	Transmission Lines	16	35
<b>Total</b>		<b>48</b>	<b>100</b>

## 4.2 COMMUNICATION SYSTEMS - I

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### RATIONALE

This course provides the basics of electronic communication systems including transmitters, receivers, antennas and various modes of propagation of signals. In addition to components and systems of fiber optic communication, the students will learn the basics of satellite communication. This course will provide the students with perspectives of different communication systems.

### DETAILED CONTENTS

1. AM/FM Transmitters (08 hrs)
  - a) Classification of transmitters on the basis of modulation, service, frequency and power
  - b) Block diagram of AM transmitters and working of each stage
  - c) Block diagram and working principles of reactance FET and armstrong FM transmitters
  
2. AM/FM Radio Receivers (14 hrs)
  - a) Principle and working with block diagram of super heterodyne AM receiver. Function of each block and typical waveforms at input and output of each block
  - b) Performance characteristics of a radio receiver: sensitivity, selectivity, fidelity, S/N ratio, image rejection ratio and their measurement procedure. ISI standards on radio receivers (brief Idea)
  - c) Selection criteria for intermediate frequency (IF). Concepts of simple and delayed AGC
  - d) Block diagram of an FM receiver, function of each block and waveforms at input and output of different blocks. Need for limiting and de-emphasis in FM reception
  - e) Block diagram of communication receivers, differences with respect to broadcast receivers.
  
3. Antennas: (14 hrs)
  - a) Electromagnetic spectrum and its various ranges: VLF, LF, MF, HF, VHF, UHF, Microwave.
  - b) Physical concept of radiation of electromagnetic energy from a dipole. Concept of polarization of EM Waves.
  - c) Definition and physical concepts of the terms used with antennas like point source, gain directivity, aperture, effective area, radiation pattern, beam width and radiation resistance, loss resistance.
  - d) Types of antennas-brief description, characteristics and typical applications of half wave dipole, medium wave (mast) antenna, folded dipole, turns tile, loop antenna, yagi and ferrite rod antenna (used in transistor receivers)
  - e) Brief description of broad-side and end fire arrays, their radiation pattern and applications (without analysis); brief idea about Rhombic antenna and dish antenna

4. Propagation: (10 hrs)
- a) Basic idea about different modes of wave propagation and typical areas of application. Ground wave propagation and its characteristics, summer field equation for field strength.
  - b) Space wave communication – line of sight propagation, standard atmosphere, concept of effective earth radius range of space wave propagation standard atmosphere
  - c) Duct propagation : sky wave propagation - ionosphere and its layers. Explanation of terms - virtual height, critical frequency, skip distance, maximum usable frequency, multiple hop propagation.
5. Fibre Optic Communications: (12 hrs)
- Advantages of Fibre Optic Communication
  - Block Principle of Light Penetration and Propagation, NA.
  - Types of optical fibres and cables.
  - Brief idea of Losses in Optical Fibres and Dispersion
  - Working principles and characteristics of optical light sources and light detectors.
  - Block diagram of fibre optic communication link.
  - Basic idea of fibre connection techniques - splicing and lensing
6. Satellite Communications: (06 hrs)
- Basic idea, passive and active satellites, Meaning of the terms; orbit, apogee, perigee
  - Geo-stationary satellite and its need. Block diagram and explanation of a satellite communication link.

### LIST OF PRACTICALS

1. To observe the waveforms at different stages of a AM transmitter
2. To observe the waveforms at different stages of a Radio Receiver
3. To align AM broadcast radio receiver
4. To identify and study the various types of antennas used in different frequency ranges.
5. To plot the radiation pattern of a directional and omni directional antenna
6. To plot the variation of field strength of a radiated wave, with distance from a transmitting antenna
7. Familiarisation and identification of fibre optic components such as fibre optic light source, detector, connector assembly etc
8. To assemble the fibre optic communication set up (using teaching module) and compare the transmitted signal with the output of the receiver
9. To measure the light attenuation of the optic fibres

**NOTE:** Visits to appropriate sites of digital/data communication networks, satellite communication, telemetry centres (like remote sensing) and fibre optic communication installations should be made with a view to understand their working. A comprehensive report must be prepared by all students on these visits, especially indicating the dates and locations of their visits.

### **INSTRUCTIONAL STRATEGY**

The subject requires both theory and practical emphasis simultaneously, so that the student can understand the practical significance of the various areas. Visits to instrumentation and communications industries must be carried out, so as to make the students can understand where and how the various instruments are used in the industry.

### **RECOMMENDED BOOKS**

1. Communication Systems by George Kennedy, Tata McGraw Hill Education Pvt Ltd, New Delhi.
2. Communication Systems by A.K. Gautam, SK Kataria and Sons, New Delhi.
3. Fundamentals of Communication System by Fitz, Tata McGraw Hill Education Pvt Ltd, New Delhi
4. Electronic Communication Sytesms by K.S. Jamwal, Dhanpat Rai and Sons, New Delhi.
5. Electronic Communication System by Roddy and Coolen, Prentice Hall of India, New Delhi.
6. Handbook of Experiments in Electronics and Communication Engineering by S. Poornachandra Rao, and B Sasikala, Vikas Publishing House Pvt Ltd, Jangpura, New Delhi

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

<b>Sr No</b>	<b>Topic</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted%</b>
1	AM/FM Transmitters	08	10
2	AM/FM Radio Receivers	14	25
3	Antennas	14	25
4	Propagation	10	15
5	Fibre Optic Communications	12	20
6	Satellite Communications	06	5
	<b>Total</b>	<b>64</b>	<b>100</b>

### 4.3 POWER ELECTRONICS

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#### RATIONALE

Diploma holders in Electronics and related fields are required to handle a wide variety of power electronic equipment used in process control Industry. This subject will provide the student basic understanding of the principles of their working. The practical training will further re-inforce the knowledge and skill of the students.

#### DETAILED CONTENTS

1. Introduction to thyristors and other Power Electronics Devices (18 hrs)
  - a) Construction, Working principles of SCR, two transistor analogy of SCR, V-I characteristics of SCR.
  - b) SCR specifications & ratings.
  - c) Different methods of SCR triggering.
  - d) Different commutation circuits for SCR.
  - e) Series & parallel operation of SCR.
  - f) Construction & working principle of DIAC, TRIAC & their V-I characteristics.
  - g) Construction, working principle of UJT, V-I characteristics of UJT. UJT as relaxation oscillator.
  - h) Brief introduction to Gate Turn off thyristor (GTO), Programmable uni-junction transistor (PUT), MOSFET.
  - i) Basic idea about the selection of Heat sink for thyristors.
  - j) Application such as light intensity control, speed control of universal motors, fan regulator, battery charger.
  
2. Controlled Rectifiers (08 hrs)
  - a) Single phase half wave controlled rectifier with load (R, R-L)
  - b) Single phase half controlled full wave rectifier (R, R-L)
  - c) Fully controlled full wave bridge rectifier.
  - d) Single phase full wave centre tap rectifier.



3. Inverters, Choppers, Dual Converters and Cyclo converters. (16 hrs)
- Principle of operation of basic inverter circuits, concepts of duty cycle, series & parallel. Inverters & their applications.
  - Choppers: Introduction, types of choppers (Class A, Class B, Class C and Class D). Step up and step down choppers.
  - Dual Converters and cyclo converters: Introduction, types & basic working principle of dual converters and cyclo converters & their applications.
4. Thyristorised Control of Electric drives (14 hrs)
- DC drive control
    - Half wave drives.
    - Full wave drives
    - Chopper drives (Speed control of DC motor using choppers)
  - AC drive control
    - Phase control
    - Constant V/F operation
    - Cycloconverter/Inverter drives.
5. Power supplies (08 hrs)
- Block diagram of Power Supply line & load regulation, fixed and variable voltage regulators (78xx&79xx) & variable voltage regulates
  - UPS, on-line, off line & its specifications
  - Concept of high voltage DC transmission
  - Concept of SMPS

### LIST OF PRACTICALS

- To plot VI characteristic of an SCR.
- To plot VI characteristics of TRIAC.
- To plot VI characteristics of UJT.
- To plot VI characteristics of DIAC.
- Study of UJT relaxation oscillator. And observe I/P and O/P wave forms
- Observation of wave shape of voltage at relevant point of single-phase half wave controlled rectifier and effect of change of firing angle.
- Observation of wave shapes of voltage at relevant point of single phase full wave controlled rectifier and effect of change of firing angle.
- Observation of wave shapes and measurement of voltage at relevant points in TRIAC based AC phase control circuit for Varying lamp intensity and AC fan speed control.

- 9) To realize positive and negative fixed voltage DC power supply using 7805/7905
- 10) Installation of UPS system and routine maintenance of batteries.

### INSTRUCTIONAL STRATEGY

Power Electronics being very important for industrial controls requires a thorough know how about industrial devices. Teacher should take to the class various SCRs and other semiconductor devices to demonstrate these to the students. The teacher may encourage students to perform practical simultaneously for better understanding of the subject and verification of theoretical concepts. So industrial visit in between the course is a must.

### RECOMMENDED BOOKS

- 1) Power Electronics by P.C. Sen, Tata Mc Graw Hill Education Pvt Ltd. New Delhi
- 2) Power Electronics by P.S. Bhimbhra, Khanna Publishers, New Delhi
- 3) Power Electronics – Principles and Applications by Vithayathi, Tata Mc Graw Hill Education Pvt Ltd. New Delhi
- 4) Power Electronics by M.S. Berde, Khanna Publishers, New Delhi.
- 5) Power Electronics by MH Rashid
- 6) Industrial Electronics and Control by SK Bhattacharya and S. Chatterji, New Age Publications. New Delhi
- 7) Power Electronics by S Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi
- 8) Power Electronics by Sugandhi and Sugandhi
- 9) Power Electronics – Principles and Applications by J Michael Jacob, Vikas Publishing House, New Delhi

### SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING PAPER SETTER

Sr No	Topic	Time Allotted (Hrs)	Marks Allotted%
1	Introduction to thyristors and other power electronics devices	18	30
2	Controlled Rectifiers	08	15
3	Inverters, Choppers, Dual Converters and Cyclo converters.	16	25
4	Thyristorised Control of Electric drives	14	20
5	Power supplies	08	10
	<b>Total</b>	<b>64</b>	<b>100</b>

## 4.4 MICROPROCESSORS

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### RATIONALE

The study of microprocessors in terms of architecture, software and interfacing techniques leads to the understanding of working of CPU in a microcomputer. The development in microprocessors of 32 bit architecture brings them face-to-face with mainframe finding employment in R&D, assembly, repair and maintenance of hardware of microprocessors and computers. Microprocessors find application in process control industry. They also form a part of the electronic switching system between source and destination in long distance telecommunications. Thus the microprocessor is an area of specialization. Students of electronics and related engineering branches often use microprocessors to introduce programmable control in their projects, in industrial training.

### DETAILED CONTENTS

1. Evolution of Microprocessor (04 hrs)  
 Typical organization of a microcomputer system and functions of its various blocks. Microprocessor, its evolution, function and impact on modern society
2. Architecture of a Microprocessor (With reference to 8085 microprocessor) (12 hrs)  
 Concept of Bus, bus organization of 8085, Functional block diagram of 8085 and function of each block, Pin details of 8085 and related signals, Demultiplexing of address/data bus generation of read/write control signals, Steps to execute a stored programme
3. Programming (with respect to 8085 microprocessor) (16 hrs)  
 Brief idea of machine and assembly languages, Machines and Mnemonic codes. Instruction format and Addressing mode. Identification of instructions as to which addressing mode they belong. Concept of Instruction set. Explanation of the instructions of the following groups of instruction set. Data transfer group, Arithmetic Group, Logic Group, Stack, I/O and Machine Control Group. Programming exercises in assembly language. (Examples can be taken from the list of experiments).
4. Memories and I/O interfacing (10 hrs)  
 Memory organization, Concept of memory mapping, partitioning of total memory space. Address decoding, concept of I/O mapped I/O and memory mapped I/O. Interfacing of memory mapped I/O devices. Concept of stack and its function. Basic RAM Cell, N X M bit RAM, Expansion of word length and capacity, static and dynamic RAM, basic idea of ROM, PROM, EPROM and EEPROM.
5. Instruction Timing and Cycles (08 hrs)  
 Instruction cycle, machine cycle and T-states, Fetch and execute cycle.

6. Interrupts (04 hrs)  
 Concept of interrupt, Maskable and non-maskable, Edge triggered and level triggered interrupts, Software interrupt, Restart interrupts and its use, Various hardware interrupts of 8085, Servicing interrupts, extending interrupt system
7. Data transfer techniques (04 hrs)  
 Concept of programmed I/O operations, sync data transfer, async data transfer (hand shaking), Interrupt driven data transfer, DMA, Serial output data, Serial input data
8. Peripheral devices (06 hrs)  
 8255 PPI and 8253 PIT, 8257 DMA controller, 8279 Programmable KB/Display Interface, 8251 Communication Interface Adapter, 8155/8156

### LIST OF PRACTICALS

1. Familiarization of different keys of 8085 microprocessor kit and its memory map
2. Steps to enter, modify data/program and to execute a programme on 8085 kit
3. Writing and execution of ALP for addition and sub station of two 8 bit numbers
4. Writing and execution of ALP for multiplication and division of two 8 bit numbers
5. Writing and execution of ALP for arranging 10 numbers in ascending/descending order
6. Writing and execution of ALP for 0 to 9 BCD counters (up/down counter according to choice stored in memory)
7. Interfacing exercise on 8255 like LED display control
8. Interfacing exercise on 8253 programmable interval timer
9. Interfacing exercise on 8279 programmable KB/display interface like to display the hex code of key pressed on display
10. Study and use of interfacing 8 bit A/D card and D/A card in sampling, wave generation, multiplexer, de-multiplexer and counter
11. Use of 8085 emulator for hardware testing

### 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). Help may be taken in the form of charts, simulation packages to develop clear concepts of the subject. Programming exercises other than the given in the list may be given to the students.

### RECOMMENDED BOOKS

1. Microprocessor Architecture, Programming and Applications with 8080/8085 by Ramesh S Gaonker, Willey Eastern Ltd. New Delhi
2. Introduction to Microprocessor by Mathur ,Tata McGraw Hill Education Pvt Ltd , New Delhi
3. Microprocessor and Microcontrollers by Dr BP Singh, Galgotia Publications, New Delhi

4. Microprocessor and Applications by Badri Ram: Tata McGraw Hill Education Pvt Ltd , New Delhi
5. Microprocessor and Microcomputers by Refiquzzaman, Prentice Hall of India Ltd., New Delhi.
6. Digital Logic and Computer Design by Mano, M Morris; Prentice Hall of India, New Delhi
7. Digital Electronics and Applications by Malvino Leach; Publishers McGraw Hills, New Delhi
8. Digital Integrated Electronics by Herbert Taub and Donals Sachilling; Prentice Hall of India Ltd., New Delhi
9. Digital Electronics by Rajaraman; Prentice Hall of India Ltd., New Delhi
10. Digital Electronics and Microprocessor by Rajiv Sapra, Ishan Publication, Ambala

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

Topic No.	Topic	Time Allotted (Hrs)	Marks Allotted (%)
1.	Evolution of Microprocessor	04	5
2.	Architecture of a Microprocessor (With reference to 8085 microprocessor)	12	20
3	Programming (with respect to 8085 Microprocessor)	16	25
4	Memories and I/O interfacing	10	15
5.	Instruction Timing and Cycles	08	10
6.	Interrupts	04	5
7.	Data transfer techniques	04	5
8.	Peripheral devices	06	15
<b>Total</b>		<b>64</b>	<b>100</b>

## 4.5 ELECTRICAL MACHINES

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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, diploma holder in Instrumentation and Control must be competent to repair and maintain these machines and give suggestions to improve their performance. 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. Three Phase Supply (6 hrs)
  - Advantage of three-phase system over single-phase system.
  - Star Delta connections
  - Relation between phase and line voltage and current in a three phase system
  - Power and power factor in three-phase system and their measurements by one, two and three wattmeter methods.
  
2. Transformers (10 hrs)

Principle of operation and constructional details of single phase and three-phase transformer, core type and shell type transformers, difference between single phase and three phase transformers and their applications.

  - Voltage Regulation of a transformer (No Derivation)
  - Losses in a transformer
  - Efficiency, condition for maximum efficiency and all day efficiency
  - Auto transformers and instrument transformer
  - CTs and PTs (Current transformer and potential transformer)
  - CVT (Constant Voltage Transformer)
  
3. Introduction to Rotating Electrical Machines (10 hrs)
  - E.M.F induced in a coil rotating in a magnetic field.
  - Definition of motor and generator
  - Basic principle of a generator and a motor
  - Torque due to alignment of two magnetic fields and the concept of Torque angle

- Basic Electromagnetic laws (Faraday's laws of Electromagnetic Induction)

#### 4. DC Machines (14 hrs)

- Principle of working of d.c motors and d.c generator, their constructional details
- Function of the commutator for motoring and generating action
- Factors determining the speed of a DC motor
- Different types of excitation
- Characteristics of different types of DC machines
- Starting of DC motors and starters
- Application of DC machines

#### 5. A.C. Motors (12 hrs)

- Revolving magnetic field produced by poly phase supply
- Brief introduction about three phase induction motors, its principle of operation
- Types of induction motors and constructional features of squirrel cage and slip-ring motors
- Starting and speed control
- Star Delta and DOL (Direct-on-line) starters.
- Reversal of direction of rotation of 3-phase induction motors
- Applications of induction motors
- Principle and working of Synchronous Machines
- Application of Synchronous Machines
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#### 6. Single Phase Fractional Kilowatt Motors (12 hrs)

- Introduction
- Principle of operation of single phase motors
- Types of single phase induction motors and their constructional details (i.e. split phase, capacitor start, capacitor start and run, shaded pole and reluctance start)
- Single phase synchronous motors – reluctance motor ( hysteresis motor)
- Commutator type single-phase motors – Repulsion Induction motor, AC series motor and universal motors

- Introduction to servo- motors and stepper motors
- Concept of micro-motors.

### LIST OF PRACTICALS

Demonstrate various instruments use viz Ammeter, Voltmeter, Wattmeter, p.f meter etc for their identification and connecting procedure in a circuit.

1. To measure power and power factors in 3 Phase load by two wattmeter method
2. To determine the efficiency of a single phase transformer from the data obtained through open circuit and short circuit test
3. To connect the primary and secondary windings of a three phase transformer in a suitable circuit and to verify line and phase current and voltage relationship respectively
4. To connect a dc shunt motor with supply through a 3 point starter and to run the motor at different speeds with the help of a field regulator
5. To run a 3 phase squirrel cage induction motor with the help of a star-delta starter. To change the direction of rotation of the motor.
6. To measure power and power factor of a single phase induction motor.
7. To run a synchronous motor with a.c supply and to measure speed to verify the relation  $N=120 f/P$
8. To make connections of starting and running winding of a single phase capacitor motor and to run it with the help a DOL starter and to measure its speed
9. Study construction of a stepper and servomotor and to write their complete specifications.

### INSTRUCTIONAL STRATEGY

A visit to a small factory (Preferably Transformer Factory) must be organised to give live exposure to students. For this the teacher should visit first to understand the assembly line-up which could be followed by a visit of the students in groups of 10-20 (depending upon the size of the factory), where the instructor can give an idea of the working of the factory without much seeking assistance of the factory staff.

### RECOMMENDED BOOKS

- 1) Electrical Machine by SK Bhattacharya, Tata McGraw Hill Education Pvt Ltd, New Delhi
- 2) Electrical Machines by Nagrath and Kothari, Tata McGraw Hill Education Pvt Ltd, New Delhi
- 3) Experiments in Basic Electrical Engineering: by S.K. Bhattacharya, KM Rastogi: New Age International (P) Ltd. Publishers, New Delhi
- 4) Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar
- 5) Electrical Engineering by JB Gupta, SK Kataria & Sons, New Delhi
- 6) Electrical Machines by DR Arora, Ishan Publications, Ambala city



7) Electrical Technology Vol. - I and II B.L. Thareja, S Chand and Co. New Delhi

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

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Three phase Supply	6	10
2.	Transformers	10	15
3.	Introduction to Rotating Electrical Machines	10	15
4.	DC Machines	14	20
5.	A.C. Motors	12	20
6.	Single Phase Fractional Kilowatt Motors	12	20
Total		64	100

## 4.6 GENERIC SKILLS AND ENTREPRENEURSHIP DEVELOPMENT

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### RATIONALE

Generic Skills and Entrepreneurship Development is one of the courses from “Human Science” subject area. Generic skills have emerged as an important component of employability skills, which enable an individual to become and remain employable over lifetime and to lead happy and prosperous life. Entrepreneurship development aims at developing conceptual understanding for setting-up one’s own business venture/enterprise. This aspect of Human Resource Development has become equally important in the era, when wage employment prospects have become meager.

Both the subject areas are supplementary to each other and soft skills are required to be developed in diploma passouts for enhancing their employability and self confidence.

### DETAILED CONTENTS

1. Introduction to Generic Skills (4 hrs)
  - 1.1 Importance of Generic Skill Development (GSD)
  - 1.2 Global and Local Scenario of GSD
  - 1.3 Life Long Learning (LLL) and associated importance of GSD.
  
2. Managing Self (8 hrs)
  - 2.1 Knowing Self for Self Development
    - Self-concept, personality, traits, multiple intelligence such as language intelligence, numerical intelligence, psychological intelligence etc.
  - 2.2 Managing Self - Physical
    - Personal grooming, Health, Hygiene, Time Management
  - 2.3 Managing Self – Intellectual development
    - Information Search: Sources of information
    - Listening: Effective Listening
    - Speaking: Effective Oral Communication
    - Reading: Purpose of reading, different styles of reading, techniques of systematic reading; Note Taking: Importance and techniques of note taking
    - Writing: Correspondence - personal and business

**Note:** Practical sessions should be coupled with teaching of effective listening, speaking, reading and writing.

## 2.4 Managing Self – Psychological

- Stress, Emotions, Anxiety-concepts and significance (Exercises related to stress management)
- Techniques to manage the above

3. Managing in Team (6 hrs)
- 3.1 Team - definition, hierarchy, team dynamics
- 3.2 Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background
- 3.3 Communication in group - conversation and listening skills
4. Task Management (3 hrs)
- 4.1 Task Initiation, Task Planning, Task execution, Task close out
- 4.2 Exercises/case studies on task planning towards development of skills for task management
5. Problem Solving (5 hrs)
- 5.1 Prerequisites of problem solving- meaningful learning, ability to apply knowledge in problem solving
- 5.2 Different approaches for problem solving.
- 5.3 Steps followed in problem solving.
- 5.4 Exercises/case studies on problem solving.
6. Entrepreneurship (22 hrs)
- 6.1 Introduction
- Concept/Meaning and its need
  - Competencies/qualities of an entrepreneur
  - Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level.
- 6.2 Market Survey and Opportunity Identification (Business Planning)
- How to start a small scale industry
  - Procedures for registration of small-scale industry
  - List of items reserved for exclusive manufacture in small-scale industry
  - Assessment of demand and supply in potential areas of growth.
  - Understanding business opportunity
  - Considerations in product selection
  - Data collection for setting up small ventures.
- 6.3 Project Report Preparation
- Preliminary Project Report
  - Techno-Economic Feasibility Report
  - Exercises on Preparation of Project Report in a group of 3-4 students

## INSTRUCTIONAL STRATEGY

This subject will require a blend of different teaching and learning methods beginning with lecture method. Some of the topics may be taught using question answer, assignment, case studies or seminar. In addition, expert lectures may be arranged from within the institution or from management organizations. Conceptual understanding of Entrepreneurship, inputs by teachers and outside experts will expose the students so as to facilitate in starting ones own business venture/enterprise. The teacher will discuss success stories and case studies with students, which in turn, will develop managerial qualities in the students. There may be guest lectures by successful diploma holding entrepreneurs and field visits also. The students may also be provided relevant text material and handouts.

## RECOMMENDED BOOKS

1. Generic skill Development Manual, MSBTE, Mumbai.
2. Lifelong learning, Policy Brief ([www.oecd.org](http://www.oecd.org))
3. Lifelong learning in Global Knowledge Economy, Challenge for Developing Countries – World Bank Publication
4. Towards Knowledge Society, UNESCO Paris Publication
5. Your Personal Pinnacle of Success by DD Sharma, Sultan Chand and Sons, New Delhi
6. Human Learning, Ormrod
7. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
8. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
9. Handbook of Small Scale Industry by PM Bhandari

## SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1	Introduction to Generic Skills	4	5
2	Managing Self	8	15
3	Managing in Team	6	10
4	Task Management	3	10
5.	Problem Solving	5	10
6.	Entrepreneurship	22	50
	<b>Total</b>	<b>48</b>	<b>100</b>

## ENTREPRENEURIAL AWARENESS CAMP

This is to be organized at a stretch for two to three days during or at the end of 4<sup>th</sup> semester. Lectures will be delivered on the following broad topics. There will be no examination for this subject.

1. Who is an entrepreneur?
2. Need for entrepreneurship, entrepreneurial career and wage employment
3. Scenario of development of small scale industries in India
4. Entrepreneurial history in India, Indian values and entrepreneurship
5. Assistance from District Industries Centres, Commercial Banks, State Financial Corporations, Small industries Service Institutes, Research and Development Laboratories and other financial and development corporations
6. Considerations for product selection
7. Opportunities for business, service and industrial ventures
8. Learning from Indian experiences in entrepreneurship (Interaction with successful entrepreneurs)
9. Legal aspects of small business
10. Managerial aspects of small business

## **INDUSTRIAL TRAINING OF STUDENTS** (after IV Semester examinations)

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of a minimum of 6 weeks duration to be organised during the semester break starting after second year i.e. after IV Semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. A minimum of one visit per week by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An internal assessment of 50 and external assessment of 50 marks have been provided in the study and evaluation scheme of V Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. The formative and summative evaluation may comprise of weightage to performance in testing, general behaviour, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry.

Teachers and students are requested to see the footnote below the study and evaluation scheme of IV Semester for further details.