

नेपाली सेना

प्रा.उ.से.मेकानिकल ईन्जिनियर (खुला) पदको लिखित परीक्षाको पाठ्यक्रम

समय : २ घण्टा ३० मिनेट

पुर्णाङ्क : १००

उत्तीर्णाङ्क : ४०

यो पाठ्यक्रम नेपाली सेनाको विभिन्न ईकाईहरूमा रिक्त रहेको प्रा.उ.से. मेकानिकल ईन्जिनियर (खुला) पदका उम्मेदवार छनौट परीक्षाको लागि निर्धारण गरिएको हो । लिखित परीक्षामा सरिक हुने उम्मेदवारहरूको पेशा सम्बन्धि 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 गराईने छ ।
- (ग) प्रश्न पत्र निर्माण गर्दा पाठ्यक्रममा समावेश भएका सबै विषयहरूलाई समेटिनेछ ।
- (घ) नेपाली सेनाको आवश्यकता तथा विविध परिस्थितमा नेपाली सेना अनुकूल हुने गरी उल्लेखित विवरणहरूमा हेरफेर हुन सक्नेछ ।
- (ङ) पाठ्यक्रमको रूपरेखा देहायमा उल्लेख गरे अनुसार हुनेछ ।
- (च) पाठ्यक्रम लागु मिति २०७३/१/१२ गते ।

विषय	पुर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली		प्रश्न संख्या X अङ्क	समय
पेशा सम्बन्धी	१००	४०	वस्तुगत (Objective)	बहुवैकल्पिक प्रश्न (MCQs)	४० प्रश्न X १ अङ्क = ४०	२ घण्टा ३० मिनेट
			विषयगत (Subjective)	छोटो उत्तर	६ प्रश्न X ५ अङ्क = ३०	
				लामो उत्तर	३ प्रश्न X १० अङ्क = ३०	

पेशा सम्बन्धी विषयको पाठ्यक्रम

(SYLLABUS FOR MECHANICAL ENGINEER)

1. Material Science and Metallurgy

- 1.1 Basic concepts on structure of solids
- 1.2 Crystalline materials
- 1.3 Imperfections in atomic arrangement
- 1.4 Slip and Twinning
- 1.5 Dislocation
- 1.6 Points and Surface Defects
- 1.7 Alloys and binary phase diagrams
- 1.8 Iron-carbon equilibrium diagram
- 1.9 Types of steel
- 1.10 Heat treatment of steels
- 1.11 Plastics
- 1.12 Ceramics and composite materials

2. Machine Component Design and Drawing

- 2.1 Types of projection, sectional views, auxiliary views
- 2.2 Developments and Intersections
- 2.3 Production Drawings
- 2.4 Terminologies of mechanisms
- 2.5 Mobility and Degrees of Freedom
- 2.6 Design Process
- 2.7 Factors affecting choice of materials for design: Strength, Toughness, Durability, Hardness
- 2.8 Loading: Tensile, Compressive, Shearing, Bending, Bearing and Torsion
- 2.9 Common Types of Failure: theories of failure, stress concentration effects, ductile and brittle materials, factor of safety

3. Production Engineering

- 3.1 Workshop hand tools. basic hand operations
- 3.2 Metal Forming: basic principles of forging, drawing and extrusion
- 3.3 Metal Casting: Gating and Riser design, melting furnaces
- 3.4 Metallurgy of Welding
- 3.5 Principles of Gas, Arc, Shielded Arc Welding, Weldability
- 3.6 Machine tools: Lathe, Shaper, Milling, Grinding, Drilling Machines.
- 3.7 Metal Cutting: Turning, Methods of Screw Production, Drilling, Boring, Milling, Gear Manufacturing, Production of flat surfaces
- 3.8 Grinding and finishing processes
- 3.9 Computer Controlled Manufacturing Systems - CNC, DNC, FMS, Automation and Robotics
- 3.10 Cutting Tools Materials, Tool Geometry, Mechanism of Tool Wear, Tool Life and Machinability, Jigs and Fixtures.
- 3.11 Fits and tolerances, Linear Measurement: Block Gages, Length Bars, Comparators

4. Industrial Engineering

- 4.1 Plant Location and Plant Layout Design
- 4.2 Production Planning and Control: Selection of materials, methods, machines and manpower
- 4.3 Product development, Break-even analysis, Capacity planning
- 4.4 Network methods: PERT, CPM
- 4.5 Control Operations: Inventory control ABC analysis, EOQ model, Materials requirement planning. Job design, Job standards, Work measurement
- 4.6 Quality Management - Quality analysis and control
- 4.7 Forecasting Techniques: Requirements of forecasting
- 4.8 Time series and moving average methods, regression analysis
- 4.9 Value engineering: Value analysis for cost/value

5. Thermodynamics

- 5.1 Basic concepts, open and closed systems, heat and work
- 5.2 Zeroth, First and Second Law of thermodynamics
- 5.3 Properties of ideal gases and vapors
- 5.4 Thermodynamic Cycles: Carnot cycle, Otto cycle, Diesel cycle, Brayton cycle, Rankine cycle
- 5.5 Refrigeration: Reversed Carnot cycle, vapor compression cycle, absorption refrigeration systems, Refrigerants and their properties
- 5.6 Air Conditioning: Psychometric properties and psychometric chart, heating, cooling, humidification and dehumidification process
- 5.7 IC engines: Classifications, components, two stroke and four stroke operations, performance of IC engines, Ignition system, Cooling system, Lubrication system. Pre-ignition, Detonation and Diesel-knock, Fuel injection and Carburation, Supercharging
- 5.8 Engine Cooling, Emission and Control

6. Fluid Mechanics

- 6.1 Properties and classification of fluids, forces on immersed surfaces, center of pressure, buoyancy, elements of stability of floating bodies
- 6.2 Equations of Fluid Flow: types of flow, continuity equation, Bernoulli's equation, and momentum equation, fully developed flow through pipes, pressure drop calculations, measurement of flow rate and pressure drop
- 6.3 Elements of boundary layer theory, integral approach, laminar and turbulent flows, separations
- 6.4 Dimensionless numbers, dimensional analysis
- 6.5 Flow measurement: Pitot-static tube, Orifice, Venturimeter, Nozzle, Rotameter

7. Hydraulic and Electric Machines

- 7.1 Performance, operation and control of Pelton, Francis, Kaplan and Cross flow turbines
- 7.2 Performance, operation and control pumps: Centrifugal pump and Reciprocating pump, Hydraulic ram

- 7.3 DC Motors: shunt field, series field and compound field motors, torque-speed characteristics
- 7.4 DC Generators: shunt, series and compound field machines, voltage/speed/load characteristics, effects of variable load, variable torque
- 7.5 Synchronous and Induction Machines: Basic structure of synchronous machines, Generator on isolated load, Generator on large system, Synchronous motor

8. Maintenance Management

- 8.1 Maintenance objectives and maintenance costs
- 8.2 Workshop Layout
- 8.3 Types of maintenance schemes
- 8.4 Basic maintenance decisions
- 8.5 Occupational safety and health

9. Professional Practice

- 9.1 Ethics and Professionalism: perspective on morals, codes of ethics and guidelines of professional engineering practice
- 9.2 Legal aspects of Professional Engineering in Nepal: Engineering Council Act, Provision for private practice and employee engineers
- 9.3 Contract law
- 9.4 Tendering and contract documents

10. Renewable Energy

- 10.1 Solar Energy and its application
- 10.2 Biomass Energy Technologies
- 10.3 Wind Energy Systems
- 10.4 Micro and Small Hydroelectric Systems
- 10.5 Economics of Renewable Energy Systems

11. Automobile Engineering

11.1 Automotive Engine Systems

- 11.1.1 Engine Construction and Operation: Four stroke SI and CI engines, Working principle, function, materials, constructional details of engine components, Valve timing diagram, Firing order and its significance
- 11.1.2 Fuels and Combustion: Properties and rating of fuels (petrol and diesel), chemical energy of fuels, properties of air/fuel mixture
- 11.1.3 Combustion in CI Engines, Knock, methods of controlling knock
- 11.1.4 Intake and Exhaust system of automotive engines
- 11.1.5 Carburetion and Gasoline Injection
- 11.1.6 Diesel Injection
- 11.1.7 Engine Performance
- 11.1.8 Lubrication and Cooling
- 11.1.9 Supercharging and Scavenging

11.2 Automotive Transmission

- 11.2.1 **Clutch and Gear Box:** Requirements of transmission system, Different types of clutches, Objective of the gearbox, Determination of gear ratios for vehicles, Performance characteristics at different speeds, Different types of gearboxes operation, Differentials
- 11.2.2 **Hydrodynamic Drive:** Fluid coupling, principle of operation, constructional details, torque capacity, performance characteristics, reduction of drag torque, Torque converters, Principle of operation, constructional details, performance characteristics, converter coupling, multistage and poly phase torque converters
- 11.2.3 **Automatic Transmission:** Ford–T model gearbox, Wilson gearbox, Automatic over drive, Hydraulic control system, Applications (Chevrolet Turbo glide transmission, Toyota “ECT-i” Power glides Transmission (Intelligent Electronic control system), Mercedes Benz Automatic transmission, Hydraulic actuation system)
- 11.2.4 **Hydrostatic and Electric Drives:** Hydrostatic drive: principle, types, advantage and limitations, Comparison of hydrostatic drive with hydrodynamic drive. Construction and working of typical Janny hydrostatic drive, Electric drive, Principle of early and modified Ward Leonard Control system

11.3 Automotive Chassis

- 11.3.1 Automotive Suspension Systems
- 11.3.2 Automotive Steering Systems
- 11.3.3 Automotive Brakes: ABS Brake Diagnosis and Service
- 11.3.4 Tires and Wheels: Tubes, tires and speed ratings; Tire and Wheel Inspection, Balance, Service and Repair
- 11.3.5 Vehicle Aerodynamics: Car Body Types, Bus Body Types, Commercial Vehicle Types, Body Materials, Trim and Mechanisms.

11.4 Automotive Electrical Systems

- 11.4.1 Storage Battery, Charging System (Cutout, Voltage and current regulators, Bridge rectifiers)
- 11.4.2 Starting System (Behavior of starter during starting, principle and construction of starter motor)
- 11.4.3 Ignition System (Spark plugs ignition, Electronic ignition systems, programmed ignition, distributor less ignition)
- 11.4.4 Lighting System and Accessories (Fusing of circuits, low and high voltage automotive cables, wiring diagram for typical automotive wiring system, headlamp, fog lamps, temperature gauge, oil pressure gauge, fuel gauge, speedometer, odometer)

यस पेशा सम्बन्धी विषयको पाठ्यक्रमका एकाईहरूबाट सोधिने प्रश्नहरूको संख्या निम्नानुसार हुनेछ ।

एकाइ नं. (Unit No.)	अङ्कभार (Weightage)	बहुवैकल्पिक प्रश्न (MCQs) को संख्या	छोटो उत्तर प्रश्नको संख्या	लामो उत्तर प्रश्नको संख्या
१	३५	१५	६ प्रश्न X ५ अङ्क	३ प्रश्न X १० अङ्क
२				
३				
४				
५	२०	१०		
६				
७				
८	२५	१०		
९				
१०				
११	२०	५		
जम्मा	१००	४० प्रश्न x १ अङ्क = ४० अङ्क	६ प्रश्न x ५ अङ्क = ३० अङ्क	३ प्रश्न x १० अङ्क = ३० अङ्क