

**FOURTH SEMESTER (ELECTRONICS ENGINEERING)**

| Sr. No.                           | SUBJECTS                                | STUDY SCHEME |    |           | Credits | MARKS IN EVALUATION SCHEME |     |     |                     |     |     |     |     | Total Marks of Internal & External |
|-----------------------------------|---|--------------|----|-----------|---------|----------------------------|-----|-----|---------------------|-----|-----|-----|-----|------------------------------------|
|                                   |   | Periods/Week |    |           |         | INTERNAL ASSESSMENT        |     |     | EXTERNAL ASSESSMENT |     |     |     |     |                                    |
|                                   |   | L            | T  | P         |         | Th                         | Pr  | Tot | Th                  | Hrs | Pr  | Hrs | Tot |                                    |
| 4.1                               | *Communication Skill-II                 | 4            | -  | 2         | 4       | 20                         | 10  | 30  | 50                  | 2 ½ | 20  | 3   | 70  | 100                                |
| 4.2                               | Industrial Electronics and Transducers  | 4            | -  | 4         | 5       | 20                         | 30  | 50  | 50                  | 2 ½ | 50  | 3   | 100 | 150                                |
| 4.3                               | Network Filters and Transmission Line   | 4            | -- | 4         | 5       | 20                         | 30  | 50  | 50                  | 2 ½ | 50  | 3   | 100 | 150                                |
| 4.4                               | Electronic Instruments and Measurement  | 4            | -  | 4         | 5       | 20                         | 30  | 50  | 50                  | 2 ½ | 50  | 3   | 100 | 150                                |
| 4.5                               | Principles of Communication Engineering | 4            | -  | 4         | 5       | 20                         | 30  | 50  | 50                  | 2 ½ | 50  | 3   | 100 | 150                                |
| 4.6                               | *Energy Conservation                    | 3            | -  | 2         | 3       | 20                         | 10  | 30  | 50                  | 2 ½ | 20  | 3   | 70  | 100                                |
| #Student Centred Activities (SCA) |   | -            | -  | 5         | 1       | -                          | 30  | 30  | -                   | -   | -   | -   | -   | 30                                 |
| <b>Total</b>                      |   | 23           | -  | <b>25</b> | 28      | 120                        | 170 | 290 | 300                 | -   | 240 | -   | 540 | 830                                |

\* Common with other diploma programmes

# Student Centred Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

Industrial training of 4 weeks duration to be organised after 4<sup>th</sup> semester exams

#### 4.1 COMMUNICATION SKILLS – II

**L T P**  
**4 - 2**

##### **RATIONALE**

Knowledge of English Language plays an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills as parts of Communication Skill.

##### **LEARNING OUTCOMES**

After undergoing the subject, the students will be able to:

- Frame correct sentences with illustrations
- Comprehend the language correctly
- Interpret the language correctly
- Use given material in new situations.
- Correspond effectively using various types of writings like letters, memos etc.
- Communicate effectively in English with appropriate body language making use of correct and appropriate vocabulary and grammar in an organised set up and social context.

##### **DETAILED CONTENTS**

- |                       |              |
|-----------------------|--------------|
| 1. Functional Grammar | (16 periods) |
| 1.1 Prepositions      |              |

- 1.2 Framing Questions
  - 1.3 Conjunctions
  - 1.4 Tenses
- 2 Reading (16 periods)
- 2.1 Unseen Passage for Comprehension (Vocabulary enhancement - Prefixes, Suffixes, one word substitution, Synonym and Antonym) based upon the passage should be covered under this topic.
- 3 Writing Skill (24 periods)
- 3.1. Correspondence
    - a) Business Letters- Floating Quotations, Placing Orders, Complaint Letters.
    - b) Official Letters- Letters to Government and other Offices
  - 3.2. Memos, Circular, Office Orders
  - 3.3. Agenda & Minutes of Meeting
  - 3.4. Report Writing

## LIST OF PRACTICALS

**Note:** Teaching Learning Process should be focused on the use of the language in writing reports and making presentations. Topics such as Effective listening, effective note taking, group discussions and regular presentations by the students need to be taught in a project oriented manner where the learning happens as a byproduct.

### Speaking and Listening Skills

1. Debate
2. Telephonic Conversation: general etiquette for making and receiving calls
3. Offering- Responding to offers.
4. Requesting – Responding to requests
5. Congratulating
6. Exploring sympathy and condolences
7. Asking Questions- Polite Responses
8. Apologizing, forgiving
9. Complaining
10. Warning
11. Asking and giving information
12. Getting and giving permission
13. Asking for and giving opinions

## INSTRUCTIONAL STRATEGY

Students should be encouraged to participate in role play and other student-centered activities in class rooms and actively participate in listening exercises

### MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

### RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by RevathiSrinivas; Abhishek Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. e-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

### Websites for Reference:

1. [http://www.mindtools.com/](http://www.mindtools.com/page 8.html) page 8.html – 99k
2. <http://www.letstalk.com.in>
3. <http://www.englishlearning.com>
4. <http://learnenglish.britishcouncil.org/en/>
5. <http://swayam.gov.in>

### SUGGESTED DISTRIBUTION OF MARKS

| Topic No.    | Time Allotted (Periods) | Marks Allotted (%) |
|--------------|-------------------------|--------------------|
| 1            | 16                      | 28                 |
| 2            | 16                      | 28                 |
| 3            | 24                      | 44                 |
| <b>Total</b> | <b>56</b>               | <b>100</b>         |

## 4.2 INDUSTRIAL ELECTRONICS AND TRANSDUCERS

**L T P**  
**4 - 4**

### RATIONALE

Measurement of different parameters is required in industries to maintain the product within specified limits. The measurement can be done by direct or indirect method. Transducers are used as sensing elements in indirect system of measurements. The students equipped with knowledge about thyristors will prove useful in the world of work.

### LEARNING OUTCOME

After undergoing the subject, the students will be able to:

- understand the thyristor family such as SCR, DIAC, TRIAC etc
- describe the application of thyristor such as AC Phase control using SCR
- understand the working principle of Induction and dielectric heating.
- understand basic idea and principle of transducer such as thermistor and piezoelectric crystal
- demonstrate how the weak transducer signals are processed.

### DETAIL CONTENTS

1. Thyristors families (14 Periods)
  - 1.1 Name, symbol and typical applications of members of thyristor family.
  - 1.2 SCR, Triac and Diac-Basic structure, operation, V-I characteristics and ratings, gate circuits, ratings, triggering process and triggering circuits, turn off methods and circuits, selections of heat sinks, mounting of thyristor on heat sinks, basic idea of protection of thyristor circuits.
  - 1.3 Operation, V-I characteristics, equivalent circuit and parameters of an UJT: Description of UJT relaxation oscillator, use of UJT relaxation oscillator for triggering thyristors.
  
2. Thyristor Applications (14 Periods)
  - 2.1 Single phase, various type of phase controlled rectifiers using SCR for resistive and inductive load explanation using wave shapes and appropriate mathematical equation (No derivation).

- 2.2 A.C. phase control using SCRs and triacs, Application of phase controlled rectifiers and A.C, phase control circuits in illumination control. Temperature control, variable speed drives using D.C.. motors and small A.C. machines
- 2.3 Half wave, Full wave (including bridge) using SCRs; explanation using wave shapes and formula (no derivation)
- 2.4 Principle of operation of basic inverter circuits, basic series and parallel commutated inverters, principle of operation of cycloconverter, choppers and dual converter. Basic idea of U.P.S and SMPS.

3. Induction and Dielectric Heating (04 Periods)

Principles and Applications of Induction and Dielectric Heating (No Mathematical Treatment)

4. Transducers (16 Periods)

Basic idea and principle of operation of the following types of transducers and their applications in measuring physical parameters.

- 4.1 Variable Resistance Type: Potentiometric Resistance, strain gauge, Resistance Thermometer, Resistance Temperature detector, Thermistors.
- 4.2 Variable Capacitance Type : Variable capacitance pressure gauge, Capacitor microphone, Dielectric gauge
- 4.3 Variable Inductance Type : Differential Transformer.
- 4.4 Piezoelectric Type : Crystal Microphone, Crystal Oscillator

5. Processing of Transducer Signals (08 Periods)

- 5.1 Characteristic of instrumentation amplifiers in respect of input impedance, output impedance, drift, dc offset, noise, gain common mode rejection, frequency response.
- 5.2 Introduction to AC and DC signal conditioning (only Block diagram)

### LIST OF PRACTICALS

1. Identification of various types of packages and terminals of various low and high power thyristors (SCR and Triac).
2. To determine and plot firing characteristic voltage.
  - a) By varying the anode to cathode voltage.
  - b) By varying the gate current.
3. Observing voltage wave shapes at various points of UJT relaxation oscillator circuit.

4. Observation of wave shapes at relevant points of the circuit of a single phase controlled rectifier using SCR and UJT relaxation oscillator.
5. Test of A. C. phase control circuit using triac and observe wave shapes and voltages at relevant points in circuits (while using for lamp intensity control and/or A. C. fan speed control).
6. To study the working of a single phase SCR/transistor inverter circuit by observing wave shapes at input and output.
7. To measure force and pressure by using strain gauge transducer.
8. To observe the working of Piezo crystal as transducer.

### RECOMMENDED BOOKS

1. Power Electronics by M. D. Singh and K.B Khanchandani; McGraw Hill Publication
2. Industrial Electronics and Control by SK. Bhattacharya, S. Chatterjee, TTTI, Chandigarh.
3. Electrical and Electronic Measurement by A. K. Sawhney.
4. E-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

### INSTRUCTIONAL STRATEGY

The teacher should lay stress on the thyristor family such as SCR, DIAC and TRIAC used in Industrial electronics. The students must learn how one form of energy has been transformed into another form by using transducers. The teachers should also give emphasis on how weak signals are processed using instrumentation amplifiers.

### MEANS OF ASSESSMENTS

- Class Test/Quizzes
- Home Assignments
- Attendance
- Sessional and end semester Examination.
- Practical Tasks

| Topic No. | Time Allotted (Periods) | Marks Allotted (%) |
|-----------|-------------------------|--------------------|
| 1.        | 14                      | 25                 |
| 2.        | 14                      | 25                 |
| 3.        | 04                      | 06                 |
| 4.        | 16                      | 30                 |
| 5.        | 08                      | 14                 |

**SUGG  
ESTED**

|              |           |            |
|--------------|-----------|------------|
| <b>Total</b> | <b>56</b> | <b>100</b> |
|--------------|-----------|------------|

**DISTRIBUTION OF MARKS**



### 4.3 NETWORK FILTERS AND TRANSMISSION LINES

**L T P**

**4 - 4**

#### 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.

#### LEARNING OUTCOMES

After completion of the course, the students will be able to:

- describe the concept of symmetrical, asymmetrical, balanced, unbalanced, T, PI, ladder, lattice, L and Bridge T networks
- demonstrate the operation of attenuators and filters.
- understand the concept and applications of transmission lines.
- measure standing wave ratio and characteristic impedance of the line

#### DETAILED CONTENTS

1. Networks (16 Periods)
  - 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 Network:
    - Concept and significance of the terms characteristic impedance, propagation constant, attenuation constant, phase shift constant and insertion loss.
    - T-network and  $\pi$  Network (No Derivation)
  - Asymmetrical Network
    - Concept and significance of iterative impedance, image impedance,

- The half section (L-section); symmetrical T and  $\pi$  sections into half sections (No Derivation)
2. Attenuators (10 Periods)
- Units of attenuation (Decibels and Nepers): General characteristics of attenuators
  - Analysis and design of simple attenuator of following types; Symmetrical T and  $\pi$  type, L type.
3. Filters (16 Periods)
- Brief idea of the use of filter networks in different communication systems, concept of low pass, high pass, band pass and band stop filters.
  - Prototype Filter Section:
    - Impedance characteristics vs frequency characteristics of a low and high pass filter and their significance
    - Simple design problems of prototype low pass section.
  - M-Derived Filter Sections  
Limitation of prototype filters, need of m-derived filters
  - Crystal Filters  
Crystal and its equivalent circuits, special properties of piezoelectric filters and their use
  - Active Filters  
Basic concept of active filters and their comparison with passive filters.
4. Transmission Lines (14 Periods)
- Transmission Lines, their types and applications.
  - Distributed constants, T and  $\pi$  representation of transmission line section.
  - Concept of infinite line
  - Condition for minimum distortion and minimum attenuation of signal on-the-line and introduction to loading methods.
  - Concept of reflection and standing waves, definition of reflection coefficient, SWR & VSWR and their relation (no derivation).
  - Concept of transmission lines at high frequencies.
  - Introduction to stubs. (single, open and short stubs).
  - HVDC (High Voltage DC transmission) – Concept and Advantage, Disadvantage and areas of application.

## 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:
  - Determine the characteristic impedance experimentally
  - 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.

### MEANS OF ASSESSMENT

- Class test/quizzes
- Home assignments
- Attendance
- Sessional Test

– Practical Tasks

**RECOMMENDED BOOKS**

1. Network Filters and Transmission Lines by AK Chakarvorty; Dhanpat Rai and Co. Publication, New Delhi
2. Network Analysis by Soni and Gupta; Dhanpat Rai and Co. Publication, New Delhi
3. Network Filters and Transmission Line by Yash Pal; Ishan Publications, Ambala City
4. Electrical and Electronics Measuring instrumentation, A.K Sawhney; Dhanpat Rai and Co. Publication, New Delhi
5. E-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

**Websites for Reference:**

<http://swayam.gov.in>

*SUGGESTED DISTRIBUTION OF MARKS:*

| <b>Topic No.</b> | <b>Time Allotted<br/>(Periods)</b> | <b>Marks Allocation<br/>(%)</b> |
|------------------|------------------------------------|---------------------------------|
| 1                | 16                                 | 29                              |
| 2                | 10                                 | 18                              |
| 3                | 16                                 | 29                              |
| 4                | 14                                 | 24                              |
| <b>Total</b>     | <b>56</b>                          | <b>100</b>                      |

#### 4.4 ELECTRONIC INSTRUMENTS AND MEASUREMENT

L T P  
4 - 4

##### RATIONALE

In the real world of work, the technician is required to handle wide variety of instruments while testing, trouble shooting, calibration etc. The study of this subject will help students to gain the knowledge of working principles and operation of different instruments. During practical sessions, he will acquire the requisite skills.

##### LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- describe the specifications of measuring instruments.
- demonstrate the working principle voltage, current and resistance measurement along with their applications.
- understand the working of various parts of CRT.
- measure frequency, voltage, time period and phase using CRO and DSO
- demonstrate the working of RF signal generator, pulse generator and analysers
- understand the working principle of DC/AC bridges and meters.

##### DETAILED CONTENTS

## 1. Basics of Measurements

### (10 Periods)

- Measurement, method of measurement, types of instruments
- Specifications of instruments: Accuracy, precision, sensitivity, resolution, range, errors in measurement, sources of errors, limiting errors, loading effect, importance and applications of standards and calibration

## 2. Voltage, Current and Resistance Measurement (08 Periods)

- Principles of measurement of DC voltage, DC current, AC voltage, AC current,
- Principles of operation and construction of permanent magnet moving coil (PMMC) instruments and Moving iron type instruments,

### **3. Cathode Ray Oscilloscope (12 Periods)**

- Construction and working of Cathode Ray Tube(CRT)
- Block diagram description of a basic CRO and triggered sweep oscilloscope, front panel controls
- Specifications of CRO and their explanation
- Measurement of current, voltage, frequency, time period and phase using CRO
- Digital storage oscilloscope (DSO) : block diagram and working principle
- Working Principle of spectrum analyser

#### 4 Impedance Bridge Q Meters (08 periods)

- Wheat stone bridge
- AC bridges: Maxwell's induction bridge, Hay's bridge, De-Sauty's bridge, Schering bridge and Anderson bridge
- Block diagram description of laboratory type RLC bridge, specifications of RLC bridge.
- Block diagram and working principle of Q meter.

### **5 Signal Generators and Analytical Instruments (08 Periods)**

- Explanation of block diagram specifications of low frequency and RF generators, pulse generator, function generator
- Distortion factor meter
- Instrumentation amplifier: its characteristics, need and working

### **6. Digital Instruments (10 Periods)**

- Comparison of analog and digital instruments
- Working principle of ramp, dual slope and integration type digital voltmeter
- Block diagram and working of a digital multi-meter
- Specifications of digital multi-meter and their applications
- Limitations of digital multi-meters.

- Working principle of logic probe, logic pulser, logic analyzer and signature analyzer.

## **LIST OF PRACTICALS**

### **1 Measurement of voltage, resistance, frequency using digital multimeter**

- 2 Measurement of voltage, frequency, time period and phase using CRO
- 3 Measurement of voltage, frequency, time and phase using DSO
- 4 Measurement of Q of a coil
- 5 Measurement of resistance and inductance of coil using RLC Bridge
- 6 Measurement of impedance using Maxwell Induction Bridge
- 7 To find the value of unknown resistance using Wheat Stone Bridge
- 8 Measurement of distortion using Distortion Factor Meter

**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.

**MEANS OF ASSESSMENT**

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Model/prototype making
- Actual laboratory and practical work
- Model/prototype making
- Assembly and disassembly exercises
- Viva-Voce

**RECOMMENDED BOOKS**

1. Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Sons, New Delhi
2. Electronics Instrumentation by Cooper, Prentice Hall of India, New Delhi
3. Electronics Instrumentation by JB Gupta, Satya Prakashan, New Delhi
4. E-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

**Websites for Reference:**

<http://swayam.gov.in>

**SUGGESTED DISTRIBUTION OF MARKS**

| Topic No     | Time Allotted<br>(Periods) | Marks Allocation<br>(%) |
|--------------|----------------------------|-------------------------|
| 1.           | 10                         | 18                      |
| 2.           | 08                         | 14                      |
| 3.           | 12                         | 22                      |
| 4.           | 08                         | 14                      |
| 5.           | 08                         | 14                      |
| 6.           | 10                         | 18                      |
| <b>Total</b> | <b>56</b>                  | <b>100</b>              |



## 4.5 PRINCIPLES OF COMMUNICATION ENGINEERING

**L T P**  
**4 - 4**

### RATIONALE

The study of principles of communication systems leads to further specialized study of audio and video systems, line communications and microwave communication systems. Thus the diploma-holder in Electronics and Communication Engineering shall find employment in areas of R and D, production, servicing and maintenance of various communication systems. The students should understand the advantage and limitations of various analog and digital modulation systems on a comparative a scale and relate to them while studying practical communication systems.

### LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Explain the concept and need of modulation and demodulation
- Measure the modulation index of the Amplitude Modulated wave and frequency deviation of FM.
- Use different types of modulators and demodulators.
- Obtain modulating signal from an AM Detector Circuit and FM detector
- Use different types of Pulse Modulation Techniques (PAM, PPM, PWM and PCM)
- Classify different radio transmitters and radio receivers.

### DETAILED CONTENTS

1. Introduction (04 Periods)
  - 1.1 Need for modulation, modulation and demodulation in communication systems
  - 1.2 Basic scheme of a communication system.
  
2. Amplitude modulation (06 Periods)
  - 2.1 Derivation of expression for an amplitude modulated wave. Carrier and side band components. Modulation index. Spectrum and BW of AM Wave. Relative power distribution in carrier and side bands.

- 2.2 Elementary idea of DSB-SC, SSB-SC, SSB and VSB modulations, their comparison, and areas of applications
3. Frequency modulation (05 Periods)
- 3.1 Expression for frequency modulated wave and its frequency spectrum (without Proof and analysis of Bessel function) Modulation index, maximum frequency deviation and deviation ratio, BW of FM signals, Carson's rule.
- 3.2 Effect of noise on FM carrier. Noise triangle, Role of limiter, Need for pre-emphasis and de-emphasis, capture effect.
- 3.3 Comparison of FM and AM in communication systems
4. Phase modulation (04 Periods)
- 4.1 Derivation of expression for phase modulated wave, modulation index, comparison with frequency modulation.
5. Principles of AM Modulators (04 Periods)  
Circuit Diagram and working operation of:
- Collector and Base Modulator
  - Square Low Modulator
  - Balanced Modulator
6. Principles of FM Modulators (04 Periods)
- 6.1 Working principles and applications of reactance modulator, varactor diode modulator, VCO and Armstrong phase modulator.
- 6.2 Stabilization of carrier using AFC (Block diagram approach).
7. Demodulation of AM Waves (04 Periods)
- 7.1 Principles of demodulation of AM wave using diode detector circuit

## 8. Demodulation of FM Waves

(05 Periods)

- 8.1 Basic principles of FM detection using slope detector
- 8.2 Principle of working of the following FM demodulators
  - i. Foster-Seeley discriminator
  - ii. Ratio detector
  - iii. Block diagram of Phase locked Loop (PLL) FM demodulators (No Derivation)

9. Pulse Modulation (05 Periods)
- 9.1 Basic concepts of time division multiplexing (TDM) and frequency division multiplexing (FDM)
- 9.2 Pulse Amplitude Modulation (PAM), Pulse Position Modulation (PPM), Pulse Width Modulation (PWM).
10. Pulse Code Modulation (05 Periods)
- 10.1 Basic concept of sampling theorem, quantization, coding and Shanon's theorem.
- 10.2 Types of PCM system and its application(Basic idea only)
- 10.3 Digital modulation techniques.  
(ASK, FSK,PSK, DPSK (Brief idea only)
11. Radio Transmitter (05 Periods)
- 11.1 Classification of transmitters on the basis of power, frequency and modulation.
- 11.2 Block diagram of an AM transmitters and working of each stage. Low level and High level modulation.
- 11.3 Block diagram and working principle of reactance tube and Armstrong FM transmitters
12. Radio Receiver. (05 Periods)
- 12.1 Brief description of crystal and TRF radio receivers; Need for and principles of super heterodyne radio receiver.
- 12.2 Block diagram of super- heterodyne AM receiver, function of each block and typical waveforms at the input and output of each block.
- 12.3 Block diagram of an FM receiver, function of each block and wave/forms at input and output at different blocks.

### LIST OF PRACTICALS

1.
  - a) To observe an AM wave on CRO produced by a standard signal generator using internal and external modulation
  - b) To measure the modulation index of the wave obtained in above practical
2.
  - a) To obtain an AM wave from a square law modulator circuit and observe waveforms
  - b) To measure the modulation index of the obtained wave form.

3. To obtain an FM wave and measure the frequency deviation for different modulating signals.
4. To obtain modulating signal from FM detector.
5. 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.
6. To observe and note the pulse amplitude modulated signal (PAM) and compare them with the corresponding analog input signal
7. To observe PPM and PWM signal and compare it with the analog input signal
8. To observe wave form of different modulation Technique (ASK, FSK, DPSK)

## **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.

### **MEANS OF ASSESSMENT**

- Class test/quizzes
- Home assignments
- Attendance
- Sessional Test
- Practical Tasks

### **RECOMMENDED BOOKS**

1. An Introduction to Analog and Digital Communication by Simon Haykin, Wiley Student Edition.
2. Electronics Communication System by Kennedy, Tata McGraw Hill Education Pvt Ltd, New Delhi
3. Principle of communication Engineering by Taub, TMH Publication.
4. E-books/e-tools to be used as recommended by AICTE/NITTTR, Chandigarh.

#### **Websites for Reference:**

<http://swayam.gov.in>

**SUGGESTED DISTRIBUTION OF MARKS**

| <b>Topic No.</b> | <b>Time Allotted<br/>(Periods)</b> | <b>Marks Allocation<br/>(%)</b> |
|------------------|------------------------------------|---------------------------------|
| 1.               | 04                                 | 07                              |
| 2.               | 06                                 | 11                              |
| 3.               | 05                                 | 09                              |
| 4.               | 04                                 | 07                              |
| 5.               | 04                                 | 07                              |
| 6.               | 04                                 | 07                              |
| 7.               | 04                                 | 07                              |
| 8.               | 05                                 | 09                              |
| 9.               | 05                                 | 09                              |
| 10.              | 05                                 | 09                              |
| 11.              | 05                                 | 09                              |
| 12.              | 05                                 | 09                              |
| <b>Total</b>     | <b>56</b>                          | <b>100</b>                      |

## 4.6 ENERGY CONSERVATION

**L T P**  
**3 - 2**

### RATIONALE

The requirement of energy has increased manifold in last two decades due to rapid urbanization and growth in industrial/service sector. It has become a challenging task to meet ever increasing energy demands with limited conventional fuels and natural resources. Due to fast depletion of fossil fuels and a tremendous gap between supply and demand of energy, it is essential to adopt energy conservation techniques in almost every field like industries, commercial and residential sectors etc. Energy conservation has attained priority as it is regarded as an additional energy resource. Energy saved is energy produced. This course covers the concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in general industry and details out energy audit methodology and energy audit instruments.

### LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- define principles and objectives of energy management and energy audit.
- understand Energy Conservation Act 2001 and its features.
- understand various forms & elements of energy.
- identify electrical and thermal utilities. Understand their basic principle of operation and assess performance of various equipments.
- identify areas of energy conservation and adopt conservation methods in various systems.
- evaluate the techno economic feasibility of the energy conservation technique adopted.

### DETAILED CONTENTS

1. Basics of Energy
  - 1.1 Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy, Capacity factor of solar and wind power generators.
  - 1.2 Global fuel reserve
  - 1.3 Energy scenario in India and state of U.P. Sector-wise energy consumption (domestic, industrial, agricultural and other sectors)
  - 1.4 Impact of energy usage on climate
  
2. Energy Conservation and EC Act 2001
  - 2.1 Introduction to energy management, energy conservation, energy efficiency and its need

- 2.2 Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance. Prominent organizations at centre and state level responsible for its implementation.
  - 2.3 Standards and Labeling: Concept of star rating and its importance, Types of product available for star rating
3. Electrical Supply System and Motors
- 3.1 Types of electrical supply system
  - 3.2 Single line diagram
  - 3.3 Losses in electrical power distribution system
  - 3.4 Understanding Electricity Bill: Transformers Tariff structure, Components of power (kW, kVA and kVAR) and power factor, improvement of power factor, Concept of sanctioned load, maximum demand, contract demand and monthly minimum charges (MMC)
  - 3.5 Transformers: Introduction, Losses in transformer, transformer Loading, Tips for energy savings in transformers
  - 3.6 Electric Motors  
Types of motors, Losses in induction motors Features and characteristics of energy efficient motors, Estimation of motor loading, Variation in efficiency and power factor with loading, Tips for energy savings in motors
4. Energy Efficiency in Electrical Utilities
- 4.1 Pumps: Introduction to pump and its applications, Efficient pumping system operation, Energy efficiency in agriculture pumps, Tips for energy saving in pumps
  - 4.2 Compressed Air System: Types of air compressor and its applications, Leakage test, Energy saving opportunities in compressors.
  - 4.3 Energy Conservation in HVAC and Refrigeration System: Introduction, Concept of Energy Efficiency Ratio (EER), Energy saving opportunities in Heating, Ventilation and Air Conditioning (HVAC) and Refrigeration Systems.
5. Lighting and DG Systems
- 5.1 Lighting Systems: Basic definitions- Lux, lumen and efficacy, Types of different lamps and their features, Energy efficient practices in lighting
  - 5.2 DG Systems: Introduction, Energy efficiency opportunities in DG systems, Loading estimation
6. Energy Efficiency in Thermal Utilities
- 6.1 Thermal Basics: Thermal energy, Energy content in fuels, Energy Units and its conversions in terms of Metric Tonne of Oil Equivalent (MTOE)



- 6.2 Energy Conservation in boilers and furnaces : Introduction and types of boilers, Energy performance assessment of boilers, Concept of stoichiometric air and excess air for combustion, Energy conservation in boilers and furnaces, Do's and Don'ts for efficient use of boilers and furnaces
- 6.3 Cooling Towers: Basic concept of cooling towers, Tips for energy savings in cooling towers
- 6.4 Efficient Steam Utilization
- 7. Energy Conservation Building Code (ECBC)
  - 7.1 ECBC and its salient features
  - 7.2 Tips for energy savings in buildings: New Buildings, Existing Buildings
- 8. Waste Heat Recovery and Co-Generation
  - 8.1 Concept, classification and benefits of waste heat recovery
  - 8.2 Concept and types of co-generation system
- 9. General Energy Saving Tips  
Energy saving tips in:
  - 9.1 Lighting
  - 9.2 Room Air Conditioner
  - 9.3 Refrigerator
  - 9.4 Water Heater
  - 9.5 Computer
  - 9.6 Fan, Heater, Blower and Washing Machine
  - 9.7 Colour Television
  - 9.8 Water Pump
  - 9.9 Cooking
  - 9.10 Transport
- 10. Energy Audit
  - 10.1 Types and methodology
  - 10.2 Energy audit instruments
  - 10.3 Energy auditing reporting format

## **PRACTICAL EXERCISES**

1. To conduct load survey and power consumption calculations of small building.
2. To check efficacy of different lamps by measuring power consumption and lumens using lux meter.

3. To measure energy efficiency ratio (EER) of an air conditioner.
4. To measure effect of valve throttling and variable frequency drive (VFD ) on energy consumption by centrifugal pump.
5. To measure and calculate energy saving by arresting air leakages in compressor.
6. To measure the effect of blower speed on energy consumed by it.

### **STUDENT ACTIVITIES ON ENERGY CONSERVATION/ENERGY EFFICIENCY**

- Presentations of Case Studies
- Debate competitions
- Poster competitions
- Industrial visits
- Visual Aids

### **INSTRUCTIONAL STRATEGY**

Teachers are expected to lay considerable stress on understanding the basic concepts in energy conservation, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject must be supplemented by demonstrations and practical work in the laboratory. Visits to industries must be carried out. Expert from industry must be invited to deliver talks on energy conservation to students and faculty.

### **RECOMMENDED BOOKS**

1. Guide book on General Aspects of Energy Management and Energy Audit by Bureau of Energy Efficiency, Government of India. Edition 2015
2. Guide book on Energy Efficiency in Electrical Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
3. Guide book on Energy Efficiency in Thermal Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
4. Handbook on Energy Audit & Environmental Management by Y P Abbi & Shashank Jain published by TERI. Latest Edition

#### **Important Links:**

- (i) Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India.  
[www.beeindia.gov.in](http://www.beeindia.gov.in).
- (ii) Ministry of New and Renewable Energy (MNRE), Government of India.  
[www.mnre.gov.in](http://www.mnre.gov.in).

- (iii) Uttar Pradesh New and Renewable Energy Agency (UPNEDA), Government of Uttar Pradesh. [www.upneda.org.in](http://www.upneda.org.in).
- (iv) **Central Pollution Control Board (CPCB)**, Ministry of Environment, Forest and Climate Change, Government of India. [www.cpcb.nic.in](http://www.cpcb.nic.in).
- (v) **Energy Efficiency Services Limited (EESL)**. [www.eeslindia.org](http://www.eeslindia.org).
- (vi) Electrical India, Magazine on power and electrical products industry. [www.electricalindia.in](http://www.electricalindia.in).

## **INDUSTRIAL TRAINING OF STUDENTS**

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 4 weeks duration to be organised during the semester break starting after second year i.e. after 4<sup>th</sup> 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. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An external assessment of 50 marks has been provided in the study and evaluation scheme of 5<sup>th</sup> 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