

COURSE CODE: EEC017

COURSE NAME: DIPLOMA IN REFRIGERATION & AIR CONDITIONING ENGINEERING

COURSE DURATION: ONE YEAR

SNo	Subject Code	Subject
1	EEC017-01	COMMUNICATIVE ENGLISH & COMPUTER FUNDAMENTALS(MS-OFFICE)
2	EEC017-02	INTRODUCTION TO ELECTRICAL & ELECTRONICS
3	EEC017-03	COMPONENTS & WORKING PRINCIPLES
4	EEC017-04	DIAGNOSIS & TROUBLE SHOOTING
5	EEC017-05	REFRIGERATORS REPAIR & MAINTENANCE
6	EEC017-06	AIR CONDITIONER REPAIR & MAINTENANCE
7	EEC017-07	PRACTICAL - I
8	EEC017-08	PRACTICAL - II
9	EEC017-09	INTERNAL ASSESSMENT
10	EEC017-10	RECORD & VIVA

DIPLOMA IN REFRIGERATION & AIR CONDITIONING ENGINEERING

SYLLABUS

ELECTRICITY

- 1. FUNDAMENTAL OF ELECTRICITY TYPES**
- 2. CIRCUIT**
- 3. CURRENT**
- 4. TRANSFORMER**
- 5. MOTORS**
- 6. METERS**
- 7. CAPACITOR**
 - STARTING CAPACITOR
 - RUNNING CAPACITOR
- 8. RESISTANCE**
- 9. MOTOR TYPE**
 - SIGNAL PHASE
 - THREE PHASE
- 10. RELAY TYPE**
- 11. RELAY CHECKING**
- 12. ELECTRIC MOTOR**
 - A.C MOTOR
 - D.C MOTOR
- 13. WINDING**
- 14. TERMINAL CHECKING**
- 15. OHMS LAW**

FUNDAMENTAL OF REFRIGERATION & AIR CONDITION

- 16. WHAT IS REFRIGERATION?**
- 17. WHAT IS HEAT**
- 18. TYPES OF HEAT**
- 19. HEAT TRANSMISSION METHOD EXPLAIN**
- 20. PRESSURE**
- 21. PRESSURE UNIT**
- 22. TON OF REFRIGERATION?**
- 23. METHOD OF REFRIGERATION**
- 24. VCS SYSTEM**
- 25. VAS SYSTEM**
- 26. REFRIGERANT**
- 27. TYPES OF REFRIGERANT**
- 28. REFRIGERANT CHEMICAL NAME & CHEMICAL FORMULA**

- 29. ALTERNATIVE REFRIGERANT
- 30. METHOD OF REFRIGERANT RECOVERY
- 31. METHOD OF LEAK TESTING
- 32. OIL TYPES
- 33. LUBRICATION SYSTEM
- 34. DESRABLE PROPERTIES OF LUBRICATION OIL
- 35. TYPES OF COMPRESSOR
- 36. TYPES OF CONDENSER
- 37. TYPES OF EVAPORATOR
- 38. TYPES OF THROTTLING DEVICE
- 39. TYPES OF COOLING TOWER
- 40. NRE – NET REFRIGERANT EFFECT R22
- 41. REFRIGERATOR
- 42. ELECTRICAL PARTS OF REFRIGERATOR
- 43. SINGLE DOOR REFRIGERATOR WIRING DIAGRAM
- 44. DOUBLE DOOR REFRIGERATOR WIRING DIAGRAM
- 45. AIR CONDITIONER
- 46. INSTALLATION OF WINDOW AIR CONDITIONER
- 47. SPLIT AIR CONDITIONER
- 48. AIR CIRCULATION
- 49. TROUBLE SHOOTING OF AIR CONDITIONER
- 50. SERVICE IN THE SPLIT AIR CONDITIONER
- 51. CAR A/C WIRING AND PRACTICAL EXPLAIN
- 52. THERMAL CONTROL SWITCH
- 53. RECEIVER
- 54. DEEP FREEZER
- 55. DUCT
- 56. PACKAGE A/C
- 57. AIR COOLER
- 58. CENTRAL PLANT A/C
- 59. CENTRAL PLANT CHILLER SYSTEM
- 60. TRANSPORT A/C
- 61. VACUM
- 62. REFRIGERANT (GAS) CHARGING
- 63. REFRIGERATION EQUIPMENTS
- 64. SAFETY DEVICES
- 65. BLUE STAR
- 66. COMPRESSOR WORKING TYPE
- 67. HVAC TOOLS
- 68. HVAC MAINTENANCE
- 69. METER TYPES

COMMERCIAL & TRANSPORT PURPOSE

- 70. PURPOSE OF AIR CONDITION**
- 71. BLUE STAR CHILLER CAREER CHILLER**
- 72. AUTOMOBILE AIR CONDITION**
- 73. REFRIGERATED VEHICLES**
- 74. COLD STORAGE AIR CONDITIONER**
- 75. CSCR METHOD WRING OF WINDOW A/C**
- 76. PSC METHOD OF SPLIT A/C WRING**

Detailed Curriculum

Level 3 (Semester I)

(3.GE.01)Language - I

Module 1: Reading comprehension (prescribed texts) and functional grammar

A variety of genres – short stories, expository pieces, biographies, poems, plays, newspaper and magazine excerpts have been included. Teaching of grammar has been integrated with the reading texts. The emphasis is on functional grammar.

The following ten prose texts and five poems have been selected for development of different reading skills.

Prose texts (Prescribed)

1. A warmer or a colder earth (popular science) Arthur – C. Clark
2. The tiger in the tunnel (narrative) – Ruskin Bond.
3. First two or four pages from Sunny Days (autobiographical) – By Sunil Gavaskar
4. Case of suspension (narrative)
5. Big brother (narrative) Shekhar Joshi
6. Father, dear father (news paper article form the Hindu)
7. Face to face (autobiographical) Ved Mehta
8. I must know the truth (narrative) SigrunSrivastva
9. If I were you (play) Douglas James
10. India, her past and her future (speech) Jawahar Lal Nehru

Poems

1. Leisure – W H Davis
2. The road not taken – Robert Frost
3. Where the mind is without fear- Tagore
4. My grandmother's house – Kamla Das
5. The night of the scorpion – Nissi, Ezekiel

Non prescribed

In this section learners will be exposed to newspaper, articles, tables, diagrams, advertisements etc. which they have to read carefully and interpret. In the examination similar pieces will be used.

Grammar and usage:

The following points of grammar and usage have been selected from the reading passages.

1. agreement/concord: number – gender etc.
2. Tenses: simple past (negatives/interrogatives) present perfect, past perfect continuous, past perfect, expressing future time (will and going to)
3. Passive voice (perfect tenses and modals)
4. Modals (must, should ought to, would)
5. Linking words (to like because although, instead of, if, as, since, who, which that, when however, inspite of)
6. Reported speech, statements, questions (yes/no)

Module 2: Functional writing and study skills

This module help the learner to write descriptive and narrative paragraph, letters, reports notices etc. and also practice skills of note making

1. Paragraph writing
 - Describing objects
 - Describing people
 - Narrating events, stories
2. Letter writing
 - Application for leave
 - Application for jobs
 - Asking for information form various agencies (e.g. Last date for getting prospects; price of items before placing doers etc.)
3. Note making
4. Ending (punctuation, spelling, appropriate vocabulary, structures)

(3.GE.02)Applied Chemistry

1. Structure of Atom:

Rutherford model of the structure of atom, Bohr's theory of electrons, quantum numbers and their significance, de-Broglie equation and uncertainty principle, electronic configuration of 1 to 30 elements

2. Periodic Properties of Elements:

Periodic law, periodic table, periodicity in properties like atomic radii and volume, ionic radii, ionization energy and electron affinity, Division of elements into s, p, d and f blocks

3. Chemical Bonds:

Electrovalent, covalent and coordinate bond and their properties, Metallic bonding (electron cloud mode) and properties (like texture, conductance, luster, ductility and malleability).

4. Fuel and their Classification:

Definition, characteristics, classification into solid, liquid and gaseous fuel,. Petroleum and brief idea of refining into various fractions and their characteristics and uses, Calorific value of fuel, Gaseous fuels- preparation, properties, composition and use of producer gas, water and oil gas.

5. Water:

Impurities in water, methods of their removal, hardness of water, its types, causes and removal, disadvantages of hard water in boilers, pH value and its determination by calorimetric method.

6. Corrosion:

Its meaning, theory of corrosion, prevention of corrosion by various methods using metallic and non-metallic coatings

7. Plastic and Polymers:

Plastic-thermo-plastic and thermo-setting, Introduction of Polythene, P.V.C. Nylon, synthetic rubber and phenol-formal-dehyde resin, their application in industry.

(3.GE.03)Applied Physics

- 1. Units & Dimensions:** M.K.S. fundamentals & derived units, S.I. base units supplementary units and derived units, Dimensions of various physical quantities, uses of dimensional analysis.
- 2. Surface Tension and Viscosity:** molecular forces, molecular theory of surface tension, surface energy, capillary action, concept of viscosity, coefficient of viscosity, principle and construction of viscometers.
- 3. Vibrations:** Vibration as simple spring mass system, elementary and qualitative concept of free and forced vibrations, resonance. Effects of vibrations on building bridges and machines members.
- 4. Heat:** Temperature and its measurement, thermoelectric, platinum resistance thermometers and pyrometers. Conduction through compound media and laws of radiations.
- 5. Ultrasonics:** Productions of ultrasonic waves by magnetostriction and piezo-electric effect, application of ultrasonics in industry.
- 6. Optics:** Nature of light, reflection and refraction of a wave from a plane surface. Overhead projector and Epidiascope.

(3.GE.04)Applied Mathematics – I

Sets, Relations and Functions

1. Sets
2. Relations and Functions-I
3. Trigonometric Functions-I
4. Trigonometric Functions-II
5. Relation between Sides and Angles of A triangle

Sequences and Series

1. Sequences and Series
2. Some Special Sequences

Algebra-I

1. Complex Numbers
2. Quadratic Equations and Linear inequalities
3. Principle of Mathematical Induction
4. Permutations and Combinations
5. Binomial Theorem

Co-ordinate Geometry

1. Cartesian System of Rectangular Co-ordinates
2. Straight Lines
3. Circles
4. Conic Sections

Statistics and Probability

1. Measures of Dispersion
2. Random Experiments and Events
3. Probability

(3.GP.01) Applied Chemistry - Lab

1. Proximate analysis of solid fuel.
2. Experiments based on Bomb Calorimeter.
3. Determination of turbidity in a given sample.
4. To determine the flash and fire point of a given lubricating oil.
5. To determine the viscosity of a given lubricating oil by Redwood viscometer.
6. To determine cloud and pour point of a given oil.

(3.GP.02)Applied Physics – Lab

1. To determine the surface tension of a liquid by rise in capillary.
2. To determine the viscosity of a given liquid.
3. To determine the frequency of tuning fork using a sonometer.
4. To determine the frequency of AC main using sonometer.
5. Time period of a cantilever.

Level 3 (Semester II)**(3.GV.01) General Foundation Course – I****A. Business Management and Entrepreneurship**(a) **Entrepreneurship Orientation**

Importance and relevance in real life: Emphasis on self-employment.

(b) **Entrepreneurship Values and Attitudes**

Innovativeness, Independence, Risk Taking, Analytical ability.

(c) **Entrepreneurial Motivation**

Achievement Planning, personal efficacy, entrepreneurial goal setting.

(d) **Launching of a Business Venture**

Identification of project, steps in setting up a business, information about various institutions providing assistance, project formulation.

B. Computational Skills

(a) Percentage, ratio & proportion, profit & loss, discount, simple and compound interest, population growth and depreciation of value of articles using logarithm. Area and volume: rectangle, parallelogram, circle, cube, cone, cylinder &

(b) sphere.

C. Environmental Education

(a) Environment and the society.

(b) Environment properties risks in different economic enterprises, in use of raw materials, in processing / manufacturing and designing.

(c) Poverty and environment.

D. Rural Development

(a) Agriculture, the back bone of Indian Economy.

(b) Rural development projects in India including Integrated rural development programme.

(c) Agro based rural industries.

(d) Community approach to rural development.

(3.GV.02)Basic Electricity**1. Current Electricity**

Definition of Resistance, Voltage, Current, Power, Energy and their units, Relation between electrical, mechanical and thermal units, Temperature variation of resistance, Difference between AC and DC voltage and current

2. D.C. Circuits

Ohm's Law, Series – parallel resistance circuits, calculation of equivalent resistance, Kirchhoff's Laws and their applications.

3. Electric Cells

Primary cell, wet cell, dry cell, battery, Li-ion battery, series and parallel connections of cells, Secondary cells, Lead Acid Cell, Discharging and recharging of cells, preparation of electrolyte, care and maintenance of secondary cells.

4. Lighting Effects of Current

Lighting effect of electric current, filaments used in lamps, and Tube-light, LED, their working and applications.

5. Capacitors

Capacitor and its capacity, Concept of charging and Discharging of capacitors, Types of Capacitors and their use in circuits, Series and parallel connection of capacitors, Energy stored in a capacitor.

6. Electromagnetic Effects

Permanent magnets and Electromagnets, their construction and use, Polarities of an electromagnet and rules for finding them.

Faraday's Laws of Electromagnetic Induction, Dynamically induced e.m.f., its magnitude and induction, inductance and its unit. Mutually induced e.m.f., its magnitude and direction, Energy stored in an inductance.

Force acting on a current carrying conductor in magnetic field, its magnitude and direction, Principles and construction of dynamo.

7. A.C Circuits

Generation of A.C. voltage, its generation and wave shape. Cycle, frequency, peak value R.M.S. value, form factor, crest factor, Phase difference, power and power factor, A.C. Series Circuits with (i) resistance and inductance (ii) resistance and capacitance and (iii) resistance inductance and capacitance, Q factor of R.L.C. series circuits.

(3.GV.03)Basic Electronics

i) Overview of Atom, Sub-Atomic Particles and CRO

- Brief History of Electronics.
- Atom and its elements,
- Electron, Force, Field intensity, Potential, Energy, current
- Electric field, Magnetic field, Motion of charged particles in electric and magnetic field.
- Overview of CRO, Electronic and Magnetic deflection in CRO, Applications.

ii) Voltage and Current

- Resistance, Ohm's law, V-I Characteristics, Resistors, Capacitors, Inductors.
- Voltage and Current sources, Symbols and Graphical representation
- Overview of AC, DC, Cells and Batteries, Energy and Power.

iii) Basics of Semiconductor

- Semiconductor materials, Metals and Semiconductors and Photo-electric emission.
- N-type and P-type semiconductor, Effects of temperature on Conductivity of semiconductor.
- PN junction diode, depletion layer, Forward & Reverse bias, V-I Characteristic, Effects of temperature, Zener diode, Photo diode, LED, Types and applications of diode.
- Diode as a rectifier, Half wave and full wave rectification, Zener diode Regulator.
- Introduction to Filters, Clippers, Clampers

iv) Bipolar Junction Transistor

- Operation of NPN and PNP transistors, Biasing of BJT.
- CB, CE and CC configuration
- Introduction to FET, JFET, MOSFET, CMOS and VMOS

v) Transistor Amplifier and Applications

- Introduction, Single and Multi-stage amplifiers
- Introduction to Oscillators
- Introduction to Thyristors, PNPN diode, SCR, LASCR, DIAC, TRIAC

(3.GV.04) Applied Mathematics - II

Algebra-II

1. Matrices
2. Determinants
3. Inverse of a Matrix and its Applications

Relations and Functions

1. Relations and Functions-II
2. Inverse Trigonometric Functions

Calculus

1. Limits and Continuity
2. Differentiation
3. Differentiation of Trigonometric functions
4. Differentiation of Exponential and Logarithmic functions
5. Application of Derivatives
6. Integration
7. Definite Integrals
8. Differential Equations

Vectors and Three Dimensional Geometry

1. Introduction to Three Dimensional Geometry
2. Vectors
3. Plane

4. Straight Line

Linear Programming and Mathematical Reasoning

1. Linear Programming
2. Mathematical Reasoning

(3.VP.01)Basic Electricity Lab

1. Verify that resistance of conductor is directly proportional to resistivity and length and inversely proportional to cross- sectional area of the conductor.
2. Verification of Ohm's Law.
3. Verification of temperature co-efficient of resistance:
 - (i) Positive for Tungsten and Nichrome and
 - (ii) Negative for carbon.
4. Study of series resistive circuits.
5. Study of parallel resistive circuits.
6. Study of series and parallel connection of cells in circuits.
7. Preparation of Electrolyte for lead acid battery and its charging and measurement of Specific gravity with the help of hydrometer.
8. To find heat efficiency of an electric kettle.
9. Charging and Discharging of a capacitor.
10. Verification of magnetic field of a Solenoid with:
 - (i) Iron core and
 - (ii) Air core.
11. Verification of Faraday's Laws of electromagnetic induction.
12. Verification of Torque development in a current carrying coil in magnetic field.
13. Study of R.L. series circuit and measurement of power and power factor.
14. Study of R.C. series circuit and measurement of power and power factor.
15. Study of R.L.C. series circuit and measurement of power and power factor.
16. Study of R.L.C. series circuit for calculation of inductive reactance, capacitive reactance, impedance and Q- Factor.

Instruments Required

- Trainer kit for verifying ohm's law,
- Trainer kit for measuring TCR
- Lead acid battery,
- Hydrometer,
- Electric kettle,

- Trainer kit for measuring power and power factor in RLC circuits

(3.VP.02)Basic Electronics - Lab

1. Study of current and voltage measurement using Ammeter and Voltmeter.
2. Study of current and voltage measurement using Galvanometer.
3. Study of current, voltage and resistance measurement using of Multi-meter
4. Study of Power and Energy measurement using Wattmeter and Energy meter.
5. Study of working principle of Signal Generator and measurement of amplitude, time period and frequency of signal using Oscilloscope.
6. Study of V-I Characteristic of Diode.
7. Study of V-I Characteristic of Zener Diode. And use of Zener Diode as voltage regulator.
8. Study of Half wave rectifier with and without filter circuit.
9. Study of Full wave rectifier with and without filter circuit.
10. Study CE configuration for NPN and PNP transistors and measurement of voltage and current gain.
11. Study CB configuration for NPN and PNP transistors and measurement of voltage and current gain.
12. Study CC configuration for NPN and PNP transistors and measurement of voltage and current gain.
13. Study of working of single layer PCB manufacturing
14. Study of working of double layer PCB manufacturing.
15. Design of 7 segment display using LED and bread board.

Instruments Required

- Ammeter
- Voltmeter,
- Multi-meter,
- Galvanometer,
- Energy Meter,
- CRO,
- Diode Trainer kit
- Zener diode Trainer kit
- Rectifier trainer kit
- Transistor characteristics trainer kit,
- PCB manufacturing Lab
- Bread board trainer kit to design 7 segment displays.

Level 4 (Semester I)**(4.GV.01)Engineering Science****i) Soldering and Brazing**

General characteristics of soldering, brazing joints, processes and their characteristics, brief description of soldering and brazing tools equipment, types of solders and fluxes and their uses, soldering defects and their remedies, brazing materials, advantages and disadvantages of soldering and brazing. Introduction to PCB, PCB designing, wet etching, dry etching, track correction, wiring, single sided and double-sided PCB.

ii) Measuring Instruments

Construction and working principles of moving iron and moving coil voltmeters and ammeters, dynamometer type wattmeter, ohm meter, megger and induction type energy meter- their circuit connection and application for measurement of electrical quantities.

iii) Electrical Engineering Drawing

Schematic and wiring diagram for domestic simple wiring, symbols used for different electrical devices and equipments.

iv) Electrical wiring

Types of wiring – cleat wiring, casing and capping, C.T.S./T.R.S. wiring, metal sheath wiring, conduit wiring and concealed wiring – their procedure. Factors of selection of a particular wiring system, importance of switch, fuse

v) Earthing

Earthing of wiring system, types of faults, their causes and remedies, Types of earthing- plate earthing and Pipe earthing, their procedure and application. Methods of finding numbers of circuits and circuit distribution by distribution board system loop in system of wiring connections IE rules related to wiring.

(4.GV.02) Soldering & De-Soldering of Components-I

1. Soldering & De Soldering of Basic Components

- Soldering Tools
- Different types of Soldering Guns related to Temperature and wattages, types of tips
- Solder materials and their grading
- Soldering and De Soldering Stations and their Specifications
- Preparing Component for Soldering
- PCB Applications
- Types of PCB
- Soldering Basic Components on PCB

- De soldering Basic Components
- Safety precautions while Soldering & De soldering
- Check for cold continuity of PCB
- Identification of loose/dry solder, broken tracks on printed wire assemblies & discrete components mounted circuit boards
- Join the broken PCB track and test
- De soldering using Pump and wick
- Introduction of SMD Components

(4.GV.03)IT Tools

- I. Computer Organization & OS: User perspective.
 - Understanding of Hardware.
 - Basics of Operating System.
- II. Networking and Internet.
 - Network Safety concerns.
 - Network Security tools and services.
 - Cyber Security.
 - Safe practices on Social networking.
- III. Office automation tools:
 - Spreadsheet.
 - Word processing.
 - Presentation.
- IV. Multi Media Design: (Open Source Design Tools).
 - Interface and Drawing Tools in GIMP.
 - Applying Filters.
 - Creating and handling multiple layers.
 - Using Stamping and Smudging tools.
 - Importing pictures.
- V. Troubleshooting: Hardware, Software and Networking.
 - Commonly encountered problems.
 - (Monitor: No display, KB/Mouse not responding, monitor giving beeps, printer not responding, check for virus, Delete temporary files if system is slow, adjust mouse speed).

Work Integrated Learning IT – ISM

- Identification of Work Areas.
- Work Experience.

(4.GE.01) Language - II

Module - 3: Listening and speaking skills

In this module the learners will be exposed to a variety of listening activities recorded on audiotapes. These will be samples of good spoken English, which the learners can use as models. Work sheets will accompany the listening material.

This module will include the following:

1. Introducing yourself/friends in formal and informal situations.
2. Inviting people (over the phone and face to face) giving details of occasion, time place and date. Acceptance and refusal of invitation – formal and informal.
3. Seeking and supplying information (example opening an account in a bank, applying for loans etc.)
4. Talking and conveying messages (over the phone and face to face).
5. Giving directions / instruction.
6. Discussing contemporary issues related to environment, child labour, gender bias etc.
7. Listening to excerpts from television and radio.
8. Listening to poems/plays (prescribed).
9. Listening to speeches / talks.
10. Listening to songs like "We shall overcome".

Module - 4 to 6(English for specific purposes) (opt any one)

There are three modules being offered. A learner has to opt for any one. The first is for academic purposes and the next two are for vocational purposes. The focus is not on the teaching of the subject matter like science and literature but on the way in which language is used in the different subjects.

Module 4: English for Science

This course will introduce learners to some interesting pieces of popular science

1. Health and hygiene
2. Conservation of (nearly extinct) animals.
3. Plant life.
4. Bio gas / solar energy.

These pieces illustrate the use of English in scientific writing: giving information factually, logically and objectively.

Module 4: English for Receptionist

This module will introduce the learners to a variety of exercises, tasks and meaningful activities related to the receptionist's use of English. The printed course materials will be supported by tapes.

The following competencies be developed:

1. Receiving messages, making requests etc.
2. Supplying information
3. Giving advice and making suggestions
4. Dealing with complaints

5. Making entries in an appointment book, register etc.

Module 4: English for Office Use

This course will help the learner to use English effectively and appropriately in the office environment. The competencies will be developed.

1. Using the telephone taking and passing messages.
2. Receiving messages
3. Marking noting on files and circular.
4. Writing office notes, memos, notices, agendas for meetings.
5. Telegrams and fax messages.
6. Writing business letters, application enquires, complaints.
7. Filling in forms, cheques, pay in slips etc.

(4.VP.01)Engineering Science - Lab

1. Introduction to tools and measuring instruments, their safe keeping, safety
2. precautions
3. Measurement of resistance by ammeter and voltmeter method and Ohm meter.
4. Dismantling and reassembly of dynamo.
5. Calibration of ammeter, voltmeter and wattmeter with the help of standard meters.
6. Calibration of single phase energy meter with the help of standard wattmeter and stop watch.
7. Controlling lamps in series, parallel and series parallel.
8. Controlling lamps for two or three places.
9. Drawing schematic diagram to give supply to consumers.
10. Practice on casing and capping wiring.
11. Practice on cleat wiring.
12. Practice on CTS/TRS wiring.
13. Practice on metal sheet weather proof rigid PVC wiring.
14. Practice on conduit wiring.
15. Practice on concealed wiring.
16. Measurement of insulation resistance of wiring installation by megger.
17. Polarity test of wiring installation.
18. Testing of wiring installation.
19. Installation of pipe earthing for wiring installation.
20. Installation of plate earthing for wiring installation.

Instruments Required

- Ammeter
- Voltmeter
- Ohm meter
- Dynamo
- Wattmeter,
- Stop watch controlling lamp

- Different types of wire for practice on wiring,
- Conduit pipes
- Megger
- Materials for earthing

(4.VP.02)IT Tools Lab.

- Spreadsheets, Word, Presentation
- Multimedia Design
- Troubleshooting
- Project / Practical File
- Viva Voce

Level 4 (Semester II)**(4.GV.04) General Foundation Course - II****A. Business Management and Entrepreneurship**

Management of Business, Elementary treatment/exposure to basic conceptual frame work of the topic listed below:

- (a) Basic Function
- (b) Marketing Management
- (c) Financial Management
- (d) Production Management
- (e) Personnel Management

B. Computational Skills

1. (a) Solution of linear equations and their application to problem of commercial mathematics.

(b) System of linear equations and in equation in two variables. Applications in formation of simple linear programming problems

2. Statistics: Raw data, bar charts and Histogram; Frequency Tables; Frequency Polygon; Ogive; Menu, Median and Mode of ungrouped and grouped data; Standard Deviation; Introduction to Mortality tables; Price Index etc. Introduction to Computers

C. Environmental Education & Rural Development

Environmental Education:

- a. Modernization of agriculture and environment, irrigation, water logging, use of fertilizers, pesticides, soil erosion, land degradation (desertification and deforestation), silting and drying of water resources.
- b. Rational utilization, conservation and regeneration of environmental resources (soil, air, water, plant, energy, minerals).

2. Rural Development

Principles and goals of rural development, major problems/constraints in rural development in India

(4.GV.05) Manufacturing Technology**1. Introduction:**

(a) Scope of subject "Manufacturing Technology" in engineering (b) different shop activities and broad division of the shops on the basis of nature of work done such as (i) Wooden Fabrication-carpentry (ii) Metal Fabrication (shaping and Forming, Smithy, sheet metal and Joining-welding, Riveting, Fitting and Plumbing).

2. Carpentry:

(a) Fundamental of wood working operations (i) marking & measuring (ii) Holding & Supporting (iii) Cutting & Sawing (iv) drilling& boring (v) Turning (vi) Joining (b) Common Carpentry Tools. (b) Joining of Timber Components and tools used

3. Metal Fabrication:

Metal Shaping-Smithy Operations and tools used - Preparation of fire, Supporting and holding the metal, cutting the metal in size, heating, drawing down or fullering, upsetting, swaging, bending, punching, drifting and forge welding. Foundry - elementary idea of patterns, green sand moulds and moulding, tools and equipment used in green sand moulding. Sheet metal working: Tools and operation: joining processes Operations involved, Laying out, marking and measuring, cutting, Shearing and blanking, Straightening bending and seaming, Punching and piercing, burring, Stamping. Sheet metal joints-Lap, seam, Locked seam, hemp, wired-edge, cup or circular, Flange, angular and cap.

4. Metal Joining processes:

(a) Permanent Joining: (i) Welding methods- forge welding, gas welding, high and low pressure-oxy-acetylene welding, types of flames. (ii) Electric welding - D.C. & A.C., Connected tools operation, materials and safety measures. Introduction to non-ferrous welding-Soldering & Brazing.

5. Various Tools Used in Mechanical Engineering Workshop:

Marking & Measuring tools, striking tools, cutting tools, holding tools, Miscellaneous Tools-Wrenches, keys, Spanners, pliers, Screw drivers their specifications, special tools.

(4.GV.06) Basics of Thermodynamics

Basics of Thermodynamics

UNIT 1

Steam Generators: Types of steam generators - Fire tube, water tube boilers, boiler mountings and accessories, Equivalent evaporation, boiler efficiency, elements of power plant.

Reciprocating Steam Engines: Working principles, classification, a brief idea and concept only.

Steam Turbines: Classification, principle of operation of Impulse reaction steam turbines.

UNIT 2

Steam Condensers: Principle of operation, classification, a brief concept, condenser details, applications

Air Compressors: Definition and their use, Difference between reciprocating and rotary compressors, their types and working, Inter cooling in two stage compression volumetric efficiency, Compressor lubrication. Simple numerical problems.

UNIT 3

Internal Combustion (I.C.) Engines: Meaning and classification of I.C. engines, I.C. engines mechanism, -four stroke cycle engine and two stroke cylinder engine mechanism. Knowledge of important parts, their functions and terminology, positions of operating piston, its stroke or stroke length, Swept volume and clearance volumes, Cylinder volumes and Compression ratio.

Air standard cycles for I.C. engines-Otto and Diesel cycle and also Dual cycle, expression for their efficiencies, Concept of means effective pressure and specific fuel consumption (Simple Numerical Problems)

Brief idea of engine lubricating and cooling system.

UNIT 4

Basic Thermodynamics: Definition, concept of thermodynamic system and surroundings, closed system, open system, isolated system thermodynamics, definition of work, Zeroth law of thermodynamics, First law of thermodynamics for cyclic and noncyclic processes, Idea of internal energy and enthalpy, Applicability of first law on various thermodynamics processes, simple numerical problems.

UNIT 5

Steady state flow process, its equation and its applications: Second law of thermodynamics, Thermodynamics concept of perpetual motion machine of first order and that of second order, Concept of heat engine, heat pump and refrigerator, Carnot cycle efficiency for heat engine and C.O.P for refrigerator and heat pump, Entropy: Its physical concept and significance.

(4.GV.07)Electrical Machines (787)**1. Single-Phase Transformer:**

Types of transformer - step-up and step-down transformer, voltage and current transformer, autotransformer, Construction, working principles and applications of different types of transformers, rewinding of transformers, cooling of transformers

2. D.C. Motors:

Types of motor - series, shunt, compound and universal, construction, working principles, characteristics, winding details and applications of different types of motors including fractional horsepower, starting and starters for D.C. motors, Installation of D.C. motor and testing, speed reversal and speed control of D.C. motors, common faults, their causes, testing and repairs.

3. Three Phase Induction Motors:

Principle, working & starting of three phase induction motor.

4. Single Phase A.C. Motor:

Types of A.C. Motors – induction motor (Split phase and repulsion start), capacitor motor, shaded polemotor, universal motor, construction, working principles, special characteristics, winding details and applications of different types of fractional horse power motors, Starting and starters for different motors. Speed reversal and speed control of A.C. Motors, installation of A.C. motor and testing, common faults, their causes, testing and repairs, rewinding of fractional h.p. motors.

6. Electrical Solderers: Types of Solderers, flux and methods, techniques of soldering

(4.VP.03) Material Science Lab.

1. (a) Study of various crystals structures through models BCC, FCC, HCP, tetrahedral and octahedral voids.
 (b) Material identification of, say, 50 common items kept in a box.
2. Specimen preparation for metallographic examination /micro structural examination-cutting, grinding, polishing, etching.
3. Comparative study of microstructures of different given specimens (mild steel, gray C.I., brass, copper etc.)
4. Heat treatment experiments such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after.
5. Study of Microstructure and hardness of steel at different rates of cooling, Microstructure examination of white cast iron.

(4.VP.04) Production Practice Lab.

Machine Shop

- To study lathe machine construction and various parts including attachments, lathe tools cutting speed, feed and depth of cut.
- To perform step turning, knurling and chamfering on lathe machine as per drawing.

Foundry Shop

- To prepare mould of a given pattern requiring core and to cast it in aluminum.
- To perform moisture test and clay content test.
- Strength Test (compressive, Tensile, Shear Transverse etc. in green and dry conditions) and Hardness Test (Mould and Core).

Welding Shop

- Hands-on practice on spot welding.
- Hands-on practice on submerged arc welding
- Hands-on practice on metal inert gas welding (MIG) and tungsten inert gas welding (TIG).

Level 5 (Semester I)**(5.GV.01) Basics of Refrigeration****UNIT 1**

INTRODUCTION: Its meaning and application, unit of refrigeration; Various methods of refrigeration.

UNIT 2

REFRIGERATION SYSTEMS: Refrigeration Cycles: Refrigeration, carnot cycle of refrigeration (ideal cycle), Bell-Coleman cycle of refrigeration, their COP and Conditions for its highest value, Temperature limitations. Representation of these cycles, in P-V, T-S and P-H diagrams and also their flow diagrams, Simple numerical problems

UNIT 3

Vapour compression system: Standard vapour compression cycle, wet and dry compression, Effect of sub cooling and super heating, Effect of temperature and pressure on COP of the cycle. Simple numerical problems with the help of P-H diagram. Concept of house hold refrigerator working on vapour compression cycle.

UNIT 4

Vapour Absorption System: Cycle of operation, Construction and working of refrigerator based on this system. Simple numerical problems (Simple line diagram)

UNIT 5

REFRIGERANTS: Definition, classification & properties of few important refrigerants such as Ammonia, Sulphur-Di-Oxide (SO_2) Carbon-Di-Oxide (CO_2) Freon -12 (F-12) F-11. Qualities of good refrigerants, secondary refrigerant

(5.GV.02) Basics of Air Conditioning**UNIT 1**

INTRODUCTION: Its meaning and general application. Psychrometry: Definition, Composition of air, Daltons law of partial pressure, Gas and Vapour mixture, Dry and Wet bulb temperature, Wet bulb depression, Dew point, Dew point depression, Saturated air,

UNIT 2

Specific humidity, Degree of saturation, Relative humidity, Absolute humidity, Humid specific volume and humid specific heat, Enthalpy of moist air,

UNIT 3

Use of psychometric charts and tables, Sensible heating and cooling, Humidification and dehumidification and their methods, Simple numerical problems concerning above

UNIT 4

HEAT LOAD: Brief idea of various types of heat loads, Sensible and latent heat loads. Sensible heat factor

UNIT 5

ROOM AIR CONDITIONING: Brief idea of room air conditioning, Window types packaged air conditioner. Central air conditioning system, Round the year air conditioning

2. Refrigeration and Air Conditioning: A Sarao
3. Refrigeration and Air Conditioning: RS Khurmi

(5.GV.03) Engineering Material

UNIT 1: ELECTRICAL ENGINEERING MATERIALS

Conducting Materials: Properties of good conducting materials, Brief idea about conductivity & Resistivity

UNIT 2

(a) Insulating Materials: (a) Plastic insulating materials-definition and classification, thermo-setting and thermoplastic materials, their applications and commercial names & uses in industry. (b) Various insulating materials-mica asbestos, ceramic materials, glass, cotton, silk, jute, paper their properties and applications

(B) Semiconductor Materials: Characteristics and applications of semiconductor materials

UNIT 3

(A) Non-Metallic Materials-Timber. Preservation of timber, Defects of timber, Surface treatment, Plywood, Hard Board, Batten Board, Veneer board, units of purchase

(B) Miscellaneous Materials: Important properties, characteristics and use of the following materials: Abrasives, Asbestos, Celluloid, Cork, Mica, Refractory

UNIT 4: Mechanical Engineering Materials

Non-Ferrous Metals: Aluminium, Zinc, Copper, Tin, Silver, Lead - Trade names; Physical, mechanical, and electrical properties and use

(ii) Base metal with principal alloying elements - Aluminium Alloys, Copper Alloys, Nickel Alloys, Bearing Metals-Lead base alloys, Tin base alloys, (White metals or babbitt metals), Copper base alloys.

UNIT 5: Civil Engineering Materials

General idea of raw materials, properties and uses of Bricks, lime, cement

Foundation: (i) Bearing capacity of soil and its importance, need of foundation for machines

(ii) Foundations for heavy, light and vibrating machines (iii) Concrete proportion, mixing w/c ratio, workability RCC and its use.

(5.GV.04) Soldering & De-soldering components & Emergency actions

1. Introduction to SMD Components

- Identification of 2, 3, 4 terminal SMD components
- Soldering the SMD components on the PCB
- Make the necessary settings on SMD soldering station to solder various ICs of different packages by choosing proper clamping tools
- Identify various connections and the setup required for SMD soldering station
- De solder the SMD components from the given PCB
- Make the necessary settings on SMD soldering station to de solder various ICs of different packages by choosing proper clamping tools
- Make a panel board using different types of switches for a given application
- Identification of crimping tools for various IC packages
- Reliable Soldering Practices

1. Emergency actions

- Minimum Requirements
- Reporting Emergencies
- Emergency exits
- Primary and secondary evacuation routes
- Locations of fire extinguishers
- Fire alarm pull stations' location
- Assembly points
- Medical Services

(5.VP.01) Metrology and Measuring Instruments lab.

1. Measurement of angle with the help of sine bar/ Vernier Bevel protractor.
2. Study and sketch of various types of optical projectors.
3. Study and sketch of various types of comparators and use them for comparing length of given piece.
4. To measure the diameter of a hole with the help of precision balls.
5. To measure external and internal taper with the help of taper gauges, precision rollers.
6. To test the squareness of a component with auto-collimator.
7. To measure the pitch, angle and form of thread of a screw.
8. To measure the geometry of a gear having involute profile.
9. To measure the straightness of the edge of a component with the help of auto-collimator.
10. To measure the length, breadth, thickness, depth, height with micrometer.
11. To measure the length, breadth, thickness, depth, height, with height gauge and Vernier calipers.
12. Calibration of Vernier calipers/micrometers.
13. Calibration of height gauge/depth gauge.
14. Study of a tool maker's microscope.
15. Checking of accuracy of snap gauge with slop gauge.
16. Checking of accuracy of a plug gauge with micrometer.
17. Measurement of areas by polar planimeter.
18. Use of feeler, wire, radius and fillet gauges measurement of standard parameters.

(5.VP.02) Heat Transfer Lab.

Experiments on Conduction

1. Determination of Thermal conductivity of insulation powder
2. Determination of overall heat transfer coefficient of Composite Wall
3. Determination of overall heat transfer coefficient of Lagged Pipe
4. Determination of Thermal Conductivity of given Metal Rod

Experiments on Convection

5. Determination of heat transfer coefficient of Pin-Fin (Natural and Forced Convection)
6. Determination of heat transfer coefficient of Natural Convection

7. Determination of heat transfer coefficient of Forced Convection.

Experiments on Radiation

8. Determination of Stefan Boltzman Constant

9. Determination of Emissivity of test plate

Experiments on Applications of heat transfer and heat transfer with phase change

10. Determination of effectiveness and overall heat transfer coefficient using Parallel and Counter flow Heat Exchanger

11. Determination of heat transfer coefficient in drop and film wise condensation

12. Determination of Critical Heat flux

13. Study of heat pipe and its demonstration