SENIOR SCHOOL

CURRICULUM

2016-17

VOLUME-IV
(PART-2)

Engineering and
Technology Based Courses

CENTRAL BOARD OF SECONDARY EDUCATION
"SHIKSHA KENDRA", 2, COMMUNITY CENTRE, PREET VIHAR, DELHI – 110 301"

ENGINEERING AND TECHNOLOGY BASED COURSES

1. ELECTRICAL TECHNOLOGY
2. AUTOMOBILE TECHNOLOGY
3. CIVIL ENGINEERING
4. AIR CONDITIONING AND REFRIGERATION TECHNOLOGY
5. ELECTRONICS TECHNOLOGY
6. GEOSPATIAL TECHNOLOGY
7. FOUNDRY TECHNOLOGY
8. TRANSPORT SYSTEMS AND LOGISTIC MANAGEMENT
9. IT APPLICATION

ELECTRICAL TECHNOLOGY

Introduction

After successfully completing the two years of Senior Secondary Vocational Course the student would have acquired relevant appropriate and adequate technical knowledge together with professional skills and competencies in the field of Electrical Technology so 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, maintenance, constructional details and functions of electrical motors, electrical appliances, measuring and testing instruments and electrical circuits.

(d) Testing, installation, fault identification and repairing of electrical motors, appliances and instruments.

(e) Different types of electrical wiring.

B. Adequate Professional Skills and Competencies in

(a) Testing, installation, commissioning, fault location, repairing, servicing and major repairs of electrical motors, appliances and instruments.

(b) Undertaking complete house wiring jobs, testing, location of faults and repairing of house wiring.

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.

CLASS–XI
ELECTIVE
BASIC ELECTRICITY (787)
THEORY

Time: 2 Hours ***Marks: 40***

1. Current Electricity 4

Electricity as a source of energy, Definition of Resistance, Voltage, Current, Power, Energy and their units, Relation between electrical, mechanical and thermal units, Factors affecting resistance of a conductor, Temperature co-efficient of resistance, Difference between AC and DC voltage and current.

2. D.C. Circuits 5

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

3. Electric Cells 5

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

4. Heating and Lighting Effects of Current 5

Joule's Law of electric heating and its domestic applications, heating efficiency, lighting effect of electric current, filaments used in lamps, and gaseous discharge lamps, their working and applications.

5. Capacitors 5

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 7

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, Static induction, self-induced e.m.f., its magnitude and direction, 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, Torque produced on a current carrying coil in a magnetic field, Principles and construction of dynamo.

7. A.C Circuits 9

Generation of A.C. voltage, its generation and wave shape. Cycle, frequency, peak value (maximum value), average value, instantaneous value , R.M.S. value, form factor, crest factor, phase, 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.

PRACTICAL

Time: 3 Hours ***Marks: 60***

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.

PRACTICAL GUIDELINES

Parameters	Marks
Project / Practical Activities.	15
Viva Based on Project.	10
Practical File / Report or Portfolio.	10
Demonstration of skill Competency in Lab Activities.	25
Total	**60**

CLASS–XI
ELECTIVE
ENGINEERING SCIENCE (788)
THEORY

Time: 2 Hours ***Marks: 40***

1. Dimensioning Techniques — 4

Necessity of techniques, methods and principles, dimensioning of chamfered portions, hatched figures, countersunk holes, irregular figures, scales.

2. Principles of Projections – I — 5

Third angle projections – principles of orthographic projections, three views of given object, six views, exercise in auxiliary views, centre line and extension line.

3. Sections — 4

Importance, methods of representing, conventional sections of various materials, classification of sections, conventions.

4. Pictorial and Isometric Views — 5

Isometric axis, oblique drawing axonometric views, pictorial view from two or three views, isometric views (introduction) and exercise, conical projections, tracing, blue printing and ammonia printing.

5. Working Drawing/ Details and Assembly — 4

Principles of detailed and assembly drawing, detailed working drawing by actual measurement of a job already prepared practical exercise in drawing from detailed assembly and vice versa using actual job prepared in workshop.

6. Soldering and Brazing — 4

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.

7. Measuring Instruments — 6

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.

8. Electrical Engineering Drawing 4

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

9. Electrical wiring 4

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 and 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.

BIS regulations, recommendations and NE pertaining to wiring installation IE regulation related to Earthing.

PRACTICAL

Time: 3 Hours ***Marks: 60***

1. Fitting Shop: Introduction to tools and measuring instruments, their safe keeping, safety precautions, practical exercises involving sawing, fitting, marking, squareness, chipping.
2. Description of work bench, work holding devices, care and maintenance of various tools used in fitting, fitting practice, checking by straight edge and tri square, specifications of files, precautions while filing, jobs on drilling and tapping.
3. Sheet Metal Shop: Description of tools and operations involved in sheet metal fabrication such as shearing, bending, joining (locked groves, joint, riveting, soldering, brazing, exercise) like tray mug, funnel etc.
4. Measurement of resistance by ammeter and voltmeter method and Ohm meter.
5. Dismantling and reassembly of dynamo.
6. Calibration of ammeter, voltmeter and wattmeter with the help of standard meters.
7. Calibration of single phase energy meter with the help of standard wattmeter and stop watch.
8. Controlling lamps in series, parallel and series parallel.
9. Controlling lamps for two or three places.
10. Drawing schematic diagram to give supply to consumers.
11. Practice on casing and capping wiring.
12. Practice on cleat wiring.
13. Practice on CTS/TRS wiring.
14. Practice on metal sheet weather proof rigid PVC wiring.
15. Practice on conduit wiring.
16. Practice on concealed wiring.
17. Measurement of insulation resistance of wiring installation by megger.
18. Polarity test of wiring installation.
19. Testing of wiring installation.
20. Installation of pipe earthing for wiring installation.
21. Installation of plate earthing for wiring installation.

PRACTICAL GUIDELINES

Parameters	Marks
Project / Practical Activities.	15
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Demonstration of skill Competency in Lab Activities.	25
Total	**60**

CLASS–XI

GENERAL FOUNDATION COURSE (501)

(Common for Engineering & Technology Based Courses)

Time: 3 Hours ***Marks: 100***

Part–I: (Compulsory to all Vocational Courses) *Marks: 50*

A. Business Management and Entrepreneurship 30

(a) **Entrepreneurship Orientation** **5**
Importance and relevance in real life: Emphasis on self employment.

(b) **Entrepreneurship Values and Attitudes** **5**
Innovativeness, Independence, Risk Taking, Analytical ability.

(c) **Entrepreneurial Motivation** **5**
Achievement Planning, personal efficacy, entrepreneurial goal setting.

(d) **Launching of a Business Venture** **15**
Identification of project, steps in setting up a business, information about various institutions providing assistance, project formulation.

B. Computational Skills 10

(a) Percentage, ratio & proportion, profit & loss, discount, simple and compound interest, population growth and depreciation of value of articles using logarithm. **6**

(b) Area and volume: rectangle, parallelogram, circle, cube, cone, cylinder & sphere. **4**

C. Environmental Education 5

(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 5

(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.

Part–II: Applied Physics *Marks: 30*

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**

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. **2**

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. **3**

4. **Heat:** Temperature and its measurement, thermoelectric, platinum resistance thermometers and pyrometers. Conduction through compound media and laws of radiations. **3**

5. **Ultrasonics:** Productions of ultrasonic waves by magnetostriction and piezo-electric effect, application of ultrasonics in industry. **3**

6. **Optics:** Nature of light, reflection and refraction of a wave from a plane surface. Overhead projector and Epidiascope. **3**

7. **Electrostatics:** Coloumb's law, electric field, potential, electric flux, gauss theorem and the electric field, around a charged sphere, a long straight conductor and plane charged sheet, potential difference, and potential of a charged sphere and a point charge, principle of capacitor, capacitance of a parallel plate capacitor having a number of media, energy stored in capacitor and combination of capacitor. **4**

8. **Electromagnetism:** Magnetic field around a current carrying conductor and its direction, concept of B & H and permeability, force experienced by a moving charge and current carrying conductor placed in a magnetic field. Magnetic field at the centre of a circular coil, straight conductor and solenoid. **4**

9. **Nuclear Physics:** Nuclear fission and fusion, use of radio isotopes, the application of nuclear fission in nuclear power station, nuclear fuels, radiation hazard. **3**

10. **Basic Electronics:** Semi conductors and their resistivity. Atomic structure of Ge & Si, P & N type materials, formation of P-N and N-P junctions, forward and backward raising working of semiconductor diode, and its application in half wave and full wave rectifiers, P-N-P and N-P-N transistors and their principles of working. **3**

PRACTICAL

Time: 1 Hour ***Marks: 20***

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. Draw forward and reverse characteristics of P & N junctions.
6. To find resistivity of a given metal by using metere-bridge.
7. To compare e.m.f. of two cells by using a potentiometer.
8. To determine 'K' of a bad conductor.
9. To determine 'K' of a good conductor.
10. Time period of a cantilever.

CLASS–XII
ELECTIVE
ELECTRICAL MACHINES (787)
THEORY

Time: 2 Hours ***Marks: 40***

1. **Single-Phase Transformer** **8**

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

2. D.C. Motors **12**

Types of motor - series, shunt, compound and universal, construction, working principles, characteristics, winding details and applications of different types of motors including fractional horse power, 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**

4. Single Phase A.C. Motor **12**

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 different motors. Speed reversal and speed control of A.C. Motors, installation of A.C. motor and testing, common faults, their causes, testing and repairs, rewinding of fractional h.p. motors.

5. Electrical Solders: Types of Solders, flux and methods, techniques of soldering. **4**

PRACTICAL

Time: 3 Hours ***Marks: 60***

1. To test and repair a defective cycle dynamo.
2. Dismantling, study and reassembling of a D.C. motor.
3. Measurement of resistance of series, shunt field and armature of a given D.C. motor and identification of terminals by multimeter.
4. Measurement of insulation resistance of armature and field.
5. Testing, fault finding and repair of a D.C. motor.
6. Overhauling of a D.C. motor.
7. Dismantling, study and reassembling of a D.C. motor starter.
8. To study D.C. series motor, its running, speed control and reversing rotation and measurement of current, voltage and speed.
9. To study D.C. shunt motor, its running, speed control and reversing rotation and measurement of current, voltage and speed.
10. To study D.C. compound motor, its running, speed control and reversing rotation and measurement of current, voltage and speed.
11. To study D.C. universal motor, its running, speed control and reversing rotation and measurement of current, voltage and speed.
12. Identification of semi-conductor devices.
13. To draw forward & reverse characteristics of given semiconductor diode.
14. Study of transistor circuits: (i) Common Base, (ii) Common Emitter, and (iii) Common Collector.
15. Study of a half-wave rectifier circuit with and without filter.
16. Study of a full-wave rectifier circuit with centre tap transformer with and without filter.
17. Study of bridge rectifier circuit with and without filter.

18. Study of transistor amplifier circuits: (i) Common Base, (ii) Common Emitter and (iii) Common Collector.
19. Study of (i) Voltage Transformer, (ii) Current Transformer and (iii) Auto-Transformer.
20. To rewind the given 230/12 v transformer.
21. Dismantling, study and reassembling of an A.C. motor.
22. Overhauling of an A.C. motor.
23. Dismantling, study and reassembling of an A.C. motor starter.
24. Testing, fault finding and repair of an A.C. motor starter.
25. Connecting, starting, running and reversing of a three phase squirrel cage induction motor.
26. Connecting, starting, running of a shaded pole motor.
27. Connecting, starting, running and reversing of a capacitor start/run motor.
28. Connecting, starting, running and reversing of an A.C. Universal motor.
29. Installation of D.C. motor.
30. Installation of A.C. motor.
31. Study of DOL starter for starting three phase induction motor.

MARKING SCHEME

Marks: 60

Note:

1. The marks for sessional work will be awarded by the teacher concerned and included in the final award.
2. Students may be asked to perform any one of the experiments listed above.

DISTRIBUTION OF MARKS

1. Sessional Work **10**

(a) All listed practical performed.

(b) Maintenance of proper records pertaining to sessional and On-Job-Training.

2. Experiment(s) **40**

(a) List of material/tools/equipment.

(b) Circuit/connection diagram (wherever diagram is not applicable then these marks should be clubbed with performance of experiments).

(c) Performance of experiment(s).

3. Viva Vioce **10**

(a) Question related to the experiment assigned.

(b) Question related to the remaining experiments.

CLASS–XII
ELECTIVE
ELECTRICAL APPLIANCES (788)
THEORY

Time: 2 Hours ***Marks: 40***

1. Electric Room Heater: 2

Construction and working principle of reflector type room heater, common defects, testing and repairs.

2. Electric Iron 2

Types of electric iron – ordinary type and automatic / thermostat control type – construction and working principles of electric irons. Common defects testing and repairs.

3. Electric Stove 3

Types of electric stoves- coiled type, covered type, hot plate, grill/oven, cooking range – construction and working principle of electric stoves, common defects, testing and repairs, induction heater, OTG & microwave oven.

4. Electric Toaster 3

Types of toasters – ordinary and automatic. Construction and working principle of electric toasters. Common defects, testing and repairs.

5. Immersion Heater and Geyser 2

Construction, working principle and use of immersion heater. Common faults – their causes, testing and repairs. Construction, working principles and use of geyser and thermostat, common defects, their causes, testing and repairs. Testing and installation of geyser. Precautions in using immersion heater and geyser.

6. Electric Kettle and Coffee Percolator 2

Working principle and use of electric kettle (all types) and coffee percolator. Common faults, their causes, testing and repair.

7. Electric Room Heater 2

Construction and working principle of blower type room heater. Heat convector – common defects, their causes, testing and repair.

8. Electric Fans 2

Types of fans – ceiling fan, pedestal fan, table fan, bracket fan, exhaust fan, construction, working principles. Characteristics and applications of electric fans. Common faults, their causes testing and repairs, installation of all purpose fan and exhaust fan.

9. Electric Mixer, Grinder and Blender 3

Construction, working principles, characteristics and applications of electric mixer, grinder and blender. Common faults, their causes, testing and repairs, servicing, maintenance and over.

10. Electric Washing Machine 2

Construction, working principles, special features and applications of washing machine, Common faults, their causes, testing and repair, repairing, servicing, maintenance and overhauling of washing machine.

11. Hair Dryer/Curler 2

Construction and working principles of hair dryer/curler, Common faults, their causes testing and repair.

12. Room Cooler 2

Construction and working details of room cooler, desert cooler, Common cooler faults, their causes, testing and repair, Installation of room cooler/desert cooler.

13. Vacuum Cleaner 2

Construction and working principles of vacuum cleaner, common faults, their causes, testing and repair.

14. Emergency Light and Voltage Stabilizer 3

Construction and working principles of emergency light and voltage stabilizer (manual and automatic), Common faults – their causes, testing and repair.

15. Electric Hand Drill 2

Construction and working principles of electric hand drill, common faults, their causes, testing and repair.

16. Electric Motor Used in Domestic Appliances 4

Split phase, capacitor start, capacitor-run, shaded-pole motors, two speed motors, reverse motors, universal motors, components testing, trouble shooting, and servicing.

17. Basic Occupational and Safety Practices 2

Safety signs, lighting and handling loads, moving heavy equipments, Electrical safety- safety practices- first aid, Practice safe methods- lifting and handling of heavy objects, Rescue a person from live wire, Artificial respiration- Nelson's arm and Schafer's Method.

PRACTICAL

Time: 3 Hours ***Marks: 60***

1. Dismantling reassembling of reflector type room heater.
2. Testing and repair of reflector type room heater.
3. Dismantling and reassembling of electric iron (i) ordinary type and (ii) automatic thermostat control type.
4. Testing and repair of electric iron (i) ordinary type and (ii) automatic / thermostat control type.
5. Dismantling and reassembling of electric stove (i) coiled type, (ii) covered type- (a) hot plate, (b) grill or hot case.
6. Testing and repair of electric stove (i) coiled type, (ii) covered type – (a) hot plate, (b) grill or hot case.
7. Dismantling and reassembling of cooking range/oven.
8. Testing and repair of cooking range/oven.
9. Dismantling and reassembling of electric toaster:
   (i) Ordinary, (ii) semi automatic, (iii) automatic with thermostat.
10. Testing and repair of electric toaster:
    (i) Ordinary, (ii) semi automatic, (iii) automatic.
11. Dismantling and reassembling of geyser: (i) instant, (ii) storage.
12. Testing and repair of geyser: (i) storage, (ii) instant.
13. Dismantling and reassembling of electric kettles (all types) and coffee percolator.
14. Testing and repair of: (i) electric kettle (all types) and (ii) coffee percolator.
15. Connection of fluorescent tube-lamp circuit.
16. Testing and repair of: (i) table lamp, (ii) night lamp, (iii) fluorescent tube light.
17. Testing and repair of: (i) electric bell, (ii) buzzer, and (iii) door chimes.
18. Controlling lamp from two or three place.
    (Stair case wiring and godown wiring)
19. To control one lamp with one switch on batton/conduit wiring.
20. To control one lamp and one socket with separate switches on batton/conduit wiring.
21. To prepare series/parallel testing board.
22. To connect fan regulator with a ceiling fan.
23. To fit MCB in a circuit in place of fuse.

24. Measurement of insulation resistance of wiring installation by meggar.
25. Polarity test of installation.
26. Earth testing and measurement of earth resistance.
27. Identification of faults of wiring, installation and rectification.
28. Testing, fault finding, repair and overhauling of blower type room heater and heat connector.
29. Testing, fault finding, repair and overhauling of electrical fans.
30. Testing, fault finding, repair and overhauling (i) electric mixer, (ii) grinder, and (iii) blender.
31. Testing, fault finding, repair and overhauling of washing machine.
32. Testing, fault finding, repair and overhauling of hair dryer.
33. Testing, fault finding, repair and overhauling of room cooler/desert cooler.
34. Testing, fault finding, repair and overhauling of vacuum cleaner.
35. Testing, fault finding, repair of emergency light and voltage stabilizer (manual and automatic).
36. Testing, fault finding, repair and overhauling of electric hand drill machine.
37. Testing, fault finding, repair and overhauling of motors used in domestic appliances.
38. Winding/re-winding of electrical motor used in domestic appliances.
39. To test the given fan with the help of Meggar insulation resistance tester for:
    (i) Insulation resistance between body of the fan and winding.
    (ii) Continuity of windings – starting and running.
40. To study emergency light circuit.

PRACTICAL GUIDELINES

Parameters	Marks
Project / Practical Activities.	15
Viva Based on Project.	10
Practical File / Report or Portfolio.	10
Demonstration of skill Competency in Lab Activities.	25
Total	**60**

CLASS–XII

GENERAL FOUNDATION COURSE (501)

(Common for Engineering & Technology Based Courses)

Time: 3 Hours ***Marks: 100***

Part–I: (Compulsory to all Vocational Courses) *Marks: 50*

A. Business Management and Entrepreneurship 30

Management of Business

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

(a)= Basic Function. **6**
(b) Marketing Management. **6**
(c) Financial Management. **6**
(d) Production Management. **6**

(e) Personnel Management. **6**

B. Computational Skills **10**

1. (a) Solution of linear equations and their application to problem of commercial mathematics. **5**

   (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. **5**

C. Environmental Education & Rural Development **10**

1. **Environmental Education** **5**

   (a) Modernisation of agriculture and environment, irrigation, water logging, use of fertilisers, pesticides, soil erosion, land degradation (desertification and deforestation), silting and drying of water resources.

   (b) Rational utilisation, conservation and regeneration of environmental resources (soil, air, water, plant, energy, minerals).

2. **Rural Development** **5**

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

Part–II: Applied Chemistry *Marks: 30*

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. **3**

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**

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). **3**

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. **3**

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. **3**

6. Problems based on Gravimetric and Volumetric Analysis. **3**

7. **Metals:** Cast iron and its properties, effect of sulphur, silicon and phosphorus as impurities in cast iron. Elementary knowledge of heat treatment of steels - hardening tempering annealing, normalizing and case hardening. **3**

8. **Alloys:** Definition, classification and necessity for making alloys. Composition, properties and uses of following alloys: Brass, Bronze, Gun-metal and Duralumin. Effect of carbon, nickel, chromium, manganese on steel. **3**

9. **Corrosion:** Its meaning, theory of corrosion, prevention of corrosion by various methods using metallic and non-metallic coatings. **3**

10. **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**

PRACTICAL

Time: 1 Hour ***Marks: 20***

1. To find the strength in grams per litre of the given solution of sodium hydroxide with the help of standard oxalic acid solution.

2. Find the strength in grams per litre of given sodium hydroxide solution with the help of standard sodium-carbonate solution and intermediate solution of an acid.
3. Determine the strength of oxalic acid solution in grams per litre using standard oxalic acid and intermediate solution of potassium permanganate.
4. Determine the total alkalinity in ppm in the given sample of water using standard sulphuric acid.
5. To find the amount of chloride ions present in water using silver nitrate solution (potassium chromate as indicator).
6. Estimate the amount of copper in the given sample of copper sulphate or copper alloy solution using a standard solution of sodium thiosulphate.
7. Estimate the amount of ash in the given sample or coal or coke or charcoal.
8. Estimate the amount of moisture in the given sample coal or coke.
9. Study the reaction of dilute and concentrated acid with any two metals (irons, copper, zinic, magnesium).
10. To arrange Mg, Zn, Fe, Fb, Sn, Cu according to their activity by studding the interaction of these metals with their salt solutions.
11. To determine the pH value of water.

LIST OF EQUIPMENTS, TOOLS AND INSTRUMENTS

1. Work Bench 1.8 m × 1.2 m and 1.5 m × 1.5 m, Heavy duty legs 7.5 cm × 7.5 cm with one 2.5 cm thick top of Shisham and hard wood with spirit polish.
2. Bench Vice – 1 No. 2 No. 3 No. 4 No. Size
   6 each 6 each 2 each 2 each
3. Pipe Vice : 2 Nos., size - 1 No.
4. Hammers Ball Pien, 100 gms. 6 each
   Ball Pien, 0.25 kg. 6 each
   Ball Pien, 0.5 kg. 4 each
   Ball Pien, 1 kg. 2 each
   Ball Pien, 2.5 kg. 1 No.
5. Mallets of wood different size. 6 each
6. Hammers of Plastic head (Plastic Mallets) of different size. 3 each size
7. Micrometer 0 to 25 mm Japanese Mitutoyo. 2 No.
8. Inside Micrometer 5 to 30 mm Japanese Mitutoyo. 2 No.
9. Depth gauge 20 cm Mitutoyo. 1 No.
10. Try Square 15 cm Japanese or English. 6 No.
11. Marking Blocks Adjustable. 2 sets
12. V. Block 7.5 cm one set with clamp. 2 sets
13. Surface plate 45 cm × 45 cm. 1 No.
14. Centre Punch 10 cm length. 10 No.
15. Wire gauge SWG. 1 No.
16. Files of different length, grade and shapes Length (10 cm to 30 cm), Grade Bastered, smooth dead smooth. Shapes flat, Round, Half round, Triangular, Square, knife edge, Mill file, wooden file (Rasp file). 6 each
    Needle files of different shapes. 3 each
17. Cold Chiesel 15 cm to 20 cm. 6 Nos.
    Taparia/Jhalani or other standard make.

18.	Drills High speed steel 0.5 mm to 6 mm, 1/6.	3 + 3 set
	I.T. Make 6 mm to 18 mm, $1/4^3$ to $3./4^3$.	1 + 1 set
19.	Crimping Tools.	2 No.
20.	Diamond Tip Glass Cutter.	2 No.
21.	Hand Reamers 20 mm or other required size.	1 No.
22.	Tap sets with handle $1/8^3$ to $3/8^3$ BSW.	1 Set
	Tap set with handle $3/16^3$ to $3/8^3$ BSF.	1 Set
	Tap sets with handle 0^3 to 10^3 BA.	1 Set
23.	Dies sets with stocks $1/8^3$ to $3/8^3$ BSW.	1 Set
	Dies sets with stocks $3/16^3$ to $3/8^3$ BSF.	1 Set
	Dies sets with stocks 0^3 to 10^3 BA.	1 Set
24.	Screw Driver Non breakable handle Assorted.	2 Set
25.	Philips Head Screw Driver – Set of 10 Nos.	2 Sets
26.	Pliers – Combination Insulated 15 cm, Long Nose, 15 cm, Side Cutting,	
	Pliers 15 cm, Flat Nose 15 cm, Round Nose 15 cm.	10 Nos. each
	Bend Nose 15 cm.	2 No
27.	Round Nose Seal Remover Pliers 20 cm.	2 No.
28.	Adjustable Wrench 25 cm – 30 cm.	2 each
29.	Pipe Wrench 25 cm – 2.5 cm.	2 Nos. each
30.	Pipe type spanner set of 8 – Spanners – SURA make.	1 Set
31.	Double End open spanner set of 12 spanners.	2 Sets
32.	Ring Spanners set of 24 spanners.	1 Set
	Make Jhalani / Taparia.	
33.	Box Spanner – set of 24 spanners.	1 Set
	Make Jhalani / Taparia or imported.	
34.	T. spanner set from 4 No. to 13 No.	2 Set
35.	Allen Key set – Set of 12 pcs.	1 Set
36.	Bearing/Pulley Puller.	1 No.
37.	Grease Gun manual Operated.	1 No.
38.	Oil cane.	1 No.
39.	Oil Stove.	1 No.
40.	Blower Stove	. 2 No
41.	Scissor 20 cm.	6 Nos.
42.	Sheet cutter 25 cm Blade length.	2 Nos.
43.	Rawl Plugs.	5 Sets
44.	Wooden saw 30 cm to 45 cm.	10 Nos.
45.	Adjustable Hacksaw.	10 Nos.
46.	Fix Hacksaw.	10 Nos.
47.	Junior Saw.	2 Nos.
48.	Wooden Chisels (Sathari)/(Chaursi).	10 each
49.	Electrician Knife.	20 Nos.

50.	Photo cutter (9^3 and 1^3).	1 each
51.	Poker.	20 N
52.	Scale 15 cm and 30 cm stainless steel Japanese make.	10 each
53.	Wooden Planer Wood.	10 Nos.
	Steel Planer (Anant Make).	5 Nos.
54.	Wooden Planner for Design for one sided for groove with accessories.	2 Sets
55.	Phase or Neon tester (Taparia).	20 Nos.
56.	Morce Taper Socket 2.3 for drill machine.	1 No
57.	Soldering Iron 35 Watts to 120 Watts, 35 Watts and 65 Watts (make Raj/Toni).	10 Nos. each
	120 Watts (Raj/Toni make).	2 Nos.
	15 WAtts.	10 Nos.
58.	Thermocouple prone type for temp.control.	2 Nos.
	Thermocouple rod type for temp.control.	2 Nos.
59.	Bimetallic relay (Faridge and other relays).	2 Nos.
60.	Thermostat for refrigerator, for Geyser, for Hot case.	2 Nos. each
61.	Dynamo D.C. small (Cycle Dynamo).	5 Nos.
62.	Universal motor – 1/4 HP and 1/2 HP.	1 No. each
63.	Soldering Iron stand.	20 Nos.
64.	Demonstrational Transformer Ratio 1 : 1.	
	230/230 V with 25%, 50%, 85.6% voltage tapping on both side.	3 Nos.
65.	Air Break Contractor.	2 Nos.
66.	Voltage Transformer 440 V/110 V.	2 Nos.
67.	Current transformer 5/100 amps.	2 Nos.
68.	Auto Transformer 0 to 270 V 15 amps.single phase AE.	2 Nos
69.	Electrical Sprayer Pilot – make 800 gram capacity.	1 No.
70.	D.O.L. Starter – Make GEC, Cromptom, Kirlosker, ABB upto 5 HP 3.	3 Nos.
71.	Star Delta Starter – Manually operated upto 15 HP.	2 Nos.
72.	Star Delta Starter – Semi Automatic upto 15 HP.	2 Nos.
73.	Star Delta Starter – Fully automatic with additional accessories upto 10 HP.	2 Nos.
74.	Torch of 4 cells portable.	2 Nos.
75.	Flourescent Tube Fixture with choke and starter complete.	10 Nos.
76.	Heating Element of different types used in industrial closed type Heating elements as Round Kettle and type other shapes.	2 ea
77.	3 Phase Reversing switch L & T, other best make.	2 each type
78.	Rotary Switches of different types as AGI make R 416, R 316, R 216, 216 K, 216 KF, RT 415, R 415 F, R 415 D.	2 Nos. each
79.	I.C.T.P. and I.C.D.P. Main switches.	4 each
80.	Distribution Boards.	2 Nos.
81.	Bus Bar.	2 Nos.
82.	Old Ceiling fan with complete parts.	4 Nos.
83.	Old Table fan with complete parts.	4 Nos.

84. Exhaust fan with complete parts. 4 Nos.

85. Old Shaded pole Motor 1/2 HP. 4 Nos

86. Different types of Centrifugal Switch Assembly complete make Cromptom/GEC etc. 4 Nos. each

87. Single Phase capacitor start capacitor run Motor. 2 Nos.

88. Single Phase 1440 RPM old motor with complete parts. 2 Nos.

89. A.C. Induction squirrel cage 3 phase motor 1440 RPM old with complete parts. 2 Nos.

90. Hand drill Machine 6 mm capacity. 10 Nos.

91. Electrical Gun drill machine-portable 6 mm max. capacity High speed with accessories 1 No.

92. Electrical Gun drill machine portable 12 mm capacity low speed with accessories. 1 No.

93. Bench Drill machine pillar type capacity upto 12 mm or 18 mm Taper Drill and 9 mm Drill chuck capacity with all accessories and Drill chuck with key with motor single phase or 3 phase 1 HP as per facility of electricity available in the lab. 1 No

94. Bench Grinder 1 HP 220 V, Single Phase, Three Phase power 2880 RPM with one smooth and one medium grinding wheel of Carborundum. 1 No.

95. Electrical Welding machine upto 250 AMp.capacity single phase 250 Volt AC supply oil filled tank type or air cooled type with all accessories as screen, welding lead and holder, earth clamp etc. 1 Set

96. Winding Machine for Motor coil winding Hand operated. 2 Nos.

97. Winding Machine for Transformer winding hand operated single coil. 1 No.

98. D.C. Motor series – 1 HP, D.C. Motor Shunt-1 HP RMP 1500. 1 No.

D.C. Motor Compound – 1 HP RMP 1500. 1 No.

99. A.C. Motor, Single Phase, condenser Start Motor 1/2 HP and 1 HP. 1 each

100. Single phase condenser run motor Fractional H.P. 3 Nos.

101. Three Phase Induction Motor 2 HP, 410 V, 1450 RMP. 1 No.

102. Shade Pole Motor 1/2 HP, 1/4 HP or small. 2 each

103. Demonstrational AC Single phase Squirrel cage induction conden Run F.H.P. Motor all terminal of Motors. Condenser mounted on Bakelite plate of 12 mm thickness fitted with motor on separate Mild Steel Channels.2 Nos.

104. Demonstrational type A.C. Single phase squirrel cage inducation condenser start Motor 1/2 HP terminals of running winding, starting winding, condenser and centrifugal switches, mounted on bakelite 12 mm thick plate fitted with motor on separate mild steel channels. 2 Nos.

105. Demonstrational Model for study of Transistor circuits (circuit fitted on sun mica 3 mm board with proper terminals I. common base, II. common emitter, III. common collector. 2 Nos.

106. Demonstrational Model for study of Transistor Amplifier circuit I common base II common Emitter III common collector. Circuit fitted on sun mica board with proper Terminals. 2 Nos.

107. Solenoid coil of copper wire (HTP) Highly insulated bobin (Formula R of coil) made of mica and bakelite operating on 220 V. Copper Wire 29 SWG, length of coil at least 10 cm with two terminals mounted on side of coil. Coil will be fixed on 12 mm ply and sunmica table or 2 mm sunmica Board with 50 cm wooden or plastic rule and Core Material Free Cutting Grade Steel, Cost Iron, Copper, Brass, Aluminium, Carbon Steel one each.2 Nos.

108. Apparatus for comparison of Aluminium and copper conductivity, resistivity and magnetic field strength. Design-table bedsize 45 cm × 30 cm of 12 mm ply with sunmica/bakelite sheet 3 mm fitted with identical coils (one copper coil wounded and one coil aluminium wounded gauge and turn of wire will be same operating on 220 V one metre rule of wood or plastic will be fitted with screws on both side of coil. Both coils having two terminals on side for connection, core will be permanently fitted inside the coil, core material wrought iron/free cutting grade of steel.

2 Nos.

109. Two heating coils wounded on china clay or procelain rod one coil Ureka/Constantan and one Nichrome wire of same gauge and same wire of length fitted on 30 cm × 38 cm board of bakelite and asbestos sheet fitted on 12 mm Ply board with brass terminal insulated for connection. 2 Nos.

110. Half wave rectification model with filer circuit condenser 25 V 1000 MFD transformer 12–0–12 V I amp. output, one 50 VAC Diode 5408 and 6 terminals, fitted on sunmica board with lead and plug. 2 Nos.

111. Full wave rectification model with center gap earth and filter circuit. Condenser 25 V/1000 Mfd., Transformer 12–0–12 V Amp. output, two Diode 5408–50 VAC, 6 Terminal fitted on Sunmica Board with lead and plug.

112. Full wave rectification model with full wave rectifier bridge (Bridge of 4 Diode) and II Filter Circuit Transformer 12–0–12 V 1 Amp.output, 4 Diode (No. 5408) 50 VAC Condensor 25 V/1000 Mfd. II Filter Circuit with two condensor and choke of 1 Amp. capacity 6 terminal fitted on Sunmica Board with lead and plug.

B. Measuring Instruments

1.	Ammeter MI type 0–5–10 Amps.	4 Nos.
2.	Ammeter MC type 0–1–5 Amps.	2 Nos.
3.	Voltmeter MI type 0–300 Volts.	4 Nos.
4.	Voltmeter MI type 0–600 volts	2 Nos.
5.	Voltmeter MC type 0–300 volts.	2 Nos.
6.	Voltmeter MC type 0–15 volts.	4 Nos.
7.	Watt metreDynameter type 0–300 5 amp./10 amp.	2 Nos.
8.	Energy meter 230 V, 5 amps.	2 Nos.
9.	Insulation megger – 500 volts.	2 Nos.
10.	Earth tester.	1 No.
11.	Neon tester.	2 Nos.
12.	Multimeter.	2 Nos.
13.	Clip on meter.	2 Nos.
14.	Growler inside and outside.	1 No.
15.	Phase sequence indicator.	2 Nos.
16.	Frequency meter Pointer type.	1 No.
17.	Frequency meter digital type.	1 No.
18.	Power factor meter.	1 No. each
	(i) Dimmerstat 230/0–270 V 4 amp.	
	(ii) Rheostat (a) 1 amp. 50 ohm, (b) 10 amp. 8 ohm.	
	(iii) Variable Single Phase Inducter 5/10 amps.	
	(iv) Capacitor 50 MF, 400 Volts.	
19.	Conduct Pipe Tee.	6 Nos.
20.	Bulbs 60 Watts.	1 Dozen

C. Consumable Material

1.	P.V.C. wire 3/22.	4 coils
2.	Wooden Batten 12 mm × 18 mm.	100 meter each size
3.	Casing Copping (Standard Size).	100 meter
4.	Link Clips Standard size.	2 Gross
5.	Nail Standard size 12 mm.	1 Kg

6.	Wooden screws standard size.	4 Dozen each size
7.	Round Blocks standard size.	1 Gross
8.	Wooden Board standard size.	2 Dozen each size
9.	Insulation Tape.	1 Dozen
10.	5 Amps Switch.	2 Dozen
11.	15 Amps Switch.	1 Dozen
12.	Batton Holder.	2 Dozen
13.	Pendant Holder.	1 Dozen
14.	Angle Holder.	1 Dozen
15.	5 Amps 2 way switch.	1 Dozen
16.	Intermediate Switch.	6 Nos.
17.	5 Amps 3 pin plug.	2 Dozen
18.	15 Amps 3 pin plug.	1 Dozen
19.	5 Amps 3 pin shoe.	1 Dozen
20.	15 Amps 3 pin shoe.	1 Dozen
21.	Electric Press Connector.	6 Nos.
22.	Piano Type Switch Saps.	1 Dozen
23.	Conduit Pipe 18 mm, 25 mm.	50 each
24.	Junction Box	. 6 No
25.	Conduit Pipe Tee.	6 M Nos.
26.	Bulbs 60 Watts.	1 Dozen
27.	Grease.	2 Kg.
28.	Lubricating Oil.	5 Litre
29.	Insulating Varnish.	

AUTOMOBILE TECHNOLOGY

Introduction

The present course curriculum intends to educate the students about the initial level of automobile service sector while fulfilling the needs and requirements of the students who are willing to learn activities relating to automobile service sector. It is designed in a way so that the students can begin their study of the design, construction, service, maintenance, and repair of the modern automobile.

This course will develop an interest amongst the students on various aspects of the automobile sector and will simultaneously enable the students to get a general look into the major auto systems, which includes cooling, engine, steering and suspension, transmission, electrical and braking systems. It will also enable the students to perform maintenance and minor repairs to engines, transmissions, rear axles, brakes, tires, cooling and electrical systems, and perform new vehicle preparation. The present course is developed to identify the potential future career opportunities, shop safety, certifications and environmental issues which would enhance the effectiveness of the students in the field.

COURSE OBJECTIVES

After successfully completing the two year of senior secondary vocational course, the student would have acquired relevant appropriate and adequate technical knowledge together with professional skills and competencies in the field of Automobile Engineering, so that he/she is properly equipped to take up gainful employment in this vocation.

Thus he 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, constructional details, and functions of major components, assemblies, and sub-assemblies of automobiles, buses, trucks, motor cycles, and scooters.

(d) The proper method of using various tools and measuring equipment commonly used in garrage.

(e) Importance and procedures of preventive, operating and break-down maintenance.

(f) Preparing estimate of repair jobs.

(g) Garrage procedure.

(h) Major vehicle rules.

(i) Specifications of vehicles and their components.

B. Adequate Professional Skill and Competencies in

(a) Use of hand tools, instruments, and garrage equipments.

(b) Dismantling, repair and assembly of different components of vehicles.

(c) Servicing and maintenance of vehicles.

(d) Testing of sub-assemblies and vehicles – before as well as after repairs.

(e) Organising and looking after a repair shop.

(f) Implementing of manufacturers repair and maintenance.

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

(a) An analytical approach while working on a vehicle, motor cycle or scooter.

(b) An open mind while locating/rectifying faults in vehicles, motor cycles or scooters.

(c) Respect for working with his own hands.

(d) Respect for honesty, punctuality and truthfulness.

CLASS–XI
ELECTIVE
AUTO ENGINEERING (627)
THEORY

Time: 2.5 Hours+2.5 Hours ***Theory: 50***
Practical: 50

1. Introduction to Automobile **6**

- Introduction to Automobile, classification of vehicles on the basis of load, wheels, final drive, fuel, axles, position of engine, transmission, body.
- Layout of an automobile, function of major components of vehicle and introduction to their different system.

2. Automobile Engine **15**

- Introduction to engine terminology, classification of automobile engines, thermodynamic cycles-Otto cycle, Diesel cycle, four stroke/two stroke petrol and diesel engine (working & comparison), value timing diagrams. Fuel supply system of petrol engine, air filter, fuel tank, fuel filter; A.C. Fuel pump and electric fuel pump, Carburettor - types function and working principle of simple carburettor, different circuits, trouble shooting.
- Fuel supply system of diesel engine, air cleaner/filter, fuel tank, fuel filter, fuel feed pump fuel injection and fuel injector.

3. Transmission System — 12

- Function of clutch, types, working of single plate (helical spring & diaphragm spring types) and multi plate clutch used in cars / Motor Cycles / Scooters etc. trouble shooting.
- Gear box assembly – function, need of gear box, working of a constant mesh and Synchromesh gear box, selector mechanism.

4. Braking System — 10

- Function and principle of braking system, classification, braking systems-constructional details and working of mechanical brake, hydraulic brake, drum brake, disc brakes, servo brake air brake and parking brake.

5. Wheel and Tyres — 7

- Classification of wheel rims, constructional details. Classification, constructional features, function of different types of tyres (tubed & tubeless), Tyres specifications, Causes of tyre wear and their remedies, Tyre maintenance, tyre pressure (over inflation, under inflation, correct) and their effects on vehicle performance.

Note: Practical will be based on aforesaid theory paper.

CLASS–XI
ELECTIVE
AUTO SHOP REPAIR & PRACTICE (628)
THEORY

Time: 2.5 Hours+2.5 Hours — ***Theory: 50*** / ***Practical: 50***

1. Regular Maintenance of an Engine — 15

- Inspection of an engine.
- Washing of an engine.
- Tuning fuel system of an engine.
- Tuning of the ignition system of an engine.
- Tuning engine lubrication system.
- Tuning engine cooling system.
- Checking other engine components (Mechanical Setting).
- Engine Timing and engine sound test after setting.

2. Regular Maintenance of Transmission System — 10

- Transmission system.
- Clutch maintenance.
- Clutch adjustments.

- Overhauling of clutch.

3. Regular Maintenance of Gear **8**

- Lubrication of gear box.
- Setting of gears.

4. Service of Wheels **7**

- Importance of wheels.
- Importance of hub greasing and bearing play adjustments.

5. Regular Maintenance of Tubes and Tyres **5**

- Tyre and its maintenance.
- Tyre puncture.

6. Regular Maintenance of Brakes **5**

- Brakes and maintenance.
- Brakes and adjustment.

Note: Practical will be based on aforesaid theory paper.

CLASS–XI
OPTIONAL
ENGINEERING SCIENCE (622)
(Common for Automobile Technology and Airconditioning & Refrigeration Technology)

THEORY

Time: 3 Hours ***Marks: 70***

A. Engineering Drawing **40**

Drawing, characteristics and types, Drawing instruments, their use and care. IS specifications, Layout and fixing of drawing sheets according to ISI. Free hand sketching and lettering of various sizes and types. **4**

1. **Conventions & Symbols and Materials** **4**
   - Conventional of lines, types, centre of focus line, various types of lines and their use.
   - Conventions for materials.
   - Civil Engineering Sanitary fitting symbols.
   - Electrical fittings symbols and domestic installations.
   - Building plan drawing with electrical and civil Engineering symbols.

2. **Lettering Techniques and Practice** **4**
   - Requirements of good lettering. Freehand printing and numerical in 3, 5 8 and 12 mm sizes vertical and inclined at 75 degrees, General composition of alphabets.
   - Instrumental lettering in single and double stroke in 12 mm.

3. **Dimensioning Techniques** **4**
   - Necessity of techniques, methods and principles, dimensioning of chamfered portions, hatched figures,
     countersunk holes, irregular figures, scales.

4. **Principles of Projections – I** **5**

- Third angle Projections – Principles of orthographic Projections.
- Three views of given object.
- Six views.
- Exercise in auxiliary views.
- Centre Line and extension lines.

5. **Sections** **4**

- Importance, methods of representing, conventional sections of various materials, classification and sections, conventions.

6. **Pictorial and Isometric Views** **5**

- Isometric axis, oblique drawing axonometric views.
- Pectoral views from two or three views.
- Isometric view (introduction) and exercise.
- Conical projections.
- Tracing, blue printing and ammonia printing.

7. **Working Drawing/Details and Assembly** **5**

- Principle of detailed and assembly drawings.
- Detailed working drawing by actual measurement of a job already prepared.
- Practical exercise in drawing from detailed assembly and vice versa using actual job prepared in workshop.

8. **Rivets, Riveted Joints and Welded Joints** **5**

- Nuts and bolts, proportioning and views.
- Types of rivet heads, riveted joints, spigot and socket joints.
- Welded joints, IS welding symbols, butt joints, lap joints, corner joints, T-joints.

B. Workshop Technology **30**

- **Pipes and Pipe Fittings:** Classification of pipes according to their material and use. ISI specifications of pipes. Various types of pipe fittings and their application. Pipe Vice, Pipe threads and thread cutting. **9**
- **Metal Sawing:** Power Hack and Band Saw, their applications, specifications of blades used in above machines. **6**
- **Drilling:** Introduction, types of drills, portable and bench type drilling machines, drilling speed and feeds; Drill, Chucks and other accessories used in drilling machines. **7**
- **Soldering & 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. Brazig materials. Advantages and disadvantages of soldering & brazing. **8**

PRACTICAL

Time: 2 Hours ***Marks: 30***

1. **Carpentary Shop:** Identification of wood, introduction of tools, safety precautions. Practical exercises involving practice of sawing, planning, chiselling, joining various joints. To make some utility jobs such as brackets,

office
tray. **7**

2. **Fitting Shop:** Introduction to tools and measuring instruments, their safe keeping, safety precautions, practical exercises involving sawing, filing, marking, squareness, chipping. **8**

   Description of work bench, work holding devices, care and maintenance of various tools used in fitting.

   Fitting Practice, checking by straight edge and tri square.

   Specifications of files, Precautions while filing.

   Jobs on Drilling and Tapping.

3. **Forging Shop**: Introduction and demonstration of tools, equipment and operations used in smithy and forging. **8**

   Upsetting operation, production of a blank for a bolt from a round bar.

   Exercise on drawing down operation.

   Exercise involving use of Power Hammer.

   Exercise in the making of D.E. Spanner/Hook.

4. **Sheet Metal Shop:** Description of tools and operations involved in Sheet metal fabrication such as shearing, bending, joining (locked groves joint, Riveting, soldering Brazing) Exercise like tray, Mug, Funnel etc. **7**

CLASS–XI
OPTIONAL
APPLIED MECHANICS (626)
THEORY

Time: 3 Hours ***Marks: 60***

1. **Introduction:** Concept and explanation of mechanics and applied mechanics, its importance and necessity giving suitable examples laws of motion. Explanation of branches of this subject, concept of rigid bodies. **6**

2. **Laws of Forces:** Force and its effect, units and measurement of force, characteristics of force, vector representation. Bows notation graphical method to find stressed in simple trusses.

   Types of forces-action and reaction, tension, thrust and shear force. Force action and reaction, tension, thrust and shear force. Force systems, Coplanar and space force systems. Coplanar concurrent and non-concurrent forces body diagram.

   Resultant and components of forces. Concept of equilibrium, Axioms in statics, parallelogram laws of forces. Equilibrium of two forces, superimposition and transmissibility of forces, triangle of forces, different cases of concurrent coplanar two force system, extension of parallelogram law and triangle law to many forces acting at one point, polygon law of forces, method of resolution into resolution into orthogonal components for finding the resultant, graphical methods, special case of three concurrent Coplanar forces Lami's theorem. **8**

3. **Moments:** Concept of moment, variants theorem (Statement only) Principle of moments – application of moments to simple mechanisms. Parallel forces like and unlike, calculation of their resultant. Concept of couple properties and effect. Moving a force parallel to its line of action. General cases of coplanar force system. General conditions of equilibrium of bodies under coplanar forces. **7**

4. **Friction:** Concept of friction, laws of friction, limiting friction and co-efficient of friction, sliding friction and rolling friction, angle of friction. **6**

5. **Concept of Gravity:** Concept of gravity, gravitational force, centroid and centre of gravity, centriod of regular lamina and centre of gravity of regular solids. Position of centre of gravity of compound bodies and centriod of composite centre of gravity of areas with portions removed. **7**

6. **Laws of Motion:** Concept of momentum. Newton's law of motion, their application derivation of force equation from second law of motion. Numerical problems on second law of motion. Piles, lifts, bodies tied with strings. Conservation of moments, impulse and impulsive force. **7**

7. **Work Power Energy:** Review of concept of the work power energy. Types of energy Conservation of energy. Horse power. Work done against gravity and work done against friction. **6**

8. **Circular Motion:** Circular motion, angular velocity and acceleration, relation between angular and rectilinear motion. Centrifugal and centripetal forces, uniform motion of a vehicle in a circular path. **6**

9. **Simple Machine:** Concept of machine, MA, VR, efficiency and their relationship. Reversibility of a machine and self locking law of machine. Simple machine, lever included plane, wheel and axle (simple and differential) Screw jack, Winch crabs pulleys fixed and moveable systems, certain differential pulley and work. **7**

PRACTICAL

Time: 2 Hours ***Marks: 40***

1. To verify the law of parallelogram of forces and triangle law of forces.
2. To verify the law of polygon of forces.
3. To verify the principle of moments.
4. To verify the coefficient of friction (M) between wood, steel, copper and glass (horizontal and inclined plane).
5. To find the mechanical advantage, velocity ratio, co-efficient of simple machine (wheel and axle Weston's differential pulley, screw jack)
6. To determine moment of inertia by flywheel.
7. To find the reaction at supports of beam, simply supported at the ends carrying concentrated load at one or more points.
8. To find out the forces in the jib and tie of a jib crane.
9. To establish law of a given machine.

CLASS–XI
GENERAL FOUNDATION COURSE (501)
(Common for Engineering & Technology Based Courses)

(Refer to page 7)

CLASS–XII
ELECTIVE
AUTO ENGINEERING (627)
THEORY

Time: 2.5 Hours+2.5 Hours ***Theory: 50***
Practical: 50

1. Service Equipment 10

- Construction, working and application of – air compressor, hydraulic hoist, car washer, oil dispenser, grease dispenser, tyre inflator, spark plug cleaner and tester, wheel balance (Dynamic), brake efficiency tester.
- Preventive, operative and breakdown maintenance schedules.

2. Automobile Lubrication and Cooling System 8

- Necessity of lubrication, different type of lubricants and their grades (SAE Number), type of lubrication system, function and working of different components (oil pump, oil filter) used in lubrication system, trouble shooting and remedies.
- Necessity of cooling system, different type of cooling system (water and oil cooling), their merits and demerits, function and working of different components (water pump, radiator, radiator pressure cap, thermostat valve etc.) used in cooling system, trouble shooting and remedies.

3. Final Drive System 6

- Function, type and working of universal joints, propeller shafts.
- Principle and working of differential, rear axle.

4. Front Axle and Steering 6

- Function, type and operational details of front axles and stub axles: Ackermann's principle of steering, toe-in, toe-out, castor, camber, king pin inclination (steering axis inclination), steering gear box (rack and pinion, worm and nut with re-circulating balls) and steering linkages, power steering, trouble shooting and remedies.

5. Frame and Suspension 6

- Frame and frameless construction, description of suspension system, leaf springs, coil springs and torsion bar. Function and working of different types of shock absorbers, trouble shooting and remedies.

6. Automobile Electrical System 7

- Battery (lead acid type) – construction, charging and discharging action, maintenance of batteries concept of maintenance free batteries, different circuit diagrams (Charging circuit, starting circuit, lighting circuit, horn circuit, wiper circuit), Wiring diagram of car, functions of various components used in electrical circuits of automobile. Function and working principle of dynamo alternator, self-starter and three GC unit regulators.
- Ignition system (battery ignition and magneto ignition), Spark plug – classification, ignition timing.

7. Motor Vehicle Act 1983 and Rules 7

- Provision regarding issue of driving licence, registration, insurance, transfer of ownership, fitness certificate, traffic signs, hand signals used by driver and traffic personnel.
- Emission, control, sources of emission/pollutants, Emission Norms in India.

Note: Practical will be based on aforesaid theory paper.

CLASS–XII
ELECTIVE
AUTO SHOP REPAIR & PRACTICE (628)
THEORY

Time: 2.5 Hours+2.5 Hours | *Theory: 50* | *Practical: 50*

1. Service Manual — 2

- Reading of service manual.

2. Inspection and Repairs of the Fasteners — 4

- Identification of fasteners used in a vehicle.
- Various procedure used for removal of fasteners from the unit.

3. Measuring Equipments — 10

- Handling and Use of dial gauge, telescopic gauge and bore gauge.
- Handling and Use of Vernier caliper and tyre depth gauge.
- Handling and Use of micrometer.
- Handling and Use of hydrometer and bevel gauge.
- Handling and Use of torque wrench and filler gauge.
- Usage of various gauges in a dashboard in vehicle.

4. Suspension System — 10

- Maintenance of suspension system.
- Service and replacement of leafs, cambering of leaf springs, shackle, shackle pin and centre bolt.
- Replacement of strut/shock absorbers, inspection of steering linkages.
- Manual and Power steering systems, Air suspension system.
- Steering system adjustments.

5. Serviceability, Replacement or Repair of Components — 10

- Reconditioning of valve mechanism.
- Inspection and replacement of piston rings.
- Inspection and replacement of connecting rod and engine bearing.
- Testing of cooling system and replacement of defective component.
- Regular servicing of MPFI system.
- Servicing of CRDI / Non-CRDI system.

6. Transmission System — 6

- Servicing of propeller/drive shaft, universal and slip joints.
- Servicing of differential unit and adjustments.
- Introduction to automatic transmission system.

7. Auto Electrical System 8

- Reading of electrical symbol, circuit diagrams, colour codes and specification of cables and wiring hardness.
- Multi meter, timing light (stroboscope) and oscilloscope and its application.
- Battery and its maintenance.
- Circuit diagram for battery charging.
- Checking of electrical connections and lights in a vehicle.
- Lighting system, application and replacement of fuses.
- Horn assembly, electrical fuel gauge and fuel pump their application and maintenance.
- Circuit diagram for starter circuit.
- Circuit diagram for ignition circuit.
- Servicing of wiper system.
- Introduction of HVAC System in a vehicle.

Note: Practical will be based on aforesaid theory paper.

CLASS–XII
OPTIONAL
ENGINEERING SCIENCE (622)
(Common for Automobile Technology and Airconditioning & Refrigeration Technology)

THEORY

Time: 3 Hours ***Marks: 70***

A. Engineering Drawing 40

(a) **Section of Solids:** Concepts of sectioning. Projection of sections of poly-Hedron including their true shapes. **9**

(b) **Development of Surfaces:** Development of Poly-Hedron and solids of revolution including their sections. **8**

(c) **Fasteners:** Introduction of temporary and permanent fasteners, riveted joints and welded joints. Types of screw threads, conventional symbols for Internal and External threads, ISI specifications. Drawing of Bolts, Nuts, studs and locking devices. Their application in Engineering field. **9**

(d) **Keys and Cotters:** Different types of keys, sleeve and cotter joints, socket and spigot joints, knuckle joints. **7**

(e) **Couplings:** Solid and split coupling, flanged coupling, simple and protected. **7**

B. Workshop Technology 30

(a) **Welding:** General characteristics of welded joints, Principle of welding, Types of welding processes and their brief description e.g. gas welding and arc welding, high pressure gas welding and low pressure gas welding. DC welding and AC welding, brief description of resistance welding, spot welding, butt welding, seam welding, submerged arc welding, thermit welding, inert gas welding, tungsten inert gas welding, mig. atomic hydrogen welding.

Gas welding and AC welding tools and equipments, selection of electrodes, fluxes, currents, torches and equipments. Specifications of tools, equipment and materials according to BSI. Different types of flames and their application in welding, Defects in welding and their detection. **15**

(b) **Metallic and Non-Metallic Coatings:** Necessity of metallic and non-metallic coatings. Principle and processes of electroplating and galvanising, their applications. Properties and uses of varnishes, paints including primers and enamels. **6**

(c) **Plastics Technology:** Introduction to thermoplastic and thermo-setting plastics, general properties, injection moulding, compression moulding-process and equipment, other plastic moulding methods, Machining plastics. **9**

PRACTICAL

Time: 2 Hours ***Marks: 30***

1. **Welding Shop:** Are welding-introduction to tools and equipments, safety precautions, use of welding transformer/ welding machine, method of selecting current, choice of electrode. Exercise involving surface and edge preparation, making of simple welding joints.

   Gas Welding: Introduction to gas welding equipment, safety precautions, selection of gas pressure, welding toruch type of flame, flux, welding rod and welding technique. Exercise involving job preparation and making Single Joints, Brazing practice of brazing by gas.

2. **Machine Shop:** Introduction to various types of Drilling machine (portable Drilling Machine, Pillar type, Bench type, Radial drilling machine).

   Simple Exercises involving the use of above machines.

   Introduction to Lathe (Job mounting, Tool holding Devices).

   Simple exercises on Lathe (Turning, Facing, Parting, Step Turning, Chamfering, Knurling, Groove cutting by Form tool).

3. **Painting and Polishing:** Introduction to paints and allied materials, exercises on surface, preparation, varnishing, spirit polishing painting-using brush and spray, casual painting.

List of Experiments

Machine Shop

1. Drilling at specified position using a bench drilling machine.
2. Drilling holes upto 40 mm diameter, using a radial drilling machine.
3. Use of pillar type drilling machine for drilling hole upto 25 mm diameter.
4. Mountaning a job on a lathe machine in the four jaw chuck.
5. Setting of various types of cutting tools in tool post of a lathe machine.
6. Facing, centering, plain turning and chamfering on a lathe machine.
7. Step Turning and parting of job on a lathe machine.
8. Knurling and growing of job on a lathe machine with the help of forming tool.

Welding Shop

A. Arc Welding

1. Introduction of tools and welding transformer for electric arc welding.
2. Safety precautions of arc welding.
3. Introduction to various types of electrodes for arc welding and selection of current.
4. Edge preparation and making a Butt-joint.
5. Making a lap joint with the help of arc welding.
6. Making a T-Joint with the help of arc welding.
7. Making a corner-joint with the help of arc welding.

B. Gas Welding

1. Demonstration of gas welding equipment including.
   (i) Selection of gas pressure welding torches.
   (ii) Various types of welding rods, flames and fluxes.
2. Safety precautions in gas welding.
3. Edge preparation and making Butt joint with help of ages welding.
4. Making a lap-joint with the help of gas welding.
5. Making a T-joint with the help of gas welding.
6. Making a Corner-joint with the help of gas welding.
7. Brazing practice with the help of welding-toruch.

Painting and Polishing Practices

1. Filling or putty application.
2. Staining.
3. Sand preparing.
4. Varnish Polishing.
5. Spirit Polishing.
6. Brush Painting.
7. Spray Painting.

Note: Each student should perform all the experiments and Practices during the session.

List of Experiments

1. To test safety and operating controls such as Relay, Thermostat, L.P. cut-out, H.P. cut-out, Over-load protector, solenoid valve, oil pressure, Failure Control etc.
2. To carry out electric wiring of Refrigerator and Bottle Cooler.
3. To carry out electric wiring of window type Air Conditioner.
4. To test compressor for efficiency and earthing etc.
5. To service a window type Air Conditioner.
6. To find fault in Refrigerator and Bottle cooler.
7. To find fault in Air Conditioner.
8. To Check Comfort Conditions such as air, temperature, humidity, Air Motion etc.
9. To adjust the Automatic System.
10. To study compressor capacity control methods.

Note: Each student should perform all the experiments during the session.

CLASS–XII
OPTIONAL
MECHANICAL ENGINEERING (626)
THEORY

Time: 3 Hours ***Marks: 60***

1. **Transmission of Power:** Uses of belts and ropes (without including their materials), pulleys different types of pulleys. Chain drive, its comparison with belt drive. Gear drive, types of gears, simple gear trains and velocity ratio. Description of single plate disc. clutch. **12**

2. **Steam Biolers:** Coch boiler, Lancashire boiler, Bibcock and Wilcox boiler, Baby Vertical boiler, their mountings and accessories. **12**

3. **Turbines:** Classification and application of turbines. Elementary study of different types of turbines-construction and working of D' Level and Parson's turbine, pelton wheel, Francis and Kaplan turbine. **12**

4. **I.C. Engines and Compressors:** Classification and application of I.C. engines commonly used, spark ignition and compression ignition engines, working principles of two stroke and four stroke Petrol and Diesel engines Ignition engines, working principles of two stroke and four stroke Petrol and Diesel engines. Ignition systems in Petrol engines. Construction and working of a simple reciprocating compressors. **12**

5. **Material Handling:** Brief treatment of bulldozer, shovel, road roller, concrete mixer, crane, travelling gantry crane, screw Jack, hydraulic Jack. **12**

PRACTICAL

Time: 2 Hours ***Marks: 40***

1. To study various devices for transmission of power, models of belts, pulleys, gears and chains.
2. To study baby vertical boiler with the help of model.
3. To study Lancashire boiler with the help of model.
4. To study Bibcock and Wilcox boiler with the help of model.
5. To study simple steam turbine with the help of model.
6. To study 4 stroke petrol and diesel engines with the help of model.
7. To study 2 stroke petrol engine with the help of model.
8. To study ignition system of petrol engine.
9. To study cooling system of IC engine.
10. To study simple reciprocating air compressor.
11. To study Hydraulic Jack and screw-Jack.

Guidelines for Examiners

(Common for Practical Paper II & III)

Examiner will evaluate the candidate as per the following guidelines:

1. Systematic approach to the problem.
2. Dismantling, assembling and replacing of components etc.
3. Safety precautions.
4. Initiative taken by individual candidate.
5. Proper use of tools.
6. Special consideration be given for skill, workmanship and finish.
7. Records of on-job-training.

Note: Each student may be allotted two experiments from the list and he/she may perform any one out of the two.

General Instructions to the Students/Candidates

(Common for Practical Paper II & III)

1. It is essential for each student to complete every Practical himself and not merely watch others doing it.

2. The student should make simple line diagram of the assembly components/circuit and note the provisions for important points adjustments therein.
3. After completing the practical exercise, he must write in his Practical note book using the following heading:
   - Title to include objective of Practical exercise.
   - Tools-Equipments and Materials used (if possible, with specifications).
   - Procedure of performing the Practical including any special precautions to be taken during Dismantling or Reassembling.
   - Examination of Parts, noting methods of adjustments and recording reason for service ability of amount of wear.
   - Conclusion: A report on the general condition of the assembly components including a list of new parts fitted/replaced or recommendation to make the component fit for further service.
   - Safety precautions to be taken while performing the Practicals.
4. In case of any difficulty while performing the Practicals, the Examinee must approach his teacher without hesitation.

CLASS–XII
GENERAL FOUNDATION COURSE (501)
(Common for Engineering & Technology Based Courses)

(Refer to page 13)

LIST OF RECOMMENDED BOOKS

S. No.	Title of Book	Authors Name	Publishers/Address
1.	Automobile transmission servicing and overhaul	Staton Abbey	London Pitman Publisher
2.	Practical Automobile Engg.	Staton Abbey	Bombay Asia Publishing House
3.	Automotive Mechanics.	W.H. Crouse	Tata McGraw Hill Publishing Cotte
4.	Automotive tune up	Crouse & Anglin	Tata McGraw Hill Publishing Cotte
5.	Automotive Engg.	G.B.S. Narang	Khanna Publishers
6.	Automotive Engine Repair	Ivan D. Hinerman	Glancee Publishing Co.
7.	Automotive Chasis & Body	P.L. Kohli	–
8.	I.C. Engine	Keswani	–
9.	Automotive Fuel Lubricating & Cooling System	W.H. Crouse	Tata McGraw Hill
10.	Motor Vehicle Tech. and Practical Work (Vol. I and II)	J.D. Dolan	Heinemann Educational Book Ltd., London
11.	Industrial Management	O.P. Khurana	–

12.	Industrial Management	K.K. Ahuja	–
13.	Automotive Engineering	R.K. Rajput	–
14.	Automobile Engineering	Domkundwar	–

LIST OF EQUIPMENTS FOR AUTOMOBILE TECHNOLOGY

A Lab. / Workshop must be set up with following tools, machines and equipments

Measuring & Marking Tools

1. Vernier Calliper (metric system).
2. Micrometer:
   - External – Ranges: 0 – 25 mm, 25 – 50 mm, 50 – 75 mm.
   - Internal
3. Dial gauge (metric system) with magnetic stand, telescopic gauge, bore gauge.
4. Feeler Gauge.
5. Straight Edge.
6. Dividers: Inside & Outside.
7. Torque Wrench.
8. Voltmeter, Multimeter.
9. Hydrometer.
10. Timing Light (stroboscope).
11. Depth gauge, bevel gauge.
12. Various fasteners used in automobile.
13. Electrical fuel gauge.

General Purpose Tools

1. Fix Spanner (Double ended)

   Sizes: 6 X 7mm, 8 X 9mm, 10 X 11mm, 12 X 13mm, 14 X 15mm, 16 X 17mm, 18 X 19mm, 20 X 22mm.
2. Ring Spanner (Double Ended)

   Sizes: 6 X 7mm, 8 X 9mm, 10 X 11mm, 12 X 13mm, 14 X 15 mm, 16 X 17 mm, 18 X 19 mm, 20 X 22 mm.
3. Socket Spanner set with following items:
   - 20 Sockets (sizes 6mm onward).
   - T – handle.
   - 4 inch extension rod.
   - 8 inch extension rod.
   - Ratchet handle.
   - Rotating union (Angular Joint).
4. Pliers:
   - Side Cutting Pliers.

- Round nose Pliers.
- Flat nose Pliers.

5. Hammer – Ball Pane, Cross Pane, Hide Face.
6. Screw Drivers: Straight Tip – 8 inch & 12 inch.
   Philips – 8 inch & 12 inch.
7. Hacksaw Frame with blades.
8. Chisel – 6 inch (Flat).
9. Allen key – 4mm. to 14mm.
10. Oil Cane.
11. Files: Bustard, Rough, Smooth and Rasp cut.
12. Emery Papers / Cloth.

Equipments (For Demonstration)

- Old Chassis frame (Jeep or any heavy vehicle & Car Chassis).
- Old engine / Cut model of any engine.
- Live axle assy. With differential & Final drive / Cut model of same.
- Dead axle assy. with Stub axle.
- Components of Suspension System (at least each one).
- Cut model of shock absorber.
- Components of steering System (at least each one).
- Components of Brake System (at least each one).
  - Mechanical brake assembly.
  - Hydraulic brake assembly.
  - Air brake assembly.
- Components of Automobile Electrical System (at least each one).
- Different coloured automobile cables.
- Cooling System Components: Radiator, Water pump, Cooling Fan, V – belt, Thermostat valve and Hoses.
- Lubrication System Components: Strainer, Oil pump, PRV, etc.
- Compressor (in working condition).
- Gearbox (old) and clutch assembly.

SUGGESTIVE LIST OF MODELS/CHARTS

S. No.	Name of Instrument	Qty. Reqd.
1.	A.C. Fuel pump.	1
2.	Carburettor- solex, cartor.	1
3.	Epicylic gear box.	1
4.	Engine 4 stroke - 2 strokes (Both petrol and diesel).	2 each

5.	Electrical fuel pump.	1
6.	Electric Horn.	1
7.	FIP Model.	1
8.	G/box sliding, constant and synchrometer.	1
9.	Hydraulic Braking system.	1
10.	Oil Pump.	1
11.	Radiator.	1
12.	Steering Assembly.	1
13.	Torque convertor (optional).	1

Other Points to be Implemented

- As far as possible the teacher must demonstrate the parts or equipments simultaneously with the lecture.
- Safety precautions must be properly observed by the students while doing practical work in the workshop (safety first rules also must be taught by the teacher).

CIVIL ENGINEERING

Introduction

In our country more than sixty percent of plan budget goes to construction activities/industry, directly or indirectly. According to the latest information available in various five year plans much of the country's development work, especially in rural and suburban areas, is still pending, awaiting urgent attention. As per the plan document, millions of shelters are required to be constructed, many villages remain in the category of 'No Source' and most of them 'partially covered' villages having safe drinking water supply level less than 40 liters per capital per day. It has also been experienced that we construct good building but in the course of time, they require continuous repair and maintenance. A realization is thus growing and picking up moments, particularly in urban sector for keeping the building and other structures in perfect condition. These and many more potential exist where Civil Engineering vocational students can get wage/self employment.

There is considerable scope of employment of Civil Engineering vocational students in service sector like repair and maintenance of buildings and building services. Marketing of new building material is another potential area of employment. Civil Engineering vocational students should get the exposure of required knowledge and associated skills in the above areas and entrepreneurial support system should provide soft loans and guidance to such students.

There is a need to establish networking with selected number of field organizations for effective implementation of this vocational course in Civil Engineering.

In the times to come, wage employment, particularly in the government sector is likely to dwindle. Civil Engineering vocational students will have to provide guidance and career counselling to the entrants, schools will have to provide guidance and career counselling to the entrants, for promoting undertaking self-employment ventures like sub contractor ship, undertaking repair and maintenance services and installation of sanitary and water supply systems etc. In addition, students need to be counselled for opting their career in technical education, such as Polytechnic and engineering colleges etc.

Thus major employment of vocational students in Civil Engineering is envisaged in the following construction organizations/departments.

1. Construction Industry in Private Sector.
2. Self employed as Civil Engineering Contractor.
3. State and Central Public Works Departments and other Government undertakings (need based employment).

COMPETENCY PROFILE OF VOCATIONAL STUDENTS IN CIVIL ENGINEERING

Based on employment opportunities and activity profile of vocational students in civil engineering, following competency profile is arrived at:

1. Skill in preparing, reading and interpreting drawing pertaining to civil engineering and allied works.
2. Knowledge of various types of construction materials and their characteristics.
3. Knowledge of various construction techniques and ability to supervise various civil works such as buildings, industrial structures etc.
4. Understanding of concepts, principles and practices in making concrete and concreting operations for different types of civil works.
5. Knowledge of the principles and methods of surveying and skills in conducting surveys.
6. Knowledge of behaviour of various types of soils and their use for civil works.

7. Knowledge in the analysis and design of simple structural elements.
8. Competencies in estimating and costing.
9. Skill in managing construction materials.
10. Ability to develop scientific temper and facilitate understanding of technical subjects.
11. Knowledge of interpersonal relations and skills in communication.
12. Knowledge of appropriate attitude and values.
13. Skill in using computers in the field of civil engineering.

CLASS–XI
ELECTIVE
ELEMENTS OF CIVIL ENGINEERING (797)
THEORY

Time: 2.5 Hours ***Marks: 50***

Unit–1: Construction Tools — 10

- Introduction and necessity of tools in construction, Types of tool.
- Hand Tools.
- Power Tools.
- Site Machinery.

Unit–2: Construction Materials — 15

- Basic Structure Material.

  Bricks/Blocks/Stone/Rubble, Sand, Cement, Lime, Aggregate, Steel Bars and Binding wires, Timber, Water.
- Basic supporting Material.

  Admixtures (In Cement, Concrete etc.), Protective Coatings, Bitumen (Type &its uses), Sealing Compounds, Grouting Compounds.
- Basic Finish Material.

  Type of Tiles (Floor, Roof, Cladding & special purpose), Plaster of Paris, Paints (External & Internal), Aluminium Glazing, Doors & Windows, Glass, Sanitary Fittings, Indoor & external paints.

Unit–3: Construction Plants and Equipment — 10

- Static Plant & Equipment.
- Tower Cranes.
- Batching Plants.
- Concert pumps.
- Mobile Plant & Equipment.
- Road Rollers.
- Pavers.

Unit–4: Material Testing — 10

- Lab Testing.
- Test of Cement, Brick, Tiles, Water, Aggregate, Bitumen.

Unit–5: Safety and Precautions in Construction **5**

- Personal Safety.
- Equipment Safety.
- Dos & Don'ts at Site.

PRACTICAL

Time: 2.5 Hours ***Marks: 50***

1. Identification & Uses of Hand Tools.
2. Identification & Uses of Power Tools.
3. Identification of Various Types of Steel.
4. Identification of Various Types of Timber.
5. Identification of Various Types of Glass.
6. Identification of Various Type of Aluminium Section.
7. Cutting of Plywood & Timber pieces.
8. Making Timber Surface Plane.
9. Making of Plywood & Timber Joints.
10. Silt Test for sand.
11. Test of Cement.
12. Test of Water.
13. Test of Brick.
14. Test of Tiles.
15. Test of Aggregate.
16. Test of Bitumen.
17. Thickness Measurement of Materials Using Gauges.

PRACTICAL GUIDELINES

Parameters	Marks
Project / Practical Activities.	10
Viva Based on Project.	10
Practical File / Report or Portfolio.	10
Demonstration of skill Competency in Lab Activities.	20
Total	**50**

CLASS–XI
ELECTIVE
CAD IN ENGINEERING (798)

THEORY

Time: 2.5 Hours *Marks: 50*

Unit–1: Introduction to Computers **10**

- Computer and its types.
- Block diagram of a computer & over view of its working,
- Overview of software and hardware in computer, Input/output devices - interconnections of various peripherals with Computer, Auxiliary storage device.
- Application Vs System software.
- Operating System, Brief introduction to DOS, Bios and MS Windows, Linux, Booting the system.
- Free and Open Source Software.
- Basics of printing, scanning, faxing devices used in industries.
- Web technologies/Introduction and Application to Internet, Search engines, E-mailing.

Unit–2: Familiarization with Microsoft Office tools **5**

- MS Office Word.
- MS Office Excel.
- MS Office PowerPoint.
- MS Office Access.

Unit–3: Introductions to Engineering Drawing **10**

- Drawing instruments & their uses.
- Layout of drawing sheet, Lines, Lettering, Dimensioning.
- Types of scales, plain scale, diagonal scale.
- Dimensioning of Drawing.
- Conventional Representation and symbols.

Unit–4: Projections and Isometric Views **15**

- Principles of projections, methods of projections, orthographic projections, planes of projections, first angle projection, third angle projection, difference between first and third angle projection.
- Simple examples of Projections of point, lines and planes.
- Fundamentals of isometric projections, Isometric views from 2 or 3 given orthographic views.
- Isometric Drawings of Plane Geometrical Figures.

Unit–5: Introduction to CAD **10**

- Fundamental of CAD, Advantages of CAD.
- Geometric Shapes.
- Introduction to AUTOCAD, Basic commands used, Exercises on basic figures.
- Isometric drawing, basic dimensioning, Simple Exercises using basic AutoCAD commands.
- Introduction to Software used in civil engineering and their applications (Names of software and applications only).

PRACTICAL

Time: 2.5 Hours *Marks: 50*

1.	Scanning a picture and to prepare a jpg file	**3**
2.	Collection of some relevant information on current topic with the help of search engines.	**4**
3.	Practice of composing and sending an e-mail.	**2**
4.	Preparation of documents through MS Word	**4**
5.	Practice of inserting commands in MS-Word.	**2**
6.	Preparation of a spread sheet through MS excels.	**4**
7.	Preparation of bar chart/graph/pie-chart through MS excel.	**4**
8.	Preparation of power point presentation on any current topic consisting of minimum 5 slides.	**3**
9.	Preparation of database of class marks of various subjects by MS Access.	**4**
10.	Preparation of drawing sheet for Lettering/Scales.	**3**
11.	Preparation of drawing sheet for various types of lines used in engineering drawings.	**3**
12.	Preparation of drawing sheet for orthographic projections in 1st angle.	**2**
13.	Preparation of drawing sheet for orthographic projections in 3rd angle.	**2**
14.	Preparation of drawing sheet for isometric projections of simple objects.	**2**
15.	Drawing and dimensioning of various Geometrical features using AutoCAD.	**4**
16.	Simple Views.	**2**
17.	Isometric Views.	**2**

CLASS–XI
OPTIONAL
ENGINEERING MECHANICS (799)
THEORY

Time: 2.5 Hours ***Marks: 50***

Unit–1: Introduction **8**

- Concept of mechanics and applied mechanics - Explanation of mechanics and applied Mechanics, its importance and necessity, Rigid body.

Unit–2: Laws of Forces **8**

- Force and its effects, Units and measurements of force. Types of forces, action and reaction, Force systems: Coplanar and space force systems, Coplanar, concurrent and non-concurrent forces. Free body diagrams. Resultant and components of forces; parallelogram law of forces, triangle law of forces, polygon law of forces, Lami's theorem.

Unit–3: Moments **5**

- Concept of moment, Varignon's theorem - statement only, Principle of moments-Parallel forces, like and unlike parallel forces, concept of couple, properties of couple.

Unit–4: Friction **8**

- Concept of friction, laws of friction, limiting friction and coefficient of frictions, sliding friction and rolling frictions.

Unit–5: Centre of Gravity **5**

- Centriod and centre of gravity. Centroid for regular lamina, centriod of composite figures.

Unit–6: Moment of Inertia of Plane Areas **8**

- Concept of Moment of Inertia and second moment of area and Radius of gyration, theorems of parallel axes, second moment of area of common geometrical sections: rectangle, triangle, circle (without derivations). Second moment of area for I., T. and I sections.

Unit–7: Laws of Motion 8

- Concept of momentum, Newton's laws of motion, their application, derivation of force equation from second law of motion, numerical problems on second law of motion. Newton's third law of motion.

PRACTICAL

Time: 2.5 Hours ***Marks: 50***

1.	Verification of the laws of polygon of forces.	**5**
2.	To verify the forces in the different members of a jib crane.	**5**
3.	To verify the reaction at the supports of a simply supported beam.	**5**
4.	To verify the principal of moment using bell crank lever.	**5**
5.	To find out the coefficient of friction between two surfaces (wood and glass) in contact by using horizontal plane.	**5**
6.	To find the mechanical advantage, velocity ratio and efficiency in the case of Screw Jack.	**5**
7.	To find the mechanical advantage, velocity ratio and efficiency in the case of worm and worm wheel.	**5**
8.	To find the mechanical advantage, velocity ratio and efficiency of a single purchase crab.	**5**
9.	To determine the personal horse power by using manual horse power apparatus.	**5**
10.	Determination of mechanical advantage, velocity ratio and efficiency of wheel and differential axle.	**5**

CLASS–XI
GENERAL FOUNDATION COURSE (501)
(Common for Engineering & Technology Based Courses)

(Refer to page 7)

CLASS–XII
ELECTIVE
CONSTRUCTION TECHNOLOGY (797)
THEORY

Time: 2.5 Hours ***Marks: 50***

1. Building Construction 10

- Site Selection for construction, various components of a building (sub structure and super structure with elaboration of technical terms).
- Foundations: Need and function of foundation, different types of foundations and their uses.
- Masonry: General principles of bricks masonry, types of bonds.
- Floors: Types of flooring and their uses.
- Stairs: Need and types of stairs.
- Doors and Windows, Purpose of each and their classification.

2. Concrete Technology 10

- Definition of concrete, different types of concrete and their uses, Ingredients of Concrete.
- Preparation of concrete:

  Batching, Mixing, Transportation, Placement, Compaction, Curing, Finishing.
- Properties of Concrete:

  Properties in plastic stage: workability, segregation, bleeding.
- Properties of hardened concrete: strength, durability.
- Introduction to standard concrete mixes.

3. Formwork, Scaffolding and Steel Fixing **10**

- Introduction and purpose of formwork.
- Timber joints, cutting and drilling of plywood.
- Shuttering for beam, column and slab floor.
- Codal provisions on formwork.
- Introduction and purpose of scaffolding, Component parts, Types of scaffolding.
- Types of ties and their uses.
- Making and placing reinforcement for slab & foundation.
- Codal provision on steel fixing.

4. Services & Utilities **10**

- Introduction to plumbing, plumbing tools and their uses.
- Water distribution system, material for service pipes, service connection, valves.
- Aim and principles of house drainage, Pipes and traps.
- Sanitary fittings.
- House wiring: Types of wires used, tools used for house wiring, Circuit diagram for tube light, bulb, fan and switches & sockets.
- Fire protection: Fire hazards, characteristics of fire resisting materials, general fire safety requirements for buildings, fire alarms, fire extinguishing equipment.

5. Construction Work Supervision **10**

- Roles and responsibilities of construction work supervisor.
- Record keeping: Muster roll, measurement book, register for material receipt and issue, logbook for construction equipment.
- Site Registers: site diary, site order book, inspection register, cement register, steel register, register for approval of other materials, material requisition and issue records.
- Register for scrap material, POL records, register for construction equipment.
- Check list (Dos and Don'ts) for construction work supervision.

PRACTICAL

Time: 2.5 Hours ***Marks: 50***

1. Laying of bricks in different layer using English bond. **5**
2. Laying of bricks in different layer using Flemish bond. **5**
3. To determine workability of concrete by slump test. **5**
4. Test for compressive strength of concrete cubes. **5**

5.	To make T-joint and dove tail joint in timber.	**5**
6.	Cutting of plywood in different patterns.	**5**
7.	Drilling in plywood.	**5**
8.	T- joint in service pipes.	**5**
9.	Wiring from MCB to switch board having a three pin socket, switches for fan and tube light.	**5**
10.	Making entries in the measurement book for small piece of construction work.	**5**

CLASS–XII
ELECTIVE
ESTIMATION IN CIVIL ENGINEERING (798)
THEORY

Time: 2.5 Hours ***Marks: 50***

1. Introduction to Surveying — 10

- Principal of Surveying.
- Purpose of Surveying.
- Surveying Equipment and Accessories.
- Contouring.
- Scale of Map.
- Errors in Surveying.

2. Types of Surveying — 15

(a) **Physical Surveying**

- Chain Surveying.
- Compass Surveying.
- Plane Table Surveying.
- Levelling.

(b) **Equipment Surveying**

- Dumpy Level.
- Theodolite.
- Total Station.

3. Estimation — 15

- Definition & Necessity of Estimation.
- Types of Estimates (including technical terms).
- Units of Measurements.
- Items of Works & Specifications.
- Methods of Measurements.
- Preparation of Detailed Estimate (Simple 1 & 2 room with foundation).
- Abstract of Cost & Bill of Quantity (BOQ).

4. Analysis of Rates — 10

- Introduction & Purpose.
- Method of Analysis of Rates.
- Analysis of Rates of Common Items of Works:
  - (a) Earth Work.
  - (b) Brick Masonry.
  - (c) RCC.

PRACTICAL

Time: 2.5 Hours ***Marks: 50***

1.	Identification of Surveying Equipment and Accessories.	**5**
2.	Chaining and Ranging.	**5**
3.	Compass surveying.	**5**
4.	Plane Table surveying.	**5**
5.	Demonstration of instruments for survey equipment at site. - Auto level/ Theodolite/ Total station.	**5**
6.	Preparation of Estimate of Boundary wall.	**5**
7.	Preparation of Estimate of 1 Room.	**5**
8.	Preparation of Estimate of 2 Room.	**5**
9.	Calculate area and volumes of various geometric figures.	**5**
10.	Exercise on Analysis of Rates of Common Items of Works: (a) Earth Work. (b) Brick Masonry. (c) RCC.	**5**

CLASS–XII
OPTIONAL
ELEMENTARY STRUCTURAL MECHANICS (799)
THEORY

Time: 2.5 Hours ***Marks: 50***

Rationale

This is basic engineering subject. The purpose of the subject is to impart basic knowledge and skill regarding properties of materials, concept of stresses and strains, bending moment and shear force diagrams, second moment of area, bending and shear stresses, slope and deflection and analysis of trusses. The above knowledge will be useful analysis and design of structural components. This subject is very important to develop basic concept and principles related to structural engineering. This subject will also enable the students to continue their further education. **This subject is complimentary to Engineering Mechanics (optional-1 of class 11th). Students are advised to opt for this optional subject in class 12th after studying Engineering Mechanics as optional in class 11th.**

Note: Weightage of each topic for external examination is given in the brackets.

DETAILED CONTENTS

1. Properties of Materials **5**

- Classification of materials, elastic materials, plastic materials, ductile materials, brittle materials.

- Tensile test, compressive test, impact test, fatigue test, torsion test.

2. Simple Stresses and Strains — 10

- Concept of stress, normal and shear stresses, stresses due to torsion.
- Concept of strain, strain and deformation, longitudinal and transverse strain, poison's ratio, volumetric strain.
- Hook's Law, modulus of elasticity and rigidity, Bulk modulus of elasticity, relationship between the elastic constants.
- Stresses and strains in bars subjected to tension and compression. Extension of uniform bar under its own weight, stress produced in compound bars (two or three) due to axial load.
- Stress-Strain diagram for mild steel, mechanical properties, factor of safety.
- Temperature stresses and strains.

3. Bending Moment and Shear Force — 5

- Concept of a beam and supports (Hinges, Roller and Fixed), types of beam: simply supported, cantilever, fixed and continuous beam.
- Types of loads (point, uniformly distributed and varying loads).
- Concept of bending moment and shear force, sign conventions.
- Bending Moment and shear force diagrams for cantilever, simply supported subjected to concentrate, uniformly distributed load (simple numerical may be given).

4. Bending and Shear Stresses — 5

- Theory of simple bending with assumptions.
- Application of the equation M/I = F/Y = E/R (No derivation).
- Moment of resistance, sectional modulus and permissible bending stresses in (c5*) circular, rectangular, I, T, and L sections; Concept of shear stresses in beam, shear stress distribution in rectangular, I, and T section (Formula to be stated, no derivation), (simple numerical may be given).

5. Columns — 10

- Theory of columns, Euler's critical load, empirical design formulae, Rankin's, formulae.

6. Combined Direct and Bending Stresses — 5

- Concentric and eccentric loads, eccentricity.
- Effect of eccentric load on the section, stresses due to eccentric loads, examples in the case of short columns.

7. Analysis of Trusses — 10

- Concept of a frame, redundant and deficient frame, and supports.
- Analysis of determinate trusses by
  - (i) Method of joints.
  - (ii) Methods of sections.

PRACTICAL

Time: 2.5 Hours — ***Marks: 50***

1. Verification of forces in framed structure. **5**
2. Tensile test on bars of Mild steel/Aluminium with universal testing machine. **5**

3. Double shear test on specimen of two different metal wires. **5**
4. Bending tests on a simply supported steel bar or a wooden beam and calculatee young modules of elasticity. **5**
5. Impact test on metals Izod test/ Charpy test. **5**
6. Torsion test on specimens of different metals for determining the angle of twist for a given torque. **5**
7. To determine the stiffness of a helical spring and to plot a graph between load and extension. **5**
8. Hardness test on metal and finding the Brinel and Rockwell hardness. **5**
9. Determination of Young's modulus of elasticity for steel wire with Searl's apparatus. **5**
10. Determination of modulus of rupture of a timber beam. **5**

CLASS–XII

GENERAL FOUNDATION COURSE (501)

(Common for Engineering & Technology Based Courses)

(Refer to page 13)

LIST OF RECOMMENDED BOOKS

S. No.	Title of Book	Publisher by	Author
1.	Engg. Drawing Geometrical and Mechanical Drawing	Charotar (Gujarat)	N.D. Bhatt
2.	Engg. Materials	Vikas	Surender Singh
3.	Materials of Construction	-do-	Ghosh
4.	Engg. Drawing	-do-	Kapur
5.	Introduction to Engg. Materials	-do-	Aggarwal
6.	Material Science & Processes	Dhanpat Rai	Jha
7.	Workshop	S. Chand	G.K. Gupta

LIST OF TOOLS/EQUIPMENTS

1. Work Benches. 4 Nos.
2. Bench Vices 100 mm. 3 Nos.
3. Tools kit which include different types and sizes of files, try square, steel rules, hack-saw frame, hammer centre punches, chisels etc. 4 Sets
4. Surface plates. 2 Nos.
5. Anvil with stand, 50 kgs. 1 Nos.
6. Vernier Calliper. 2 No.
7. Micrometer 0-25 mm. 2 Nos.
8. Gauge . 2 No
9. Dial Gauge set. 2 Nos.
10. Combination set. 2 Nos.
11. Thread Gauge. 2 Nos.
12. Feeler Gauge. 2 Nos.
13. Drilling Machine 12 mm (Pedestal type) with Drill Chuck and key. 1 No.

14. Drills of different sizes. 1 Set

15. Vernier Micrometer.

16. Material required for conducting curriculum experiments.

AIR CONDITIONING AND REFRIGERATION TECHNOLOGY

Course Objectives

After successfully completing the two year of Senior Secondary Vocational Course the student would have acquired relevant appropriate and adequate technical knowledge together with the professional skills and competencies in the field of Airconditioning and Refrigeration Technology so that he/she is properly equipped to take up gainful employment in this vocation.

Thus he 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 and principles of working of refrigeration and airconditioning equipment.

(d) The knowledge of testing, faults, identification and repair procedures in respect of refrigeration and air conditioning equipment.

(e) The knowledge to prepare estimates for cost of repair/installation/maintenance/ overhauling jobs.

B. Adequate Professional Skills and Competencies in

(a) testing, fault location and repairing of refrigeration and airconditioning equipment.

(b) Installing and commissioning of refrigeration and airconditioning equipment.

(c) Carrying out preventive maintenance of refrigeration and airconditioning equipment.

(d) dismantling, overhauling and reassembling of refrigeration and airconditioning equipment.

C. A healthy and Professional Attitudes of that He/She has

(a) An analytical approach while working on a refrigeration or airconditioning equipment.

(b) An open mind while locating/rectifying faults in a refrigeration or airconditioning equipment.

(c) Respect for working with his/her own hands.

(d) Respect for honesty, punctuality and truthfulness.

CLASS–XI
ELECTIVE
AIR CONDITIONING AND REFRIGERATION–I (632)
THEORY

Time: 2 Hours *Marks: 40*

1. **Introduction**

   Meaning of Air Conditioning and Refrigeration, Brief history of Air Conditioning and Refrigeration, Application of Refrigeration, Concept of System, its boundary, and surroundings, Principles and processes involved in production of low temperatures expansion of a liquid with flashing, reversible adiabatic expansion of a gas, irreversible adiabatic expansion (throttling) of a real gas, thermo electric cooling, adiabatic demagnetization, Unit of Refrigeration, Energy Balance of a Refrigeration machine–heat energy absorbed from the system, heat rejected to surroundings, and work done, Carnot cycle, and Reverse Carnot Cycle, Coefficient of Performance, Comparison of heat engine, heat pump and refrigeration machine. Comparison of heat pump and electric resistance heater. Rating of Refrigeration Machines. **13**

2. Refrigeration System, Air Refrigeration cycle, applications, and its limitations, Vapour Compression Cycle, Representation of Vapour Compression Cycle on temperature– entropy and pressure– enthalpy diagram, Effect of sub-cooling, Super heating, change in suction pressure and discharge pressure on coefficient of performance, Deviation of actual cycle from the theoretical cycle, Simple mathematical circulation with pressure, enthalpy charts, Energy Balance of basic refrigeration system. **12**

3. Working of a Mechanical Refrigerator, Water Cooler etc., Refrigeration tools and materials, tubing, cutting, bending, flaring, joining, tube, fittings, instruments and gauges, drills, taps, dies, valves, gaskets, refrigerants, cylinders, Human safety.

4. Compressors Pressure–volume diagram of a compressor, Types of compressor–reciprocating (semi-hermetic, hermetic and open types), rotary, centrifugal and crewed type. Working of compressor, Difference between ammonia and freon compressors, Volumetric efficiency. **5**

5. Compressor construction, Valves, pistons, connecting rods, crankshafts, seals, oil circulation, hermetic and semi-hermetic units, Cooling of windings, Mufflers. **5**

PRACTICAL

Time: 3 Hours *Marks: 60*

1. Study of Tools and materials, Instruments and Gauges. **5**
2. To learn proper techniques of cutting, fitting, reaming, bending, flaring of soft and hard copper tubing, swedging, etc. **5**
3. To learn brazing of copper tubing. **5**
4. To understand the construction and functions of reciprocating compressors, condensers, and evaporators. **5**
5. To study a hermetic unit and its testing. **5**
6. To study pressure gauges and testing themina deadweight tester. **5**
7. Saturation pressure and saturation temperature, Measurement of Water and Refrigerants. **5**
8. Measurement of Temperature during throttling expansion of a Gas. **5**
9. Energy Balance of a Refrigeration machine. **5**
10. To study Domestic Refrigerator, Water Cooler, etc. **5**
11. Study of various types of compressors, dismantling and assembling compressor. **5**
12. Testing of reciprocating compressors. **5**

CLASS–XI
ELECTIVE
AIR CONDITIONING AND REFRIGERATION–II (633)
THEORY

Time: 2 Hours ***Marks: 40***

1. Meaning of Alternating Current and Voltages, Wave Shape, Maximum, Average and R.M.S. Values, Phase Difference. **4**
2. Series and parallel circuits, Application of Kirchhoff's Law, Star and Delta connections. **6**

   Measurements of current, voltage and power, Representation of circuit elements by proper symbols, Circuit diagrams.
3. Synchronous Machines. **4**
4. Induction Motors, Principles of working, construction details, and performance of SlipRing Squirrel Cage, Single Phase and Poly phase Induction Motors, Use of Megger for testing. Rewinding of single phase and poly phase motors, Detecting faults, Testing of Motors. **6**
5. Psychometry– Composition of air, moist air, vapours and gases, specific humidity, absolute humidity, degree of saturation, relative humidity, Dry Bulb Temperature, Wet Bulb Temperature, Dew Point Temperature, Wet Bulb Depression, Dew Point Depression, Dalton's Law of Partial Pressures, Enthalpy of moist air, Adiabatic Saturation Temperature, Introduction to Psychrometric Chart and Psychrometers. **8**
6. Human comfort, Concept of effective temperature, Comfort Zone. **4**
7. Applications of Air Conditioning, Comfort, Industrial and Process Air Conditioning, Study of Window – type Air Conditioners, package units, Central Air Conditioning Plants. **4**
8. Measurement of air velocity and flow. **4**

PRACTICAL

Time: 3 Hours ***Marks: 60***

1. Measurement of humidity. **2**
2. Measurement of air-velocity and flow. **3**
3. Study of room air conditioner. **4**
4. Study of Package Units. **5**
5. Performance Testing of Air Conditioner and measurement of capacity. **4**
6. Charging and testing of air-conditioner. **2**
7. Measurement of Volage, Current, Power etc. **4**
8. Series and parallel circuit arrangement and testing. **5**
9. Making Star - Delta Connections. **6**
10. Study of synchronous Machines and Components. **5**
11. Study of single phase and three phase induction motors. **4**
12. Detecting faults in Motors such as short-circuiting between phases, grounding open circuit etc. **6**
13. Testing of motors. **5**
14. Making electric circuit diagrams. **5**

CLASS–XI
OPTIONAL
ENGINEERING SCIENCE (622)
(Common for Automobile Technology and Airconditioning & Refrigeration Technology)

(Refer to page 22)

CLASS–XI
GENERAL FOUNDATION COURSE (501)
(Common for Engineering & Technology Based Courses)

(Refer to page 7)

CLASS–XII
ELECTIVE
AIR CONDITIONING AND REFRIGERATION–III (632)
THEORY

Time: 2 Hours ***Marks: 40***

1. Psychometric Processes- Sensible Cooling and Sensible Heating, Cooling with dehumidification, cooling with adiabatic humidification, chemical dehumidification, heating and humidification, Mixing of air streams, Absorption, Dehumidifiers, Steam injection, Coil and Spray Equipment, Evaporative cooling, Air Washers, By pass Factor. **5**
2. Principles of Load Estimating, Internal and External System Heat Gains, ventilation, air cleaning, Room sensible heat factor, effective room sensible heat factor. **5**
3. Refrigerant controls, Types of expansion devices and sensible heat factor, construction and operation of automatic and thermostatic valves, capillary tubes, low and high pressure side float valves, testing and adjusting thermostatic expansion valves, solenoid valves. **6**
4. Principles of heat transfer, Conduction, convection and radiation, Overall heat transfer coefficient, Use of fans, Effect of air velocity on heat transfer coefficient, Properties of insulating materials. **4**
5. Evaporators, Types of evaporators-dry and flooded, Heat absorbed in evaporators, Water chillers, brine coolers, Methods of defrosting. **4**
6. Condensers, Air and water cooled, and evaporative types, Heat rejected in condensers. Purging, Construction of condensers, Driers, Receivers. **4**
7. Refrigerants, their properties and nomenclature R11, R12, R22, R502, R113, R114, ammonia, and carbon dioxide, pressure with various refrigerants in different systems, oil miscibility, solubility in water, Secondary refrigerants, Brines and Glycols. **4**
8. Absorption refrigeration system. **3**
9. Applications, Ice manufacture, Cold storage, Ice Cream manufacture, Dairy refrigeration etc. **2**
10. Leak detection, Pressure Testing and Charging. **3**

PRACTICAL

Time: 3 Hours ***Marks: 60***

1. Measurement of Air Flow with a Pitot Tube.
2. Study of flow control devices.
3. Testing of Thermostats.
4. Experiment with Mixing of Air.
5. Experiment with Simple Heating.
6. Experiment with Steam Injection.
7. Experiment on an Evaporative Cooler.
8. Energy Balance of an Air Conditioner.
9. Fault Detection.
10. Experiment on a Cooling Tower.
11. Study of expansion-valves, testing and adjusting.
12. Performance testing of Refrigerating system.
13. Volumetric Efficiency of a Reciprocating compressor and Testing a compressor.
14. Pressure Testing and leak detection Methods.
15. Charging procedure and charging correctly a refrigerator.

LIST OF EXPERIMENTS

1. To dismantle a Reciprocating compressor open and sealed type.
2. To assemble a Reciprocating compressor open and sealed type.
3. To cut gaskets.
4. To Flare, Swedge, bend, punch and braze copper tubes.
5. To charge and test oil in the compressor.
6. To repair and service condenser and evaporator.
7. To study different types of flow control devices and to test are frigerant control valve.
8. To test the leakage of the system.
9. To evacuate the system.
10. To prepare series and parallel circuits and testing board.
11. To change the refrigerant in the system.
12. To identify fault/faults in refrigeration system.
13. To solder, rivet and steam a thin sheet.

Note: Each student should perform all the experiments during the session.

MARKING SCHEME

Marks: 60

Note:

1. Marks for sessional work will be awarded by the teacher concerned.
2. Students may be asked to perform any one experiments.

DISTRIBUTION OF MARKS

1.	**Experiments**	**40**
(a)	Identification of components.	**8**
(b)	Identification of different parts of compressor.	**8**
(c)	Functioning of different components.	**8**
(d)	Working of components.	**8**
(e)	Methods of working and safety precautions observed.	**8**
2.	**Viva Voce**	**10**
(a)	Questions related to the experiment assigned.	**3**
(b)	Questions related to the remaining experiments.	**4**
(c)	Questions based on related concepts.	**3**
3.	**Sessional Work**	**10**
(a)	All listed experiments to be performed.	**5**
(b)	Maintenance of proper record.	**5**

GUIDELINES FOR EXAMINERS

(Common for Elective II & III)

Note: Examiner will evaluate the Candidates on the following guidelines:

1. Systematic approach to the problem.
2. Safety precautions and sequence of work.
3. Initiative taken and concentration by the individual.
4. Proper use of tools.
5. Workmanship, finish and working ability must be given a special consideration.
6. Special attention to the tools and equipments taken by the individual.

GENERAL INSTRUCTIONS TO THE CANDIDATES

(Common for both Elective II & III)

1. Proper dress must be used by the student during practical and must be aware of the safety precautions to be observed.
2. Student must complete the practical himself and not merely watch others doing it.
3. Student should draw simple line diagram of the assembly components, circuits and note the important points.
4. Student must know the tools and equipments used for the particular exercise with the specification of each tool.
5. After completing the practical exercises student must write in his/her practical note book about the practical under the following headings:
   (a) Title of Exercise.
   (b) Tools, equipment and material used with complete specifications.
   (c) Time taken for the particular exercise.
   (d) Procedure.

(e) Safety precautions observed.

6. In case of any difficulty student must approach the teacher without any hesitation.
7. During practical work one should not disturb others.
8. Students must know how to repair the tools used in the exercise.
9. After using the tools should be cleaned and placed in proper way.

CLASS–XII
ELECTIVE
AIR CONDITIONING AND REFRIGERATION–IV (633)
THEORY

Time: 2 Hours ***Marks: 40***

1. Air Conditioning Systems and Equipments, Classification of air conditioning systems–all air and all water types, Fans, blowers, grills, resistors, filters, compressors, cooling coils, condensers, air handling units, fan coil units, Heating and humidifying equipments, Unit air conditioners, package units central air conditioning plants. **10**
2. Air Distribution, System of air distribution, Duct systems, Cooling Load, Air quantities, Pressure inducts–static pressure, velocity pressure and total pressure, Friction losses, Duct sizing, Duct lay-out and drawing, Duct construction. **10**
3. Controls, Sensing elements–bimetallic, bulb and bellow, solenoids, electric resistance type etc. Actuating elements–thermostats, humidistat's, pressure stats etc. **4**
4. Modulating Motors, Construction and operation, By pass controls, Use of chokes, for controlling fan motor speed.**4**
5. Starters, Capacitors, relays, overload controls, for motors and their servicing. **4**
6. Refrigeration Controls, H.P. and L.P. cut outs, oil failure safety switches, power element testing. **4**
7. Maintenance–Preventive and break down maintenance, Diagnosis and rectification of faults in electrical system, refrigeration system and air conditioning system, Pressure testing, Charging Performance Testing. **4**

PRACTICAL

Time: 3 Hours ***Marks: 60***

1. Study of Sensing Elements.
2. Study of Low and High Pressure Cut Outs.
3. Study of Thermostat, Humidistat, Pressure Stat, etc.
4. Study of capacitors, Relays, Over loads, chokes, etc.
5. Study of Modulating Motors.
6. Study of pressure Drop in Ducts.
7. Testing of Power Elements.
8. Testing of Thermostats.
9. Repairing a Hermetically sealed Unit.
10. Complete servicing of a Refrigerator.
11. Complete servicing of an Air Conditioner.
12. Fault detection.
13. Adjusting the automatic system.

14. Wiring diagrams of an Air Conditioner and central plants.
15. Wiring diagrams of Multi cylinder Compressor for capacity control.
16. Industrial visits.

PRACTICAL GUIDELINES

Parameters	Marks
Project / Practical Activities	15
Viva Based on Project	10
Practical File / Report or Portfolio	10
Demonstration of Skill Competency in Lab Activities	25
Total	**60**

CLASS–XII
OPTIONAL
ENGINEERING SCIENCE (622)
(Common for Automobile Technology and Airconditioning & Refrigeration Technology)

(Refer to page 28)

CLASS–XII
GENERAL FOUNDATION COURSE (501)
(Common for Engineering & Technology Based Courses)

(Refer to page 13)

MARKING SCHEME

Marks: 60

Note:

1. Marks for sessional work will be awarded by the teacher concerned.
2. Students may be asked to perform any one experiment.

DISTRIBUTION OF MARKS

1.	**Experiment**	**40**
(a)	Different components used in Refrigeration and Air Conditioning.	**8**
(b)	Properties of air related to Air Conditioning.	**8**
(c)	Refrigerant control.	**8**
(d)	Electrical wiring of window type Air Conditioner and Refrigerator.	**8**
(e)	Properties of Air related to A.C.	**8**
2.	**Viva-Voce**	**10**
(a)	Questions related to the experiments assigned.	**3**
(b)	Questions related to the remaining experiments.	**4**
(c)	Questions based on related concepts.	**3**
3.	**Sessional Work**	
(a)	All listed experiments performed.	**5**
(b)	Maintenance of proper record.	**5**

GUIDELINES FOR EXAMINERS

General Instructions to the Students/Candidates same as Elective II

Note: The Lists of Equipment & Consumables in respect of Engineering based vocational courses have been prepared for a Batch of 20 Students attending the Practical Work at a time. However, in case of Consumables if the class strength of Students exceeds 20, the quantities should be increased proportionately.

LIST OF RECOMMENDED BOOKS

1. Principles of Refrigeration, March and Olive Taraporewale.
2. Principles of Air Conditioning, V. and Lang Taraporewale.
3. Refrigeration Servicing, P.F. Galibet, Taraporewale.
4. Principles of Refrigeration, R.J. Dossat, Wiley.
5. ASHRAE Handbooks.
6. Modern Refrigeration and Air Conditioning by Althouse, Turnquist and Bracciane (Good Wort, Wiley).
7. Refrigeration and Air Conditioning by Sarae, Gabbiand Singh (Satya Prakashan).
8. Refrigeration and Air Conditioning by Narang and Jaina (Katson).
9. Refrigeration and Air Conditioning by Domkundwar and S.C. Arora.
10. Refrigeration and Air Conditioning by R.S. Khurana.
11. Refrigeration and Air Conditioning by P.L. Ballancy.

SUGGESTED LIST OF TOOLS, MEASURING INSTRUMENTS AND VEHICLES

S. No.	Name of Item	Quantity
1.	Kammer Ball-pane1/4Kg.	12

S. No.	Name of Item	Quantity
2.	Plier combination (Insulated) 15cm.	6
3.	Plier side cutting 15 cm.	6
4.	Plier heavy duty insulated 20 cm.	5
5.	Plier Flat nose 15 cm.	5
6.	Screw Driver 10 cm.	6
7.	Screw Driver 20 cm.	12
8.	Pin punch 10 cm.	6
9.	Centre Punch 10 cm.	6
10.	Rule 30 cm (Steel).	5
11.	Scriber 15 cm.	5
12.	Knife double edge.	5
13.	Oilstone 20×5×2.5 cm Carborundum.	2
14.	Try Square Engineering 20 cm.	6
15.	Tap and Dies whit worth 3 to 12. Ty1-5 mm with die handle and tap.	1 Set
16.	Tap and dies BAO to 6 with the holder and Tap Wrench.	2 Set
17.	Standard pipe die 9.5 to 38 mm with handle.	2 Set
18.	Drill H.S.S. Parallel shank 1.5 to 12 mm by 1.5 mm.	1 Pair
19.	Hand Drill 6 mm capacity.	4 No.
20.	Bench grinder 1/2 HP, 250 volt.	1 No.
21.	Fire Extinguisher.	3 Nos.
25.	Sealing copper washer for stand.	10 each
	(a) Filling (Assorted).	10 each
	(i) 10×1m	10 each
	(ii) M-12, M-14, M-16, M-18, M-22, M-26	6 Nos.
26.	Drill Machine Electric 12 mm cap with stand (portable).	6 Nos.
27.	Tube cutter 3 to 25 mm cap.	3 Nos.
28.	Measuring Tap 200 cm (watch makers).	2 Nos.
29.	Instruments (watch makers) screw driver1–5 mm lap1set of 6.	3 Set
30.	Blow lamp 1 litre capacity.	3 Nos.
31.	Hammer, steel head with heads in set 28.5 mm.	3 Nos.
32.	Spanner socket size 4.7 mm to 15 mm.	1 Set

S. No.	Name of Item	Quantity
	10 to 31 mm with reversible rachet short and long couplet.	
33.	Spanner ring D.E. off-set Multi point AE6 mm to 28 mm.	3 Set
34.	Electric Heaters.	1 No.
35.	Spanner open Jaw DE and across Flat 6 to 28 mm.	3 Set
36.	Spanner and Ring DE offset Multi Point with 4 to 15 Try 1.5 mm.	2 Set
37.	Spanner open Jaw DE across.	3 Set
38.	Wrench steel grip 2.5 cm cap.	3 Nos.
39.	Inside reamer.	1 No.
40.	Outside reamer.	1 No.
41.	Electronic leak detector Neon bulb.	1 No.
42.	Grip footprint 15 cm.	3 Nos.
43.	Spanner BA open Jaw DEO to 10.	3 Set
44.	Spanner sockets BA size 0–10.	3 Set
45.	Portable torch for soldering brazing for LPG/0-4.	1 Set
46.	Allen Key 1.5 to 12×0.4 mm.	3 Set
47.	Hacksaw frame adjustable.	4 Nos.
48.	Hand lamp wandering lead 10m.	3 Nos.
49.	Single thickness flaring tool with yoke size 4.5 mm to 15 mm.	1 Set
50.	Viceh and 5cm Jaw.	2 Nos.
51.	Viceh and 10cm Jaw.	2 Nos.
52.	High Vacuum pump 2 or 3 HP.	1 No.
53.	Charging board complete with calibrated glass and manifolds.	1 No.
54.	Flexible charging lines.	4 Nos.
55.	Bearings craper 15cm.	3 Nos.
56.	Hollow Punch.	3 Nos.
57.	Prick Punch.	3 Nos.
58.	Thermometers (–10^{o}C to – 700^{o}C).	12 Nos.
59.	Pocket Thermometer.	12 Nos.
60.	Adaptor Ammeter Volt-meter Instrument.	1 No.
61.	Remote bulb thermometer 10 cm dia (10^{o}C to 70^{o}C).	2 Nos.
62.	Compound gauge 6 cm dial with graduation.	6 Nos.
63.	Pressure gauge 6 cm dial 0–15 Kg/cm2.	6 Nos.

S. No.	Name of Item	Quantity
	With 2Kg/cm2 graduation.	
64.	Shut off valve socket and TEE handed Key for 6mm.	3 Nos.
65.	Shut off valve socket and Tee handed key for 4 mm.	3 Nos.
66.	Gland packing socket & Tee handed key for 6 mm.	3 Nos.
67.	Gland packing socket & Tee handed key for 4 mm.	3 Nos.
68.	Measuring glands for oil 0.45Kg.	3 Nos.
69.	Pocket Testing lamp.	3 Nos.
70.	6 mm copper tube 8 metre long for charging line and gauge.	3 Nos.
71.	Pulley puller 3 legged 20 cm.	1 No.
	30 cm	1 No.
75.	Swedging Tools 6–9 mm.	2 Sets
76.	Glass lapping Block 45×45×6 mm.	2 Nos.
77.	Spring Balance dial Type 0–50 Kg..	2 Nos.
78.	Techno meter.	1 No.
79.	Sling Psychrometer.	6 Nos.
80.	Tube bending tool for Brass & Copper Tubes upto 15 mm.	1 Set
81.	Pipe bender spring Type for bending Universal.	2 Nos.
82.	Ratchet wrench 4–6 mm.	3 Nos.
83.	Cleaning Trays 60×60×5.	6 Nos.
84.	Refrigerators household assorted type (Reciprocating), different capacities.	3 Nos.
85.	Second hand refrigerator, repairable condition.	2 Nos.
86.	Compressor fractional HP for refrigeration with 1HP motor Hermetically sealed compressor.	2 Nos.
87.	Room Air Conditioner, second hand in repairable condition.	2 Nos.
88.	Refrigerator.	1 No.
89.	Room cooler.	1 No.
90.	Thermostatic Expansion valve.	6 Nos.
91.	Automatic Expansion valve.	6 Nos.
92.	Thermostatic switch.	3 Nos.
93.	Low pressure cutout.	1 No.
94.	Solenoid valves.	1 No.
95.	High pressure cutout.	6 Nos.

S. No.	Name of Item	Quantity
96.	Check valve.	2 Nos.
97.	Wheel spanner.	2 Nos.
98.	Liquid Line indicator 9×9 mm (sight glass).	3 Nos.
99.	Two way valves.	3 Nos.
100.	Three way valves.	3 Nos.
102.	Hand shut off valves 6 mm.	12 Nos.
103.	Hand shut off valves 8 mm, 12 mm.	6 Nos. each
104	Hand shut off valves 15 mm.	3 Nos.
105.	Lockers, 24 pigeon holes.	1 No.
106.	Demonstration Table/Working Bench 2½×2×1m.	4 Nos.
107.	Almirah Steel.	4 Nos.
108.	Chairs (Steel).	4 Nos.
109.	Charts and Models of machine parts with duct arrangements.	2 Nos.
110.	Desert cooler.	1 No.
111.	Water Cooler second hand.	1 No.
112.	Deep Refrigerator second hand.	1 No.
113.	Insulation-Thermocole, Fibre-glass.	1 No.
114.	Anemometer.	1 No.
115.	Micro voltmeter.	1 No.
116.	Thermocouples (Copper constantan).	3 Nos.
117.	Cut-Modelo for pentype compressor.	1 No.
118.	Empty cylinder for F12, F22 capacity 10 Kg.	1 each
119.	Multimeter P125210/Type 260.	1 No.
120.	Soldering Iron 0.125 Kilowatt.	1 No.
121.	Trolley for gas cylinder.	1 No.
122.	Pinching Tool.	3 No.
123.	File, flat, rough (25 cm).	2 Nos.
124.	File, flat, smooth (25 cm).	2 Nos.
125.	Mallett wooden 15 to 76 cm dia.	2 Nos.
126.	Voltmeter 0–500 volts.	2 Nos.
127.	Ammeter 0–25 A.	2 Nos.
128.	Ammeter 0–10 A.	2 Nos.

S. No.	Name of Item	Quantity
129.	Drill (Electric) 12 mm with stand (Portable).	1 No.

AIR CONDITIONING AND REFRIGERATION CONSUMABLES AND RAW MATERIALS

S. No.	Name and Particulars of Item	Quantity
1.	Jack-saw Blades 30 cm × 1.25 cm.	5 doz.
2.	Solder 20% lead 80% tin.	1 Kg.
3.	Fastener.	1 Kg.
4.	Copper Tubing 6 mm Internal 9 mm Internal	 15 m. 9 m.
	12 mm Internal 15 mm Internal	3 m. 3 m.
5.	Silver Soldering Lead 42% (Easy Flow) Rod.	½ Kg.
6.	Emery Paper (Assorted).	2 doz.
7.	Emery cloth (Assorted).	2 doz.
8.	Solvent cleaning.	10 litre
9.	Lubricant cleaning.	1 litre
10.	Compressor oil (Copius).	10 litre
11.	Cotton waste.	10 Kg.
12.	Spirit.	4 litre
13.	Gasket 4 mm 1.5 × 0.6 m.	1 No.
14.	1 mm 1.5 × 0.6 m.	1 No.
15.	0.5 mm 1.5 m × 0.6 m.	1 No.
16.	Capillary tube 1.5 mm,1 mm, 0.5 mm.	10 each
17.	Araldite (Economy size).	1 No.
18.	Thermocole sheet.	5 No.
19.	Flare Nut (assorted).	10 doz.
20.	Compressor connectors 1/4"×1/8" M.P.T.	1 doz
21.	-do- 1/4" × 1/4" M.P.T.	1doz.
22.	Freon 22.	5 Kg.
23.	Oil.	20 Litre
24.	Grease.	1 Kg.
25.	Wire 2 mm (P.V.C.).	2 coil
26.	P.V.C. wire 4 mm.	2coil
27.	Nails, clips and clamps.	1 packet of 100

S. No.	Name and Particulars of Item	Quantity
		coils
28.	Wood-woods having.	80 Kg.
29.	Plastic pipe 9mm, 12 mm, 15 mm.	4 m each
30.	P.V.C. conduit 12 mm dia.	20 No.
31.	P.V.C. conduit cross bent C.T.C.	6 each
32.	P.V.C. Reducing Bush.	(As required)
33.	P.V.C. Container size: 10 litres, 25 litres.	3each
34.	Lead.	1 Kg.
35.	Button Holder 5 amp.	(As required)
36.	S.P. Switch 5 amp.	10 Nos.
37.	S.P. Switch 5 amp.	1No.
38.	Turpentine Oil.	5 litre
39.	Bitumen compound.	1 Kg.
40.	B Electric lamp for Domestic Refrigerator, Commercial Refrigerator.	3 Pieces
41.	Brine salts.	
	(a) NaCl	5 Kg.
	(b) CaCl2 (c) HgCl	5 Kg. 5 Kg.
42.	Litmus solution.	25 ml
43.	Insulating tape.	6 rolls
44.	Black paint for conductor.	2 Kg.
45.	Painting Brush (assorted).	3 Nos.
46.	Insulating coaching mud.	2 Kg.
47.	White enamel paint.	1/2 Kg.
48.	Demonstration Board 1.8 m×1.2 m.	3 Nos.
49.	Petrol.	1litre
50.	Wire Brushes 5cm (Steel).	3 Nos.
51.	Dead Nut (Assorted).	3 Kg.
52.	Old Dhoti.	25 Nos.
53.	Soldering Flux.	1 Kg.
54.	Relay 1/4 HP.	2 Nos.
55.	Refrigerant filter.	2 Nos.
56.	Relay.	2 Nos.
57.	Silica.	1 Kg.
58.	Capacitor 50 uf.	3 Nos.
59.	Running capacitor	10 Nos.

S. No.	Name and Particulars of Item	Quantity
60.	Overload protector.	4 Nos.
61.	Hermetically sealed compressor (Second Hand).	1 No.
62.	Flaring toolset.	2 Nos.

LIST OF (CONSUMABLE) FOR ENGINEERING DRAWING & DRAWING OFFICE

S. No.	Name and Particulars of Item	Quantity
1.	Drawing sheets Imperial size, superior quality.	6 dozen
2.	Water proof veeto ink, black.	6 Nos.
3.	Cello tape small roll 12 mm wide.	6 Nos.
4.	Cello tape medium roll 18 mm wide.	6 Nos.
5.	Brass Drawing pins superior quality.	One gross
6.	Ink eraser (rubbers).	2 Nos.
7.	Drawing Rubber, Superior.	3 Nos.
8.	Drawing pencil, 2H, H, HB, B (1 dozen each).	4 dozen
9.	Ammonia paper, Roll 10 m.	10 Rolles
10.	Tracing Paper Roll 101 cm–18.3 m.	One Roll
11.	Cloth duster.	3 Nos.
12.	Soap bar.	6 Bars
13.	Liquid NH3 bottles.	3 Nos.

ELECTRONICS TECHNOLOGY

Course Objectives

After successfully completing the two year of senior secondary vocational course, the student would have acquired relevant appropriate and adequate technical knowledge together with the professional skills and competencies in the field of Electronics so that he/she is properly equipped to take up gainful employment in this Vocation.

Thus he 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 basic electronic devices and circuits.

(d) The knowledge of testing procedure of components and circuits by making use of different test instruments.

(e) The procedure of making P.C.B.

(f) The concepts and principles used in Radio/Audio/Video Systems and Communication devices and its maintenance.

B. Adequate Professional Skills and Competencies in

(a) Testing different electronic components.

(b) Testing the performance of electronic circuits.

(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.

CLASS–XI
ELECTIVE
BASIC ELECTRONICS (789)
THEORY

Time: 2.5 Hours ***Marks: 50***

1. Overview of Atom, Sub-Atomic Particles and CRO — 5

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

2. Voltage and Current — 10

- Resistance, Ohm's law, V-I Characteristics, Resistors, Capacitors, Inductors.
- Voltage and Current sources, Symbols and Graphical representation, Conversion of current and voltage sources.

- Overview of AC, DC, Cells and Batteries, Energy and Power.

3. Basics of Semiconductor 15

- Semiconductor materials, Energy band structure of Insulators, Metals and Semiconductors, Energy gap, Field and Photo-electric emission.
- Intrinsic & Extrinsic semiconductor, N-type and P-type semiconductor, Drift current, Diffusion current and Total current, Mobility of charges, Effects of temperature on Conductivity of semiconductor.
- PN junction diode, depletion layer, potential barrier, Forward & Reverse bias, V-I Characteristic, Effects of temperature, Resistance levels, Breakdown in Junction diode, Zener diode, Photo diode, LED, Types and applications of diode.
- Diode as a rectifier, Half wave and full wave rectification, Voltage multipliers, Zener diode Regulator.
- *Special information – (Introduction to Filters, Clippers, Clampers).

4. Bipolar Junction Transistor 10

- Construction and operation of NPN and PNP transistors, Biasing of BJT.
- CB, CE and CC configuration, Characteristics and transistor parameters for CB, CE, CC configuration.
- Introduction to FET, JFET, MOSFET, CMOS and VMOS, Characteristics of various transistors, Comparison of various transistors.

5. Transistor Amplifier and Applications 10

- Introduction, Single and Multi stage amplifiers, General amplifier characteristics, Feedbacks in amplifier.
- Introduction to Oscillators, Multi-Vibrators and Signal generator.
- *Special information - (Introduction to Thyristors, PNPN diode, SCR, LASCR, DIAC, TRIAC).

PRACTICAL

Time: 2.5 Hours ***Marks: 50***

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.

PRACTICAL GUIDELINES

Parameters	Marks
Project / Practical Activities.	10
Viva Based on Project.	10
Practical File / Report or Portfolio.	10
Demonstration of skill Competency in Lab Activities.	20
Total	**50**

CLASS–XI
ELECTIVE
DIGITAL ELECTRONICS (790)
THEORY

Time: 2.5 Hours ***Marks: 50***

1. Number Systems and Boolean Algebra — 10

- Basics of Analog and Digital.
- Number systems: Binary, Octal and Hexadecimal, Fixed point, floating point 1's complement, 2's complement, conversions and arithmetic operations, BCD, Gray code, ASCII codes.
- Boolean algebra, De-morgan's law, Truth tables.

2. Logical Circuits — 12

- Logic gates: Negative logic and positive logic, AND, OR, NOT, NOR, NAND, XOR, XNOR.
- Combinational Circuits:
  - (i) Arithmetic Circuits: Half adders, Full adders , Subtractors,
  - (ii) Data Processing Circuits: Encoders, Decoders, Multiplexers, De-Multiplexers, Code converters, Comparators.

3. Latches and Flip-Flops — 12

- Concept of Latches, Types of Latches, SR latch.
- SR Flip Flop, JK Flip Flop, D Flip flop , T Flip Flop, Flip Flop as basic memory.
- Introduction to counters, Types of counters Asynchronous and Synchronous.
- Introduction to shift registers, types of shift registers, Universal shift registers.
- *Special Information – (Right shift, Left shift, Bi directional).

4. Introduction to Display Devices — 8

- LED, LCD, 7 segment display, Common anode and Common cathode display.

5. Integrated Circuits and Memories — 8

- Introduction to IC's, Importance and applications, Linear and Digital IC's.
- Introduction to SSI, MSI, LSI and VLSI (Terminology & Definitions).

- Memory Organisation and Operations, Classification and Characteristics of memories, RAM, ROM.
- Block diagram of basic microprocessor system and microcontroller system, applications.

PRACTICAL

Time: 2.5 Hours ***Marks: 50***

1. Verification of truth tables for AND, OR, NOT and NAND logic gates.
2. Verification of truth tables for NOR, XOR and XNOR logic gates.
3. Construction and verification of operations of half adder and full adder circuits using basic gates.
4. Construction and verification of operations of half adder and full adder circuits using XOR gates.
5. Construction and verification of operations of full adder and full adder circuits using NAND gates.
6. Construction and verification of operations of half & full Subtractor circuit using basic gates.
7. Construction and verification of operations of half & full Subtractor circuit using XOR gates.
8. Construction and verification of operations of half & full Subtractor circuit using NAND gates.
9. Study and verification of truth tables for 3 line to 8 line decoder.
10. Study and verification of truth tables for 8 line to 3 line and 10 line to 4 line encoder.
11. Study and verification of truth tables for 4:1 MUX using gates
12. Study and verification of truth tables for 1:4 DEMUX using gates.
13. Study and verification of truth tables for 8:1 MUX using IC 74151.
14. Study and verification of truth tables for 1:8 DEMUX using IC 74138.
15. To study and verify the truth table of excess-3 to BCD code converter.
16. To study and verify the truth table of binary to gray code converter.
17. Construction and verification of truth tables for S-R, D and J-K flip flops.
18. Study working of various display devices. (LED, Common anode, Common cathode 7 segment display)
19. Study and verification of truth table for universal shift register.
20. Study the operation of a synchronous counter.

PRACTICAL GUIDELINES

Parameters	Marks
Project / Practical Activities.	10
Viva Based on Project.	10
Practical File / Report or Portfolio.	10
Demonstration of skill Competency in Lab Activities.	20
Total	**50**

CLASS–XI
GENERAL FOUNDATION COURSE (501)
(Common for Engineering & Technology Based Courses)

(Refer to page 7)

CLASS–XII
ELECTIVE
OPERATION AND MAINTENANCE OF COMMUNICATION DEVICES (789)
THEORY

Time: 2.5 Hours ***Marks: 50***

1. Introduction to Communication System 15

- Information signals, Elements of communication system, Transmitters and Receivers, Bandwidth of signals, Propagation of electromagnetic waves in the atmosphere, Sky and space wave propagation.
- Noise, Classification of noise, Source and description of noise.
- Fundamentals of Analog and Digital communication, Digital data transmission.
- Need of modulation, Modulation/ Demodulation of Amplitude-modulated wave, Phase- modulated and Frequency modulated wave, Pulse modulation.
- Introduction to Wireless communication, Basics of mobile communications, A simple reference model, Mobile and Wireless devices.
- Frequencies for Radio Transmission, Regulations act.
- Basics of cellular system, Elements of cellular radio systems, Performance criteria.

2. Satellite Communications 5

- Introduction and brief history of satellite communication, Overview of Satellite system.
- Satellite frequency bands, Introduction to Telemetry, Tracking and Command, Satellite mobile communication, Introduction to C/N ratio and S/N ratio, Introduction to VSAT technology.
- *Special Information - (Introduction to Radio propagation and Antenna).

3. Mobile Technology 10

- History of Mobile technology, Generation of mobile phones.
- Basics of TDMA, FDMA, CDMA and GSM, Mobile Services.
- (* Special Information - GSM and CDMA Architecture).
- Overview of Mobile phone components, Bluetooth, Infrared, GPRS, Wi-Fi, SIM, IMEI.
- (* Special Information - DECT, UMTS, IMT-2000).
- Base and Master system

4. Mobile Hardware and Software 10

- Introduction to Mobile hardware and their faults, Basic circuit board configuration, Identification and Working of different BGA IC's, Working on SMD and PCB's.
- Introduction to software and their faults, Formatting of virus affected mobiles, Removing software problems by codes, Unlocking of mobile phones using codes and software, Unlocking codes for GSM & CDMA.

5. Support Program 10

- How to open and manage your own mobile repair shop.

- How to successfully work as a technician.
- Where to procure tools, spare parts and accessories.
- How to deal with customers and distributers.
- Technical support guidance.

PRACTICAL

Time: 2.5 Hours ***Marks: 50***

1. Assembling & disassembling of different types of mobile phones.
2. Use of various tools & instruments used in mobile phone repairing.
3. Study of basic parts of mobile phones (mic, speaker, vibrator, LCD, antenna, etc) And Testing of various parts with multi-meter.
4. Recognize different IC's and study their working.
5. Soldering and De-soldering of different BGA IC's using soldering iron.
6. Practice of changing Driver IC Jumper.
7. Practice of changing Display in mobiles.
8. Practice of changing various jacks in mobile phones.
9. Practice of changing Bluetooth module.
10. Cool testing and hot testing of mobile phones for fault finding.
11. GSM
12. CDMA

PRACTICAL GUIDELINES

Parameters	Marks
Project / Practical Activities.	10
Viva Based on Project.	10
Practical File / Report or Portfolio.	10
Demonstration of skill Competency in Lab Activities.	20
Total	**50**

CLASS–XII
ELECTIVE
TROUBLE SHOOTING & MAINTENANCE OF ELECTRONIC EQUIPMENTS (790)

THEORY

Time: 2.5 Hours ***Marks: 50***

1. Basic Occupational Safety and Precautions **15**

2. Microphones and Loudspeakers **5**

- Construction, working principle and frequency response of Carbon Microphone, Variable Reactance Microphone, Capacitance Microphone, Piezo-Electric Microphone, Moving Coil Microphone.

- Frequency ranges of musical instruments, Intensity and Dynamic Range, Constructions and working principles of Moving Coil Loudspeaker, Impedance and Power Level of loudspeaker, Frequency characteristics of Practical Loudspeakers: Woofer, Tweeter, Squawker, and Loudspeaker Enclosure.

3. Recorders 10

- Analog and digital sound recording, Disk recording and reproduction, working principle with block diagram of disk recording and reproduction.
- Principle of magnetic recording and playback, Requirement of bias, Working principle with block diagram of a tape recorder system.
- Principle of optical recording, CD/ DVD manufacturing and recording, CD/ DVD player system, Advantages/ Disadvantages.
- Steps for Fault finding & Analysis.

4. TV System 10

- Working principle with block diagram of TV transmitter and receiver, Brief description with circuit diagram: TV Tuner, Video IF stage, Sound stage, Picture tube & its associated circuit, Synchronizing circuits, Horizontal & vertical deflection circuits, Remote control of a TV receiver, Idea of bandwidth, blanking and synchronization pulses, modulation scheme, monochrome system, extension of colour transmission.
- Channel and cable type TV system, Head end processor, Trunk & cable distribution system with block diagram, Scrambling.
- Introduction to LCD and LED TV systems, Introduction to high definition systems.
- Steps for Fault finding & Analysis.

5. Modern Appliances 10

- Working principle and block diagram of following:

  Microwave oven, Telephone, Fax machine, Printers, Scanners.
- Steps for Fault finding & Analysis.

PRACTICAL

Time: 2.5 Hours ***Marks: 50***

1. Assembly study and fault finding of an audio amplifier.
2. Assembly, study and fault finding of a graphic equaliser.
3. Study working, assembly & fault finding of Colour TV.
4. Study working, assembly & fault finding of LCD TV.
5. To trace the fault in the following panel controls and correct them:
   - Volume control.
   - Brightness control.
   - Contrast control.
   - Vertical hold control.
6. To trace the following stages of T.V. set:
   - Tuner.
   - MF stage.

- Video detector.
- Video amplifier.
- Sound I.T.
- Sound output stage.
- Syne separator.
- Vertical oscillator.
- Horizontal oscillator.
- Line Driver Stage.
- Line output transformer.
- Power supply.

7. To find fault for the following defects:
   - No picture no sound.
   - Sound present, picture missing.
   - Picture rolls vertically.
   - Picture tears (Horizontal oscillator).
   - Faults in tuner/IF/power supply.
8. Study working, assembly & fault finding of tape recorder system.
9. Study working, assembly & fault finding of CD/DVD player system.
10. Study working, assembly & fault finding of Printer.
11. Study working, assembly & fault finding of Scanner.
12. Study working, assembly & fault finding of Microwave oven.
13. Study working, assembly & fault finding of Telephone.
14. Study working, assembly & fault finding of Fax Machine.
15. Study working, assembly & fault finding of UPS system.
16. Study working, assembly & fault finding of DTH kit.

PRACTICAL GUIDELINES

Parameters	Marks
Project / Practical Activities.	10
Viva Based on Project.	10
Practical File / Report or Portfolio.	10
Demonstration of skill Competency in Lab Activities.	20
Total	**50**

CLASS–XII
GENERAL FOUNDATION COURSE (501)
(Common for Engineering & Technology Based Courses)

(Refer to page 13)

GUIDELINES FOR EXAMINERS

1. Examiner should check up at least one result of the examinee.
2. As far as possible each examinee should be given separate experiment.
3. Main emphasis should be given on the evaluation of work done, professional competency, workmanship and finish etc.
4. The object of Viva-voce should be to ascertain the depth of knowledge and understanding of the student. Questions asked should pertain to experiment performed by the student as well as other experiments.
5. Each student may be allotted two experiments from the list and he/she may perform any one out of the two.

GENERAL INSTRUCTIONS TO THE STUDENTS/CANDIDATES

Note: Before starting the practical, student should submit the connection diagram along with the list of equipment to the examiner.

1. Each student should check up the material/tools and equipments as per the requirement of the examination.
2. Each student should make himself/herself clear in understanding the question paper fully before its commencement.
3. Any student who finds any problem in handling the machine/equipment should immediately contact his/her Invigilator/Examiner.
4. Each student must do all the required operations himself/herself without the help of other students.
5. Each student should bear in mind the time allotted to him/her so that he/she may finish his/her jobs within the stipulated time.

LIST OF RECOMMENDED BOOKS

1. Electronics, A first course, Owen Bishop – Published by Elsevier Ltd.
2. Electronics for Dummies, Cathleen Shamieh and Gordon McComb – Wiley Publishing Inc.
3. Electronic Devices and Circuit , JB Gupta – SK Katatria Publications.
4. Electronic Devices and Circuit Theory 7th ed. – R. L. Boylestad, Pearson.
5. Electronic-Devices-And-Circuits-by-K-Lal-Kishore – BS Publications.
6. Electronic devices and circuits By Salivahanan, - The Mcgraw Hill Companies.
7. Electronics – Analog & Digital By IG Nagrath - PHI.
8. Semiconductor Physics and Devices: Basic Principles By D. A. Neamen, - McGraw Hill.
9. Modern Digital Electronics By RP Jain - TMH.
10. Principal of Communication Systems – Taub Schilling – TMH.
11. Modern Digital and Analog Communication System, BP Lathi – Oxford University Press.
12. Principles of Wireless Networks, Kaveh Pahlavan and Prashant Krishnamurthy.
13. Television and Video Engineering By SP Bali – TMH.
14. Consumer Electronics for Engineers By Philp Hoff – Cambridge University Press.
15. Consumer Electronics By JS Chitode – Technical Publications Pune.
16. A Beginners Guide to Consumer Electronics Repair, Douglas Kinney – iUniverse Books.
17. Portable Consumer Electronics, By Sridhar Canumalla – PennWell Corp.

LIST OF EQUIPMENTS AND INSTRUMENTS

S. No.	Description of Item
1.	Resistance - various values/sizes.
2.	Condensers - various values/sizes.
3.	Transformer such as Battery Eliminator mains and Battery charger.
4.	Side cutting insulated pliers – 15 cm.
5.	Long Nose insulated pliers 15 cm.
6.	Wire cutter, spring type.
7.	Screw driver set – 10 cm, 15 cm, 20 cm.
8.	Soldering Iron – 35 W/220 V, Solder Wire – 60, 40 and soldering Iron Stand.
9.	Tinned Copper Wire.
10.	VARIAC Single Phase.
11.	Wire Stripper.
12.	Steel Scale.
13.	Combination Pliers.
14.	Crimping Tools.
15.	Electronic Tool Kit.
16.	Analog Oscilloscope: Oscilloscope 30 Mhz Dual Trace.
17.	Digital Multimeter 4 & ½ Digits.
18.	Function Generator 0.3 Mhz To 3 Mhz.
19.	DC regulated Power Supply (30 V/5A).
20.	Frequency Counter 0.1 Hz to 1 GHz.
21.	Universal IC Tester, Digital IC upto 40 pins.
22.	Three Terminal Voltage Regulator Trainer Board.
23.	Diode & Zener diode Characteristics Trainer Board.
24.	Rectifier and Filter Trainer Board.
25.	Transistors Characteristics Trainer Board (CE,CB,CC).
26.	TV pattern Generators.
27.	Telephone Trainer Kit.
28.	Mobile Communication Training System.
29.	Communication Simulation Software.
30.	Fax machine trainer.

S. No.	Description of Item
31.	Mobile Phone Trainer.
32.	Single Phase Half Wave Control Rectifier Using SCR Board.
33.	UPS Trainer.
34.	Temperature Oven (0-200 ^{0}C).
35.	Different Microphones & Loudspeaker (for study of frequency response of microphone).
36.	Microwave Oven.
37.	Colored Television Demonstration kit.
38.	CD/DVD Player Trainer Kit.
39.	Stereo Cassette player demonstration cum trainer.
40.	Facsimile Machine.
41.	DTH System.
42.	8 bit digital multiplexer.
43.	1:8 line de-multiplexer.
44.	Multiplex two BCD numbers to seven segment display.
45.	3 bit asynchronous up-counter3 bit synchronous down counter.
46.	Universal Shift Registers having SISO, SIPO, PIPO, PISO.
47.	Encoder/decoder trainer.
48.	Digital IC Testers.
49.	Digital IC Power Supplies (+/- 5V/1A, +/-12V/1A/+-15V, 1A).
50.	GSM trainer kit.
51.	CDMA trainer kit.
52.	Digital Trainer Kit with following on board facility: Breadboard, 16 Nos. of input toggle switches, Sixteen nos. of LED output provision, Fixed +5V@1A and variable ±15V@500mA power supply, Pulser switch for clock input, Variable frequency clock signal (1Hz to1KHz), Digital voltmeter Seven segment display
53.	TTL IC 7400(NAND), 7402 (NOR), 7404(NOT), 7408(AND), 7432(OR), 7486(XOR) TTL IC 7446 (Common anode decoder driver), IC 7448 (Common cathode decoder driver), seven segment display (both common anode: MAN 3910 or equivalent and common cathode: MAN 3940 or equivalent).

S. No.	Description of Item
54.	8085 microprocessor based microprocessor trainer kit.

GEOSPATIAL TECHNOLOGY

Introduction

The term Geospatial technology is an umbrella phrase associated with a range of various technologies which include remote sensing, Global Positioning System (GPS), Geographic Information System (GIS), information technologies, and field sensors, that are intended to facilitate the process of capturing/storing/processing/displaying/disseminating information tied to a particular location.

This present course curriculum offers an opportunity for the students to understand the basics of geospatial technology for developing an interest in the principles, practical uses, and resources related to geospatial technologies. With the exponential growth of Indian geospatial market, this initiative is intended to develop the pool of manpower trained in this particular subject. This course will enable the students to get an insight into the diverse geospatial database concepts, creating and implementing of the same, GIS theory and spatial analysis, supplemented by extensive practical exercises. Also, it will help the students to acquire skills for further studies and to enter into the world as professionals.

CLASS–XI
ELECTIVE
GEOSPATIAL TECHNOLOGY (740)
THEORY

Time: 3 Hours ***Marks: 60***

Chapter–1: Geospatial Overview — 5

- Introduction to Geospatial Technology.
- Why to study Geospatial Technology.
- Importance of Geospatial Technology.

Chapter–2: Mapping & Cartography — 10

- What is Map & its Importance.
- Map Scale and Types.
- Elements of Map and Indexing.
- Map Coordinate System.
- Interpretation of Satellite Images.

Chapter–3: Remote Sensing — 20

- Overview on Remote Sensing Technology.
- Fundamentals of Remote Sensing.
- Physics of Electro Magnetic Energy.
- Remote Sensing Platforms, Sensors and Data Products.
- Remote Sensing Applications.

- Indian Remote Sensing Systems.

Chapter–4: Geographical Information System (GIS) **20**

- Fundamentals of GIS.
- Components of GIS.
- GIS Acquisition of GIS.
- Data Types of GIS.
- Application of GIS.

Chapter–5: Ground Positioning System (GPS) **5**

- Overview of GPS.
- Functions of GPS.
- Segments of GPS.
- Accuracy of GPS.
- Applications of GPS.

PRACTICAL

Time: 2 Hours ***Marks: 40***

Exercise No. 1: **5**

- To map School building and surrounding environment.

Exercise No. 2: **5**

- To display the various types of the matic geological, political.
  Meteorological and cadastral maps subject to availability.
- To read the maps and identify Map features.
- To learn usage of Maps.

Exercise No. 3: **10**

- To display two different scales of Toposheets of same area.
- To read Toposheet index and identify the adjacent Toposheets.
- To understand the small and large scale concepts.
- To compare the same area coverage by two different scaled Toposheets.
- To identify the different types of point's line and polygon features.
- To identify the map elements.
- To know the four coordinates of Topo heets.
- To learn findout the location of any point.

Exercise No. 4: **10**

- To display the satellite imagery and Toposheet of same area.
- To identify the same features from Topo sheet and Satellite image.
- Compare the identified features with toposheets and satellite image.

Exercise No. 5: **5**

- To understand the GIS environment for example open file, Display images and operate various functions such as zoon in, Zoom out, open attribute table and reading them overlay etc.

Exercise No. 6: **5**

- To Understand the GPS data collection and map them.
- Prepare table of coordinates and elevation of all points collected.
- Compare the results on Google map.

CLASS–XI
GENERAL FOUNDATION COURSE (501)
(Common for Engineering & Technology Based Courses)

(Refer to page 7)

CLASS–XII
ELECTIVE
GEOSPATIAL TECHNOLOGY (740)
THEORY

Time: 3 Hours ***Marks: 60***

Chapter–1: Remote Sensing (RS) **20**

- Introduction.
- Spectral Reflectance Signature.
- Digital Image Processing.
- Visual Interpretation of Satellite data.
- Aerial Photo and Its Interpretation.
- Advanced Remote Sensing Technologies.
- Advantages and Benefits of RS.

Chapter–2: Geographic Information System (GIS) **20**

- Introduction.
- GIS Data Element and Data Structure.
- Fundamentals of Database Concept.
- Data Input to GIS System.
- GIS Data Editing.
- Attribute Data Linking.
- Spatial and Non Spatial data Analysis.
- Map Projection and Coordinate System.
- Digital Cartography.
- Advantages and Benefits of GIS.

Chapter–3: Global Positioning System (GPS) **5**

- Introduction.
- GPS Accuracy and Accuracy factors.
- Types of GPS.
- List of Global Navigation System.
- GPS Today & Limitations of GPS.
- Uses of GPS Technology.

Chapter–4: Trends in Geospatial Technology 5

- Introduction.
- Remote Sensing Trends & Technology.
- GIS Trends & Technology.
  - (i) Web Based GIS.
  - (ii) Enterprise GIS.
  - (iii) Mobile GIS.
  - (iv) 3-D Visualization and Fly through.
  - (v) Open GIS.
- GPS Trends & Technology.

Chapter–5: Applications of Geospatial Technology 10

- Water shed Studies.
- Flood Studies.
- Ground water Studies.
- Health Issues.
- Utility Studies.
- Security and Defense Studies.
- Urban and infrastructure Studies.

PRACTICAL

Time: 2 Hours ***Marks: 40***

1. Projection of Data 5

- Georeferencing.
- Coordinating System and components.
- Image to map registration.
- Image to image registration.

2. Digitization 5

- Building Topology.

3. Digital Image Processing 5

- Image enhancement.
- Unsupervised classification.

- Supervised classification.

4. Geospatial Data Creation and Editing **5**

- Querying (Location parameters, graphics etc.).
- Projection data.
- Building geo database.

5. Spatial Analysis & Thematic Mapping **5**

- Overlay analysis
- Geoprocessing of data intersection, union dissolve, merge, clip.
- Functional attribute and expression.
- Statistics and Report generation.

6. Symbology & Layouts **5**

- Map surfing.
- Preparing map and its layout.
- Indexing.
- Scale and annotation.
- Preparing maps for presentation.

7. On Job Training **10**

- Preparation of maps for.
- Environment analysis.
- Urban area.
- Water bodies.
- Agriculture and Forest Collecting ground truth with GPS Overlaying of different maps in GIS.

CLASS–XII
GENERAL FOUNDATION COURSE (501)
(Common for Engineering & Technology Based Courses)

(Refer to page 13)

LIST OF RECOMMENDED BOOKS

1. Geospatial Technology, Practical Manual XII, published by CBSE.
2. Geospatial Technology, Teachers Manual XI, published by CBSE.
3. Geospatial Technology, Teachers Manual XII, published by CBSE.
4. Geospatial Technology, Text Book XI, published by CBSE.
5. Geospatial Technology, Text Book XII, published by CBSE.
6. Applications of Geospatial Technology, Ganesh, A.

7. Introduction To Geospatial Technologies, by Bradley Shellito.

SUGGESTED LIST OF EQUIPMENTS AND TOOLS

S. No.	Name of article	Quantity
1.	Currycombs.	10 nos.
2.	Stiff brushes.	10 nos.
3.	Computer lab with internet connection.	
4.	Computers with installed Geometrical Software.	6 nos.

FOUNDRY TECHNOLOGY

Objectives

This course aims to introduce students to the foundry industry and provide clear understanding to the students of the technology processes, design flow and the techniques that can be employed to realize effective designs using our latest toolkits. The student will learn about foundry drawing, molding techniques, raw materials used, melting and pouring and cast metal techniques and so on. This course aims to develop appropriate technical knowledge as well as the professional skills of the students, so that they are equipped to take gainful employment in the said vocation.

CLASS–XI
ELECTIVE
FOUNDRY TECHNOLOGY (755)
THEORY

Time: 3 Hours ***Marks: 60***

Unit–1: Introduction, Scope and Overview of Foundry Technology 5

- Introduction to Metal Casting - its role, advantages and applications as a manufacturing process, historical development, usage of cast items, raw materials required.
- Introduction to engineering metals and alloys used for casting – cast irons, cast steels, copper and aluminium alloys.
- Type of foundry, Foundry industry in India – status and growth prospects.

Unit–2: Pattern-Making and Usage of Patterns 15

- Steps in foundry operations, role and importance of patterns.
- Elements of Engineering drawing – basic concepts, plan , elevation, isometric and sections.
- Types of pattern, pattern materials, various pattern allowances and other design considerations, pattern selection according to job order, pattern layout.
- Parting lines, core boxes, tools required in pattern making, colour codes.

Unit–3: Raw Materials for Sand Moulding and Core Making 10

- Types of sand and their characteristics, influence of sand on properties of mould and castings.
- Moulding and core sands – desired properties, binders and additives and their functions and how to obtain optimum properties.
- Preparation of moulding and core sands – equipment used, mullers and mixers, quality control aspects.

Unit–4: Mould Making, Core Making 20

- Conventional sand moulding – steps involved, parting line selection, green and dry sand moulding, loam sand moulding, moulding processes.
- Sand moulding with various types of organic binders, selection of binders and special care required, Core making use of inorganic and organic binders.
- Equipment required in moulding and core making – brief description, comparison and application, use of mould and core paints.

- Testing of moulding sand, mould inspection and testing.

Unit–5: Feeding of Castings **10**

- Introduction to Melting process and Melting furnace.
- Feeding system in a mould, their functions, Pouring basin and Sprue-basic requirements of design, Gating system – types, location of runners, ingates.
- Risers- types, functions of a riser, location, Methods of riser design- concept of Modulus, solidification time, use of Chill, exothermic compounds etc., possible casting defects due to improper feeding and precautions required.

PRACTICAL

Time: 2 Hours ***Marks: 40***

Exercise No. 1: **5**

- Line drawing, dimensioning, Geometrical construction.
- Section of solids, Isometric and Orthographic views.

Exercise No. 2: **15**

- Visit to a foundry, Layout of foundry, Report on equipment used, raw materials consumed, types of moulds, quality control aspects etc.
- Pattern layout.
- Calculation of shrinkage allowances.
- Drawing Isometric, Plan and Elevation views from an actual pattern.
- Locating sprue, runner and riser, Calculation of riser volume.

Exercise No. 3: **15**

- Sand testing – Shape and size of sand, AFS Sieve analysis of sand, clay content.
- Preparation of moulding sand and standard specimen, Permeability, Hardness determination, tests for Green strength, Dry strength, moisture content.
- Optimisation of binder and water content by variation of binder and water level.

Exercise No. 4: **5**

- Preparation of a green sand mould with a simple pattern, use of mould coating.
- Measurement of mould hardness.

CLASS–XI
GENERAL FOUNDATION COURSE (501)
(Common for Engineering & Technology Based Courses)

(Refer to page 7)

CLASS–XII
ELECTIVE
FOUNDRY TECHNOLOGY (755)
THEORY

Time: 3 Hours ***Marks: 60***

Unit–1: Special Moulding and Casting Processes 15

- Moulding processes with permanent moulds, Die casting processes, basic features of die design, equipment description, selection, pressure die casting, gravity die casting, cast products, protection of dies.
- Centrifugal casting processes – Description of true and semi centrifugal casting products and specific application areas, Centrifuging.
- Shell moulding, Investment casting and other precision casting processes.

Unit–2: Melting and Pouring Practice 10

- Classification of melting furnaces used in Foundry, Selection of melting furnaces, essential features of a melting furnace , Refractory materials – types, properties and application.
- Cupola melting - Cupola furnace: types of cupola- divided blast, hot blast, oil fired, coke less etc., brief description of design, operation and quality control aspects, charge calculation.
- Furnaces heated by electricity - Resistance, Arc and Induction furnaces various types, brief description and application and merits of each.
- Influence of melting and pouring practice on casting quality, shop floor tests for quality assurance.
- Solidification: Nucleation and growth.

Unit–3: Production Practice for Ferrous and Non-Ferrous Metals 15

- Important aspects of foundry practice for castings of Cast irons – grey, malleable and ductile irons, modularizing treatment.
- Steel foundry practice, practice and quality control in moulding, melting and pouring for production of carbon and alloy steel castings, High – manganese and Stainless steel castings, finishing operations and safety aspects.
- Foundry practice for copper and aluminium alloys, melting and pouring practice, degassing and dross removal, precautions required.

Unit–4: Cast Metals Technology 10

- Solidification of pure metal and alloys. Basic concepts of structure of pure metals, cast metals and alloys, hardness and tensile properties.
- Cast Irons - types, forms of graphite in cast irons, Alloy Cast irons-effect of alloying elements on properties, applications of Cast Iron.
- Cast steels- plain carbon and alloy steels – properties and applications.
- Properties and applications of important cast non-ferrous alloys

Unit–5: Testing and Quality Assurance in Foundry 10

- Cleaning of castings: knockout, fettling, shot blasting and grinding of casting components.
- Hardness tests and Tensile tests of castings, Non-destructive tests of castings.
- Casting defects: Causes and remedial measures.

PRACTICAL

Time: 2 Hours *Marks: 40*

Exercise No. 1: **10**

- Visit to a foundry, layout of foundry shop, report on casting quality control, and diagnosis of casting defects castings components.

Exercise No. 2: **10**

- Moulding practice in foundry.

Exercise No. 3: **10**

- Melting furnaces in the foundry.

Exercise No. 4: **5**

- Laboratory demonstration of melting and solidification.

Exercise No. 5: **5**

- Mechanical testing of castings.

CLASS–XII
GENERAL FOUNDATION COURSE (501)
(Common for Engineering & Technology Based Courses)

(Refer to page 13)

LIST OF RECOMMENDED BOOKS

1. Foundry Technology I, Theory XI, published by CBSE.
2. Foundry Technology I, Practical XI, published by CBSE.
3. Foundry Technology II, Theory XII, published by CBSE.
4. Foundry Technology II, Practical XII, published by CBSE.
5. Principles of Foundry Technology, P.L Jain, Tata McGraw- Hill Education.
6. Metal Casting: Principles And Practice, T.V. Rammana Rao, New Age International.
7. Foundry Tehnology, O.P. Khanna, Dhanpat Rai Publications Private Limited.
8. Foundry Tehnology, Peter Beeley, idea international publishers.
9. Manufacturing Technology, Vol. I: Foundry, Forming and Welding (Third Edition), P. N. Rao, Book Vistas.

LIST OF SUGGESTED EQUIPMENTS

1. Electronic Balance.
2. Drying Oven.
3. Melting furnace(Resistance Furnace).
4. Universal testing machine for sand sample.
5. Sand Rammer.
6. Glass Bicker.
7. Measuring Flask.
8. Mold Box.

9. Chisel.
10. Venting Rod.
11. Trowel.
12. Gagger.
13. Pattern.
14. Core Box.
15. Mold Hardness Tester.
16. Clay Washer.
17. Follow Board.
18. Sand Muller.
19. Sand Mixer.
20. Hand Riddle.
21. Sieve Shaker.
22. Shovel.
23. Draw Spike.
24. Lifter.
25. Permeability Tester.
26. Sand Rammer for Specimen Preparation.
27. Medium to large crucible.
28. Large plastic or metal container with lid.
29. Fine metal mesh screen.
30. Trowel and fine brush.
31. Molding box with gating system and casting components.
32. Small item to be used as a model for the molding.
33. Slag stick and metal Pliers.
34. Wooden or metal rammer.

RAW MATERIALS

1. Silica Sand.
2. Zircon Sand.
3. Chamotte Sand.
4. Powdered Bentonite clay.
5. Dextrin.
6. Soap stone powder.
7. Sodium silicate.
8. CO_2 gas.
9. Resin Coated Sand.
10. Aluminium ingots for casting.
11. Copper ingots for casting.
12. Commercial grade tin.
13. Wax.

TRANSPORT SYSTEMS AND LOGISTIC MANAGEMENT

Objective

This course intends to introduce students to the world of transport management. The curriculum aims to skill students in understanding and utilizing measurable criteria to evaluate how well the multimodal transportation system operates. Identify and address the impacts of freight movement on areas surrounding truck routes (noise, air quality, safety). Identify and reduce/eliminate freight linkage deficiencies with the objective of improving freight movement through roadways, railroads, and rivers.

CLASS–XI
ELECTIVE
FUNDAMENTALS OF TRANSPORTATION SYSTEMS (749)
THEORY

Time: 3 Hours ***Marks: 60***

Unit–1: Transportation System 12

- National Transport Policy.
- Fundamentals of Transportation Systems.
- Importance of transportation for the development of a country.
- Different forms of transportation and their advantages and disadvantages (roads, railways, airports, waterways, pipelines).

Unit–2: Road Transport 15

- What is Road Transport.
- Road transportation development in India.
- Functional classification of roads.
- Physical specifications of roads and highways, General knowledge of National Highway, State Highways, Check Posts & Toll Tax.
- Various modes of Road Transport.

Unit–3: Railway Transportation System 15

- History and general features of Indian Railway.
- Organization of Indian Railways.
- Classification of railway lines in India, Major railway cargo corridors.
- Categorization of cargo and passenger trains.
- Modernization of railways and high speed trains & Dedicated Freight Corridor.
- Cargo movement through Container.
- Specifications of Rail Coaches & Wagons, Indian Railway Assets, etc.
- Private Container train operators.

Unit–4: Air Transportation 8

- Air transportation, Development of air transportation in India and trends in air traffic.
- Airport classifications.
- Different components of airports: runway, taxiway, apron and passenger and cargo handling areas.
- Brief of Major Airports in the country.

Unit–5: Water and Pipeline Transportation **10**

- Water transportation, Historical development of ports, harbours and docks.
- Inland waterways: National Waterway and their functions.
- Coastal water transport: type of cargo.
- Pipeline transportation.

PRACTICAL

Time: 2 Hours ***Marks: 40***

Prepare a Project on:

1. Development and growth of Road transportation in India. **6**
2. Development and growth of Rail transportation in India. **7**
3. Development and growth of Air transportation in India. **7**
4. Development and growth of Water ways transportation in India. **7**
5. Development and growth of pipeline transportation in India. **7**
6. Modes of Transportation. **6**

CLASS–XI
ELECTIVE
LOGISTICS, OPERATIONS AND SUPPLY CHAIN MANAGEMENT (750)
THEORY

Time: 3 Hours ***Marks: 60***

Unit–1: Elements of Logistic, Operations and Supply Chain Management **10**

- Definition of Logistics.
- Evolution of Logistics & Logistic Functions, Need for Logistics.
- Concept of:
  - (i) Ware house, its types and functions.
  - (i) IBL.
  - (iii) OBL.
  - (iv) Inventory Management.
  - (v) Supply Chain Management.
  - (vi) Refrigerator & cold chain container movement.

Unit–2: Multimodal Transport System **10**

- Multi modal transport-features of multi-modal transport system, advantages.

- Types of intermodal movements.
- intermodal relationships; multimodal carriers.
- international movements.

Unit–3: Freight Management and Material Handling **14**

- Logistic Transport Operation (Network Planning, Route Management, Hub & Spoke system).
- Freight Management and Cost.
- Material Storage and Safety Methods.
- Stacking of goods, loading, unloading & handling of goods.

Unit–4: Safety in Transportation and Traffic Regulation **13**

- Safety in Transportation.
- Accidents in the air: probable causes, navigation aids, landing categories.
- Railway accidents and disaster management: classification of accidents, derailment and its causes, safety measures, disaster management.
- Road accidents: reasons and possible mitigation measures.
  - (i) Safe Cargo Movement Practice.
  - (ii) Safety Storage.
  - (iii) Disaster Management.
  - (iv) Accident Management.
- Traffic Management & Regulation.

Unit–5: ISO in Logistics and Occupational Hazards **13**

- ISO in Logistic.
- Quality.
- Environment.
- Occupational Hazards and Safety.

PRACTICAL

Time: 2 Hours ***Marks: 40***

1. Case Study on an overall logistic Operation of an Organization. **20**
2. Project on Company's logistics operation. **20**

CLASS–XI
GENERAL FOUNDATION COURSE (501)
(Common for Engineering & Technology Based Courses)

(Refer to page 7)

CLASS–XII
ELECTIVE
INTEGRATED TRANSPORT OPERATIONS (749)
THEORY

Time: 3 Hours ***Marks: 60***

Unit–1: Transport Operations-I — 18

- Structure of Transport organization and types (National, Regional, Local).
- Procedure for Booking consignments.
- Transhipment procedure (Hub & Spoke System).
- Goods Receiving Procedure.
- Goods Forwarding Procedure.
- Delivery Procedure.
- Documentation.

Unit–2: Transport Operations-II — 12

- Lorry hire systems.
- Fleet Operation, maintenance, fleet utilization.
- Billing Procedure.
- Tendering Process.
- Quotation to Customers.

Unit–3: Warehouse Management — 10

- Loading, Unloading & Handling of goods in warehouse.
- Stacking of goods.
- Retrieval of material.
- Warehouse activities kitting, binning etc.
- Documentation in warehouse activities.
- Importance of Security & Fire Safety at warehouse.

Unit–4: Freight Rates/Costing Methods — 12

- Road Freight.
- Rail freight.
- Air freight.
- Sea Freight.
- Waterways & Coastal Freight.

Unit–5: Brief Notes & Importance — 8

- Consignment note.
- Sales Tax forms.
- Check Post& Toll Tax procedures.

- Goods forwarding note.
- Weightment, Dimensional cargo.
- Lorry hire contract.
- Trip sheet.
- CBS.
- Route Permit.
- Truck Registration.
- Insurance.

PRACTICAL

Time: 2 Hours ***Marks: 40***

Documentation

1.	Forwarding note.	**6**
2.	Consignment Note.	**6**
3.	Types of consignment – ODC / FTL / Part / Parcel.	**8**
4.	Weighment of goods.	**7**
5.	Marking of goods.	**6**
6.	Preparation of lorry hire contract.	**7**

CLASS–XII
ELECTIVE
LOGISTICS, OPERATIONS AND SUPPLY CHAIN MANAGEMENT (750)

THEORY

Time: 3 Hours ***Marks: 60***

Unit–1: Logistics and System Concept, Objectives and Role of Logistics **10**

- Logistics and System concept - Information flow, warehousing, inventory control, packaging, transportation.
- Objectives of logistics management.
- Role of logistics in supply chain.
- 3 PL & 4 PL Logistics.
- Careers & growth in Logistics and Supply Chain.

Unit–2: Inventory Management **15**

- Inventory management and supply chain.
- Inventory functions and cost.
- Inventory related cost.
- Functions of Inventory management in supply chain operations.

Unit–3: Freight Management 10

- Freight Management - factors influencing freight cost, route planning.
- Packaging for safe product handling and in Logistic Operations.
- Containerization - its scope and types, its uses.

Unit–4: Logistic Management and Information Technology 15

- Logistics operation and Information technology - New trends - GPRS, RFID, Bar code, Radio Frequency Tag (RFT), E -commerce.
- Documentation for domestic and international trade cargoes, International Chamber of Commerce Terms.
- Sea borne trade - Ports and Ships management in India.
- Logistics and Supply Chain uses in World Industry.

Unit–5: Emerging Issues in SCM and Logistics 10

- Statutory Provisions dealing transport – Multi modal Transport Act-1993.
- Motor Vehicles Act 1988 - driving rules.
- Insurance coverage - Marine insurance, road, rail, sea, air etc.
- Insurance Claims.

PRACTICAL

Time: 2 Hours ***Marks: 40***

Preparation of Different Documents used in –

1. Domestic cargoes. **20**
2. International cargoes. **20**

CLASS–XII

GENERAL FOUNDATION COURSE (501)

(Common for Engineering & Technology Based Courses)

(Refer to page 13)

LIST OF RECOMMENDED BOOKS

1. Fundamentals of Transportation System XI, Published by CBSE.
2. Logistics, Operations and Supply Chain Management-I, Published by CBSE.
3. Logistics, Operations and Supply Chain Management-I, Teacher's Manual, Published by CBSE.
4. Integrated Transport Operations, Class XII, Published by CBSE.
5. Logistics, Operations and Supply Chain Management, Class XII, Published by CBSE.
6. Jotin Khisty C and Kent Lall B, Transportation Engineering: An Introduction; Prentice Hall International, Inc, 1998.
7. Hutchinson B.G, Principles of Urban Transport Systems Planning McGraw Hill Book Company (latest edition).

8. Kanafani Adib, Transportation Demand Analysis, McGraw-Hill Book Company (latest edition).
9. Papacostas C.S and Prevedouros, Transportation Engineering & Planning; Prentice- Hall of India Pvt. Ltd. (Third edition).
10. Bruton M.J, Introduction to Transportation Planning, Hutchinson of London (Latest Edition).

LIST OF EQUIPMENTS

1. Geographical charts.
2. Atlas.

IT APPLICATION

Introduction to Computer Applications

A. Preamble

Computer is now affecting energy sphere of human activity. It is instrumental in bringing revolutionary changes in industry, scientific research and education. This is not only the demand of time but also the demand of almost each and every subject to have an associated computer learning to equip a student with start-of-art technology to prove himself/herself a better candidate than those without computer knowledge.

Since the CBSE has been foremost in giving best to its clientele, a single paper as per requirement of industry has been designed in such a way that it can be taken as an independent subject along with any combination of vocational packages.

This paper has been designed keeping in view the need and demand of computer industry.

B. Objectives

The course is designed to fulfill the following objectives:–

- Familiarisation with computer-dominated technological world.
- To impart adequate know how to the students to be able to take up entry level jobs in the area of Data Processing.
- Exposure of utility and applications of computers.
- To get acquaintance with the basics of Computer Science and lay foundation for higher education/careers in computers in conformance with industry requirements.
- Application of computers in the specific areas such as accounting & auditing, stores accounting, office management & secretarial practice, textile designing etc.
- Algorithmic approach to problem solving.
- To use computer effectively and efficiently by acquiring working knowledge of PC softwares.
- Familiarisation with Data Processing environment and Data Processing terminology.

C. Career Opportunities

- Field Service Technician.
- IT Support Specialist.
- Executive (Web Development).
- Data Processing Assistant/Documentation Assistant.
- Programming Assistant.

The rapid changes in the area of Information Technology have significantly affected the fields of business, finance, trade, governance and communications which have not only resulted in global competitiveness in various fields but simultaneously have pushed the global technical advancements. The feasibility of easy access to information, data processing and modes of communication has made visible changes in the modes of administration at all levels. Due to the increasing demands for a deeper understanding of information technology, computer aided learning has necessitated curricular reforms incorporating basic competency and skills in the fields of information technology.

The course intends to develop skills related to web applications and advanced web designing. Knowledge of network safety and security, digital designing, multimedia anchoring, web content creation, interactive web page creating and troubleshooting will be imparted. The curriculum is designed to develop appropriate technical knowledge as well as the professional skills of the students, so that they are equipped to take gainful employment in the said vocation.

CLASS–XI
ELECTIVE
IT TOOLS (795)
THEORY

Time: 2.5 Hours ***Marks: 50***

Unit Code	Unit Title	Total Hours	Total Marks
ITDC–301	Computer Organization & OS: User perspective. ❯ Understanding of Hardware. ❯ Basics of Operating System.	15	8
ITDC–302	Networking and Internet. ❯ Network Safety concerns. ❯ Network Security tools and services. ❯ Cyber Security. ❯ Safe practices on Social networking.	10	7
ITDC–303	Office automation tools: ❯ Spreadsheet. ❯ Word processing. ❯ Presentation.	40	10
ITDC–304	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.	35	10
ITDC–305	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).	10	7
ITDC–306	Work Integrated Learning IT – **ISM** ❯ Identification of Work Areas. ❯ Work Experience.	14	8
		124	**50**

PRACTICAL

Time: 2.5 Hours ***Marks: 50***

Details	Marks Distribution
Programs / Practical Questions. ❯ Spreadsheets, Word, Presentation (10 Marks). ❯ Multimedia Design (10 Marks). ❯ Troubleshooting (5 Marks).	30
Project / Practical File	10
Viva Voce	10
Total	**50**

CLASS–XI
ELECTIVE
WEB APPLICATIONS (796)
THEORY

Time: 2.5 Hours ***Marks: 50***

Unit Code	Unit Title	Total Hours	Total Marks
ITDC–310	Multimedia Authoring- Animation Tools. ❯ Animation Concepts. ❯ Frames and Layers. ❯ Motion and Shape, Tweening. ❯ Importing AV Files. ❯ Publishing.	30	15
ITDC–311	Digital Content Creation- Adding Styles to Web Pages (CSS). ❯ Review of HTML. ❯ Adding Style Sheets. ❯ External style sheets. ❯ CSS Properties – border, box, font, margin, padding. CSS classes.	30	10
ITDC–312	Web Scripting- JavaScript. ❯ Creating interactive Web Pages with scripts. ❯ Variables and Operators. ❯ Decision making using if and switch. ❯ Iterations - loops. ❯ Window Object. ❯ Location Object. ❯ History Object. ❯ Popup Boxes – alert, confirm.	50	15
ITDC–313	Work Integrated Learning IT – **WA-I.** ❯ Identification of Work Areas. ❯ Work Experience.	14	10
		124	**50**

PRACTICAL

Time: 2.5 Hours ***Marks: 50***

Details	Marks Distribution
Programs / Practical Questions. ❯ Animation Tools (15 Marks). ❯ HTML (10 Marks). ❯ Web Scripting - Java Script (5 Marks).	30
Project / Practical File	10
Viva Voce	10
Total	**50**

CLASS–XI
GENERAL FOUNDATION COURSE (501)
(Common for Engineering & Technology Based Courses)

(Refer to page 7)

CLASS–XII
ELECTIVE
DATABASE MANAGEMENT APPLICATIONS (795)
THEORY

Time: 2.5 Hours ***Marks: 50***

Unit Code	Unit Title	Total Hours	Total Marks
ITDC–401	Database Concepts – RDBMS Tool. ❯ Basics of RDBMS. ❯ SQL – Creating and Opening Database. ❯ Creating and populating tables. ❯ Modifying the content and structure of table. ❯ Ordering and Grouping. ❯ Operating with multiple tables.	50	10
ITDC–402	Operating Web Based Applications. ❯ Online Reservation Systems. ❯ E-Governance. ❯ Online Shopping and Bill payments. ❯ Online Tutorials and Tests. ❯ Project Management – Web Based Application development. ❯ Project essentials and tips. ❯ Case Study - Online Game. ❯ Case Study - Online Quiz. ❯ Case Study – Online Bill Calculator.	30	15
ITDC–403	Fundamentals of Java programming, Introduction to Java, Object Oriented Programming, Java Language Elements, Operators, Control Flow, Array, Class Design, Exception Handling, Assertions, Threads , Wrapper Classes, String Manipulation.	30	15
ITDC–404	Work Integrated Learning IT – DMA. ❯ Identification of Work Areas. ❯ Work Experience.	14	10
		124	**50**

PRACTICAL

Time: 2.5 Hours ***Marks: 50***

Details	Marks Distribution
Programs / Practical Questions. ❯ SQL Queries (15 Marks). ❯ JAVA Programs (10 Marks).	30

) Operating Web Based Application (5 Marks).	
Project / Practical File	10
Viva Voce	10
Total	**50**

CLASS–XII
ELECTIVE
WEB APPLICATONS (796)
THEORY

Time: 2.5 Hours ***Marks: 50***

Unit Code	Unit Title	Total Hours	Total Marks
ITDC–410	Movie Editing Tools.) Familiarization of interface components.) Importing pictures.) Importing Audio and Video Files.) Splitting and Joining Movie Clips.) Adding Titles and publishing.	30	10
ITDC–411	Customizing and Embedding Multimedia components in Web Pages.) Compatible Multimedia file formats for Web Pages.) Embedding Audio file.) Embedding Video file.) Embedding Flash file.	40	15
ITDC–412	Web Scripting – Java Script.) Java Script review.) Functions – user defined.) String Object.) Math Object.) Array Object.) Events.) Case Studies.	30	15
ITDC–413	Work Integrated Learning IT – WA-II.) Advanced Features of Web Design.) Code view, Add-ins / Snippets and Page Transitions.) Dynamic Web templates.) SEO - Search Engine Optimization.) Forms - Advanced.) Publishing webpages or websites-I.) Publishing webpages or websites-II.) Authoring tools.) CSS templates.	24	10
		124	**50**

PRACTICAL

Time: 2.5 Hours ***Marks: 50***

Details	Marks Distribution
Programs / Practical Questions. - Movie Editing Tools (15 Marks). - Customizing and Embedding, Multimedia Components in Web Pages (10 Marks). - Web Scripting - Java Script (5 Marks).	30
Project / Practical File	10
Viva Voce	10
Total	**50**

CLASS–XII

GENERAL FOUNDATION COURSE (501)

(Common for Engineering & Technology Based Courses)

(Refer to page 13)

LIST OF RECOMMENDED BOOKS

1. Information Technology (IT) Student Handbook for level I, Published by CBSE.
2. IT Tools, Student Handbook, Level–III by CBSE.
3. Web Application–I, Student Handbook, Level–III by CBSE.
4. Database Management Application, Level–IV by CBSE.
5. Web Application–II, Student Handbook, Level–IV by CBSE.
6. Database Systems: Design, Implementation And Management by Peter Rob, Carlos Coronel.
7. Introduction to Information Technology by Efraim Turban (Author), R. Kelly Rainer (Author), Richard E. Potter (Author).
8. Introduction to Information Technology by ITL Education Solutions Limited.
9. JavaScript, A Beginner's Guide by McGraw-Hill Osborne Media, 2009.
10. HTML and CSS: Design and Build Websites by Wiley (ISBN-10: 1118008189, ISBN-13: 978-1118008188), 2011.
11. The Book of GIMP: A Complete Guide to Nearly Everything by No Starch Press (ISBN-10: 1593273835, ISBN-13: 978-1593273835), 2013.
12. GIMP for absolute beginners by A press Publishers (ISBN-10: 1430231688, ISBN-13: 978-1430231684), 2013.
13. Microsoft Windows Movie Maker For Dummies by Keith Underdahl.
14. Getting Start ED with Windows Live Movie Maker by James Floyd Kelly.
15. Microsoft Windows Movie Maker 2 by Jan Ozer.
16. Microsoft Windows Movie Maker Handbook (Book & CD-ROM) by Bill Birney.
17. Filmmaking For Dummies by Bryan Michael Stoller.

LIST OF EQUIPMENTS/TOOLS

Batch Size: 25 Students

1. Hardware
   a) Computers : 25
   b) Printers : 2
2. Internet Connection
3. Software
   (a) Microsoft Office / Open Office
      (i) Word Processing
      (ii) Spread Sheet
      (iii) Digital Presentation
      (iv) MS Access
   (b) Internet Browser
   (c) Java SDK
   (d) Database Software
   (e) Movie editing tools
4. UPS/ Power Backup
5. Storage Media (Pen Drive / CDs)

Annexure–1

APPLICATION FORMAT FOR OFFERING VOCATIONAL SUBJECT / COURSES AT SENIOR SECONDARY LEVEL

1. **Name of the Course(s) applied for:** .....
   (with subject codes) .....
   .....
   .....

2. **Name of the School (Complete address)** .....
   (Also provide Website address if available) .....
   .....
   .....

3. **Affiliation No.** .....
4. **School ID.** .....
5. **Name of the Principal** .....
   - Phone No. .....
   - Mobile No. .....
   - E-mail .....
6. **Infrastructure** .....
   No. of Students .....
   No. of Teachers .....
   Student-Teacher Ratio .....
   No. of Classrooms .....
   Books in Library .....
   Total Computers in Computers Labs .....
   Specification of Computers .....
   Details of Constructed area for .....
   Establishing Laboratories .....
7. **Name of Teachers for Vocational Course** .....
   (Qualifications) .....
   .....
   .....
8. **Details of Draft** (in favour of **Secretary, CBSE,** Payable at Delhi)
   DD No.: ..... Date: ..... **Amount** (in Digits)
   .....
   Bank Issues: ..... **Amount** (in Words)
   .....

Signature & Seal of the Principal

Note: The document complete in all respects may be sent to: **The Director (Vocational Education), Central Board of Secondary Education 2, Community Center, Preet Vihar, New Delhi-110092.**