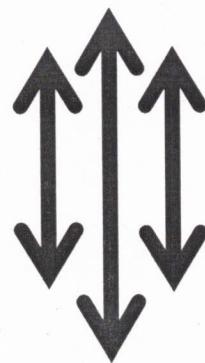


नेपाली सेना

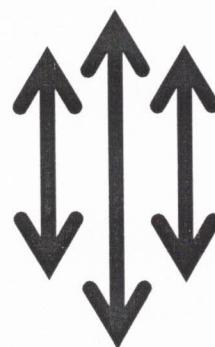
श्री भर्ना छनौट निर्देशनालय, कार्यरथी विभाग,

जंगी अड्डा



प्रा.उ.से. अटोमोबाईल इंजिनियर (खुला) पदको लिखित

परीक्षाको पाठ्यक्रम



२०७८

नेपाली सेना

प्रा.उ.से. अटोमोबाईल इंजिनियर (खुला) पदको लिखित परीक्षाको पाठ्यक्रम

समय: ४ घण्टा १५ मिनेट

पूर्णाङ्क : १५०

उत्तीर्णाङ्क : ६०

यो पाठ्यक्रम नेपाली सेनाको प्रा.उ.से. अटोमोबाईल इंजिनियर (खुला) पदका उम्मेदवार छनौट परीक्षाको लागि निर्धारण गरिएको हो । लिखित परीक्षामा सरिक हुने उम्मेदवारहरूको पेशा सम्बन्धी विषयलाई आधारमानी प्रश्नहरू सोधिने छ ।

- (क) लिखित परीक्षाको माध्यम नेपाली/अंग्रेजी वा दुवै भाषा हुनेछ ।
- (ख) लिखित परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र अर्को चरणको परीक्षामा सम्मिलित गराईनेछ ।
- (ग) प्रश्नपत्र निर्माण गर्दा पाठ्यक्रममा समावेश भएका सबै विषयहरूलाई यथासंभव समिटनेछ ।
- (घ) बस्तुगत र विषयगत संयुक्त रूपमा पूर्णाङ्क र उत्तीर्णाङ्क कायम गरिनेछ ।
- (ङ) बस्तुगत र विषयगत परीक्षाको पाठ्यक्रम एउटै हुनेछ ।
- (च) बस्तुगत र विषयगत विषयको लिखित परीक्षा एकैपटक वा छुट्टाछुट्टै गरी लिन सकिनेछ ।
- (छ) यो पाठ्यक्रम मिति २०७८/०५/११ गतेबाट लागु हुनेछ ।

लिखित परीक्षाको योजना र पाठ्यक्रम

विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली		प्रश्न संख्या अङ्क	समय
पेशा सम्बन्धी	७५	६०	बस्तुगत (Objective)	बहु वैकल्पिक प्रश्न (MCQs)	७५ प्रश्न x १ अङ्क=७५	१ घण्टा १५ मिनेट
	७५		विषयगत (Subjective)	छोटो उत्तर लामो उत्तर	७ प्रश्न x ५ अंडा =३५	३ घण्टा
				लामो उत्तर	४ प्रश्न x १० अङ्क =४०	

१५ अ५ २ मे २०७८

नेपाली सेना

प्रा.उ.से. अटोमोबाईल इन्जिनियर (खुला) पदको लिखित परीक्षाको पाठ्यक्रम

1. Strength of Materials

Introduction: Internal forces, Stresses and strains, Elasticity, Hooke's law, Poisson's ratio, Elastic constants and their relationship. Stress-strain diagram for ductile materials.

Definition of creep, fatigue and stress relaxation. Statically determinate and indeterminate problems. Bending of Beams: Shear force and bending moment diagrams for simply supported and cantilever beams. Pure bending. Bending stress in straight beams. Shear stresses in bending of rectangular and I-section beams. Beams of uniform strength.

Torsion and Columns: Torsion of circular shafts. Shear stresses and twist in solid and hollow shafts. Combined bending and torsion. Closely coiled helical springs.

Definition of columns, Types of Columns, Equivalent length, Slenderness ratio, Rankine's formula. Biaxial Stresses: Analysis of biaxial-stresses, Mohr's circle. Principal stresses and maximum shear stress-deductions from Mohr's circle. Stresses in thin walled pressure vessels. Combined bending and torsion.

Deflection of Beams: Differential equation of the elastic axis, double integration and moment methods. Strain energy in tension, compression, shear, bending and torsion. Castigiliano's theorem.

2. Thermodynamics and Heat Transfer

Basic Concepts: Systems, Zeroth law, First law. Steady flow energy equation. Heat and work transfer in flow and non-flow processes. Second law, Kelvin Planks and Clausius statements. Concept of entropy, Clausius inequality, Entropy changes in non-flow processes. Properties of gases and vapours, Carnot Cycle

Thermodynamic Cycles: Classification of Cycles, Air Standard Cycles: Otto Cycle, Diesel Cycle, Brayton Cycle, Rankine Cycle, Vapor Compression Refrigeration Cycle

One dimensional fluid flow: Application of continuity and energy equations. Isentropic flow of ideal gases through nozzles. Simple jet propulsion system.

Refrigeration and Air-Conditioning: Principles of refrigeration, air-conditioning and heat pumps. Vapour compression and vapour absorption systems, co-efficient of performance. Properties of refrigerants.

Heat Transfer: Conduction in parallel, radial and composite wall, Convective heat transfer with laminar and turbulent flows, Overall heat transfer co-efficient. Flow through heat exchangers. Fundamentals of radiative heat transfer.

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Heat exchangers: Types of heat exchangers, parallel and counter flow types, Introductions to LMTD. Correction factors, fouling factor.

Combustion Analysis: Fuels, HIV and LTV, Air requirements, excess air, analysis of products of combustion. Enthalpy of formation, adiabatic flame temperature, enthalpy of combustion, heat of reaction. Analysis of fuels and fuel gas. Orsats apparatus.

3. Fluid Mechanics and Machinery

Introduction: Classification of fluids. Properties of fluids. Centre of pressure. Plane and curved surfaces. Buoyancy and stability of floating bodies.

Fluid Dynamics: Laws of kinematics of fluid flow. Lagrangian and Eulerian method. Stream function and potential functions. Continuity, momentum and energy equations. Bernoulli's equations and its applications. Pressure measurements, pitot static tube, venturimeter, and orifice plate. Applications of momentum equations.

Laminar and Turbulent Flows: Reynolds experiments. Flow relation between shear stress and pressure gradient. Flow between parallel plates. Characteristics of turbulent flow. Flow through pipes. Energy losses in pipes. Flow around immersed bodies.

Fluid Machinery: Classification and Working Principle of various types of Hydraulic Turbines and Pumps. Major Components of Hydroelectric Plant

Gas Dynamics: Compressible flow: subsonic and supersonic flows

4. Material Science, Manufacturing and Production Process

Introduction: Classification and comparison of manufacturing processes. Criteria for selection of a process. Casting: sand-casting, types, procedure to make sand molds, cores-molding tools, pouring of metals, principle of die casting. Centrifugal casting. Investment casting Shell molding and CO₂ process.

Strengthening of material: Strain hardening, alloying, polyphase mixture, martensitic, precipitation, dispersion, fiber and texture strengthening. Iron carbon diagram.

Selection of materials: Criteria of selecting materials for automotive components viz Cylinder block, Cylinder head, Piston, Piston ring, Gudgeon pin, Connecting rod, Crank shaft, Crank case, Cam, Cam shaft, Engine valve, Gear wheel, Clutch plate, Axle bearings, Chassis, Spring, body panel and radiator, brake lining etc. Application of non-metallic materials such as composite, ceramic and polymers in automobile.

Heat Treatment and Surface Treatment: Heat treatment of steel. Annealing -types, normalizing, hardening and tempering with specific relevance to automotive components, surface hardening techniques, induction flame and chemical hardening. Coating and corrosion resistance. Electroplating, phosphating, anodizing, hot dipping, thermal spraying, hard-facing and thin film coatings.

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Welding: Classification of welding processes. Principles and equipment used in Gas welding, Arc welding, Resistance welding, Thermitt welding. Soldering. Brazing.

Conventional and Unconventional Machining: General principles of working. Types and commonly performed operations in Lathe, Shaper, Planer, Milling machine, Drilling machine, Grinding machine, Gear cutting. Need for unconventional machining processes. Principles and application of Abrasive jet machining, Ultrasonic machining, Electro discharge machining, Electromechanical machining, Chemical machining, Laser beam machining, Electron beam machining, Plasma arc machining. Metal Forming: Basic concepts and classification of forming processes. Principal equipment used and application of Forging, Rolling, Extrusion, Wire drawing, Spinning. Powder metallurgy, steps involved, applications.

5. Engine Combustion and Pollution Control

Fuels and its chemical reaction in combustion: Fuel structure and composition, Properties of fuel, Chemical reactions in fuel combustion, Combustible mixture and products of combustion, Heating value of fuel and mixture, Heat capacity of charge and combustion products

Intake and compression in engines: Differences in theoretical and actual cycles, Intake: Admission parameters, Intake coefficient, Factors affecting intake coefficient; Compression: Pressure and temperature at the end of compression, Effect of various parameters on combustion

Combustion in SI engines: Mixture formation, Ignition limits, Combustion: chemistry, types, stages and flame propagation, Rate of pressure rise and phases of combustion, Effect of operating variables on: process of combustion, flame propagation, ignition lag, Auto ignition and chemical reaction, Detonation: phenomenon, knocking, measurements, intensity, effect of engine variables and engine design, Factors governing combustion, Combustion chamber and its types

Combustion in CI engines: Direct and indirect combustion chamber, Importance of air motion swirl, squish and turbulence-swirl ratio, Fuel air mixing, Stages of combustion, Delay period and operating variables affecting delay period, Detonation: phenomenon, knocking, measurements, intensity, effect of engine variables and engine design, Factors governing combustion, Combustion chamber design

Expansion and exhaust: Expansion, Effect of various parameters on polytropic expansion, Exhaust

Characteristics of motor vehicle engine: Indicated characteristics, Brake characteristics, Effect of various operating variables on indicated and brake characteristics, Speed characteristics, Load characteristics, Adjustment characteristics, Special characteristics

Vehicular emission: Sources of pollutants: exhaust gases, crankcase gas and fuel vapour, Composition of exhaust gases, Pollutant formation, Effect of composition and structure of fuels on emission, Effect of air-fuel mixture, operating variables, combustion chamber design, driving conditions and drivability, traffic management on emission, Effect of fuels and exhaust gases on human health and environment

Methods of exhaust gas analysis: Gas chromatograph, Smoke meter, Particulate measurement, Odor and aldehyde emission, Exhaust gas analyzer, Flame ionization detectors, Chemiluminescence NOx analyzer, Non dispersive infrared (NDIR) analyzer

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Methods of emissions control: Emission standard and emission control norms, euro emission standards, Improving fuel system and ignition system of engine, Use of alternative fuels and additives, Use of neutralizer (flame, liquid and catalytic) in the exhaust system, Emission control system: exhaust gas recirculation (EGR), evaporative emission control (EVAP), positive crankcase ventilation (PCV), air injection system (AIS), Closed loop control, Change in air fuel ratio and ignition timing

Vehicular noise pollution: Sound level, Sources, effects and control methods, Technical norms and standards

6. Automotive Petrol Engines

Engine Construction and Operation: Constructional details of 4-stroke petrol engine. Working principle, Otto cycle, actual indicator diagram, Two stroke engine construction and operation. Comparison of four stroke and two-stroke engine operation. Firing order and its significance.

SI Engine Fuel System: Carburettor working principle. Requirements of an automotive carburettor; Starting, idling, acceleration and normal circuits of carburetors, compensation, Maximum power devices, constant choke and constant vacuum carburetors. Fuel feed systems, Mechanical and electrical pumps. Petrol injection.

Cooling and Lubrication System: Need for cooling system. Types of cooling system, Liquid cooled system, Thermosyphon system, Pressure cooling system. Lubrication system, Mist lubrication system, Wet sump and dry sump lubrication. Properties of lubricants. Properties of coolants.

Combustion and Combustion Chambers: Combustion in SI engines, stages of combustion, flame propagation, rate of pressure rise, abnormal combustion, knocks. Effect of engine variables and knock. Combustion chambers, Different types, Factor controlling combustion chamber design.

Two Stroke Engines: Types of two strokes engines, Terminologies and definitions, Theoretical scavenging methods. Scavenging pumps. Types of scavenging.

7. Automotive Diesel Engines

Engine construction and operation: Two stroke and four stroke diesel engines. Diesel cycle. Fuelair and actual cycle analysis. Diesel fuel, Ignition quality. Cetane number.

Fuel Injection System: Requirements, Air and solid injection, function of components, Jerk and distributor type Pumps. Pressure waves, Injection lag, Unit injector, Mechanical and Pneumatic governors. Fuel injector-types of injection nozzle, Spray characteristics, injection timing, pump calibration.

Combustion Chambers: Importance of air motion-swirl, squish and turbulence-swirl ratio. Fuel air mixing –stages of combustion, delay period, factors affecting delay period. Knock in CI enginescomparison of knock in CI & SI engines. Direct and indirect injection. Combustion

Chambers-Air cell chamber, combustion chamber design objectives. Different types of combustion chamber.

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Supercharging and Turbocharging: Necessity and limitation, Charge cooling, Types of supercharging and turbocharging, relative merits, matching of turbocharger.

Diesel Engine Testing and Performance: Automotive and stationary diesel engine testing and related standards. Engine power and efficiencies. Performance characteristics. Variables affecting engine performance. Methods to improve engine performance. Heat balance. Performance maps.

8. Automobile Chassis and Automotive Systems

Introduction: General introduction of chassis and body system, Vehicle body and its type, Body Loads and Material, Types of chassis layouts, Types of frames

Power train: Purpose, functions and operation, Types, Common problems of Clutch system, Purpose, functions and operation of gear box, Manual (sliding mesh, constant mesh, synchro mesh) gear box, Epicyclic gear box, Fluid coupling and torque converter, Automatic gear box, Over drive, Common problems of gear box, Purpose, functions and operation of Transfer case, purpose, functions and common problems of Universal joint and propeller shaft, Final Drive, Differential, Back-Lash setting, Purpose and types of Axle

Brake System: Purpose and functions, Braking distance and stopping distance, Types: Mechanical, hydraulic, servo, air assisted hydraulic, pneumatic, exhaust brake and anti-lock braking system (ABS), Disc, drum brakes and their components, Common problems

Steering system: Purpose and functions, Types: Manual and powered steering, Steering gear box and types, Power steering: Hydraulic, electric, Steering geometry, Common problems

Suspension system: Purpose, functions, Main parts, Types, Common problems

Wheel and tires: Purpose and functions, Wheels, wheel dimension and its types, Types of tire and its specifications, Factors affecting tire life, tire pressure, Tire rotation, tire changing, Wheel alignment, wheel balancing

9. Automobile Electrical and Electronics

Batteries: Principles and construction of lead-acid battery. Characteristics of battery, rating capacity and efficiency of batteries. Various tests on battery condition, charging methods. Constructional aspect of alkaline battery.

Starting System: Condition at starting. Behaviour of starter during starting. Series motor and its characteristics. Principle & construction of starter motor. Working of different starter drive units, care and maintenance of starter motor. Starter Switches.

Charging System: Generation of direct current. Shunt generator characteristics. Armature reaction. Third brush regulation. Cut-out. Voltage & current regulators. Compensated voltage regulator alternators principle & constructional aspects and bridge benefits.

Ignition Systems : Types, Construction & working of battery coil and magneto ignition systems. Relative merits, Centrifugal and vacuum advance mechanisms, types and construction of spark plugs, electronic ignition systems.

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Lighting System & Accessories: Insulated & earth return systems. Positive & negative earth systems. Details of head light & side light. Headlight dazzling & preventive methods. Electrical fuelpump, Speedometer, Fuel, oil & temperature gauges, Horn, Wiper system, Trafficator.

Automotive Electronics: Current trends in modern automobiles, Open and close loop systems, Components for electronic engine management. Electronic management of chassis system. Vehicle motion control.

Sensors and Actuators: Basic sensor arrangement, Types of sensors such as-Oxygen sensors, Crank angle position sensors-Fuel metering/vehicle speed sensor and detonation sensor-Altitude sensor, flow sensor. Throttle position sensors. Solenoids, stepper motors, and relays.

Electronic Fuel Injection and Ignition Systems: Introduction, feedback carburetor systems. Throttle body injection and multi port or point fuel injection., fuel injection systems, Injection system controls.

Advantages of electronic ignition systems: Types of solid-state ignition systems and their principle of operation, Contact less electronic ignition system, and electronic spark timing control. Digital Engine Control System: Open loop and closed loop control systems-Engine cranking and warm up control-Acceleration enrichment-Deceleration leaning and idle speed control. Distributor less ignition-Integrated engine control systems, Exhaust emission control engineering. Electronic dashboard instruments-Onboard diagnosis system, security and warning system.

10. Automobile Component Design

Design consideration: Definition and types of design, design process, morphology of design, material selection, Problem solving and decision making.

Design of fasteners: Design of riveted joints, Welded joints, Other joints like threaded joints, gib-cotter, knuckle joint, key joint, spigot, socket joint, turn buckle

Design of shaft and axle: Fatigue failure, Fatigue life methods, The endurance limit, fatigue strength, Factors affecting fatigue strength, Stress concentration effects, Fatigue failure criteria for fluctuating stress, Combination of loading modes, Design of shafts, Axle design

Rolling contact bearings: Types of rolling contact bearings, bearing life, bearing load, Selection of ball and straight roller bearing, Selection of tapered roller bearings, Lubrication and mounting of bearings

Design of gears: Spur gear design, Helical, bevel and worm gear design, Final drive and differential

Design of I.C. engine components: Materials and manufacturing process for cylinder and cylinder head, Design of cylinder and cylinder head, combustion chamber design and design of stud bolts, Crank gear (inline type) dynamics, Materials and manufacturing process and design features of a crankshaft, Design of crankshaft, Flywheel: types, construction, criteria of design for solid and rim type, Connecting rod and connecting rod pins, Design of Journal and crankpin journals, Design of Piston assembly, Design aspects of Valves and valve train, Design of cam and camshaft, rocker arm

Clutch and braking system: Internal and external expanding rim clutches and brakes, Band type clutches and brakes, Frictional contact axial clutches, Cone clutches and brakes, Energy consideration and temperature rise, Frictional material

Suspension system: Stresses in helical spring, Deflection of helical spring, Extension and compression springs, Spring materials: estimation of tensile and torsion yield strength, Design of helical spring:

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critical frequency, Fatigue loading, Belleville, helical torsion, leaf spring and torsion bar, Energy store capacity of spring

Design of steering system: Steering mechanism and linkage design for various types of steering gear box, Arrangements and design criterion for mechanical and power steering types, Steering geometry for Ackerman's steering.

11. Vehicle Body Engineering

Car Body Details: Types: Saloon, Convertibles, Limousine, Estate van, racing and sports car.

Visibility: regulations, driver's visibility, test for visibility, Methods of improving visibility and space in cars.

Safety: safety design, safety equipment for car. Car body construction. Vehicle Aerodynamics: Objectives, Vehicle drag and types, various types of forces and moments, Effects of forces and moments, side wind effects on forces and moments, various body optimization techniques for minimum drag.

Wind tunnel testing: Flow visualization techniques, scale model testing. Component balance to measure forces and moments.

Bus Body Details: Types, mini bus, single decker, double decker, two level, split level and articulated bus.

Bus Body Lay Out: Floor height, engine location, entrance and exit location, seating dimensions.

Constructional details: Frame construction, Double skin construction-Types of metal section used.

Commercial Vehicle Details: Types of body, Flat platform, drop side, fixed side, tipper body, tanker body. Light commercial vehicle body types, Dimensions of driver's seat in relation to controls, driver's cabin design.

Body Materials, Trim And Mechanisms: Steel sheet, timber, plastics, GRP, properties of materials-Corrosion anticorrosion methods, scalation of paint and painting process, body trim items. Body mechanisms.

12. Quality and Road Transport Management

Motor Vehicle Act: Laws governing use of motor vehicle, Licensing of drivers, registration of vehicles, traffic rules and controls, accident causes, analysis and prevention, RTO and regulations, Offences, penalties and procedures, Rules and regulations, testing and passing of vehicle

Taxation and Insurance: Methods of laying vehicle taxation, Tax exemption, Service life of vehicles, Types of insurance, Accident claims and settlement, surveyor and loss assessor

Total Quality Management: Definition of TQM and its philosophy, TQM implementation, Core concept of TQM, Organizing for Quality and ISO, certification, Inspection and quality control

13. Vehicle Dynamics

Fundamentals of a motor vehicle: Modeling of a vehicle, Modeling approaches: lumped mass, vehicle coordinate system, earth fixed coordinate system, Forces acting on a motor vehicle, Tractive forces on the driving wheels, Transmission efficiency, Traction characteristics of a motor vehicle, Road

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resistance (total road loads), air resistance, rolling resistance, Equation of a motion of a motor vehicle, Tractive forces according to conditions of tire road grip, Normal reactions of the road

Traction dynamics of a motor vehicle: Force and power balance, Dynamic axle loads, Load transfer during acceleration, braking, constant velocity motions, conditions of traction, Layout analysis as front engine, rear engine, Front wheel and rear wheel drive.

Aerodynamics of a motor vehicle: Mechanics of air flow and pressure distribution on a vehicle, Aerodynamic forces, drag components, Aerodynamic aids, Drag side force, lift force, Pitch, yawing and rolling moment, Crosswind sensitivity

Fuel economy of a motor vehicle: Fuel economy characteristics, Fuel consumption equation, Effect of operating factors on fuel economy, Fuel consumption rate

Braking dynamics of a motor vehicle: Introduction to braking dynamics, Basic equations of motion of a motor vehicle: constant deceleration with wind resistance, Braking properties of a motor vehicle, braking forces on wheels, Equation of motion of a motor vehicle during braking, Characteristics of a motor vehicle braking dynamics :braking deceleration, braking time and braking distance, Braking force distribution between the wheels, Brakes factor, Tyre road friction, Requirements for braking performance, braking proportioning, Rear wheel lock up, pedal force gain, Braking methods, braking efficiency, New features in the design of brake systems

Stability of a motor vehicle: Lateral stability characteristics, Body lateral rolling, Effect of operating factors on lateral stability, Longitudinal stability

Steerability of a motor vehicle: Steerability characteristics, force analysis during steering, Rolling of the steerable wheels without slipping, Wheel lateral slip and ability of a motor vehicle to turn, Four wheel steer: low speed turning, high speed cornering, Relation between angles of turn of steerable wheels, Oscillations and stabilization of the steerable wheels

Suspension system: Human response to vibration, sources of vibration, Design and analysis of passive, semi active and active suspension using quarter car, bicycle model, half car and full car model, Independent suspension, Influence of suspension stiffness, suspension damping and tire stiffness, Air suspension system and their properties, Roll centre analysis

Cross country ability of a motor vehicle: Cross country, Trafficability requirements, trafficability test, Geometrical and tractive characteristics of trafficability, Effect of a motor vehicle design on its cross-country ability

Smooth running of a motor vehicle: Smooth running and its testing, Characteristics of the smoothness of run, Oscillations of a motor vehicle, Effect of design factors on smooth running, Future developments of motor vehicle design

14. Construction Equipment

Hydraulic system: Basic principle of hydraulics, Types of hydraulic system: open center system, closed center system, Hydraulic oil, Purpose types and working principle of Pumps, Valves, Actuators and Auxiliaries such as accumulator, filter, reservoir, oil cooler, hose pipe, tubes and couplers, seals and fluids

Pneumatic system: Basic principle of pneumatics, Compressed air: functions, properties and preparation, types and working principle of compressor, valves and actuators, Auxiliaries: accumulator, filter, lubricator, air cooler, receiver, pipe

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Introduction to heavy equipment: Classification of heavy equipment Application of heavy equipment, Terminologies used in heavy equipment, construction, types, applications and general specifications of dozer, loader, excavator, grader, road roller, asphalt paving equipment, crane, Special purpose vehicles: fork lift, fire brigade, dumper, tripper, truck

Chassis components: Transmission system: clutches, mechanical transmission, hydraulic assist transmission, power shift transmission, hydrostatic drive, torque converters, differential, final drive, power take-offs, special drives, Undercarriage: track chain, idler, sprocket, track rollers, tyres

Electronic components: Functions and symbols of pressure sensor, pressure switch, proportional solenoid, pump and valve controller, engine controller

Hydraulic and pneumatic circuit: Pneumatic circuits, Hydraulic circuit, Maintenance and troubleshooting of hydraulic & pneumatic system

Management of heavy equipment: Safety inspections, Special care and precautions, Equipment procurement methods and practices, comparison between leasing and hiring

15. Automobile Repair and Maintenance Management

Maintenance: Reliability, maintainability, total life cycle, routine, fixed time, break down and shut down maintenance, maintenance work load and budget, documentation and recording, maintenance audit

Preventive and Predictive maintenance: Condition monitoring, signature analysis, online and off-line maintenance, non-destructive test, wear particles and oil analysis, thermography, scanning electron microscope

Wear in vehicle: Types of wear: adhesive, oxidative, thermal, abrasive, pitting wear, Prevention of wear, Repair of wear: welding, brazing, metal spray, machining, boring, honing, Replacement of parts,

Hygiene and safety: Introduction to hygiene and safety, Workshop environment: health hazards and prevention, sanitation, ventilation, heating system and instrumentation, Chemical handling, fire protection, electrical accident and prevention, Protection from noise and air pollution, Safety requirements for workshop equipment and operations

Measuring instrument and testing equipment: Measuring instrument: Vernier caliper, micrometer, dial gauge, bore gauge, feeler gauge, plastic gauge, compression gauge, multimeter, oscilloscope, pressure gauge, hydrometer, thermometer, vibration transducer, decibel meter, speedometer, tachometer, Testing equipment: engine scanner, engine analyzer, engine dynamometer, chassis dynamometer, timing light, injector tester, exhaust gas analyzer, spark plug tester, battery tester, fuel injection pump (FIP) test bench, wheel balancer, wheel alignment tester

Service stations: Types of service stations, Functions, operations and activities of service stations, Workshop layout for service stations, Testing or diagnostic procedure, Overhauling process: engine and transmission, Machines used in servicing and lubrication, Denting and painting, Hand tools and equipment for service stations

Workshop management practice: Workshop documents and records: pre-delivery inspection, job cards, bill, satisfaction voucher, history sheet, warranty policy

16. Alternative Fuels and Vehicles

Introduction: Estimation of petroleum reserve-Need for alternate fuel-Availability and properties of alternate fuels-general use of alcohols- LPG-Hydrogen-Ammonia, CNG, and LNG-Vegetable oils and Biogas-Merits and demerits of various alternate fuels.

Alcohols: Properties as engine fuels, alcohols and gasoline blends-Combustion characteristics in engines-emission characteristics.

Natural Gas, LPG, Hydrogen and Biogas: Availability of CNG, properties modification required to use in engines-performance and emission characteristics of CNG using LPG in SI & CI engines. Performance and emission for LPG-Hydrogen-Storage and handling, performance and safety aspects. **Vegetable Oils:** Various vegetable oils for engines Esterification-Performance in enginesPerformance and emission characteristics.

Electrical and Solar Powered Vehicles: Layout of an electric vehicle-Advantage and limitations. Specifications-System component, Electronic control system-High energy and power density batteries-Hybrid vehicle-Solar powered vehicles

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माथि उल्लेखित पाठ्यक्रमका एकाइहरुबाट सोधिने प्रश्नहरुको संख्या निम्नानुसार हुनेछ

पाठ	प्रश्नभार (Weightage)	सोधिने प्रश्नहरु			कै.
		वस्तुगत (Objective)		विषयगत (Subjective)	
		बहुवैकल्पिक प्रश्न(MCQ) (प्रश्न x अंक)	छोटो उत्तर (प्रश्न x अंक)	लामो उत्तर (प्रश्न x अंक)	
१	5	5 x 1			
२	10	5 x 1	1 x 5		
३	5	5 x 1			
४	5	5 x 1			
५	10	5 x 1	1 x 5		
६	15	5 x 1		1 x 10	
७	15	5 x 1		1 x 10	
८	15	5 x 1		1 x 10	
९	15	5 x 1		1 x 10	
१०	10	5 x 1	1 x 5		
११	10	5 x 1	1 x 5		
१२					
१३	10	5 x 1	1 x 5		
१४	10	5 x 1	1 x 5		
१५	10	5 x 1	1 x 5		
१६	5	5 x 1			
जम्मा	150	75 x 1 = 75	7 x 5 = 35	4 x 10 = 40	

18/07/2021
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MP

प्रयोगात्मक परीक्षाको पाठ्यक्रम

समय: ६० मिनेट

पूर्णाङ्क: ५०

उत्तीर्णाङ्क: २५

S.N	Topic	Marks	Times (Minutes)
1	Machine Parts Identification	5	5
2	Automobile Parts Identification	15	15
3	Use of Workshop Tools	10	10
4	Automobile Troubleshooting	15	20
5	Automobile System Briefing	5	10
Total		50	60

1. Machine Parts Identification

परीक्षार्थीले Layout गरी राखिएका विभिन्न Machine Parts को Technical नाम लेख्नु पर्ने हुन्छ र दिइएको Parts कहाकहा प्रयोग हुन्छ भन्ने समेत खुलाउनु पर्नेछ । यसमा ५ प्रकारका सामानहरू देखाइनेछ र प्रत्येक नाम र प्रयोग सहि भएमा १ अंक प्रदान गरिनेछ ।

2. Automobile Parts Identification

परीक्षार्थीले Layout गरी राखिएका विभिन्न Automobile Parts को नाम लेख्नुपर्ने हुन्छ र दिइएको Parts कहाकहा प्रयोग हुन्छ भन्ने समेत खुलाउनु पर्नेछ । यसमा १५ प्रकारका सामानहरू देखाइनेछ र प्रत्येक नाम र प्रयोग सहि भएमा १ अंक प्रदान गरिनेछ ।

3. Use of Workshop Tools

परीक्षार्थीलाई Workshop मा प्रयोग हुने कुनै ५ वटा tools प्रयोग गर्न लगाईनेछ । प्रयोग सहि भएमा २ अंकको दरले Marks प्रदान गरिनेछ ।

4. Automobile System Troubleshooting

परीक्षार्थीहरूलाई कुनै Automobile को ३ वटा Defective Systems देखाईनेछ र परीक्षार्थीले ति Defect हरू पत्ता लगाई समस्याको समाधान दिनुपर्नेछ । सहि Defect पहिचान गरेमा १ अङ्क, Defect को कारण पहिचान गरेमा २ अङ्क र सो को समस्याको सहि समाधान दिएमा २ अङ्क प्रदान गरिनेछ ।

5. Automobile System Briefing

परीक्षार्थीहरूलाई Automobile को कुनै एउटा System को बारेमा Briefing गर्न लगाईनेछ । System को सहि Introduction दिएमा १ अङ्क, System को Componentsहरू सहि उल्लेख गरेमा २ अङ्क र सो System को Working Mechanism सहि वर्णन गरेमा २ अङ्क प्रदान गरिनेछ ।

समाप्त

✓ ✓ २

✓ ८/८