

**DETAILED SYLLABUS FOR THE POST OF WORKSHOP INSTRUCTOR /
DEMONSTRATOR IN AUTOMOBILE ENGINEERING IN TECHNICAL
EDUCATION DEPARTMENT**

(Cat.No. 294/2021)

MODULE 1 – 10 MARKS

Casting methods - sand casting, permanent mould casting, centrifugal casting, special casting - die-casting. Machine forging-Production of crank shaft, connecting rod, transmission gear shafts, valves, gear blanks, steering column. Powder Metallurgy and its applications. Principles of arc welding, functions of electrode coating, welding machines and uses of arc welding. Types-Carbon arc welding, Shielded metal arc welding, Gas Tungsten Arc Welding, Gas Metal Arc Welding, Submerged arc welding, Thermit welding, Gas welding, Resistance welding.

Mechanical properties of materials, Mechanism of grain formation, effect of rate of cooling on grain size, effect of grain size on mechanical properties, factors promoting fine grain. Heat treatment of metals - cooling curve for pure iron, Need for heat treatment. Definition and explanation of tensile, compressive and shear load, stress and strain, behavior of ductile material under tension - limit of proportionality, modulus of elasticity, elastic limit, yield point, ultimate stress, percentage elongation, percentage reduction in area. Factor of safety.

MODULE 2 – 10 MARKS

Introduction to fluid mechanics, Properties of Fluids, Newton's law of viscosity, types of fluids. Fluid pressure and its measurement, Fluid pressure at a point, pressure head, Piezometer tube, simple manometer, differential manometer. Pascal's law. Fluid kinematics, types of fluid flow- steady and unsteady flow, uniform and non-uniform flow, laminar and turbulent flow, compressible and incompressible flow. Rate of flow or discharge, equation of continuity. Bernoulli's equation. Application of Bernoulli's equation. Measurement of flow rate and basic principles of Venturimeter, Notches and orifice. Principle and Working of Centrifugal pumps, Reciprocating Pumps, and other positive Displacement pumps (Gear pumps, Screw Pump, Vane pumps, Lobe pump, Simple piston pumps).

Thermodynamic system, thermodynamic properties, boundary, state, process, internal energy, flow of work, enthalpy, entropy, first and second law of thermodynamics. Specific heats at constant volume and at constant pressure. work done, change in internal energy, heat transfer, relation between P, V and T etc, during Isochoric, Isobaric, Isothermal, Isentropic and Polytropic processes. Air standard cycles, Pressure-volume diagram and temperature-entropy diagram, Theoretical thermal efficiency and air standard efficiency of Carnot cycle, Otto cycle, Diesel cycle. Power developed in I.C. Engines, Indicated power, Brake power, Friction power, Indicated thermal efficiency, Brake thermal efficiency, Volumetric efficiency, Specific fuel consumption. Morse test and preparation of heat balance sheet. Air compressors: classification of air compressors and working principle.

MODULE 3 – 10 MARKS

Constructional details of lead acid cell and nickel alkaline cell, Active materials of lead acid cell, Chemical action of lead acid cell, Rating of Battery, Capacity of Battery, Battery charging, Effect of overheating, Effect of overcharging, Dislocation of active material,

sulphation, Internal short circuits, Testing of Battery - State of charge, Specific gravity test by hydrometer, High-rate discharge test, Care and maintenance of battery, Storage of lead acid battery (in dry & wet condition), Maintenance free battery, Tubular battery.

Constructional details of automobile dynamo, Constructional details of alternator, necessity and type of regulators, maintenance of alternator. Starter motor - constructional features, maintenance of starter motors, Types of starter motor drives – inertia and pre engaged types, Over running clutch drive, Dyer drive, Starter switches- manual, solenoid switch cum shift, solenoid with relay. Battery coil ignition system, Ignition coil, Contact breaker points, Cam angle, Condenser, Distributor, Spark plug - types, Spark plug specifications, Ignition timing, Spark advance & retard mechanism (centrifugal & vacuum), Magneto ignition system - Rotating armature & rotating magnet type, Polar inductor type. C.D. ignition system, Electronic ignition systems, Distributor less ignition system.

MODULE 4 – 10 MARKS

Principle of friction clutches. Constructional features and working of - Single plate dry clutch-Diaphragm clutch, Cone clutch, Centrifugal clutch, Semi-centrifugal clutch, Vacuum clutch, Hydraulic clutch, Electromagnetic clutch, Over running clutches, Multiplate clutch (dry & wet), Fluid fly wheel. Clutch disc - constructional details and functions of each part, Pressure plate - constructional details and functions of each part. Clutch operating mechanisms. Necessity and functions of a gearbox - constructional features and working of - Sliding mesh gearbox, Constant mesh gearbox, Synchro mesh gearbox, 2-Wheeler transmissions - Progressive type gearbox, Automatic transmission - Epicyclic gearbox, Torque converter, Gear selector and shifting mechanisms, V matic transmission, CVT and ECVT.

Drive line components - Propeller shaft, slip joint and universal joint, Torque tube drive, Hotchkiss drive, Variable velocity joints, Constant velocity joints, Front wheel drive, Differential mechanism, Locking differential, Limited slip differential, Rear Axles-types. Wheels – wire, spoked wheel, disc wheel, and alloy cast wheel, composite wheel, Wheel specification. Tyres-Tyre specification, Tyre construction (cross sectional details), Tubeless tyre, Tyre treads patterns, Inflation pressure and its effects (both over & under inflation), Factors affecting tyre performance.

MODULE 5 – 10 MARKS

Properties of SI and CI engine fuels -Properties of Petrol and Diesel, Properties and performances of LPG, CNG, Alcohol, Hydrogen and Bio-diesel, Bi-fuel and Dual fuel systems. Stages of combustion in SI engines, P- θ Diagram, the effects of engine variables-ignition lag, flame propagation, abnormal combustion -detonation, pre-ignition and surface ignition. Stages of combustion in CI engines, P- θ Diagram, various air fuel ratios, delay period and variables affecting the delay period, Diesel knock and its control. Super charging, Effects of super charging, Methods of supercharging and turbo charging, Lean burn engines, Working of electric cars, hybrid vehicles, fuel cell vehicles.

Car body construction details, major body sections of a passenger car- front section, centre section, rear section. Construction types - conventional body over frame, unitised frame and body construction. Fibre reinforced and metal reinforced body structures. Classification of coach work, coach and bus body styles, typical layout of bus and coach body, typical layout of commercial vehicles, vehicle body materials- steel, light alloys, plastics, textiles, glass, wood, aluminium materials, adhesives and their properties. Corrosion and their prevention.

Paint materials, paint characteristics, refinishing process -paint removal, preparing bare metal, prime coat selection, final sanding, masking, surface cleaning. Spray guns, equipment and material preparation, spray gun setup, spray paint booth.

MODULE 6 – 10 MARKS

Classification of tractors, layout of wheeled tractor, power transmission system, steering system, accessories of wheeled tractors - power take off unit, hitch, winch mechanism, hydraulic control system - lift and draft control of implements, agricultural applications of tractors like sprayer, threshers, seed and fertilizer application, crop cultivation. Various earth moving machines- working of Bulldozers, Dumpers, Loaders, Scrapers & Shovels, methods of loading and unloading operations involved, constructional features of earth moving equipment, actuation of implements using cable control, hydraulic control, different types of buckets involved in loader.

Various construction vehicles-systems of road rollers, excavator, grader, road roller classifications, ballasting of road roller wheels, different types of compacting - sheep foot drum, vibrating type, construction and uses of excavator, applications and classification of grader, mechanism of mobile crane and truck mounted crane. Features of Oil tankers, Articulated vehicles-working, features of Ambulance, features of fire extinguishing vehicle, working of Hover craft, working of fork lift, features of campervan.

MODULE 7 – 10 MARKS

Types of frames, Frame for 2-wheeler, 3-wheelers, and 4-wheeler, frame sections, sub frames. Materials used, Testing of chassis. Front Axle types - dead & live axle, trans axles, Construction, material, cross section, Checking the alignment of front axle, Stub axle - different arrangements. Types of front suspension for Two, three and four-wheeler. Air suspension, Hydro-elastic suspension. Rear Suspension system, Types, Introduction to springs and Shock absorbing devices, Types-leaf, coil, springs and their arrangements, Helper spring, Spring shackle, shackle pin, Telescopic type Shock absorber, Hydraulic, gas filled type, Mono tube and Twin tube type, Basic suspension movements pitching, bouncing, rolling etc.

Principles of steering, Steering gear box - types, Worm & roller, worm and sector, Re-circulating ball, Rack and pinion, Steering linkages - arrangement - components Power steering - integral - linkage type, Collapsible type steering column. Wheel alignment -Factors affecting wheel alignment.

Principles of braking, Types of brakes- mechanical, hydraulic, pneumatic, servo brake, Air brake, vacuum brake, fail safe brake, dual brake, anti lock brake, Drum and disc brake system - Internal expanding and externally contracting- Layout of brake system, mechanical Components, hydraulic master cylinder - working principle, wheel cylinder, brake bleeding, brake shoe. Air brake - construction details, working details, components. Working of servo brake - types, vacuum and air, disc brake, constructional details and working of engine exhaust brake, testing of braking efficiency.

MODULE 8 – 10 MARKS

Features of M. V. Act - definition of terms - test for drivers and conductors - registration of vehicles - duties of drivers and conductors - traffic signs - mode of staffing in a depot - site selection and facilities in a depot - M. T. O. and functional wings - organization chart. Bus operation - Factors governing bus schedule - making a bus schedule - operating

characteristics - trip generation and trip distribution - No. of bus required for operation - preparation of time table for bus and crew - factors governing crew scheduling - making a crew scheduling. Components of vehicle operational cost. Types of transport co-ordination and co-coordinating factors. Intermediate public transport in Indian cities (IPT)/Para transit, Characteristics of IPT modes, Light rail transit (LRT/Tram), electric trolley bus (ETB), Magnetic levitation (MAGLEV) system, container freight station, Trailer on flat car, Automatic Guided Vehicle (AGV).

Traffic demand- trip sheet and way bill - Route survey- Fare collection - Route planning - Fare structure and table - ticket system — fare methods - fare stage - organization of automotive business - marketing back ground - functions of marketing activities - workshop management -responsibilities of dealer - duties of workshop staff - warranty. Consignment shipment. Importance of roads - traffic studies and high way planning - Road geometry - width of high way - gradient - cross section of road - super elevation and sight distance - road intersection - traffic lights - location of bus stop, bus bay, zebra crossing and parking positions - traffic census. Insurance surveying - companies - classification of policies - third party insurance - factors involved in assessing – MACT.

MODULE 9 – 10 MARKS

Various signs showing the necessity of overhauling, engine decarbonizing, vacuum test, compression test and cylinder leakage test. Causes of excessive lubricating oil consumption. Engine dismantling and assembling. Checking of engine components, causes of cylinder wear, cylinder reboring and honing, liner replacement. Valve adjustment and defects of valves. Piston defects and reconditioning methods. Testing of connecting rods. Measurement of bearing clearance and adjustment of connecting rod bearings. Crank shaft balancing and machining processes. Testing of ignition system components. Setting of ignition timing. Servicing of spark plug. Causes of excessive fuel consumption and defects of carburettor. Engine tuning procedure. Servicing of diesel engine - F.I. pump timing. Testing of Nozzles. Phasing and calibration of F.I. pump.

Servicing of clutch assembly. clutch adjustments. Removal and refitting of trans-axle. Dismantling of propeller shaft and universal joint. Defects in propeller shaft. Servicing of differential and rear axle. Removal of axles in full floating, semi floating and three-quarter floating types. Differential troubles and adjustments. Causes of tyre wear. Tyre rotation, retreading and balancing of wheels. Checking of wheel alignment. Adjustment of torsion bars. Care and maintenance of vibration dampers. Replacement of suspension rubber bushes. Play adjustment in steering gear boxes. Centralizing steering wheel. Troubles in steering system. Brake bleeding and adjustment. Servicing of master cylinder and wheel cylinder checking of braking efficiency. Troubles in hydraulic and air brake systems.

MODULE 10 – 10 MARKS

Methods of improving fuel economy, Fuel injection systems in petrol and diesel engines, Port fuel injection and throttle body injection, Types of injection- sequential, grouped and simultaneous injections. fuel supply systems in MPFI, Gasoline direct injection system, sensors, actuators, CRDI, Electronic control module (ECM) control functions, Inputs and outputs of electronic control module (ECM), electronic fuel injectors. Emission norms-BHARATH stage, Effect of pollutants-sources of pollution- methods to control petrol engine and diesel engine emissions-. Reduction of compression ratio, blow by control system, PCV

system, After burner, catalytic converter, control of oxides of nitrogen - EGR -Evaporative emission control system-Charcoal canister- Diesel smoke and its control.

Vehicle accessories-cruise control, electric seat and mirror, intelligent wind screen wiper, Automobile air conditioning system - Working, Components and their location, Refrigerants, a/c control devices, automatic climatic control. Restraint systems-Seat belt, air bag, electronic stability control, ABS, EBD, key less entry & Vehicle immobilizer, automatic traction control system, adaptive noise control system, Parking distance control, In car infotainment, Head up Display, G P S, Concept of Drive-by wire.

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.