लोक सेवा आयोग

नेपाल इञ्जिनियरिङ्ग सेवा, मेकानिकल समूह, निर्माण उपकरण संभार उपसमूहको राजपत्राङ्कित तृतीय श्रेणी पदको खुला र आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

द्वितीय पत्र :– निर्माण उपकरण संभार सम्वन्धी विषय

# Section A- 30 Marks

**1. Work shop technology and Metrology 10%**

1.1 Basic tools and Basic hand operations
1.2 Machine tools: Lathe, Shaper, Milling, Grinding, Drilling Machines
1.3 Metal Joining: Soldering, Brazing, Gas welding, Arc welding
1.4 Types of fits
15 Linear Measurement: Block Gages, Length Bars, Comparators
1.6 Errors in measurement

**4. Material Science and Metallurgy 10%**

4.1 Types of Materials, Material Selection
4.2 Imperfections in Atomic Arrangement: Slip and Twinning, Dislocation, Points and Surface Defects
4.3 Mechanical Properties and Testing: Tension, Impact, Fatigue, Hardness Test
4.3 Cold working and Hot working
4.5 Types of steel
4.6 Phase Transformation and Heat Treatment: Iron-carbon equilibrium diagram, Hardening, Tempering, Annealing, Normalizing

**5. Machine Component Design and Drawing 10%**

5.1 Types of Projection
5.2 Production Drawings
5.3 Terminologies of Mechanisms, Mobility and Degrees of Freedom
5.4 Design Process
5.5 Factors Affecting Choice of Materials for Design: Strength, Toughness, Durability, Hardness
5.6 Loading: Tensile, Compressive, Shearing, Bending, Bearing and Torsion
5.7 Common Types of Failure: Theories of failure, Stress concentration effects, Ductile and brittle materials, Factor of safety

# Section B- 20 Marks

**2. Thermodynamics and heat engines 10%**

2.1 Basic Concepts: Thermodynamic System, Thermodynamic Property, Pure Substance, Zeroth Law
2.2 First Law of Thermodynamics: Control mass and Control volume formulation
2.3 Second Law of Thermodynamics: Heat engine, Refrigerator and Heat pump, Kelvin Planck and Clausius Statements, Entropy
2.4 Refrigeration: Reversed Carnot cycle, Vapor compression cycle, Absorption refrigeration systems, Refrigerants and their properties
2.5 Air Conditioning: Psychometric properties and psychometric chart, Heating, cooling, humidification and dehumidification process, Air conditioning systems
2.6 Thermodynamic Cycles: Carnot cycle, Otto cycle, Diesel Cycle, Brayton cycle, Rankine cycle
2.7 IC engines: Classifications, components, two stroke and four stroke operations, performance of IC engines, Ignition system, Cooling system, Lubrication system
2.8 Modes of heat transfer: Conduction, Convection and Radiation

**3. Hydraulic and Electric Machines 10%**

3.1 Water turbines: Pelton, Francis, Kaplan and Cross flow (Working principle and Characteristic)
3.2 Pumps: Centrifugal pump and Reciprocating pump (Working principle and Characteristic), Hydraulic ram
3.3 DC Motors: Shunt field, Series field and Compound field motors, Torque-speed characteristics
3.4 DC Generators: Shunt, Series and Compound field machines, Voltage/speed/load characteristics, Effects of variable load, variable torque
3.5 Synchronous and Induction Machines: Basic structure of synchronous machines, Generator on isolated load, Generator on large system, Synchronous motor

## Section C- 30 Marks

**6. Industrial Engineering and Management 10%**

6.1 Role of production/Operation Management and System Concepts
6.2 Plant Location and Plant Layout Design
6.3 Production Planning and Control: Selection of materials, methods, machines and manpower
6.4 Network methods: PERT, CPM
6.5 Inventory Control: Inventory costs and Inventory models
6.6 Forecasting Techniques: Requirements of forecasting, Time series and Moving average methods, Regression analysis
6.7 Quality Management: Importance of quality, Statistical process control
6.8 Statistical Analysis: Measurement of central tendency, Deviation, Distribution

**7. Engineering Economics 10%**

7.1 Types of engineering economics decisions
7.2 Time Value of Money: Simple interest, Compound interest, Continuous compound interest
7.3 Project Evaluation Techniques: Payback period method, NPV method, Future value analysis, IRR method
7.4 Benefit and Cost Analysis: Cost benefit ratio, breakeven analysis
7.5 Corporate tax system in Nepal
7.6 Depreciation and its types

**8. Professional Practice 10%**

8.1 Ethics and Professionalism: Perspective on morals, Codes of ethics and guidelines of professional engineering practice
8.2 Legal aspects of Professional Engineering in Nepal: Engineering Council act, Provision for private practice and employee engineers
8.3 Contract law
8.4 Tendering and contract documents

# Section D- 20 Marks

**9. Maintenance Management** **10%**

9.1 Maintenance objectives and maintenance costs
9.2 Types of maintenance schemes
9.3 Basic maintenance decisions

**10. Automobile Engineering** **10%**

10.1 Classification of vehicles
10.2 Components of an automobile: Power transmission system, Suspension system, Brakes
10.3 Emission control system: Major pollutant and methods of reduction

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**द्वितीय पत्रको एकाईहरुको प्रश्नसंख्या निम्नानुसार हुनेछ**

| द्वितीय पत्रका खण्ड | A | | | B | | C | | | D | |
|---|---|---|---|---|---|---|---|---|---|---|
| द्वितीय पत्रका एकाई | 1 | 4 | 5 | 2 | 3 | 6 | 7 | 8 | 9 | 10 |
| प्रश्न संख्या | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

**विषयगत नमूना प्रश्नहरु (Sample questions)**

1. List different types of machine tools. Explain any one of them.
2. Explain the necessities of second law of thermodynamics with examples.
3. List the different type of turbines. Explain any one.
4. What do you mean by Heat treatment? Explain the following heat treatment processes: (A) Hardening and (B) Normalizing.
5. Explain the failure of ductile and tensile materials.
6. Describe the different types of plant layout.
7. Explain payback period method and NPV method. Also write down the merits of each.
8. Explain the process of tendering in Nepal.
9. Discuss the different types of maintenance schemes.
10. Explain the major components of an automobile.