श्री कार्यरथी विभाग, भर्ना छनौट निर्देशनालय
जंगी अड्डा
प्रा.हु. यान्त्रिक सेल पद (खुला) को पेशा सम्बन्धि लिखित परिक्षाको पाठ्यक्रम

समय:– ३ घण्टा

पुर्णाङ्क – १००
उतिर्णाङ्क – ४०

उद्देश्यहरु:

यो पाठ्यक्रम नेपाली सेनाको प्रा.हु. यान्त्रिक सेल पदको उम्मेदवार छनौट परीक्षाको लागि निर्धारण गरिएको हो । प्रा.हु. पदका उम्मेदवार छनौटको लिखित परीक्षामा सरिक हुने उम्मेदवारहरुको पेशा सम्बन्धी विषयलाई आधार मानि प्रश्नहरु सोधिनेछन् ।

(क) लिखित परीक्षाको माध्यम नेपाली/अंग्रेजी भाषा हुनेछ ।

(ख) निम्न पत्रहरुको पाठ्यक्रमको रुपरेखाअनुसार विषयवस्तु हुनेछ ।

(ग) लिखित परीक्षाबाट छनौट भएका उम्मेदवारहरुलाई मात्र अर्को चरणको परीक्षामा सम्मिलित गराइने छ ।

(घ) प्रश्नपत्र निर्माण गर्दा सम्भव भएसम्म पाठ्यक्रममा समावेश भएका सबै विषय समेटिने छ ।

(ङ) नेपाली सेनाको तत्कालीन आवश्यकता तथा विविध परिस्थितिमा नेपाली सेनाको अनुकूल हुने गरी उल्लेखित विवरणहरुमा हेरफेर हुन सक्नेछ ।

(च) पाठ्यक्रम लागू मिति : २०६९/२/१६ गतेदेखि ।

प्रश्नको किसिम	प्रश्न संख्या र अंक	कैफियत
लामो उत्तर दिनु पर्ने प्रश्न	५ x १० = ५०	
छोटो उत्तर दिनुपर्ने प्रश्न	५ x ५ = २५	
वस्तुगत	२५ x १ = २५	

श्री कार्यरथी विभाग, भर्ना छनौट निर्देशनालय
जंगी अड्डा
प्रा.हु. यान्त्रिक सेल पद (खुला) को पेशा सम्बन्धि लिखित परिक्षाको पाठ्यक्रम

1. Theory of mechanics **5%**

Composition and resolution of force, Friction, Simple lifting machine, Plane motion, Motion or rotation and its application, Balancing of rotation bodies, Center of gravity, Torque, Couple, Momentum, Pressure, Energy , Laws of motion

2. Machine Design **8%**

Riveted Joint: Introduction, Groups of fastening, Function of rivets, Methods of riveting, Types of riveted Joint, Related Terminology

Welded Joint: Introduction, Advantages and disadvantages, Types of welding joints Lever: Introduction, Principle of lever, Uses of lever, related problems

Spring: Introduction, Application, Types of spring, Advantages / Disadvantages, Service conditions, spring materials, Terminology, springs in series / parallel, related problems

Rope drive: Introduction, Types of ropes and advantages, Stress in wire ropes, related problems

Belt drive: Introduction, Types of belt drives and belt, Materials for belt drive, Coefficient of friction, between belt and pulley, Velocity ratio of belt drive, Power transmitted by a belt

Chain drive: Introduction, Advantages / disadvantages of chain drive over rope and belt drive, Pitch of the chain, Relationship between pitch and pitch circle diameter, Length of chain and center distance, Classification of chain, Related problem

Gear drive: Introduction, Advantages and Disadvantages, Classification of gears, Terminology, Design consideration for a gear drive, Related problems

Bearing: Introduction, Classification of bearing, Bearing lubricants, Terminology, Related problem Seal and Gasket: Introduction of Seal, Types of Seal, Introduction of Gasket, Requirements of Gasket, Materials of Gasket, Types of gasket, Engine head gasket, Engine oil pan gasket, Engine manifold gasket, Pump gasket, other gaskets

3. Automobile fundamentals **20%**

Introduction of heat engine, Types of engine, Function of engine components, Introduction of piston, crankshaft, connecting rods, cam shaft, valve
Two stroke, four stroke, & Otto cycle

Various systems: Cooling system, Lubrication system, Fuel supply system, Transmission system, Clutch, Gear box, Suspension system, Brake system, steering system
Repair & adjustment of automobile system

Recognize, remove and replace leaf spring and shock absorber
Recognize, remove and replace the cooling system components: Radiator, Water pump, Thermostat valve,
Drive belts
Identify, repair of brake system components and adjusting the brake: Recognize and test the master cylinder,
Recognize, remove and replace steering box and adjusting steering system: Checking and adjusting the front wheel, toe-in and toe-out
Recognize, remove a mechanical fuel pump
Carburetor adjustment and its type
Ignition timing, how to tune up engine, adjust clutch free play, compression ratio, engine trouble, possible cause and fault finding
Definition of B.H.P., I.H.P. mechanical and volumetric efficiency
Diesel engine: Function of compression ignition (C.I.) engine, Comparison of C.I. and S.I. engine, Merit and demerit of diesel and petrol engine, Fuel injection pump (F.I.P.), Introduction of F.I.P. and its function
Setting of F.I.P., Test of F.I.P. , F.I.P. system and its function, Injector & its construction, function
Test of injector, fault finding and remedies, Governor & its Operation, Idling front control engine trouble and its possible causes,
Compression of petrol and diesel engine,
Two stroke and four stroke diesel

4. Vehicle electrical & electronics 15%

Introduction of battery: Finding out defective battery, the use of voltmeter, to check the state of vehicle battery
Recognize the types of wiring employment and method of effective connection
Ignition system: Types of ignition system, Distributor less ignition system, Finding out defect on ignition system
Diagnose faults in minor assembly in starter circuits' switch
Diagnose faults in minor charging system
Diagnose faults in minor lighting system: Head light, Side lights, Tail numbers of convey
Diagnose faults in minor assembly level in: Windscreen wiper, Horn, Direction indicator, Fuel and temperature gauge, Brake light, Oil and choke warning light, Adjust the alignment of vehicle head lamps
Fault and possible remedies
Electronic fuel injection: Controls, Circuit diagrams, Faults and remedies
Basic concept of electronics:
Instrument and components like Oscilloscope cope, voltmeter, Ammeter, Ohmmeter, Pulse generator, function generator, semi conductor devices, resistor, capacitor, Inductor, Non-linear device, diode, Zenor diode, BJT, FET, operational amplifier, ADC, DAC .
Digital electronics, number system, Introduction to logic gates, Memory devices, L.C.D. display system
Instrumentation

- Basic Instrumentation
- Input, Processing and output unit
- Signal and system
- Sensor classification of transducer
- Force deflection transducer
- Variable resistance and sliding concept devices

- Resistance gauge
- Thermister and thermocouple

5. Internal Combustion Engine **30%**

Heat engine: Basic engine Nomenclature, I.C. engine classification, Four stroke cycle S.I. engine
Four stroke cycle C.I. engine, Two stroke engine, Comparison between S.I. and C.I. engine, Difference between S.I. engines
Air standard cycles: Introduction, The carnot cycle, The otto cycle, The diesel cycle
Fuels: Introductions, Structure of petroleum, Fuels for spark ignition engine
Combustion in C.I. engines: Introduction, Combustion in the C.I. engine, Air fuel ratio in C.I. engine
Delay period or ignition lag, Variable affecting delay period, Diesel knock
Comparison of S.I. and C.I. engines
Combustion in S.I. engines, Introduction, Ignition limits, Stage of combustion in S.I. engines, Concept of combustion quality, Effect of engines variables on ignition lag, Effect of engine variables on flame, propagation, Cycle to cycle variations, Abnormal combustion, Detonation or Knocking, Effects of detonation, Theories of detonations, Chemistry of knock or detonation, Effect of engine variable on knock or detonation, Control of detonation, Knock evaluation in a CFR engines
Carburetion: Introduction, A simple elementary carburetor, complete carburetor, Calculation of the air fuel ratio for a simple carburetor, Air craft carburetor
Fuel Injection: Introduction, Heat release pattern & fuel injection, Requirements of a diesel injection system, Types of injection system, Fuel pump, Types of fuel injectors, Types of Nozzles, Spray formation
Spray direction, Injection timing
IGNITION: Introduction, Ignition system requirements Battery ignition system. Magneto-ignition system.
ENGINE COOLING SYSTEM: Introduction, Variation of gas temperature, Area of heat flow, Heat transfer Piston and cylinder temperature
Modern trends in automobile industry.
Turbo charging concept
SUPERCHARGING: Introduction, Object of supercharging, Thermodynamic cycle with supercharging,
Supercharging of S. I. engine, Supercharging of C.I. engine, Effect of supercharging on performance of the
Engine, Supercharging limit, Supercharging of C.I. engines

6. Heavy construction equipment **10%**

General idea about dozer, loader, grader, excavator, roller, crane, fork lift, trailer, scrapper, Classification and Requirements of these Vehicles: Power plants, chassis and transmission layout, Principles of operation
Hydraulic circuit of heavy equipment, power train, construction detail,
Fault findings and trouble shootings of general problems,
Repair & Maintenance of heavy construction equipment
Land clearing machines: Bush cutter, stumpers, Tree dozer, Rippers.
scrapers, drag and self powered types – Dump track and dumpers – Loaders, single
bucket, multi bucket and rotary types- Power and capacity of earth moving machines.
Scrapers and Graders: Scrapers, elevating graders, self powered scrapers and graders.
Shovels and Ditchers : Power shovel, revolving and stripper shovels – drag lines – ditchers –
Capacity of shovels.

7. Automotive Pollution and Its Control 6%

Introduction: Pollutants-sources-formation-effects-transient operational effects on pollution.
Combustion and Pollutant Formation: Chemistry of SI engine Combustion, HC and CO formation in 4 stroke and 2 stroke SI engines, NO formation in SI Engines, Effect of operating variables on emission formation.
CI engine Combustion and Emissions: Basic of diesel combustion-Smoke emission in diesel engines-Particulate emission in diesel engines.
Effect of operating variables on emission formation.
Control Techniques for SI and CI: Design changes, exhaust gas re-circulation, fumigation, air injector PCV system-Exhaust treatment in SI engines-Thermal reactors-Catalytic converters, Catalysts, Use of unleaded petrol. Test Procedure & Instrumentation for Emission Measurement and Emission Standards: Test procedures-NDIR analyzer, Flame ionization detectors, Chemiluminescent analyzer, Smoke meters, Emission standards.

8. Quality Control 6%

Quality Concepts: Quality-Factors influencing quality, quality costs, economics of quality, Bureau of Various standards, ISO and its implication.
Statistical Process Control, Acceptance Sampling, Life Testing-Reliability-Systems Approach, Quality and Reliability

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प्रा.हु. यान्त्रिक सेल kbsf] k|of]ufTds k/LIff kf7\oqmd

१. समय : ४५ मिनेट
२. प्रश्नसंख्या : ६ वटा (सबै अनिवार्य)
३. पुर्णाङ्क : ५०
४. उत्तिर्णाङ्क : २५
५. प्रश्नको निर्माण, प्रश्नभार (weightage) र समयको बिबरण:

S.N.	Topic	Marks	Time -Minutes
1.	Parts Identification and location knowledge	5	5
2.	System verification	10	10
3.	Use of Various Measuring Instruments	10	10
4.	Assembling/Disassembling procedure and skill test	15	10
5.	Skill in using basic tools	5	5
6.	Use of machines and related equipment	5	5
	TOTAL	**50**	**45**

१. **Parts Identification and location knowledge:**
परीक्षार्थीले layout गरी राखिएका बिभिन्न Auto Parts को Technical नाम लेख्नु पर्ने हून्छ र दिइएको Parts कहा कहा प्रयोग हुन्छ भन्ने समेत खूलाउनु पर्ने छ । यसमा ५ प्रकारका सामानहरु देखाइनेछ र प्रत्येक नाम र प्रयोग सहि भएमा १ अंक प्रदान गरिनेछ ।

२. **System verification:**
परीक्षार्थीले layout गरी राखिएका बिभिन्न Automobile Systems हरु मध्ये कुनै एकको बारेमा उत्तर दिनुपर्ने हुन्छ र सो को बारे बयान गर्नुपर्ने हुन्छ । अंकभार १० रहने छ ।

३. **Use of Various Measuring Instruments**
परीक्षार्थीलाई बिभिन्न प्रकारका Measuring Instrument दिईनेछ । उक्त measuring Instruments प्रयोग गरेर कुनै बस्तूको Density, Weight, Mass, Length वा सम्बन्धित ईकाइ पत्ता लगाउनु पर्ने हुन्छ । प्रति सहि answer को अंक २ प्रदान गरिनेछ ।

४. **Assembling/ Disassembling**
परीक्षार्थीलाई Automobile मा रहेको कुनै Partially Disassembled Component/System (eg. Gearbox,

Engine, Steering Gearbox, Alternator etc) लाई assemble गर्ने कार्य दिइने छ । Component कहांको हो पत्ता लगाएमा अंक ५ र Assemble गरेमा १० अंक प्रदान गरिने छ ।

५. **Skill in using basic tools**
परीक्षार्थीलाई workshop मा प्रयोग हूने कूनै ५ वटा tools प्रयोग गर्न लगाईने छ । प्रयोग सहि भएमा १ अंकको दरले marks प्रदान गरिनेछ ।

६. **Use of machines and related equipment**
परीक्षार्थीलाई shop मा प्रयोग हुने machine and equipment हरुको सम्बन्धमा Viva पश्न लिईनेछ, उक्त Viva मा ५ वटा प्रश्न सोधिनेछ । प्रत्येक सहि उत्तरको अंक १ प्रदान गरिनेछ ।

७. प्रयोगात्मक परीक्षामा परीक्षार्थीले कार्य सम्पादन गरेको सम्पूर्ण विवरणहरुका सम्भव भएसम्म Hard/Soft Copy प्रत्येक उम्मेदवारहरुको छुट्टाछुट्टै खाममा सिलबन्दि गरी भर्ना छनौट निर्देशनालयमा पठाउनु
पर्नेछ ।

८. प्रयोगात्मक परीक्षाको अनुगमन श्री लोक सेवा आयोगका प्रतिनिधिबाट अनिवार्य रुपमा हुनेछ ।