Curriculum for

B.Voc. / D. Voc.

in

Refrigeration & Air Conditioning

1.Introduction

All India Council for Technical Education (AICTE) Ministry of HRD, Government of India has introduced Entrepreneurship oriented Skill development courses of B.Voc. /D. Voc. /Skill Diploma. These courses will be run by AICTE approved institutes by using available infrastructure and facilities. In these courses the institute will conduct general education content and sector specific skills will be imparted by Skill Knowledge Providers/ Training Providers/ Industries.

1.1 Key Features:

Objectives

- To provide judicious mix of skills relating to a profession and appropriate content of General Education.
- To ensure that the students have adequate knowledge and skills, so that they are work ready at each exit point of the programme.
- To provide flexibility to the students by means of pre-defined entry and multiple exit points.
- To integrate NSQF within the undergraduate level of higher education to enhance employability of the students and meet industry requirements. Such student apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global workforce.
- To provide vertical mobility to students admitted in such vocational courses.
- The certification levels will lead to Diploma/Advanced Diploma/B. Voc. Degree in Refrigeration and Air Conditioning and will be offered by respective affiliating University/Board of Technical Education.
- Students may be awarded Level Certificate/Diploma/Advance Diploma /Degree as out-lined in the Table below:

Award	Duration after class X	Corresponding NSQF level
Level 3 Certificate	1 Year	3
Level 4 Certificate	2Years	4
Diploma	3 Year	5
Advance Diploma	4 Years	6
B.Voc. Degree	5 Years	7

2.Course Objectives

After successfully completing the vocational course, the student would haveacquired relevant appropriate and adequate technical knowledge together with the professional skills and competencies in the field of Refrigeration and Air Conditioningso that he/she is properly equipped to take up gainful employment in this Vocation. Thus he/she should have acquired.

A. Understanding of

(a) The relevant basic concepts and principles in basic science subjects (Physics, Chemistry and Mathematics) so that he/she is able to understand the different vocational subjects.
(b) The basic concepts in engineering drawing.
(c) The concepts, principles of working of RAC systems.
(d) The knowledge of testing procedure of components used in RAC and making use of different test instruments.
(e) The procedure of installing the RAC devices.
(f) The concepts and principles used in RAC Systems and its maintenance.

B. Adequate Professional Skills and Competencies in

(a) Selecting the material for the required RAC system and its layout.
(b) Testing the performance of Refrigeration and Air Conditioning devices. (c) Locating the fault at component level and at the stage level.

C. A Healthy and Professional Attitude so that He/She has

(a) An analytical approach while working on a job.
(b) An open mind while locating/rectifying faults.
(c) Respect for working with his/her own hands.
(d) Respect for honesty, punctuality and truthfulness

D. NSQF compliant skills in Qualification developed by sector skill council in Electronic sector and Capital Goods Sector pertaining to RAC Systems

3. Course Structure

The course will consist of combination of practice, theory and hands on skills in the Electronic sector and Capital Goods Sector.

Curriculum

The curriculum in each of the years of the programme would be a suitable mix of general education and skill development components.

Skill Development Components:

- The focus of skill development components shall be to equip students with appropriate knowledge, practice and attitude, to become work ready. The skill development components will be relevant to the industry as per its requirements.
- The curriculum will necessarily embed within itself, National Occupational Standards (NOSs) of specific job roles within the industry. This would enable the students to meet the learning outcomes specified in the NOSs.
- The overall design of the skill development component along with the job roles selected will be such that it leads to a comprehensive specialization in few domains.
- The curriculum will focus on work-readiness skills in each of the year of training.
- Adequate attention will be given in curriculum design to practical work, on the job training, development of student portfolios and project work.

General Education Component:

- The general education component adheres to the normal senior secondary and university standards. It will emphasize and offer courses which provide holistic development. However, it will not exceed 40% of the total curriculum.

- Adequate emphasis is given to language and communication skills.

The curriculum is designed in a manner that at the end of year-3, year-4 and year-5, students can meet below mentioned level descriptors for level 5, 6 and 7 of NSQF, respectively:

Level	Process required	Professional Knowledge	Professional skill	Core skill	Responsibility
Level 3	Person may carry put a job which may require limited range of activities routine and predictable	Basic facts, process and principle applied in trade of employment	Recall and demonstrate practical skill, routine and repetitive in narrow range of application	Communication written and oral with minimum required clarity, skill of basic arithmetic and algebraic principles, personal banking, basic understanding of social and natural environment	Under close supervision some responsibility for own work within defined limit
Level 4	Work in familiar, predictable, routine, situation of clear choice	Factual knowledge of field of knowledge or study	Recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts	Language to communicate written or oral, with required clarity, skill to basic arithmetic and algebraic principles, basic understanding of social political and natural environment	Responsibility for own work and learning
Level 5	Job that requires well developed skill, with clear choice of procedures in familiar context	Knowledge of facts, principles, processes and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools materials and information	Desired mathematical skill, understanding of social, political and some skill of collecting and organizing information, communication.	Responsibility for own work and learning and some responsibility for other's works and learning

Level 6	Demands wide range of specialized technical skill, clarity of knowledge and practice in broad range of activity involving standard/ non-standard practices	Factual and theoretical knowledge in broad contexts within a field of work or study	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	Reasonably good in mathematical calculation, understanding of social, political and reasonably good in data collecting organizing information, and logical communication	Responsibility for own work and learning and full responsibility for other's works and learning
Level 7	Requires a command of wide ranging specialized theoretical and practical skill, involving variable routine and non-routine context	Wide ranging, factual and theoretical knowledge in broad contexts within a field of work or study	Wide range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	Good logical and mathematical skill understanding of social political and natural environment good in collecting and organizing information, communication and presentation skill	Full responsibility for output of group and development

Curriculum

Level	Code	Educational Component		Credit	Marks
3 Semester I		Theory			
	3.GE.01	Language – I		3	50
	3.GE.02	Applied Chemistry		3	50
	3.GE.03	Applied Physics		3	50
	3.GE.04	Applied Mathematics-I		3	50
		Lab/Practical			
	3.GP.01	Applied Chemistry Lab		1.5	50
	3.GP.02	Applied Physics Lab		1.5	50
	On-Job-Training (OJT)/Qualification Packs				
	Field Technician- Refrigeration (ELE/Q 3103)			15	200
3 Semester II	Theory				
	3.GV.01	General Foundation Course –I		3	50
	3.GV.02	Basic Electricity		3	50
	3.GV.03	Basic Electronics		3	50
	3.GV.04	Applied Mathematics – II		3	50
	Lab/Practical				
	3.VP.01	Basic Electricity – Lab		1.5	50
	3.VP.02	Basic Electronics – Lab		1.5	50
	On-Job-Training (OJT)/Qualification Packs				
	Operator – Conventional Training (CSC/Q0110)		(Any one)	15	200
	Fitter – Fabrication (CSC/Q0303)				

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 factions 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. 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
Percentage, ratio & proportion, profit & loss, discount, simple and compound
(a) 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

Mathematical Reasoning

1. 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.

Curriculum

4 Semester I	Theory			
	4.GV.01	Engineering Science	3	50
	4.GV.02	Soldering & De-Soldering of Components - I	3	50
	4.GV.03	IT Tools	3	50
	4.GE.01	Language – II	3	50
	Lab/Practical			
	4.VP.01	Engineering Science Lab.	1.5	50
	4.VP.02	IT Tools (Practical)	1.5	50
	On-Job-Training (OJT)/Qualification Packs			
	Functional Tester – RAC (ELE/Q3601) Manual Soldering Technician (ELE/Q0105) Fitter – Mechanical Assembly (CSC/Q0304) Draftsman – Mechanical (CSC/Q 0402)	(Any one)	15	200
	Theory			
Level	Code	Educational Component	Credit	Marks
4 Semester II	4.GV.04	General Foundation Course –II	3	50
	4.GV.05	Manufacturing Technology	3	50
	4.GV.06	Basics of Applied Thermodynamics	3	50
	4.GV.07	Electrical Machines (787)	3	50
	Lab/Practical			
	4.VP.03	Material Science Lab.	1.5	50
	4.VP.04	Production Practice Lab - I	1.5	50
	On-Job-Training (OJT)/Qualification Packs			
	One more QP to be opted from the QPs mentioned in the Level 4 first semester	(Any one)	15	200

Detailed Curriculum

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 excepts form 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 modules are 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 deferent 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 request 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 noncyclical 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

Suggested Reading:
Thermal Engineering: Khurmi & Gupta
Thermal Engineering: AS Sarao

(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 pole motor, universal motor, construction, working principles, special characteristics, winding details and applications of different types of fractional horse power motors, Starting and starters for differentmotors. 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.

5. Electrical Solders: Types of Solders, 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	Code	Educational Component		Credit	Marks
5 Semester I	Theory				
	5.GV.01	Basics of Refrigeration		3	50
	5.GV.02	Basics of Air Conditioning		3	50
	5.GV.03	Engineering Material		3	50
	5.GV.04	Soldering & De-Soldering of Components & Emergency actions II		3	50
	Lab/Practical				
	5.VP.01	Metrology and Measuring Instruments Lab		1.5	50
	5.VP.02	Heat Transfer lab.		1.5	50
	EMC 101-25	**Entrepreneurship Setup and Launch		2	50
	**The department of Higher Education and Languages, Government of Punjab endeavor to AI-powdered entrepreneurship learning platform on the said course. The Institute /Campus shall appoint an assistant professor as faculty coordinator.				
	On-Job-Training(OJT)/Qualification Packs				
	Field Technician-AC(ELE/Q3102)		(Anyone)	15	200
	Field Technician-Refrigeration(ELE/Q3103)				
	Field Engineer-RACW(ELE/Q3105)				
5 Semester II	Theory				
	5.GV.05	Industrial Management		3	50
	5.GV.06	Total Quality Management		3	50
	5.GV.07	Entrepreneurship		3	50
	5.GV.08	Refrigeration & Air Conditioning Applications		3	50
	Lab/Practical				
	5.VP.03	Project		3	50
	On-Job-Training(OJT)/Qualification Packs				
	One more QP to be opted from the QPs mentioned in the Level 5 first semester		(Anyone)	15	200

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

Reference Books:

1. Refrigeration & Air Conditioning, Sadhu Singh, Khanna Publishing House
2. Refrigeration and Air Conditioning: A Sarao
3. Refrigeration and Air Conditioning: RS Khurmi

(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 hat 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

Reference Books:

1. Refrigeration & Air Conditioning, Sadhu Singh, Khanna Publishing House

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.

Reference Books:
1. Engineering Mechanics, M.P. Poonia & D.S. Bedi, Khanna Publishing House
2. Civil Engineering Construction Materials, S.K. Sharma, Khanna Publishing House
3. Engineering Materials: Dhanpat Rai & Sons
4. Electrical Engineering Materials: Madan Publishers

(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-collimeter.
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-collimeter.
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

EMC-101	L	T	P
Entrepreneurship Setup and Launch	**0**	**0**	**4**

Introduction:
This semester lays the foundation for the learner to understand what entrepreneurship is, beyond just starting a business. It introduces key ideas like problem-solving, value creation, and self-awareness. The learner will begin exploring basic business concepts while discovering their own interests and strengths.

Learners Objective:

1. Understand the core concepts of entrepreneurship through relatable, real-life examples.
2. Begin to see themselves as problem-solvers and creators.
3. Learn about business paths and choose one to try based on interest or local fit.
4. Launch a micro-hustle (online or offline) to earn their first income.
5. Build confidence and self-belief by doing.

Outcome: By the end of this semester, learners will start a simple business activity, earn their first income, and build belief in their ability to do business.

Guiding Principles/Approach:

This syllabus is built on principles of **experiential learning, growth mindset development**, and **identity-first learning**. Drawing from learning science and behavior design, the course shifts students from passive learning to *active doing*, where they try out small business activities in real contexts. The design helps students not just learn entrepreneurship but begin to see themselves as entrepreneurs. Emphasis is placed on *small wins, peer collaboration, and locally relevant opportunities* to ensure learning feels achievable and connected to their realities. The curriculum focuses on conceptual understanding without heavy theory, combining *practical action, reflection, and collaboration. By making progress visible and success feel possible, it plants the seeds of self-reliance, initiative, and long-term motivation.*

Semester Syllabus:

Format: 12 weeks, 4 hours/week | 2 credits
Revenue Target: ₹10,000

Week	Learning Goal	Measurable Outcome
1	Understand what entrepreneurship is and who can be an entrepreneur	Students define entrepreneurship in their own words and list 2 entrepreneurs from their local area or community
2	Connect personal identity to entrepreneurship (strengths, interests, struggles)	Students create a "value map" showing how a skill/interest/problem from their life could become a business opportunity

3	Learn about 5 business paths: content creation, drop-shipping, cloud kitchen/food business, gig economy and local services	Students explore 1–2 examples from each domain and share one they're most curious to try and why
4	Choose a path and generate a basic business idea	Students write down a clear offer (what, for whom, why) and one way to reach their customer
5	Take first real action: message, post, pitch, or sell	Students reach out to or serve 1 real potential customer and record what happened
6	Reflect on first attempt and share with peers	Students share their result, a challenge faced, and one idea to improve next time
7	Improve and try again: aim for first ₹100	Students apply a change, try again, and aim to make their first ₹100 or get meaningful response
8	Learn how to identify and understand your target customer	Students talk to 2 potential customers or observe them and list 3 insights about their needs
9	Learn how to serve your target audience better	Students improve one part of their offer (product, delivery, messaging, or interaction) based on customer feedback or need
10	Explore core entrepreneurial values (resilience, honesty, effort)	Students reflect on 1 value they're building and show it in a business task or peer story
11	Focus on earning and staying consistent	Students complete a second earning task and track their consistency (e.g., same product or message for 3 days)
12	Reflect on earnings, grit, and how to keep going	Students record total earnings, one resilience moment, and one support system or habit they'll continue with

Weekly Component:

Component	Duration	Description
Learning Module	~1.5 hrs	- Introduces key concepts in a simple and engaging way - Includes, examples, and 1–2 interactive discussions or quizzes
Action Lab	~2 hrs	- Hands-on task on the weekly concept - Includes step-by-step guidance, templates, and worksheets - Ends with a submission (e.g., video, reflection, or proof of action)
Resources	Self-paced	- Supplementary videos, short readings, real- life stories, and tools to deepen understanding at their own pace

Evaluation Criteria

Evaluation Component	Description	Weightage
Weekly Task Completion	Timely submission of weekly tasks including reflections, activities, quizzes etc.	40%
Target Completion	Performance-based evaluation on hitting **revenue or profit targets** (e.g., generating ₹10,000 revenue)	30%
Final Project	A comprehensive project based on the semester's theme	30%

Week 1: What is Entrepreneurship? Who Can Be an entrepreneur?

INTRODUCTION: Could *You* Be an entrepreneur?

When people hear "entrepreneur," they often think it means having a company, investors, or an MBA. Some even believe it's only for toppers or those with high grades. But entrepreneurship is more about mindset than qualifications: it's about seeing a problem and doing something about it. Like someone who starts selling snacks because their school canteen is always shut, or a friend who fixes broken chargers for others. If you've ever spotted a need and thought, "I can solve this," - you've already taken your first step.

Component 1: Learning Module (~1.5 hours) Unit 1:

What is Entrepreneurship?

1. *Solving problems or creating value in exchange for money.*
2. Entrepreneurship is not just about starting a company: it's about initiative, resourcefulness, and value creation.
3. Different types of entrepreneurs: small shop owners, street vendors, YouTubers, local tailors, mechanics, and more.
4. Entrepreneurs build opportunities instead of waiting for them.

Simple Slide/Visual Aid Tip:

A circle that says "Problem", an arrow pointing to "Solution", then an arrow to "Earn". That's entrepreneurship.

<A video that visually shows how entrepreneurship starts with spotting a problem (e.g., long food lines), creating a solution (e.g., pre-order lunch service), and earning from it: illustrating the simple flow: Problem → Solution → Earn>

MCQ 1

Q: What best describes entrepreneurship?

A. Getting a job in a company
B. Solving problems for others and earning from it
C. Studying business in college
D. Buying expensive things

Feedback:

1. *Correct! Entrepreneurs solve problems or offer value and get paid for it.*
2. *Not quite! Entrepreneurship is about creating something useful, not just getting a job or studying.*

Unit 2: Who Can Be an entrepreneur?

Entrepreneurship starts with spotting a problem, finding a solution, and creating value. Today, anyone with a phone and an internet connection can start a business: money helps, but mindset and initiative matter more at the start.

You just need:

1. A problem to solve
2. A simple skill or product
3. The courage to start small

Examples Carousel (Swipeable cards)

1. **Pooja (India)** – Sells handmade rakhis on Instagram, learned designing on YouTube. ***Problem she saw****: Expensive or generic rakhis in the market; no personal touch.*
2. **Luis (Mexico)** – Repairs used phones in his garage, now has loyal customers. ***Problem he saw****: Many people couldn't afford new phones or didn't trust local repair shops.*
3. **Sana (Kolkata)** – Started tiffin delivery from her home kitchen, now earns ₹500/day. ***Problem she saw****: Office workers struggled to find affordable, homemade meals.*
4. **Sal Khan (USA)** – Started Khan Academy with YouTube lessons to help his cousin. ***Problem he saw****: His cousin needed help with math, but good learning resources were hard to access.*

MCQ

Q: Which of these can be a form of entrepreneurship?

A. Making reels on skincare tips and selling homemade face packs
B. Buying new clothes from malls
C. Studying engineering
D. Playing games without sharing or streaming

Feedback:

1. *Correct! Sharing useful tips + selling a product = solving a need!*
2. *Try again! Entrepreneurship is about creating value and helping others.*

Reflection Prompt

1. If you had to earn ₹100 this week, what would you do?

Component 2: Action Lab (~2 hours) Task

Find & Learn from 2 Entrepreneurs Near You

Steps (Checklist):

1. Look around your neighborhood or online: find 2 people who earn through their own work
2. Ask or observe:
   a) What do they do?
   b) How do they earn?

c) What makes them entrepreneurial?

3. Use the **Entrepreneur Tracker Template** (available in the resources tab)

Final Deliverable

Learner submits:

1. A short definition of entrepreneurship (in their words)
2. 2 entries from the Entrepreneur Tracker (name, what they do, what learner learned)

→ Submitted in the submissions tab.

Supplementary Resources (Optional)

1. Danny O'Neill - Getting started | Entrepreneurship | Khan Academy
2. The Better India – Stories of local entrepreneurs

***

Week 2: Can I Be an entrepreneur?

INTRO – What Makes an entrepreneur?

You don't need a suit, a degree, or a lot of money to be an entrepreneur.
You need one thing: a mindset. Entrepreneurs notice problems around them: and do something about it. From the boy fixing bikes outside his house to the girl teaching dance on Instagram, they all started small. What matters most is not what you have: it's how you think and act.

Component 1: Learning Module (~1.5 hours)

Unit 1: What Makes an entrepreneur?

Key Concepts:

1. **Entrepreneurs are driven by curiosity:** they ask questions, explore possibilities, and seek better ways to do things.
2. **They take initiative:** they act, experiment, and create using limited resources with creativity and courage
3. **They learn by doing:** embracing mistakes as stepping stones to progress.
4. **They take full ownership:** one day they're the marketer, the delivery person, and the customer support, all in one.
5. **They are resilient:** they persist through challenges, adapt to change, and keep moving forward with purpose.

Real-Life Examples:

1. Nithin & Nikhil Kamath (Zerodha) – Started India's largest stock brokerage without formal degrees or external funding, just deep curiosity about stock markets and a desire to simplify investing.
2. *Qualities: Took initiative early and stayed persistent through challenges.*
3. Prajakta Koli (MostlySane) – Started by making comedy sketches about everyday Indian life: family, school, relationships: and became one of India's top digital creators.
4. *Qualities: Stayed consistent, adapted over time, and built strong audience trust.*
5. Tilak Mehta (Paper n Parcels) – As a teenager, launched a courier startup using Mumbai's dabbawala network for delivery.
6. *Qualities: Thought creatively and acted with confidence at a young age.*

***

Unit 2: Start Small: Build Ideas from What You Know

In the last unit, you learned that entrepreneurs don't just have ideas: they act, solve problems, and use what they have.

But the big question now is:

"What can I offer?"

That's where the Value Map comes in. It helps you take your first step toward thinking and acting like an entrepreneur: in your own way.

What is a Value Map?

A Value Map connects three simple things:

A. **What people around you need**
   → *Look around: is there something people often struggle with or something that could be better?*

B. **What you *enjoy* or are *willing to try***
   → *You don't need to be an expert. Start with small things you like doing: talking to people, fixing, organizing, helping, designing, or learning something new.*
   → *Even if you're just curious about something: that's enough to begin.*

C. **What solution you can create**
   → *Use what you enjoy or are learning to try solving a real need around you: even in a small way*

Visuals:

3 overlapping circles:

1. "People Need"
2. "I Can"
3. "My Offer"

Examples:

1. **People Need → Affordable meals**
   I Can → Cook + have access to home kitchen My Offer → ₹40 tiffin service
2. **People Need → Study tips in Punjabi I Can → Speak clearly + love teaching**
   My Offer → 3-minute video tips on Instagram

MCQ

Q: What's the first step to being an entrepreneur?

A. Waiting for the perfect idea
B. Solving a problem with your skills
C. Buying a shop
D. Studying for years

Feedback:

1. *Correct! Entrepreneurs start by solving small problems using what they already have.*
2. *Try again! It's not about waiting: it's about starting.*

Reflection Prompt

1. If someone gave you ₹500 and asked you to earn from it, what would you do?

Component 2: Action Lab (~2 hours)

Task: Create Your Personal Value Map Steps (checklist in app):

1. Think of 2–3 problems people face around you (hunger, phone repair, boredom, etc.)
2. List your own skills, interests, or resources.
3. Match each problem with something you could offer.
4. Use the **Value Map Template in the resources** to organize your ideas.

Final Deliverable (Submitted in App):

1. Your completed **Value Map** (in 3 columns: Need, Skill, Offer)
2. Highlight **1 idea** you'd like to explore for your future hustle

Supplementary Resources (Optional)

1. "Start with Why" by Simon Sinek
2. 10 Characteristics of Successful Entrepreneurs | Business: Explained

Level 5 (Semester II)

(5.GV.05)Industrial Management

1. Introduction:

Growth of industry, The management of men, materials and machines, the art of management, Sources of capital- industrial individual enterprise, private partnership and private Ltd. Co., Joint Stock Co. shares, debentures, financial agencies and their role in promoting industries. Break even analysis.

2. Private sector and public sector:

Public sector enterprise, merits and demerits of public sector industry and private sector industry, Line, staff and functional organizations, reasons for the choice of various types of organization, functions of different departments, viz. stores, purchase and sales departments relationship between individual departments.

3. Wages & incentives:

Definition of wages, real wage and nominal wage, systems of wage payment, incentives, financial and non - financial incentives, Essentials of a good wage plan, essentials of a good incentive scheme. Introduction toelements of cost & indirect expenses, Material cost, labour cost, fixed and variable overheads, components of cost, selling price, Factory expenses, administrative expenses, selling & distribution expenses, depreciation, obsolescence, interest on capital, Idleness, Repair and maintenance.

4. Labour, industrial & tax laws:

Evolution of industrial law, factory act, workmen compensation act, payment of wages act, employee's state insurance act, Industrial dispute act. Role of technician in industry: Position of technician in various engineering departments, Role of a supervisor in industry, Foremanship, duties and qualities of a good foreman.

5. Material management:

Introduction, Scope of Material Management selective control techniques-ABC analysis, Material handling, inventory control, Essential steps in inventory control, quality standards

Reference Books:

1. Industrial Engineering & Management, S.C. Sharma, Khanna Publishing House

(5.GV.06) Total Quality Management

1. Introduction, Basic concepts of total quality management

Introduction to Quality, Dimensions of Quality, Quality Planning, Concept and definition of quality cost, Determinants of Quality, Optimum cost of performance, Principles of TQM, Pillars of TQM, Introduction to leadership and Leadership roles, Quality council and Quality statement, Strategic Planning Process, Deming philosophy

2. Continuous process improvement

Input /output process Model, Juran trilogy, PDCA Cycle, 5 – 'S' Housekeeping principle,

Kaizen Seven tools of Quality (Q-7 tools), Check Sheet, Histogram, Cause and effect diagram, Pereto diagram, Stratification analysis, Scatter diagram, Control charts, Control chart for variables & process capability, Control chart for attributes

3. Management planning tools & Bench marking
Affinity diagram, Relationship diagram, Tree diagram, Matrix diagram, Matrix data analysis, Arrow Diagram, Process decision programme chart (PDPC), Concept of bench marking, Reason to bench marking, Bench marking process, Types of bench marking, Benefits of bench marking

4. Just in time (JIT)
JIT philosophy, Three elements of JIT, Principles of JIT Manufacturing, JIT Manufacturing building blocks, JIT benefits, Kanban & 2 Bin Systems

5. Total productive maintenance (TPM)
Concept of Total Productive Maintenance, Types of maintenance, OEE (Overall Equipment Efficiency), Stages in TPM implementation, Pillars of TPM, Difficulties faced in TPM implementation.

Reference Books:
1. Total Quality Management, S.C. Sharma, T.R. Banga, Khanna Publishing House

(5.GV.07) Entrepreneurship

1. Entrepreneurship and entrepreneur:
Need of Employment and Opportunities, Essential Characteristics of a good Entrepreneur, Industrial Policy, Classification of industries- Micro, small scale , Medium scale, Large scale, Type of industries- Production, Job based & Service

2. Entrepreneurial Development:
Product identification/ selection, Site selection, Plant layout, Institutional support needed, Pre-market survey.

3. Entrepreneurship Support System and Start-ups:
Introduction to start-up's, Role of District Industries Centre in setting up industry, Function of NSIC, SISI, NISIET, NRDC, SSIC, SIDO, NMTC, KVIC, RSMML, Role of state finance corporation, state electricity corporations, pollution control board, BIS, I.S.O. etc.

4. Introduction to Tax System, Insurance and Acts:
Idea of income tax, sales tax, excise duty and custom duty, Industrial and fire insurance, procedure for industrial insurance, Introduction to Industrial acts, factory act, Workmen's compensation act 1923, Apprentices act 1961, Environmental protection act 1986

5. Project Report Preparation:

Procedure of preparing a project report, Format of project report, Preparation of project report, Introduction to ISO: 9000 Series of Quality System

(5.GV.08) Refrigeration & Air Conditioning Applications

Unit I: Food Preservation

Introduction, factors contributing to food spoilage, causes of food spoilage, methods of food preservation, freezing method of food preservation, preservation of food with direct contact of liquid N2, freeze drying, preservation of different products, cold storage and commercial cabinets.

Unit II: Commercial Applications

Introduction, air-conditioning of houses, offices, hotels and restaurants, air-conditioning of departmental stores, air-conditioning of theatres and auditoriums, hospitals and medical applications

Unit III: Ice-Manufacturing

Introduction, principles of ice production, different methods of ice manufacturing, treatment of water for making ice, brines, freezing tanks, ice cans, quality of ice

Unit IV: Industrial Applications

Introduction, importance of RH in different industries, ice-cream manufacturing, refrigeration for breweries, selection of refrigerant for breweries, use of liquid N2 for fabric, quality, air conditioning in textile and photographic industries

Unit V: Transport Air Conditioning

Introduction, automobile air conditioning, railway air-conditioning, marine air conditioning, aircraft air conditioning

Reference books:

1. Refrigeration and Air Conditioning, Sadhu Singh, Khanna Publishing House
2. Refrigeration and Air Conditioning by C.P.Arora, McGraw Hill education (India) (P) limited, New Delhi
3. Principles of Refrigeration by Roy J. Dossat, Pearson education, New Delhi
4. Refrigeration and Air Conditioning by Manohar Prasad, New age international (P) limited, New Delhi
5. course in Refrigeration and Air Conditioning by S.C.Arora and S.Domkundwar, Dhanpatrai and sons, Delhi

(5.VP.03) Project

On the basis oflearning in the vocational diploma, a project to be taken up by the student strengthening his/ her vocational skills

Level	Code	Educational Component	Credit	Marks
6 Semester I	Theory			
	6.GV.01	RAC Piping Systems -I	3	50
	6.GV.02	Refrigeration & Air-conditioning Material- I	3	50
	6.GV.03	Refrigerants	3	50
	6.GV.04	RAC Standards	3	50
	Lab/Practical			
	6.VP.01	RAC Material Lab.	1.5	50
	6.VP.02	RAC Systems Installation and its Maintenance Lab.-I	1.5	50
	On-Job-Training(OJT)/Qualification Packs			
	Safety Tester RACWO(ELE/Q3605) Field Engineer RACW(ELE/Q3105) Cold Storage Technician (FIC/Q7004)	(Anyone)	10	200
6 Semester II	Theory			
	6.GV.05	RAC Piping Systems - II	3	50
	6.GV.06	Refrigeration & Air-conditioning Material- II	3	50
	6.GV.07	RAC Maintenance-I	3	50
	6.GV.08	RAC Installation Techniques-I	3	50
	Lab/Practical			
	6.VP.03	RAC Systems Installation and its Maintenance Lab.-II	1.5	50
	6.VP.04	RAC Piping Systems Lab.	1.5	50
	On-Job-Training(OJT)/Qualification Packs			
	Onemore QP to be opted from the QPs mentioned in the Level 6 first semester	Anyone)	15	200

Level6 (Semester I)

(6.GV.01) RAC Piping Systems – I

Unit I
Codes, Standards and Specifications: Piping codes, ASME codes and standards, ASTM Specifications,
Unit II
ASME Boiler, Pressure vessel codes, ASME B31-Code for pressure piping, mechanical strength, testing of piping system and valves, fabrications.
Unit III
Piping Components: Pipe-seamless, welded pipes, pipe sizes, dimensional specifications, material, specifications, pipe ends, pipe fittings, pipe support, Unit IV valves–gate valve, globe valve, check valve, ball valve, plug valve, butterfly valve, control valve, pressure relief valve, valve, codes and standard, valve size, pressure class rating.
Unit V
Viscosity, Reynolds number, friction factor, Darcy Weisback friction factor, friction factor for laminar and turbulent flows, equivalent pipe length, hydraulic radius, compressible, flow,

Reference Books:

1. Piping and Pipeline Calculations Manual by J. Phillip Ellenberger
2. The fundamentals of piping design by Peter Smith.
3. Hand book of Air conditioning and refrigeration by Shan K Wang, McGraw-hill international edition, Singapore.

(6.GV.02) Refrigeration & Air-conditioning Material - I

Unit I
Insulator: Introduction, desired properties of ideal insulating material, factors effecting the thermal conductivity, Unit II types of insulating material., reflective insulating blinds, laprock — a thermal acoustic and fire insulation, natural insulator, new transparent heat insulator, heat transfer through insulation used for A.C, Unit III
economical thickness of insulation, few insulated systems, low temperature insulations, importance of relative humidity for the selection of the insulations, air distribution for reducing heat lose. Unit IV
Cables and Wiring: Cryocables, economics of cryocables, A.C. super conducting cables, liquid N2 cooled cables, Liquid H2 cooled cables, super magnet, electric generator, minimal insulated cables, installing cables
Unit V
Component Material: Refrigeration component material, duct material, material used in evaporator, material used in compressor, material used in condenser.

Reference Books:

1. Refrigeration and Air Conditioning, Sadhu Singh, Khanna Publishing House

(6.GV.03) Refrigerants

Unit I

Introduction: Refrigerants, cooling media and liquid absorbents, azeotropic and zeotropic, numbering of refrigerants.

Unit II

Classification and Properties of Refrigerants: Requirement for refrigerant, classification-based on working principle, safety and chemical composition, desirable properties of refrigerants-thermodynamic properties, safe working properties, physical properties etc

Unit III

Choice of Refrigerant: Important refrigerants, secondary refrigerant, anti-freeze solution, selection of refrigerant for required purpose,

Unit IV

Application of Refrigerants: refrigerant oils and applications, Properties and uses of commonly used refrigerant

Unit V

Green house effect, Global warming, Future Refrigerants

Reference books:

1. Refrigeration and Air Conditioning, Sadhu Singh, Khanna Publishing House
2. Refrigeration and Air Conditioning by C.P.Arora, McGraw Hill education, New Delhi
3. Principles of Refrigeration by Roy J. Dossat, Pearson education, New Delhi
4. Refrigeration and Air Conditioning by Manohar Prasad, New age international
5. A course in Refrigeration and Air Conditioning by S.C.Arora and S.Domkundwar

(6.GV.04) RAC Standards

Unit I

Introduction: Meaning of IS, need of IS, international classification of standards for refrigeration and air conditioning, various national and international standards for heating, ventilation and air conditioning

Unit II

Procedure of standard development, levels of standard, main standardization, organizations, i.e. ISO- international organization for standardization, IEC-international electro technical commission and others international and national organizations.

Unit III

Existing Standards: Main technical standards relevant to HCFC phase-out and low GWP (Global Warming Potential) alternatives, ISO, IEC, ECS (European Committee for Electrical Technical Standardization).

Unit IV

Adoption of International Standards at National Level: National standardization bodies, national ozone units, accreditation bodies, national RAC associations, the process of adoption

Unit V

Use of International Standards: In designing of refrigeration and air conditioning equipment, selection of materials related to refrigeration and air conditioning, safety issues related to refrigeration and air conditioning, industrial and field applications.

Reference books:

1. ISHRAE standard book for Refrigeration and Air Conditioning
2. ASHRE hand book for Refrigeration and Air Conditioning
3. Refrigeration and Air Conditioning, Sadhu Singh, Khanna Publishing House
4. International Standards in Refrigeration and Air Conditioning , UNEP (United Nations Environment Program)
5. Refrigeration and Air Conditioning data book, New Age International Publication

(6.VP.01) RAC Materials Lab.

Any eight of the following practical should be performed and recorded in laboratory book

1. Identification of types of copper tubes (dia. 3 mm, 6 mm, 12.5mm)
2. Identification of types of brazing road and its composition
3. Identification of oil and grease removals, fire hazard of the removals
4. Familiarization of joining material, gasket, pipe joint
5. Introduction of various insulating material, properties, fire hazard, etc.
6. Soldering and Brazing – types of brazing, preparation, purging. applying flux, applying heat.
7. Pipe Bending – Introduction to tools and different bends, pipe cutting.
8. Electrical requirement – introduction and familiarization with electrical symbols, circuit diagram of the RAC system
9. Introduction to gas welding set, simple gas welding, arc welding
10. Identification and testing of resistor, diodes and transistors
11. Identification of refrigerant cylinder by color coding and standing pressure – types of cylinder
12. Technique of glass wool filling method in conventional refrigerant.

(6.VP.02) RAC Systems Installation & Maintenance Lab. – I

1. Handling, use and familiarization with refrigeration tools and accessories such as: (a) Tube cutter (b) Tube bender [spring type] (c) Flaring tool (d) Swaging tool (e) Pinch off tools (f) Service valve wrench (g) Service valve (h) Adjustable wrench (i) Spanner set (j) Allen Key (k) Gauges (l) Blow lamp (m) Service cylinder (n) Gauge manifold (o) Wheel puller (p) Vacuum pump (q) Halide torch (r) Practicing of related operations.

2. Study of the following units: (a) Domestic refrigerator (b) Water cooler (c) Room Air conditioner (d) Evaporative cooler (e) Experimental ice plant.
3. Experimental ice plant.
4. Study of the following components and controls: (a) Compressor: open type and sealed types (b) Thermostatic expansion valve (c) Surface condenser (d) Different types of evaporators (e) Solenoid valve (f) Thermostat for refrigeration (g) H.P. and L.P. cut out (h) Gil safety switch (i) Strainers and driers.

Level 6 Semester II

(6.GV.05) RAC Piping Systems – II

Unit I

Pipe Size Calculations: Pipe sizing, pipe sizing formulae, pipeline wall thickness calculation, elements of total dynamic head–static head, pressure head, velocity head, friction head, Pump power required, Cavitations in pumps, NPSH required and NPSH available for pumps.

Unit II

Pipe Stress Analysis: Objectives and definition of stress analysis, piping loads, piping stresses-primary, secondary, pipe span, calculations flexibility analysis expansion loops and expansion joints, concept of thermal expansion, providing flexibility in piping

Unit III

Assembly and Erection: Fabrications materials for piping systems, fabrication drawings, fabrication processes, Assembly-alignment, flanged joints, threaded joints,

Unit IV

Piping System Testing: Examinations methods, visual examination, magnetic particle examination, Liquid penetrant examination, radiographic examination, ultrasonic examinations,

Unit V

Testing–leak, test, preparation for leak test, hydrostatic leak test, pneumatic leak test, sensitive leak test, examination of welds

Reference books:

1. Hand book of Air conditioning and refrigeration by Shan K Wang, McGraw-hill international edition, Singapore.
2. ASHRAE handbook, 2002
3. Piping and Pipeline Calculations Manual by J. Phillip Ellenberger
4. The fundamentals of piping design by Peter Smith.

(6.GV.06) Refrigeration & Air-conditioning Material - II

Unit I

Component Material: Material used in expansion valve, different type of valve material

Unit II
Material used in cooling towers, pipeline materials, drying materials, jointing, material, synthetic repair materials.

Unit III
Oils and Lubrication: Need of lubrication, types of lubrication, properties of lubrication oils, lubrication systems

Unit IV
Selection of refrigerant lubricant, compatibility of lubricant with refrigerant fluid, refrigeration oil with additives, the effect of refrigerant on lubricant density, solvent and cleaning.

Unit V
Tubing: Soft copper tubing, hard-drawn copper tubing, steel tubing, normal size copper tubing, Cutting tubing, bonding tubing, connecting tubing, flaring tubing.

Reference books:

1. ISHRAE standard book for Refrigeration and Air Conditioning
2. ASHRE hand book for Refrigeration and Air Conditioning
3. Refrigeration and Air Conditioning, Sadhu Singh, Khanna Publishing House
4. International Standards in Refrigeration and Air Conditioning, UNEP (United Nations Environment Program)
5. Refrigeration and Air Conditioning data book, New Age International Publication

(6.GV.07)RAC Maintenance - I

Unit I
RAC Tools: Engineering hand tools: spanners, screwdrivers, pliers, hammers, brazing, welding, flaring tool, tube bender, hammer, wrenches, shock wrenches, files, hacksaws, wood saws, electrical hand drill, sheet metal snips, Allen keys pop riveter, chisels, pulley extractors, Center punch, wire brush, drill bits, oil can, knife, inspection lamp, bolt extractor

Unit II
Measuring equipment's - steel tape measure, feeler gauge, Caliper, micrometer, engineers levels, pocket type of thermometer, sling psychomotor, system analyzers, temperature analyzers, electronic leak detector, voltmeter, clamp-on ammeter

Unit III
Specialist tools and accessories: flexible charging line, bending springs, pipe tube cutter, fin combs, soldering and brazing equipment's, Vacuum pump, charging cylinders, electric test lamps, jumper lead, welding goggles

Unit IV
Pipe installation work, pumping down the system, purging the system, starting the plant

Unit V
Using a system analyzer, transferring and handling liquid refrigerant

Reference books:

1. ISHRAE standard book for Refrigeration and Air Conditioning
2. ASHRE hand book for Refrigeration and Air Conditioning
3. Refrigeration and Air Conditioning, Sadhu Singh, Khanna Publishing House
4. International Standards in Refrigeration and Air Conditioning , UNEP (United Nations Environment Program)
5. Refrigeration and Air Conditioning data book, New Age International Publication

(6.GV.08)RAC Installation Techniques - I

Unit I
Introduction: Installation operation, adding oil, testing for leak detection

Unit II
Evacuation and dehydration, removing air, charging of the system, through suction valve, through discharge valve.

Unit III
Installation of Room Air-Conditioner: Selection of proper location, providing proper slope and provision for to drain water

Unit IV
Ventilation arrangement for window air conditioner, wiring diagram for installation for room air, conditioner

Unit V
Installation of split air conditioner, providing arrangement for pipes and pipe, pipe insulations

Reference books

1. Refrigeration Technicians pocket book by F.H. Meredith, Butterworths
2. Air conditioning: procedures and installation by V. Paul Lang, CBS publishers & distributors, Delhi

(6.VP.03)RAC System Installation & Maintenance Lab. - II

1. Leak detection in refrigeration system by different methods.
2. Air removal and charging of a refrigeration unit.
3. Testing of a refrigeration system to find out: (a) Refrigerating capacity (b) Power input (c) C.O.P.
4. Determination of psychrometric properties of air with the help of a sling psychrometer and aspiration psychrometer.
5. Determination of bye pass factor of a cooling coil.
6. Determination of humidifying efficiency of a evaporative cooler.

7. Determination of cooling load for a specified situation.
8. Study of the following system by visit: (a) Ice Plant (b) Cold storage plant (c) Control air conditioning system.

(6.VP.04)RAC Piping Systems Lab.

List of Experiments
Any six of the following practical should be performed and recorded in laboratory book:

1. Study of piping codes, ASME codes and standards, ASTM Specifications
2. Study of Pipe-seamless, welded pipes, pipe sizes, dimensional specifications, material specifications, pipe ends
3. Study of pipe fittings–elbows, tees, flanges, butt welded end fittings, socket welded and threaded end fittings
4. valves-gate valve, globe valve, check valve, ball valve, plug valve, butterfly valve, control valve, pressure relief valve, valve codes and standard, valve size, pressure class rating.
5. Study of pipeline wall thickness calculation
6. Study of NPSH required and NPSH available for pumps
7. Study of piping load and piping stresses
8. Study of different leak detection methods
9. Checking the performance of air ducting system

7 Semester I	Theory			
	7.GV.01	RAC Maintenance- II	3	50
	7.GV.02	RAC Installation Techniques-II	3	50
	7.GV.03	Automobile Air conditioning	3	50
	7.GV.04	Non-conventional Refrigerating System	3	50
	Lab/Practical			
	7.VP.01	Automobile AC Lab.	1.5	50
	7.VP.02	AC Components and Assembly Laboratory	1.5	50
	On-Job-Training(OJT)/Qualification Packs			
	AC Specialist Automobile (ASC/Q1416) Assembly Operator (ELE/Q3501)	(Anyone)	15	200
7 Semester II	Theory			
	7.GV.05	RAC Safety	3	50
	7.GV.06	Process Planning and Cost Estimation	3	50
	Lab/Practical			
	7.VP.03	Project Work	9	200
	On-Job-Training(OJT)/Qualification Packs			
	One more QP to be opted from the QPs mentioned in the Level 7 first semester	(Anyone)	15	200

(Level 7 Semester I)

(6.GV.01)RAC Maintenance - II

Unit I
Checking the charge, electrical circuits (servicing), evacuation of the system, installation, and location of main components, leak detection methods

Unit II
Servicing Techniques: Piping and Joining Work, Burn out repair, capillary tube cleaning

Unit III
Charging the system, compressor work expansion valve (thermostatic), servicing, hermetic compressor motors (stating problems) repairing leaks, sealed system connections.

Unit IV
Electrical Fault Finding: Compressor motor fails to start, compressor motors tries to start but does not run, compressor motor starts but does not reach running speed, thermostat failure type, pressure cut-out failure, wiring and collection faults

Unit V
Mechanical Fault Finding: Fault analysis by temperature and pressure, methods of confirming the fault, finding the fault when the compressor is not running, abnormal noise problem, domestic system faults

(6.GV.02)RAC Installation Techniques - II

Unit I
Commercial Installations of Refrigeration Systems: Ice manufacturing plant, ice bank

Unit II
Commercial Installations of Refrigeration Systems: Cold storage plant, milk dairy plant

Unit III: Commercial Installation of Air Conditioning Systems: Office air conditioning, Hotel air conditioning

Unit IV
Central air conditioning, Designs, Factors of consideration for Central AC

Unit V
Automobile air conditioning: Need, Types, Selection of AC System, Ducts

(6.GV.03) Automobile Air Conditioning

Unit I

Introduction: Methods of refrigeration. Vapour compression refrigeration system, vapour absorption refrigeration system, applications of refrigeration & air conditioning, Automobile air conditioning, air conditioning for passengers, isolated vehicles, Refrigerated transport vehicles, applications related with very low temperatures, Study of Psychometric charts: Psychometric properties, tables/charts, psychometric processes, comfort charts, factors affecting comfort, effective temperature, ventilation requirements.

Unit II

Refrigerants & AC Systems: Importance of Refrigerant- Classification, properties, selection criteria, commonly used refrigerants, alternative refrigerants, eco-friendly refrigerants; applications of refrigerants, refrigerants used in automobile air conditioning, Air Conditioning Systems- Classification, layouts, central / unitary air conditioning systems, System components, Switch and electrical wiring circuit.

Unit III

Design Automobile AC system: Load Calculations & Analysis- Design considerations for achieving desired inside/room conditions with respect to prevailing outside/environment conditions. Factors affecting/contributing towards the load on refrigeration & air conditioning systems, Cooling & heating load calculations, Load calculations for automobiles, Effect of air conditioning load on engine

Unit IV

Air Distribution: Air Distribution Systems- Distribution ducting, sizing, supply / return ducts, type of grills, diffusers, ventilation, air noise level, layout of duct systems for automobiles and their impact on load calculations, Air Routing & Temperature Control - Objectives of the dashboard re-circulating unit, automatic temperature control, controlling flow, control of air handling systems & air flow through - evaporator care

UNIT V

AC Service & Control: Air Conditioning Service- Air conditioner maintenance & service - removing & replacing Components. Compressor service, Testing, Diagnosis & trouble shooting of air conditioning system, Refrigerant gas charging procedure &. Servicing of heater system, Air Conditioning Control - Common controls such as thermostats, humidistat, control dampers, pressure cut outs, relays.

Reference Books:

1. Refrigeration and Air Conditioning, Sadhu Singh, Khanna Publishing House
2. Automobile Mechanics, A.K. Babu, Khanna Publishing House

(6.GV.04) Non-conventional Refrigerating System

1. Vapour Absorption Refrigeration System: Principle of absorption system, comparison between vapour compression system and vapor absorption system, theory of binary mixtures,
2. Aqua-ammonia vapour absorption system, theory of mixtures, temperature concentration diagram and enthalpy concentration diagram, processes used in aquaammonia absorption system, adiabatic mixing, separation, throttling process,
3. Vapour absorption system its components, working principle and mathematical analysis, b. Lithium-bromide- water absorption system its components, working principle, and mathematical analysis
4. Steam Jet Refrigeration System: Introduction, steam jet refrigeration system, components of steam jet refrigeration system, advantage and limitation of steam jet refrigeration system, performance of steam jet refrigeration system
5. Thermo-Electric Refrigeration System: Introduction, thermo-electric effects, Seebeck effect, Peltier effect, Thomson effect

Reference books:

1. ISHRAE standard book for Refrigeration and Air Conditioning
2. ASHRE hand book for Refrigeration and Air Conditioning
3. Refrigeration and Air Conditioning, Sadhu Singh, Khanna Publishing House
4. International Standards in Refrigeration and Air Conditioning , UNEP (United Nations Environment Program)
5. Refrigeration and Air Conditioning data book, New Age International Publication

(7.VP.01)Automobile AC Lab.

1. To study the load requirement of AC in the vehicle.
2. To design the AC System for the automobile according to the use.
3. To select the components for Automobile AC System
4. To install the AC System in automobile
5. To diagnose the fault in Automobile AC System
6. To conduct the mechanical repair in the Automobile AC System 7. To charge the Refrigerant in the Automobile AC System 8. To test the Automobile AC System.

(7.VP.02)AC Components and Assembly Laboratory

Any five of the following practical should be performed and recorded in laboratory book

1. To study hermetically sealed compressor, condensing units, performance, volumetric efficiency, performance of the ideal compressor and power requirement

2. To study different types of condensers and condenser design
3. To study different types of evaporators and evaporator performance, pressure drop in tubes, frost.
4. To study selection of expansion valves, and capillaries for various refrigeration and air conditioning applications
5. Find out the heat rejection factor of condenser, condenser capacity, efficiency and effect of fouling factor
6. Capillary bore checking, performance test conducted by test rig (consisting of capillary tube and thermostatic expansion valve) for finding C.O.P.
7. Familiarization of capillary selection guide

(Level 7Semester II)

(7.GV.01) RAC Safety

Unit I

Introduction to Industrial Safety: History and development of safety movement, need for safety, safety legislation: acts and rules, safety standards and codes, safety policy: safety organization and responsibilities and authorities of different levels, accident sequence theory, causes of accidents, accident prevention and control techniques, plant safety inspections, job safety analysis and investigation of accidents, first aid.

Unit II

Overview of Standard: ANSI/ASHRAE Standard, ANSI/ASME boiler and pressure vessel code, refrigeration, piping code, boiler and pressure vessel code, safety for refrigerant-containing components and accessories, nonelectrical, uniform mechanical code, basic national mechanical code

Unit III

Safety on the Job: Personal safety, protective clothing and equipment, harmful substances, safe work, practices, safety when working with electricity, refrigeration safety.

Unit IV

Safety for RAC Engineers: Types of accident, physical injuries from mechanical causes, use of tools and handling precautions, electrical injuries, electrical safety rules

Unit V

Injuries in RAC and Precaution: Refrigerant cylinder, corrosion, burn and other scalds, refrigerants and other gases Construction materials, firefighting precautions, breathing, toxic gases, asphyxiation and precaution for the same.

Reference books

"HVAC Handbook", Part I and II, ISHRAE
"Industrial refrigeration Hand Book", Wilbert F. Stoecker
"Air conditioning Systems principles, equipments and Services", Joseph Moravek,
Prentice Hall
Refrigeration and Air Conditioning, Sadhu Singh, Khanna Publishing House

(7.GV.02) Process Planning and Cost Estimation

1. Introduction to Process Planning:
   Process Planning—Definition, Purpose of Process Planning, Concept of Process Planning, Objectives of Process Planning, Scope of Process Planning, and Information required to do Process Planning, Preparing Operation Planning Sheet

2. Process Planning activities:
   Process Planning Procedure, Approaches of Process Planning, Manual Process Planning, Computer Aided Process Planning, Factors Affecting Selection Process, Machine Capacity, Determination of Man, Machine and Material Requirements, Factors Influencing Choice of Machinery
3. Introduction to Cost Estimation:
   Reasons for doing Estimates, Importance of Estimating, Objectives or Purpose of Estimating, Functions of Estimating, Cost Accounting of Costing, Importance of Costing, Aims of Cost Accounting, Difference Between Cost Estimating and Cost Accounting, Cost of Product (Ladder of Cost) Production Cost Estimation, Determination of Material Cost, Mensuration in Estimating
4. Assembly & Installation Time Calculation:
   Time calculation: Study of RAC requirement, design of RAC System, Selection of RAC components & material, Fabrication of ducts and distribution system, installation of RAC System, Testing of RAC System.

(7.VP.03) Project

On the basis of learning in the B.Voc. Programme, i.e. Level 5 to Level 7, a project to be taken up by the student strengthening his/ her vocational skills