Fourth Semester

ELECTRICAL ENGINEERING AND MACHINES (DEC-401)
Basic Engineering and Science (BES) Core: Credit 4(3-0-2)

Objective:
For a diploma holder, it becomes imperative to know the fundamentals of the electrical engineering in order to grasp the knowledge of the field. This subject will provide acquaintance with various terms, knowledge of fundamental concepts of electricity, and various motors and machines.

COURSE OUTLINE:

1. **Over view of DC Circuits** (08 period)

1.1 Basic concept of AC & DC

1.2 Applications of Kirchoff's Lawsin solving electrical network problems.

1.3 Networkstheorem such as superposition, Thevenin theorem , Norton theorem and maximum power transfer theorem.

1.4 Star-delta transformation

2. **AC fundamentals** (10 period)

2.1 Concept of alternating current, and voltage , equation of instantaneous values.

2.2 Representation of alternating sinusoidal quantities by phasor.

2.3 Power in pure resistance, inductance, capacitance. RL, RC, RLC circuits

2.4 Active and reactive components of current and their significance

2.5 Power factor and its practical significance

2.6 Resonance in series and parallel circuits

2.7 Active power reactive power, apparent power

3. **Three phase supply** (10period)

3.1 Advantage of three phase system over single phase system

3.2 Star –delta connection

3.3 Relation between phase voltage and line voltage, also between phase current and line current in a 3 phase

4. **Transformer** (10 period)

Working principle of a Transformer, constructional features, voltage and current transformation. Methods of connection 3 phase transformers, current and voltage relationship, auto transformer and its uses, instruments transformer, voltage regulation and its significance , need for isolation. Losses in a transformer, cooling of transformer

5. Electrical Machines (16 Period**)**

Principles of electromechanical energy conversion,

DC Machines: Types, e.m.f. equation of generator and torque equation of motor, construction characteristics and applications of dc motors, speed control of DC motor.

Single Phase Induction Motor: Principle of operation and construction brief of single phase motor introduction to methods of starting, applications.

Three Phase Induction Motor: Types, constructional brief & Principle of operation, Slip-torque characteristics, speed control and starting methods

Three Phase Synchronous Machines: Constructional brief & Principle of operation of alternator and synchronous motor and their applications.

6. Batteries (10Period**)**

6.1 Basic idea about primary and secondary cells,

6.2 Construction, working and applicants of Lead-Acid, Nickel-Cadmium and Silver oxide batteries,

6.3 Capacity and efficiency of lead acid battery

6.4 Series and parallel connections of batteries,

6.5 Testing of lead acid battery for fully charged condition and their specification

6.6 Application of lead acid battery

6.7 Introduction to maintenance free batteries.

LIST OF PRACTICALS

1. Familiarization of measuring instruments viz. voltmeter, ammeter , wattmeter and other accessories
2. To measure (very low) resistance ofan ammeter and (very high) resistance of a voltmeter
3. To verify in d.c. circuits

·Thevenin's theorem

·Norton's theorem

·Super Position Theorem

·Maximum Power Transfer Theorem

4. To find a voltage current relationship in a single phase R-L and R-C Series circuits, draw their impedance triangles and determination of the power factor in each case.
5. To determine effect of a single phase transformer from the data obtained through open circuit and short circuit test.
6. To connect the primary and secondary winding of a three phase transformer and to verify line and phase current and voltage relationship respectively.
7. 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.
8. To run a 3 phase induction motor with the help of a star-delta starter. To change the direction of rotation of the motor.
9. To run a synchronous motor with a.c. supply and to measure speed to verify the relation N= 120f/p .
10. To test a lead –acid storage battery for charged & discharged condition (with hydrometer & to recharge it)

RECOMMENDED BOOKS

1. Basic Electricaland ElectronicsEngineering by SK Sahdev ,DhanpatRai and CO, New Delhi.

2. Electrical Science by Choudhury S; Narosa Publishing House Pvt. Ltd. Daryaganj New Delhi.

MICROPROCESSOR AND ITS APPLICATIONS (DEC-402)

Discipline core (DC) : Credit 4(3-0-2)

Objective: 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.

COURSE OUTLINE:

1. Evolution and Architecture of a Microprocessor (12 period)

Typical organization of a microcomputer system and functions of its various blocks. 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.

2. Programming (with respect to 8085 microprocessor) (16 period)

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.

3. Memories and I/O interfacing (10 period)

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.

4. Instruction Timing and Cycles (08 period)

Instruction cycle, machine cycle and T-states, Fetch and execute cycle

5. Interrupts (06period) 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

6. Data transfer techniques (06period)

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

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 foraddition and substation 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 BCDcounters (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

RECOMMENDED BOOKS

1. Microprocessor Architecture by Ramesh S Gaonker, Willey Eastern Ltd. New Delhi
2. Introduction to Microprocessor by Mathur ,Tata McGraw Hill Education Pvt Ltd , New Delhi

ELECTRONICS MEASURING INSTRUMENTS (DEC-403)

Discipline core (DC) : Credit 4(3-0-2)

Objective: 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.

COURSE OUTLINE:

1. Basics of Measurements (06 period)
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 (12 period)
2.1 Principles of operation and construction of permanent magnet moving coil (PMMC) instruments
2.2 Moving iron type instruments, measurement of d.c voltage and current, measurement of d.c voltage and current, milli-volt measurement 2.3 Measurement of voltage, current and resistance using multimeter2.4 Specifications of multimeter and its applications 2.5 Limitations with regard to frequency
3. Cathode Ray Oscilloscope (10 period)
3.1 Construction and working of Cathode Ray Tube (CRT)
3.2 Time base operation and need for blanking during fly back, synchronization
3.3 Block diagram, description of a basic CRO and triggered sweep oscilloscope, front panel controls.
3.4 Specifications of CRO and their explanation.

3.5 Measurement of voltage, current, frequency, time period and phase using CRO.

3.6 CRO probes, special features of dual beam, dual trace, delay sweep.

3.7 Digital storage oscilloscope (DSO) : block diagram and working principle.

4. Signal Generators and Analytical Instruments (08 period)

4.1 Explanation of block diagram specifications of low frequency and RF generators, pulse generator, function generator

4.2 Wave analyzer, distortion measurement and spectrum analyser

5. Impedance Bridges and Q Meters (14 period)

5.1 Wheat stone bridge

5.2 AC bridges: Maxwell's induction bridge, Hay's bridge, De-Sauty's bridge, Schering bridge

5.3Block diagram description of laboratory type RLC bridge, specifications of RLC bridge

5.4 Block diagram and working principle of Q meter

6. Digital Instruments (14 period)

6.1 Comparison of analog and digital instruments

6.2 Working principle of ramp, dual slope and integration type digital voltmeter

6.3 Block diagram and working of a digital multimeter

6.4Measurement of time interval, time period and frequency using universal counter/frequency counter

6.5 Working principle of logic probe, logic pulser, logic analyzer, logic comparator, signature analyzer

LIST OF PRACTICALS

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance
2. To observe the limitations of a multimeter for measuring high frequency voltage
3. Measurement of voltage, frequency, time period and phase using CRO
4. Measurement of rise time and fall time using CRO
5. Measurement of Q of a coil and its dependence on frequency
6. Measurement of voltage, frequency, time and phase using DSO
7. Measurement of resistance and inductance of coil using RLC Bridge
8. Use of logic pulser and logic probe
9. Measurement of time period, frequency, average period using universal counter/ frequency counter

RECOMMENDED BOOKS

1. Electronics Measurement and Instrumentation by AK Sawhney, DhanpatRai and Sons, New Delhi

2. Electronics Measurement and Instrumentation by Oliver, Tata McGraw Hill Education Pvt Ltd, New Delhi

NETWORK FILTERS AND TRANSMISSION LINES (DEC-404)

Discipline core (DC) : Credit 4(3-0-2)

Objective: 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.

COURSE OUTLINE:

1. Circuit Theory &Networks (20period)

a) Elements of Networks and its type, Current Sources, Voltage Source and their conversion, Dependent and Independent Sources, Nodal and Mesh analysis.b) Two port (four terminals) network: Basic concepts of the following terms i) Symmetrical and asymmetrical networks: Balanced and unbalanced network, T-network, Л network, Ladder network; Lattice network; L-network and Bridge T-network c) Symmetrical Network: i) Concept and significance of the terms characteristic impedance, propagation constant, attenuation constant, phase shift constant and insertion loss. ii) T-network and Л Network d) Asymmetrical Network i) Concept and significance of iterative impedance, image impedance, image transfer constant and insertion loss ii) The half section (L-section); symmetrical T and Л sections into half sections

2. Attenuators (08period)

2.1 Units of attenuation (Decibels and Nepers): General characteristics of attenuators

2.2 Analysis and design of simple attenuator of following types; Symmetrical T and Л type, L type

3. Filters (16period)

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

i) Impedance characteristics vs frequency characteristics of a low and high pass filter and their significance ii) Attenuation Vs frequency; Phase shift Vs frequency, characteristics impedance vs frequency of T and Л filters and their significancevs

iii) Simple design problems of prototype low pass section.

c) M-Derived Filter Sections - Limitation of prototype filters, need of m-derived filter 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 (20period)

4.1 Transmission Lines, their types and applications.

4.2 Distributed constants, T and Л representation of transmission line section.

4.3 Definition of characteristic impedance, propagation constant, attenuation constant and phase shift constant.

4.4 Concept of infinite line

4.5 Condition for minimum distortion and minimum attenuation of signal on-the-line and introduction to loading methods.

4.6 Concept of reflection and standing waves, definition of reflection coefficient, SWR &VSWR and their relation (no derivation).

4.7 Transmission line equation, expression for voltage, current and impedance at a point on the line.

4.8 Concept of transmission lines at high frequencies.

4.9 Introduction to stubs. (single, open and short stubs).

LIST OF PRACTICALS

1.To measure the characteristic impedance of symmetrical T and Л networks

2.To measure the image impedance of a given asymmetrical T and Л networks

3.For a prototype low pass filter:

·Determine the characteristic impedance experimentally

·Plot the attenuation characteristic

4.To design and measure the attenuation of a symmetrical T/ Л 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

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; DhanpatRai and Co. Publication, New Delhi

SIGNAL SENSING AND CONDITIONING (DEC-405)

Discipline core (DC) : Credit 4(3-0-2)

Objective: This subject provides knowledge about signals, sensing of signals, signal transmission, conditioning and recording.

COURSE OUTLINE:

1. Introduction (04 Periods)
1.1 Signal
1.2 Types of Signals
1.3 Functional Elements of System
1.4 Importance of Sensing of Signals
2. Sensing Elements (24 Periods)
2.1 Resistive sensing elements: potentiometers, resistance thermometers, strain gauges, Load cell/Pressure cell
2.2 Capacitive sensing elements: variable separation, area and dielectric
2.3 Inductive sensing elements: variable reluctance and LVDT displacement sensors
2.4 Electromagnetic sensing elements: velocity sensors
2.5 Thermoelectric sensing elements: laws, thermocouple characteristics, installation problems 2.6 Elastic sensing elements : sensing elements for force, torque, acceleration, pressure
2.7 Piezoelectric sensing elements: static and dynamic characteristics
2.8 Electrochemical sensing elements: ion selective electrodes, solid state gas sensors
2.9 Photo sensing elements : Basic principle and characteristics of photo sources and photo detector, photo resisters, photo diodes, photo transistors, photo electric cells, LCDs, LEDs and photocouplers, LDR
2.10 Photo Detectors : Optical detection Principles, Electro-optic effect, Integrated Optical Devices, Magneto optic effect, Acousto-optic effect
3. Signal Transmission (12 Periods)
3.1 Introduction
3.2 Methods of Data Transmission
3.3 General Telemetry System
3.4 Types of Telemetry Systems
3.5 Land Line Telemetering System
3.6 Voltage Telemetering Systems
3.7 Current Telemetering System
3.8 Position Telemetering System
3.9 Land Line Telemetering
4. Signal Conditioning (07 Periods)
4.1 Basic Instrumentation Amplifier
4.2 Applications of Instrumentation Amplifiers (Specific Bridge)
4.3 Chopped and Modulated DC Amplifier

6. Signal Recording and Display (10Periods)
6.1 Recording Requirements
6.2 Analog Recorders
6.3 Graphics Recorders
6.4 Strip Chart Recorders
6.5 Types of Strip Chart Recorders
6.6 Galvanometer Type Recorders
6.7 Null Type Recorders
6.8 Potentiometric Recorders
6.9 X-Y Recorders
6.10 Direct Recording
6.11 Digital Display Methods
6.12 Digital Display Units
6.13 Segmental Displays
6.14 Dot Matrices
7. Data Acquisition System (07 Periods)
7.1 Introduction
7.2 Objective of DAS
7.3 Single Channel Acquisition System
7.4 Multi-Channel DAS
7.5 Computer Based DAS
7.6 Data Loggers

LIST OF PRACTICALS

1. Measurement of Displacement using LVDT
2. Measurement of Temperature using Thermocouple &Thermister
3. Measurement of Strain using strain gauge
4. Application of Load Cell/Pressure Cell
5. Application of capacitive transducer
6. Application of Potentiometer
7. Application and use of LDR, Photocell
8. Application of Potentiometer recording
9. Application and use of graphic and strip chart recorder
10. Use of Telemetry System

RECOMMENDED BOOKS

1. Electronic Instrumentation; by H.S.Kalsi; McGraw-Hill Education India Pvt.Ltd.
2. Principles of Measurement Systems by John P.Bently (Pearson)

Communication Engineering (DEC-406)

Discipline Electives (DE): Credit 3(3-0-0)

RATIONALE

Study of principles of communication systems leads to further study of audio and video systems, line communication and microwave communication systems. Thus the diploma holders shall find employment in areas of R & amp; D, production, servicing and maintenance of various communication systems.

DETAILED CONTENT

1. AM/FM Transmitters

a) Classification of transmitters on the basis of power and frequency

b) Concept of low level and high level modulation, Block diagram of low and high level modulation, AM Transmitters and working of each stage.

c) Block diagram and working principles of reactance transmitter and Armstrong FM transmitters.

2. AM / FM Radio Receivers

a) Brief description of crystal and TRF receiver

b) Block diagram and working principle of super hetrodyne AM receiver, function of each block and typical wave at I/P and

O/P of each block Advantages of super heterodyne reception.

c) Performance characteristics of a radio receiver - sensitivity, selectivity, fidelity, S/N ratio, image rejection ration and their measurement procedure.

d) Selection criteria for intermediate frequency (IF), Concepts of simple and delayed AGC.

e) Block diagram of an FM receiver, function of each block and wave forms at input and output of different blocks. Need for limiting and de-emphasis in FM reception.

f) Block diagram of communication receivers, differences with respect to broadcast receivers.

3. Antennas

a) Physical concept of radiation of electromagnetic energy from a dipole, Concept of polarization of EM waves, electromagnetic spectrum and its various ranges: VLF, LF, HF, VHF, UHF, Micro-wave

b)Definition and physical concepts of the terms used with antennas like point source, gain, directivity, aperture, effective area, radiation pattern, beam angle, beam width and radiation resistance.

c) Types of antennas : brief description, characteristics and typical applications of

- half wave dipole
- medium wave (mast) antenna
- yagi and ferrite rod antenna

d) Brief description of broadside and end fire arrays, their radiation pattern and applications (without analysis); brief idea about rhombic antenna and disc antenna.

4. Propagation

a) Basic idea about different modes of radio wave propagation, ground wave propagation, space wave communication and sky wave propagation and troposcatter (duct propagation their characteristics and typical areas of applications (e.g. medium wave, short wave, radio and TV communication etc.)

b) Basic idea of field strength in case of ground wave propagation and space wave propagation

c) Explanation of terms – critical frequency, maximum usable frequency (MUF) and skip distance

d) Noise in Radio communication, signal fading

LIST OF PRACTICALS

1. To plot the sensitivity characteristics of a radio receiver and determine the frequency of maximum sensitivity
2. To plot the selectivity characteristics of a radio receiver
3. To align AM broadcast radio receiver
4. To study the faults in radio receiver
5. To measure the DC/AC voltage at different points of a radio receiver
6. Installation of directional antenna for best reception
7. Installation of dish antenna for best reception

RECOMMENDED BOOKS

1. Electronic Communication by Kennedy, Tata McGraw Hill Publishers, New Delhi
2. Electronic Communication System by Reddy & Coolen, Prentice Hall of India
3. Electronic Communication System by KS Jamwal, Dhanpat Rai & Sons, Delhi