

**द्वितीयपत्र (Paper II) : Technical Subject**

**Section (A) - 30 Marks**

**1. Machine Design and Drawing**

- 1.1. Design analysis: Types of loads and stresses, Theories of failure, Factor of safety
- 1.2. 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 and welded connections
- 1.3. 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
- 1.4. Design of bearings: Hydrodynamic journal bearings, Pressure fed bearing, self-contained bearings and Rolling contact bearings
- 1.5. Load lifting devices: Selection of steel wire ropes for hoists and cranes, Crane hooks, Design of hook block, sheaves and rope winding drums
- 1.6. Pressure vessels: Classification, Material selection, Loads and types of failures.
- 1.7. Types of projections, Production drawings, Computer Aided Design
- 1.8. Design standardization: Importance of standardization, International organizations for standardization

**2. Environmental engineering**

- 2.1. Air Pollution: Pollution from combustion and atmospheric pollution, Types of pollutants, Sources of pollutants, Particulate control, Control of gaseous pollutants, Indoor air pollution control
- 2.2. Vehicle emission: Vehicle emission standard, Types, Control strategy, Mechanism
- 2.3. Noise Pollution: Measurement of noise, Noise control
- 2.4. Water Pollution: Causes and effects, Waste water treatment
- 2.5. Solid Waste Management: Recycling, Energy recovery, Incineration, Land filling
- 2.6. Global impacts: Green-House Effect, Acid rain, Climate change, Ozone layer depletion

**3. Energy Resources**

- 3.1. Energy consumption scenario of Nepal, Commercial and non-commercial energy resources
- 3.2. Hydroelectricity: National potentials, Achievements and utilization
- 3.3. Solar energy and its applications: Solar thermal, Solar photovoltaic
- 3.4. Biomass energy, Wind energy
- 3.5. Methods of enhancing energy efficiency and energy conservation

**Section (B) - 30 Marks**

**4. Automobile Engineering**

- 4.1. Introduction to automobiles, Chassis, Frame: Construction and types, Modern structure

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प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

- 4.2. Automotive engine: Principle of engine operation, Basic engine construction, Engine types and classification, Valves and valve trains, Engine performance characteristics
  - 4.3. Engine cooling system, Lubricating system, Fuel system and Trouble shootings
  - 4.4. Drive trains: Clutch, Transmission and types, Drive line and final drive, Four-wheel drive, Fault diagnosis and services
  - 4.5. Automotive chassis: Suspension system and types, Steering system and types, Wheels and tires, Fault diagnosis and services
  - 4.6. Automotive brakes: Braking system, Brakes types, Trouble shooting and services
  - 4.7. Electrical system: Ignition system, Charging system, Lightings and Accessories
  - 4.8. Vehicle and occupant's safety, comfort features
- 5. Refrigeration and Air conditioning**
- 5.1. Principles of refrigeration, Air-conditioning and Heat pumps
  - 5.2. Air conditioning system: Classification, Layout, Central/ unitary air conditioning system, System components, Switch and electrical circuit, Trouble shooting and maintenance
  - 5.3. Refrigerants: Classification and their properties, Commonly used alternatives and eco-friendly refrigerants
  - 5.4. Vapour compression, Vapour absorption, Vapour jet, Thermo-electric, Vortex tube refrigeration system and Coefficient of performance
  - 5.5. Compressors, Condensers, Evaporators and Expansion devices
  - 5.6. Psychometric properties and process, Comfort chart
  - 5.7. Comfort and industrial air conditioning, Load calculation and Heat pumps
  - 5.8. Air distribution system: Ducts, Grills, Diffuser and Ventilation
  - 5.9. Automobile air conditioning system, trouble shooting and service

**Section (C) - 20 Marks**

**6. Industrial Engineering**

- 6.1. Plant location and layout: Factors affecting location of factory plant building and service facilities, Product or line layout, Process or functional layout and fixed position layout
- 6.2. Production planning and inventory control: Forecasting techniques: Time series, Moving average, Exponential smoothing, Trend and seasonality. Inventory: Functions, Cost, Classification, Deterministic and Probabilistic inventory models
- 6.3. Operation research: Linear programming, Problem formulation, Simplex method, Duality and sensitivity analysis, Transportation and assignment models, PERT and CPM methods of project management
- 6.4. Quality Management: Concept of quality, Statistical quality control, Acceptance sampling, Zero defects, Six sigma, Quality circle, Quality assurance, Total quality management

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- 6.5. Ergonomics: Productivity and working environment, Man-machine systems, Illumination, Noise and vibration, Ventilation, Air conditioning, Temperature control, Anthropometry, Work-space layout
- 6.6. 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

**7. Maintenance Management**

- 7.1. Maintenance: Reliability, Maintainability, Total life cycle, Routine maintenance, Fixed time maintenance, Break down maintenance and Shut down maintenance, Maintenance work load and budget, Documentation and recording, Maintenance audit
- 7.2. 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, Scanners and modern scanning devices
- 7.3. Corrosion: Types of corrosion, Corrosion testing, Control and prevention
- 7.4. Tribology: Surfaces, Friction and wear, Lubrication, Surface topography measurement
- 7.5. Total Productive Maintenance (TPM): Types of losses, Measures to control losses, Basics of TPM, Cost estimation and safety measures

**Section (D) - 20 Marks**

**8. Professional Practice**

- 8.1. Ethics and Professionalism: Perspectives on morals, Codes of ethics and guidelines of professional engineering practice, Nepal Engineering Council Act and Rules
- 8.2. Procurement and procurement procedure, Public Procurement Act, Rules and Guidelines in Nepal
- 8.3. Standard bidding documents (PPMO), Cost estimate, Bid document preparation, evaluation, contract award and contract management
- 8.4. Introduction to Intellectual Property: Copy right, Trademark, Industrial design, Patent, Unfair competition, World Intellectual Property Organization (WIPO)

**9. Equipment/Vehicle Planning and Management**

- 9.1. Construction equipment, their types and uses: Earthmoving equipment, Hauling equipment, Hoisting equipment, Finishing equipment, Drilling equipment, Blasting equipment, Tunneling equipment, Pile driving equipment
- 9.2. Equipment/Vehicle life and replacement procedures: Physical life, Economical life, Lifecycle costing and replacement analysis, Replacement decision making, Asset disposal
- 9.3. Planning of equipment/vehicle: Equipment/vehicle selection, Fleet standardization, Resources management for operation
- 9.4. Service facility and facility location

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**प्रतियोगितात्मक परीक्षाको पाठ्यक्रम**

नेपाल आर्थिक योजना तथा तथ्याङ्क, इन्जिनियरिङ्ग, कृषि, वन, संघीय संसद, विविध र शिक्षा सेवाका सबै समूह/उपसमूह, राजपत्राङ्कित तृतीय श्रेणी एवं स्वास्थ्य सेवाको सातौं र आठौं तहका पदहरूमा प्रथम चरणको लिखित परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र लिइने **सामूहिक परीक्षण (Group Test)** को लागि

**सामूहिक छलफल (Group Discussion)**

यस प्रयोजनको लागि गरिने परीक्षण १० पूर्णाङ्क र ३० मिनेट अवधिको हुनेछ जुन नेता विहिन सामूहिक छलफल (Leaderless Group Discussion) को रूपमा अवलम्बन गरिने छ। दिइएको प्रश्न वा Topic का विषयमा पालैपालोसँग निर्दिष्ट समय भित्र समूह बीच छलफल गर्दै प्रत्येक उम्मेदवारले व्यक्तिगत प्रस्तुति (Individual Presentation) गर्नु पर्नेछ। यस परीक्षणमा मूल्याङ्कनको लागि देहाय अनुसारको ३ जना भन्दा बढीको समिति रहनेछ।

आयोगका सदस्य	-	अध्यक्ष
मनोविज्ञ	-	सदस्य
दक्ष/विज्ञ (१ जना)	-	सदस्य

**सामूहिक छलफलमा दिइने नमुना प्रश्न वा Topic**

उदाहरणको लागि - उर्जा संकट, गरीबी निवारण, स्वास्थ्य बीमा, खाद्य सुरक्षा, प्रतिभा पलायन जस्ता Topics मध्ये कुनै एक Topic मात्र दिइनेछ।