

# SENIOR SCHOOL CURRICULUM

## 2017-18

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### AUTOMOBILE TECHNOLOGY

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#### 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 garage.
- (e) Importance and procedures of preventive, operating and break-down maintenance.
- (f) Preparing estimate of repair jobs.
- (g) Garage 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 Synchronesh gear box, selector mechanism.

### **4. Braking System**

**10**

- Function and principle of braking system, classification, braking systems-constructural 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.
- Pictorial 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. Brazing materials. Advantages and disadvantages of soldering & brazing. 8

## PRACTICAL

*Time: 2 Hours*

*Marks: 30*

1. **Carpentry 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,

**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 ( $\mu$ ) 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*

- |           |   |           |
|-----------|---|-----------|
| <b>1.</b> | <b>Service Manual</b>   | <b>2</b>  |
|           | <ul style="list-style-type: none"><li>• Reading of service manual.</li></ul>  |           |
| <b>2.</b> | <b>Inspection and Repairs of the Fasteners</b>  | <b>4</b>  |
|           | <ul style="list-style-type: none"><li>• Identification of fasteners used in a vehicle.</li><li>• Various procedure used for removal of fasteners from the unit.</li></ul>   |           |
| <b>3.</b> | <b>Measuring Equipments</b>   | <b>10</b> |
|           | <ul style="list-style-type: none"><li>• Handling and Use of dial gauge, telescopic gauge and bore gauge.</li><li>• Handling and Use of Vernier caliper and tyre depth gauge.</li><li>• Handling and Use of micrometer.</li><li>• Handling and Use of hydrometer and bevel gauge.</li><li>• Handling and Use of torque wrench and filler gauge.</li><li>• Usage of various gauges in a dashboard in vehicle.</li></ul> |           |
| <b>4.</b> | <b>Suspension System</b>  | <b>10</b> |
|           | <ul style="list-style-type: none"><li>• Maintenance of suspension system.</li><li>• Service and replacement of leafs, cambering of leaf springs, shackle, shackle pin and centre bolt.</li><li>• Replacement of strut/shock absorbers, inspection of steering linkages.</li><li>• Manual and Power steering systems, Air suspension system.</li><li>• Steering system adjustments.</li></ul>                          |           |
| <b>5.</b> | <b>Serviceability, Replacement or Repair of Components</b>  | <b>10</b> |
|           | <ul style="list-style-type: none"><li>• Reconditioning of valve mechanism.</li><li>• Inspection and replacement of piston rings.</li><li>• Inspection and replacement of connecting rod and engine bearing.</li><li>• Testing of cooling system and replacement of defective component.</li><li>• Regular servicing of MPFI system.</li><li>• Servicing of CRDI / Non-CRDI system.</li></ul>                          |           |
| <b>6.</b> | <b>Transmission System</b>  | <b>6</b>  |
|           | <ul style="list-style-type: none"><li>• Servicing of propeller/drive shaft, universal and slip joints.</li><li>• Servicing of differential unit and adjustments.</li><li>• Introduction to automatic transmission system.</li></ul>   |           |

## 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)

## THEORY

*Time: 3 Hours*

*Marks: 70*

### A. Engineering Drawing

40

- Section of Solids:** Concepts of sectioning. Projection of sections of poly-Hedron including their true shapes. 9
- Development of Surfaces:** Development of Poly-Hedron and solids of revolution including their sections. 8
- 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
- Keys and Cotters:** Different types of keys, sleeve and cotter joints, socket and spigot joints, knuckle joints. 7
- Couplings:** Solid and split coupling, flanged coupling, simple and protected. 7

### B. Workshop Technology

30

- 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 torch 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. Mounting 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 gas 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-torch.

## **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 Boilers:** 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 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**

<b>S. No.</b>	<b>Name of Instrument</b>	<b>Qty. Reqd.</b>
1.	A.C. Fuel pump.	1
2.	Carburettor- solex, cartor.	1
3.	Epicyclic 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).

