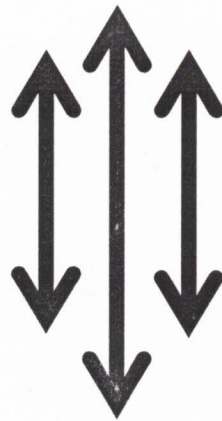


नेपाली सेना

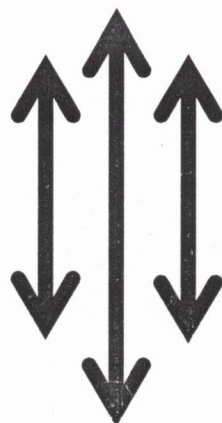
श्री भर्ना छनौट निर्देशनालय कार्यरथी विभाग

जंगी अड्डा



प्रा.उ.से. मेकानिकल ईन्जिनियर (खुल्ला) पदको लिखित परीक्षाको

पाठ्यक्रम



२०७८

## नेपाली सेना

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

समय: ४ घण्टा १५ मिनेट

पुर्णाङ्क: १५०

उत्तीर्णाङ्क: ६०

यो पाठ्यक्रम नेपाली सेनाको 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 गराइने छ ।
- (ग) प्रश्नपत्र निर्माण गर्दा पाठ्यक्रममा समावेश भएका सबै विषयहरूलाई यथासंभव समेटिनेछ
- (घ) वस्तुगत र विषयगत संयुक्त रूपमा पूर्णाङ्क र उत्तीर्णाङ्क कायम गरिनेछ ।
- (ङ) वस्तुगत र विषयगत परीक्षाको पाठ्यक्रम एउटै हुनेछ ।
- (च) वस्तुगत 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	पुर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली		प्रश्न संख्याxअंङ्क	समय
पेशा सम्बन्धी	७५	६०	वस्तुगत (Objective)	बहुवैकल्पिक प्रश्न (MCQs)	७५ प्रश्न x १ अंङ्क = ७५	१ घण्टा १५ मिनेट
	७५		विषयगत (Subjective)	छोटो उत्तर	९ प्रश्न x ५ अंङ्क = ४५	३ घण्टा
				लामो उत्तर	३ प्रश्न x १० अंङ्क = ३०	



## नेपाली सेना

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

#### 1. Machine Design and Drawing

- 1.1 Materials Selection: Properties of materials, Evaluation methods for materials selection, Cost versus performance, Cost and value analysis
- 1.2 Design analysis: Types of loads and stresses, theories of failure, factor of safety.
- 1.3 Design of machine components: Design of parts subjected to tension, compression, shear, bending. Design of shafts, keys, splines, couplings, fasteners, power screws, helical compression springs, knuckle joints, riveted joints, welded connections, clutches, brakes and flywheels.
- 1.4 Design of power transmission elements: Belt drives, selection of flat and V belts, design of pulleys and flywheels, design of gear drives, spur, helical, bevel and worm gear drives.
- 1.5 Design of bearings: Hydrodynamic journal bearings, pressure fed and self-contained bearings and rolling contact bearings
- 1.6 Load lifting devices: Selection of steel wire ropes for hoists and cranes, crane hooks, design of hook block, sheaves and rope winding drums.
- 1.7 Types of projections, production drawings, Computer Aided Design
- 1.8 Design standardization: Importance of standardization, international organizations for standardization

#### 2. Industrial Engineering

- 2.1 Production systems: Type of the project, type of the job order. Features of control system for different types of production system. Production planning and Control (PPC) Section. Conventional organizational structure for PPC. Variation in organization structure. Central and decentralized PPC.
- 2.2 Forecasting: Techniques used for forecasting, trend line, market survey, exponential smoothing, correlation analysis, Historical estimate, seasonability distribution.
- 2.3 Quality Management: Concept of quality, statistical quality control, acceptance sampling, zero defects, six sigma, quality circle, quality assurance, total quality management
- 2.4 Ergonomics: Productivity and working environment, man-machine systems, illumination, noise and vibration, ventilation, air conditioning, temperature control, anthropometry, work-space layout
- 2.5 Safety: Workplace hazards and risks, hazard identification and risk assessment, risk control, causes and prevention of accidents, fire prevention and firefighting equipment, electrical safety, safe handling of chemicals, material handling and material safety data sheets





### 3. Maintenance Management

- 3.1 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
- 3.2 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
- 3.3 Corrosion: Types of corrosion, corrosion testing, control and prevention
- 3.4 Tribology: Surfaces, friction and wear, lubrication, surface topography measurement
- 3.5 Total Productive Maintenance (TPM): Types of losses, measures to control losses, basics of TPM, cost estimation and safety measures

### 4. Environmental engineering

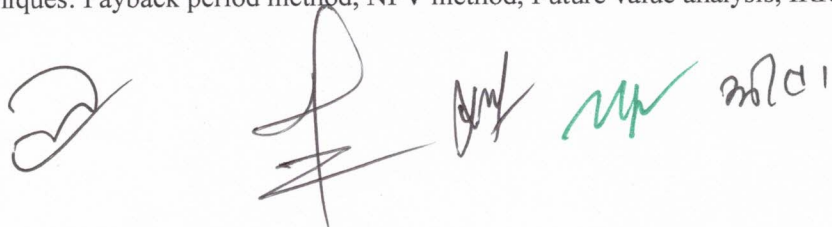
- 4.1 Air Pollution: Pollution from combustion and atmospheric pollution, types of pollutants, sources of pollutants, particulate control, control of gaseous pollutants, indoor air pollution control
- 4.2 Noise Pollution: Measurement of noise, noise control
- 4.3 Water Pollution: Causes and effects, Waste water treatment
- 4.4 Solid Waste Management: Recycling, energy recovery, incineration, landfilling
- 4.5 Global impacts: Green-House Effect, acid rain, climate change, ozone layer depletion
- 4.6 Environmental Impact Assessment.

### 5. Energy Resources and Planning

- 5.1 Energy consumption scenario of Nepal.
- 5.2 Conventional, Non-Conventional and Nuclear energy.
- 5.3 Energy Security in the context of Nepal.
- 5.4 Solar, Biomass, wind energy, Geo thermal Energy, Hydropower, Coal
- 5.5 Hydroelectricity, national potentials, achievements and utilization
- 5.6 Methods of enhancing energy efficiency & energy conservation

### 6. Engineering Economics

- 6.1 Time Value of Money: Simple interest, Compound interest, Continuous compound interest
- 6.2 Project Evaluation Techniques: Payback period method, NPV method, Future value analysis, IRR method



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6.3 Benefit and Cost Analysis: Cost benefit ratio, breakeven analysis, make or buy decision

6.4 Engineering economic decisions

6.5 Corporate tax system in Nepal

6.6 Depreciation and its types

## 7. Material Science and Metallurgy

7.1 Types of materials and material selection

7.2 Imperfections in atomic arrangement: Slip and twinning, dislocation, points and surface defects

7.3 Mechanical properties and testing: Tension, impact, fatigue and hardness tests

7.4 Cold working and hot working

7.5 Types of steel

7.6 Phase transformation and heat treatment: Iron-carbon equilibrium diagram, hardening, tempering, annealing and normalizing

## 8. Fluid Mechanics

8.1 Fluid properties: Viscosity, surface tension, compressibility, Vapor Pressure

8.2 Fluid statics: Pressure variations in static fluid, pressure head, manometer, force on submerged surfaces

8.3 Equations of fluid flow: Types of flow, continuity equation, Bernoulli's equation, and momentum equation

8.4 Viscous effects: Reynold's number, boundary layer, frictional resistance to flow in pipes

8.5 Flow measurement: Pitot-static tube, orifice, venturimeter, nozzle, rotameter

## 9. Thermodynamics and Heat Transfer

9.1 Basic concepts: Thermodynamic system, thermodynamic property, pure substance, laws of thermodynamics, heat engine, refrigerator and heat pump

9.2 Refrigeration: Reversed Carnot cycle, vapor compression cycle, absorption refrigeration systems, refrigerants and their properties

9.3 Air Conditioning: Psychometric properties and psychometric chart, heating, cooling, humidification and dehumidification process, air conditioning systems

9.4 Thermodynamic cycles: Carnot cycle, Otto cycle, Diesel cycle, Brayton cycle, Rankine cycle

9.5 IC engines: Classifications, components, two-stroke and four-stroke operations, performance of IC engines

9.6 Modes of heat transfer: Conduction, convection and radiation

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## 10. Workshop Technology and Metrology

- 10.1 Machine tools operation and application: Lathe, shaper, milling, grinding, drilling machines
- 10.2 Metal joining operation and application: Oxy-acetylene welding and arc welding
- 10.3 Limits, fits, tolerances and gauges
- 10.4 Linear measurement: Block Gages, length bars, comparators
- 10.5 Angular measurement: Bevel protractor, sine bar, spirit level, clinometers and angle gauges
- 10.6 Errors in measurement

## 11. Advance Machines and Machining Techniques

- 11.1 Numerical Control (NC) and Computer Numerical Control (CNC) machines, CNC machine tools, machine control units, general introduction to CNC programming
- 11.2 Modern Machining techniques: Ultrasonic machining, Abrasive water jet machining, electro chemical machining, electrical discharge machining, laser beam machining, electron beam machining, plasma arc machining

## 12. Hydraulic and Electric Machines

- 12.1 Working principle and characteristic of water turbines: Pelton, Turgo, Francis, Kaplan and Cross flow turbines
- 12.2 Working principle and Characteristic of Pumps: Centrifugal pump and Reciprocating pump, Hydraulic ram
- 12.3 DC Motors: Shunt field, Series field and Compound field motors, Torque-speed characteristics
- 12.4 DC Generators: Shunt, Series and Compound field machines, Voltage/speed/load characteristics, Effects of variable load, variable torque
- 12.5 Synchronous and Induction Machines: Basic structure of synchronous machines, Generator on isolated load, Generator on large system, Synchronous motor

## 13. Instrumentation and Control

- 13.1 Basic concepts of control system: Classification, transfer function, block diagram and signal flow graph





13.2 Sensors and transducers: Mechanical detector-transducer elements, resistance, variable inductance, mutual inductance, capacitive, piezo-electric, linear variable differential, thermoelectric, Hall effect, photo electric and photo emissive transducers, strain gauges

13.3 Basic concepts of microprocessors and microcontrollers and their applications

13.4 Basic Boolean algebra and numbering systems, basic logic gates

13.5 Control system: Components, derivative, proportional and integral controllers and their combinations, hydraulic and pneumatic control systems, response characteristics of control systems

#### **14. Automobile Engineering**

14.1 Classification of automobiles and their features, parts and components of engine

14.2 Fuel Systems: Fuel system for petrol engine, fuel injection for diesel engine, petrol fuel injection system

14.3 Cooling and lubrication systems for engines

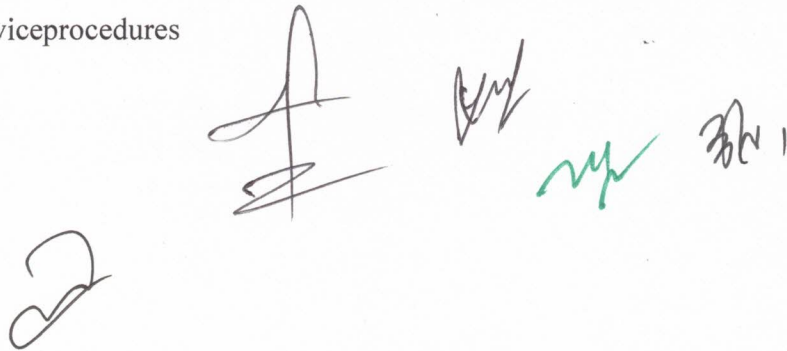
14.4 Electrical system : Battery, ignition system, charging system, accessories

14.5 Chassis layout and frames, suspension system, wheels, tyres and brake

14.6 Transmission system and steering system

14.7 Automobile emission and its control: combustion, constituents of exhaust, effect of air fuel ratio and driving mode, control of automobile emission

14.8 Automobile service stations and service procedure: types of service stations, location and layout, equipment, tools, service procedures



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माथी उल्लेखित पाठ्यक्रमका एकाइहरूबाट सोधिने प्रश्नहरूको संख्या निम्नानुसार हुनेछ

विषय	परिक्षा प्रणाली			कै
	वस्तुगत(Objective)	विषयगत (Subjective)		
	बहुवैकल्पिक प्रश्न (MCQs) (प्रश्न X अंक)	छोटोउत्तर (प्रश्न X अंक)	लामो उत्तर (प्रश्न X अंक)	
1	5x1	1x5	-	
2	5x1	1x5	-	
3	5x1		1x10	
4	5x1	1x5	-	
5	5x1		-	
6	5x1	1x5	-	
7	5x1	1x5	-	
8	5x1	1x5	1x10	
9	5x1		-	
10	5x1	1x5	-	
11	5x1		-	
12	5x1	1x5	-	
13	5x1		-	
14	10x1	1x5	1x10	
Total	75 x 1 = 75	9 x 5 = 45	3 x 10 = 30	

प्रयोगात्मक परिक्षाको पाठ्यक्रम

समय: ६० मिनेट

पूर्णाङ्क: ५०

उत्तीर्णाङ्क: २५

S.N.	Topic	Marks	Time (Minutes)
1	Machine Component Identification and it's application	10	10
2	Machine tools & accessories Identification	10	10
3	Machine operation	10	10
4	Technical drawing	15	20
5	Viva	5	10
<b>Total</b>		<b>50</b>	<b>60</b>

