

## 4.1 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, advantages and disadvantages.

  - 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)
  
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
  - Common features of rotating electrical machines.

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(only)
  - Application of Synchronous Machines
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, shaded pole motors, AC series motor and universal motors
  - Introduction to servo- motors and stepper motors
  - Concept of micro-motors.

## LIST OF PRACTICALS

1. To measure power and power factors in 3 Phase load by two wattmeter method
2. To determine effect 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 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 run a 3 phase alternator in synchronism with busbar and to measure its voltage and frequency
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 servo motor and to write their complete specifications.

## RECOMMENDED BOOKS

1. Electrical Machine by SK Bhattacharya, Tata Mc Graw Hill, New Delhi
2. Electrical Machines by SK Sahdev, Unique International Publications, Jalandhar
3. Electrical Machines by Nagrath and Kothari, Tata Mc Graw Hill, New Delhi
4. Electrical Engineering by JB Gupta, SK Kataria & Sons, New Delhi
5. Electrical Technology Vol. - I and II B.L. Thareja, S Chand and Co. New Delhi

## 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 Hills, New Delhi
- 2) Electrical Machines by Nagrath and Kothari, Tata McGraw Hills, 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, Unique International Publications, Jalandhar
- 5) Electrical Technology Vol. - I and II B.L. Thareja, S Chand and 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.	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
<b>Total</b>		<b>64</b>	<b>100</b>

## 4.2 ADVANCED COMMUNICATION

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### RATIONALE

This course provides the basics of electronic communication including Pulse and delta modulation, antennas and various modes of propagation of signals. In addition to these components the students will learn the basics of fibre optic communication. This course will provide the students with perspectives of different communication systems.

### DETAILED CONTENTS

1. Pulse Modulation (20 hrs)
  - a) Statement of sampling theorem and elementary idea of sampling frequency for pulse modulation
  - b) Basic concepts of time division multiplexing (TDM) and frequency division multiplexing (FDM)
  - c) Basic ideas about PAM,PPM,PWM
  - d) Pulse code Modulation (PCM) Basic scheme of PCM system. Quantisation, quantisation error, compounding, block diagram of TDM-PCM communication system and function of each block. Advantages of PCM systems. Concepts of differential PCM (DPCM), Introduction to Multiple Access.
  - e) Delta Modulation (DM)  
Basic principle of delta modulation system, advantages of delta modulation over PCM system. Limitations of delta modulation, concept of adaptive delta modulation (ADM)
  
2. 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
3. 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.
4. Fibre Optic Communication: (16 hrs)
- Advantages of Fibre optic communication
  - Block diagram of a fibre-optic communication link
  - Constructional features of optical fibre and fibre optic cables. Concepts of numerical aperture (NA). Modes of propagation in an optical fibre and characteristics of single mode and multi mode fibres. Fibre attenuation and dispersion
  - Light sources - Diode, Laser, LEDs and their characteristics
  - Light detectors and their characteristics
  - Basic idea of fibre connection techniques - splicing and lensing
5. Facsimile (FAX) (04 hrs)
- Basic idea of FAX system and its applications; Principle of operation and block diagram of modern FAX system. Important features of modern FAX machines.

### LIST OF PRACTICALS

1. To observe the sampled signal and compare it with the analog input signal. Note the effect of varying the sampling pulse width and frequency on the sampled output.
2. To verify the sampling theorem
3. To observe and note the pulse modulated signals (PAM, PPM, PWM) and compare them with the corresponding analog input signal
4. To measure the Quantisation noise in a 3 bit/4 bit coded PCM signal
5. To feed an analog signal to a PCM modulator and compare the demodulated signal with the analog input. Also note the effect of low pass filter at the demodulated output.

6. To study the process of delta modulation/demodulation
7. To plot the radiation pattern of a directional and omni directional antenna
8. To plot the variation of field strength of a radiated wave, with distance from a transmitting antenna
9. Familiarisation and identification of fibre optic components such as fibre optic light source, detector, connector assembly etc
10. To assemble the fibre optic communication set up (using teaching module) and compare the transmitted signal with the output of the receiver
11. To measure the light attenuation of the optic fibres
12. To study the working of FAX Machine.

**NOTE:**

Visits to appropriate sites of digital/data communication networks,, 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**

This course provides the basics of modulation, its types, electronic communication systems including transmitters, receivers, antennas and various modes of propagation of signals etc.

**RECOMMENDED BOOKS**

1. Communication systems By George Kennedy Tata McGraw Hill, New Delhi.
2. Communication systems By A.K. Gautam, SK Katria and Sons, New Delhi.
3. Electronic communication sytesms By K.S. Jammal, Dhanpat Rai and Sons, New Delhi.
4. Electronic communication system by Roddy and Coolen Prentice Hall of India, New Delhi.
5. Handbook of Experiments in Electronics and Communication Engineering by S. Poornachandra Rao, and B Sasikala, Vikas Publishing House Pvt Ltd, Jangpura, New Delhi
6. Optical fibre Communication by Fraser.

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

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1	Pulse Modulation	20	30
2	Antennas:	14	25
3	Propagation:	10	15
4	Fibre Optic Communication	16	25
5	Facsimile (FAX)	4	5
<b>Total</b>		<b>64</b>	<b>100</b>

### 4.3 NETWORK FILTERS AND TRANSMISSION LINES

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#### RATIONALE

The Study of networks, filters and transmission lines leads to understanding of lines 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)

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.

Symmetrical Networks:

- Concept and significance of the terms characteristics impedance, propagation constant, attenuation constant, phase in terms of insertion loss.
- Expression for characteristics impedance propagation constant, attenuation constant phase shift constant in terms of  $Z_o$ ,  $Z_{oc}$  for the following:
  - T network
  - Pi network

Asymmetrical Network

Concept and significant of iterative impedance, image impedance, image transfer constant and insertion loss.

The half section (L-section);symmetrical T and Pi sections into half sections, derivation of iterative impedance, image impedance. Open and short circuit impedance of half section.

#### 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 (20 hrs)

Brief idea of the use of filter networks in different communication system. Concept of low high pass, band pass and band stop filters.

- a) Theorem connecting attenuation constant and characteristics impedance ( $Z_0$ ); determination of cut off frequency, constant K section.
- b) Prototype filter section:
- Reactance's-frequency characteristics of a low-pass filter and its significance.
  - Attenuation Vs frequency : phase shift Vs frequency , characteristics impedance Vs frequency of T and Pi curves and their significance.
  - Simple design problems of prototype low pass section.
- c) M- Derived Filter Sections
- Limitations of prototype filters, need of m-derived filters
  - Expressions for m in terms of  $f_c$  (cut off frequency ) and  $f_{\infty}$  (frequency at which attenuation is infinity) for low pass and high pass filters.
  - Simple design problems of m-derives low pass and high pass filters.
  - T and Pi high pass filter section: reactance frequency curve of a high pass prototype filter and its significance.
  - Plots of attenuation, phase shift, characteristic impedance of T and Pi sections with frequency and their significance.
  - Simple design problems of prototype
4. Impedance Matching of filters: (05 hrs)
- Impedance matching half section
  - Terminating half sections
  - Design problems of composite simple filter
5. Crystal Filters: (05 hrs)
- Crystal and its equivalent circuits. Special properties of piezoelectric filters and their use.
6. Transmission Lines (15hrs)
- a) Transmission lines and their application: shapes of different types of transmission lines; (including) 300 ohms antenna feeder cable, 75 ohm co-axial cable)
- b) Distributed (or primary) constant of transmission line, equivalent circuit of an infinite line, T and Pi type representation of a section of transmission line.
- c) Definition of characteristics impedance of line; concept of short line termination in  $Z_0$ ; currents and voltage along an infinite line, propagation constant attenuation and phase shift constant attenuation and phase shift constant of the line.
- d) Relationship of characteristic impedance , propagation constant attenuation constant and phase necessity and different methods of loading the communication line.

- e) Concept of reflection and standing waves on a transmission line; definition of reflection coefficient in terms of characteristics impedance and load relation between VSWR and voltage reflection co-efficient, maximum impedance on a line in terms of characteristics impedance and VSWR.

### LIST OF PRACTICALS

1. To measure the characteristic impedance of a symmetrical and Pi network
2. To measure the image impedance of a given asymmetrical T/Pi network
3. For a prototype low pass filter:
4. Determine the characteristic impedance experimentally
5. Plot the attenuation characteristics
- 10 To design and measure the attenuation of a symmetrical T/Pi type attenuator.
- 11 For a prototype high pass filter:
- 12 Determine the characteristics impedance experimentally
- 13 To plot the attenuation characteristics
- 14 To plot the impedance characteristics of a prototype band-pass filter
- 15 To plot the attenuation characteristics of a prototype band-pass filter.
- 16 To plot the impedance characteristic of am-derived low pass filter
- 17 To plot the attenuation characteristics of a m-derived high pass filter.
- 18 To observe the formation of standing waves on a transmission line and measurement of SWR and Characteristic impedance of the line.

### 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. Electrical & Electronics Measuring instrumentation , A.K Sawtney

2. Network Analysis , G.K. Mithal
3. Network Filters and Transmission line by Umesh Sinha
4. Network Lines and fields by Jhon D Rider

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

<b>Sr. No.</b>	<i>Topic</i>	<b>Time Allotted (hrs)</b>	<b>Marks Allocation</b>
1.	Networks	14	25
2.	Attenuators	5	7
3.	Filters	20	30
4.	Impedance Matching of Filters	5	5
5.	Crystal Filters	5	8
6.	Transmission Lines	15	25
<b>Total</b>		<b>64</b>	<b>100</b>

## 4.4 MICROPROCESSORS AND APPLICATIONS

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### RATIONALE

The study of microprocessor in terms of architecture, software and interfacing techniques lead to the understanding of working of CPU in a computer. Also study of peripherals like PPT, PIT, etc. enables understanding and designing of small process control systems.

### DETAILED CONTENTS

1. Introduction (06 hrs)  
Microprocessors – evolution, importance and Application
2. Architecture of a Microprocessor – 8085 (18 hrs)
  - a) Concept of bus and bus organisation
  - b) Functional block diagram and function of each block
  - c) Pin details of 8085 and related signals
  - d) Demultiplexing of address/data bus and memory read/write cycles.
3. Instruction Set for Intel 8085 (20 hrs)
  - a) Instruction and data format – opcode and operand and its word size
  - b) Instruction cycle, machine cycle, T-states, fetch cycle, and execute cycle
  - c) Different addressing modes
  - d) Status flags and their importance
  - e) Data transfer, arithmetic and logical operation, branching, and machine control instructions
  - f) Use of stacks and subroutines
  - g) Assembly language programming
4. Interfacing and Data Transfer Schemes (08 hrs)
  - a) Memory mapped I/O and I/O mapped I/O schemes
  - b) Interrupts of 8085
  - c) Programmable data transfer, DMA data transfer and interrupt driven data transfer schemes with their applications
5. Peripheral Devices (12 hrs)  
Detailed study of the following  
8255 PPI and 8253 PIT

**LIST OF PRACTICALS**

1. Familiarisation with 8085 microprocessor kit .
2. Steps to enter, modify data/program and to execute a programme on 8085 kit
3. Writing and execution of ALP for addition and subtraction 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 numbers in ascending/descending order
6. Writing and execution of ALP for multiplication of two 16 bit numbers
7. Interfacing exercise on 8255 like LED display control
8. Interfacing exercise on 8253 programmable interval timer

**LIST OF RECOMMENDED BOOKS**

1. Microprocessor Architecture, Programming and Applications with 8085 by RS Gaonkar
2. Microprocessor and Applications by B Ram
3. Comprehensive Study of Microprocessor by Naresh Grover
4. Introduction to Microprocessor by Adithya P Mathur, Tata McGraw Hill Publishers, New Delhi
5. Introduction to Microprocessor by Naresh Gupta

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

<b>Sr. No.</b>	<i>Topic</i>	<b>Time Allotted (hrs)</b>	<b>Marks Allocation</b>
1.	Introduction	6	10
2.	Architecture of a Microprocessor - 8085	18	25
3.	Instruction Set for Intel 8085	20	30
4.	Interfacing and Data Transfer Schemes	8	15
5.	Peripheral Devices	12	20
<b>Total</b>		<b>64</b>	<b>100</b>

## 4.5 FUNDAMENTALS OF ELECTRONIC INSTRUMENTATION

L T P Cr  
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### RATIONALE

The purpose of teaching this subject to the student is to give knowledge and application of Op-amps voltage regulators besides the of principle and working of different types of instrumentation system which is used to measure different parameters and is further used for control system.

### DETAILED CONTENTS

1. Operational Amplifiers (12 hrs)
  - a) Characteristics of an ideal operational amplifier and its block diagram
  - b) Definition of differential voltage gain, CMRR, PSRR, slew rate and input offset current
  - c) Operational amplifier as an inverter, scale changer, adder, subtractor, differentiator, and integrator
  - d) Concept of Schmitt trigger circuit and sample/hold circuit using operational amplifier and their applications
  
2. Active filters (06 hrs)
 

Basic concept of active filters . Simple design problems on Low pass, and High pass first and second order Butter worth filter
  
3. Voltage Regulators (06 hrs)
  - a) Introduction to voltage Regulators : Linear & switching regulators.
  - b) Linear voltage regulators: Circuits, block schematic, Pin diagram, salient features, specifications, ratings & operating principle of 723, 3085, 78XX & 79XX series IC's voltage regulators circuits and operating Principle. Dual tracking power supply using 78XX and 79XX series demerits.
  
4. Introduction to instrumentation (04 hrs)
 

Basic Measurement system functions of its elements namely the transducer, signal conditioner, display or read-out and power supply.

Brief idea of telemetry .
  
5. Transducers (16 hrs)
  - a) Distinguish between active and passive transducers with examples. Basic requirement of a transducer.

- b) Principle of operation of the following transducers and their applications in measuring the physical quantities listed against each one of them.

	<b>Transducer</b>	<b>Physical Quantities</b>
c)	- Potentiometric RTD	Displacement and force Temperature
	- Strain gauge	Torque and displacement
	- Thermistor	Temperature
	- Resistance Hygrometer	Humidity.
d)	Variable capacitance Type	
	- Variable capacitance pressure gauge	Displacement and pressure
	- Dielectric gauge	Liquid Level and thickness.
e)	Variable Inductance Type	
	- LVDT	Pressure, force. Displacement and position
e)	Photo sensitive Photo Diode/photo Transistor	Light

6. Signal Conditioners (08 hrs)

Characteristics of instrumentation amplifiers with respect to input impedance, output impedance, drift, dc off set, noise gain, common mode rejection ratio, frequency response, relating to suitability of these characteristics for amplifying signals from various transducers. Need and working of a typical isolation amplifier.

7. A/D and D/A Converters (08 hrs)

General principle of A/D and D/A conversion and brief idea of their applications, Binary resistor network and resistor ladder network methods of D/A conversion. Dual slope and successive approximation types of ADCs. ADC and DAC (IC)

8. Output devices and displays (04 hrs)

Basic principles of operation, constructional features and application of Alphanumeric and Graphic Displays. Seven segment displays (LED and LCD type).

### LIST OF PRACTICALS

1. To use IC 741 (op-amplifier) as

i) Inverter

ii) Non-Inverter

2. To use IC 741 (op-amplifier) as
  - i) Adder
  - ii) Subtractor
3. To use IC 741 (op-amplifier) as
  - iii) Differentiator
  - iv) Integrator
4. To use Op-Amp as first order low pass and high pass active filter.
5. To realize positive and negative fixed voltage using three terminal voltage regulator IC (7805, 7812, 7905)
6. Study of various transducers like strain gauge, thermistor, photo diode, photo transistor, etc.
7. To assemble and test an instrumentation amplifier, measure its gain, input and output impedance.
8. To construct 4 bit of A/D and D/A Converters.

### **INSTRUCTIONAL STRATEGY**

Industrial Electronics being very important for industrial/power controls needs a thorough know how about industrial devices and various transducers employed in measurement of various physical quantities. So industrial visit in between the course is a must. Teacher should take to the class various SCRs and other semiconductor devices to demonstrate these to the students. Likewise transducers should also be shown in the class practical should be carried out at the completion of the topic. Teacher should discuss with the students about the practical setup in detail.

### **RECOMMENDED BOOKS**

1. Op- Amps by Gayakwad
2. Electronic instrumentation by J.B. Gupta S.K. Kataria, New Delhi
3. Electronic instruments and measurements by Cooper, Prentice Hall of India, New Delhi
4. Electronic instrumentation by Kalsi

**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.	Operational Amplifiers	12	25
2.	Active Filters	6	10
3.	Voltage Regulators	6	10
4.	Introduction to Instrumentation	4	5
5.	Transducers	16	25
6.	Signal Conditioners	8	10
7.	A/D and D/A Converters	8	10
8.	Output devices and displays	4	5
<b>Total</b>		<b>64</b>	<b>100</b>

## 4.6 MINOR PROJECT WORK

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### RATIONALE

Minor project work aims at exposing the students to various developments taking place in the field of electronics and related areas in addition to developing interest in the students about the, working and fabrication of electronics devices. The project may be selected from utility items pertain to their laboratories or homes. It would enable first hand experience of components, their purchase, assembly, testing and trouble shooting. It would also boost up confidence of the students in repairing and maintenance of electronics gadgets. There should not be more than 2-3 students for each project. A report must be prepared with a hard and soft copy.

The purpose of this subject is also to give practice to the students in elementary design and fabrication of simple electronic circuits. The topics of assembly, soldering, testing, and documentation have been included to give overall picture of the process of manufacturing of electronic devices.

**The teacher may guide/ help students to identify their minor project work and chalk out their plan of action well in advance.**

For this purpose, the concerned teachers must identify curriculum related industrial problems which should be expository in nature and ask students (individual/group) to carry out their investigation/ activity such that enough industrial exposure is gained by them during this process.

Some of the projects are listed below which is just a guideline for selecting the minor project. Students can also select any other project in consultation with his teacher.

1. Regulated power supply
2. Timers using 555 and other oscillators
3. Touch plate switches – transistorized or 555 based
4. Door bell/cordless bell
5. Clapping switch and IR switch
6. Blinkers
7. Sirens and hooters
8. Single hand AM or FM
9. Electronic toy gun, walker, blinkers
10. Electronic dice
11. Cell charger, battery charger, mobile charger
12. Fire/smoke/intruder alarm
13. Liquid level controller
14. Counters
15. Combination locks
16. Electronics musical instruments
17. Telephone handset
18. Audio amplifiers
19. Tape recorders
20. Automatic stabilizer/CVT

21. Emergency light
22. Design and manufacture of transformer
23. Fan regulator
24. Triac using Fan Regulator
25. 555 using lighting delay Circuits
26. Temperature sensor based fabrication
27. Design and fabricate transistor switch to operate an LED.
28. Design and Fabricate a single stage Amplifier for 1 kHz

This minor project work of 96 hours duration will carry 100 marks. 50 marks in external assessment will be given by industrial/field supervisors and 50 marks of internal assessment by the teacher supervising this training.

The Minor Project work if taken at a stretch may require to place a student with a relevant industry for a period of 1-2 weeks for collection of information and exposure to the industrial process will carry a total of 100 marks.

The components and criteria of evaluation will include the following :

<b>Criteria</b>	<b>Weightage</b>
a) Punctuality and regularity	15%
b) Initiative in learning new things	15%
c) Relationship with people	15%
d) Report writing and seminar	55%

#### **LIST OF RECOMMENDED BOOKS**

1. Module on Electronic Fabrication Techniques by Rajesh Kumar, NITTTR, Chandigarh
2. Module on CAD for PCBs using EAGLE software by Rajesh Kumar, NITTTR, Chandigarh

## ENTREPRENEURIAL AWARENESS CAMP

The employment opportunities for diploma holders especially in public sector are dwindling. The diploma holders need to explore the possibilities of becoming entrepreneurs. For this, they must be acquainted with entrepreneurial development, scope of setting up small scale industry, existing business opportunities, financial support available and various aspects of managing business. In this context, an entrepreneurial awareness camp is suggested. During the camp, experts from various organizations such as banks, financial corporations, service institutes etc. may be invited to deliver expert lectures. Successful entrepreneurs may also be invited to interact with the students. In addition, the students may be encouraged to read papers or give seminar during the camp on Entrepreneurship Development and related topics.

The camp is to be organized preferably at a stretch for two to three days during 4<sup>th</sup> semester(second year). Expert Lectures will be delivered on the following broad topics. There will be no examination for this subject/camp.

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