काठमाण्डौं महानगरपालिका

नेपाल इञ्जिनियरिङ्ग सेवा, मेकानिकल समूह, अधिकृत छैटौं तह, मेकानिकल इञ्जिनियर पदको खुला र आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम एवं परीक्षा प्रणाली (योजना)

पाठ्यक्रमको रुपरेखा :– यस पाठ्यक्रमको आधारमा निम्नानुसार दुई चरणमा परीक्षा लिइने छ :

प्रथम चरण :– लिखित परीक्षा — पूर्णाङ्क :– २००

द्वितीय चरण :– अन्तर्वार्ता — पूर्णाङ्क :– ३०

१. प्रथम चरणः – लिखित परीक्षा योजना (Written Examination Scheme)

पत्र	विषय	पूर्णाङ्क	उतीर्णाङ्क	परीक्षा प्रणाली	प्रश्नसंख्या X अङ्क	समय
प्रथम	मेकानिकल इञ्जिनियरिङ्ग सम्बन्धी विषय	१००	४०	वस्तुगत: बहुवैकल्पिक प्रश्न (MCQ)	१०० प्रश्न x १ अङ्क	१ घण्टा १५ मिनेट
द्वितीय	निर्माण उपकरण र संभार सम्बन्धी विषय	१००	४०	विषयगत	१० प्रश्न X १० अङ्क	३ घण्टा

२. द्वितीय चरणः - अन्तर्वार्ता (Interview)

विषय	पूर्णाङ्क	परीक्षा प्रणाली
अन्तर्वार्ता (Interview)	३०	मौखिक (Oral)

द्रष्टव्य :

१. यो पाठ्यक्रम रुपरेखालाई प्रथम चरण (लिखित परीक्षा) र द्वितीय चरण (अन्तर्वार्ता) गरी दुई चरणमा विभाजन गरिएको छ ।

२. लिखित परीक्षाको माध्यम भाषा अंग्रेजी वा नेपाली अथवा अंग्रेजी र नेपाली दुवै हुन सक्नेछ ।

३. प्रथम र द्वितीय पत्रको विषयवस्तु फरक फरक हुनेछ तथा प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।

४. प्रथम पत्रका एकाईहरुको प्रश्नसंख्या यथासम्भव निम्नानुसार हुनेछ । द्वितीय पत्रको पाठ्यक्रमका एकाईहरुबाट सोधिने प्रश्नहरुको संख्या द्वितीयपत्रको पाठ्यक्रम उल्लेख भए अनुसार हुनेछ ।

प्रथम पत्रका एकाइ	1	2	3	4	5	6	7	8	9
प्रश्न संख्या	10	20	10	10	10	10	15	10	5

५. वस्तुगत बहुवैकल्पिक **(Multiple Choice)** प्रश्नहरुको गलत उत्तर दिएमा प्रत्येक गलत उत्तर बापत २० प्रतिशत अङ्क कट्टा गरिनेछ । तर उत्तर नदिएमा त्यस बापत अङ्क दिइने छैन र अङ्क कट्टा पनि गरिने छैन ।

६. बहुवैकल्पिक प्रश्नहरु हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर **(Calculator)** प्रयोग गर्न पाइने छैन ।

७. विषयगत प्रश्नका लागि तोकिएका १० अङ्कका प्रश्नहरुको हकमा १० अङ्कको एउटा लामो प्रश्न वा एउटै प्रश्नका दुई वा दुई भन्दा बढी भाग (**Two or more parts of a single question**) वा एउटा प्रश्न अन्तर्गत दुई वा बढी टिप्पणीहरु (**Short notes**) सोध्न सकिने छ ।

८. यस पाठ्यक्रम योजना अन्तर्गतका पत्र/विषयका विषयवस्तुमा जेसुकै लेखिएको भए तापनि पाठ्यक्रममा परेका कानून, ऐन, नियम तथा नीतिहरु परीक्षाको मिति भन्दा ३ महिना अगाडि (संशोधन भएका वा संशोधन भई हटाईएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्क्रममा परेको सम्झनु पर्दछ ।

९. प्रथम चरणको परीक्षाबाट छनौट भएका उम्मेदवारहरुलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ ।

१०. पाठ्यक्रम लागू मिति :–

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प्रथम पत्र :– मेकानिकल इन्जिनियरिङ्ग

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
1.5 Linear Measurement: Block Gages, Length Bars, Comparators
1.6 Errors in measurement

2. Thermodynamics and heat engines 20%

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. Fluid Mechanics 10%

3.1 Fluid Properties: Viscosity, Surface tension, Compressibility, Vapor Pressure
3.2 Fluid Statics: Pressure variations in static fluid, Pressure head, Manometer, Force on submerged surfaces
3.3 Equations of Fluid Flow: Types of flow, Continuity equation, Bernoulli's equation, and Momentum equation
3.4 Viscous Effects: Reynolds number, Boundary layer, Frictional resistance to flow in pipes
3.5 Flow measurement: Pitot-static tube, Orifice, Venturimeter, Nozzle, Rotameter

4. Hydraulic and Electric Machines 10%

4.1 Water turbines: Pelton, Francis, Kaplan and Cross flow (Working principle and Characteristic)

4.2 Pumps: Centrifugal pump and Reciprocating pump (Working principle and Characteristic), Hydraulic ram

4.3 DC Motors: Shunt field, Series field and Compound field motors, Torquespeed characteristics

4.4 DC Generators: Shunt, Series and Compound field machines, Voltage/speed/load characteristics, Effects of variable load, variable torque

4.5 Synchronous and Induction Machines: Basic structure of synchronous machines, Generator on isolated load, Generator on large system, Synchronous motor

5. Material Science and Metallurgy 10%

5.1 Types of Materials, Material Selection

5.2 Imperfections in Atomic Arrangement: Slip and Twinning, Dislocation, Points and Surface Defects

5.3 Mechanical Properties and Testing: Tension, Impact, Fatigue, Hardness Test

5.4 Cold working and Hot working

5.5 Types of steel

5.6 Phase Transformation and Heat Treatment: Iron-carbon equilibrium diagram, Hardening, Tempering, Annealing, Normalizing

6. Machine Component Design and Drawing 10%

6.1 Types of Projection

6.2 Production Drawings

6.3 Terminologies of Mechanisms, Mobility and Degrees of Freedom

6.4 Design Process

6.5 Factors Affecting Choice of Materials for Design: Strength, Toughness, Durability, Hardness

6.6 Loading: Tensile, Compressive, Shearing, Bending, Bearing and Torsion

6.7 Common Types of Failure: Theories of failure, Stress concentration effects, Ductile and brittle materials, Factor of safety

7. Industrial Engineering and Management 15%

7.1 Role of production/Operation Management and System Concepts

7.2 Plant Location and Plant Layout Design

7.3 Production Planning and Control: Selection of materials, methods, machines and manpower

7.4 Network methods: PERT, CPM

7.5 Inventory Control: Inventory costs and Inventory models

7.6 Forecasting Techniques: Requirements of forecasting, Time series and Moving average methods, Regression analysis

7.7 Quality Management: Importance of quality, Statistical process control

7.8 Statistical Analysis: Measurement of central tendency, Deviation, Distribution

8. Engineering Economics 10%

8.1 Types of engineering economics decisions

8.2 Time Value of Money: Simple interest, Compound interest, Continuous compound interest

8.3 Project Evaluation Techniques: Payback period method, NPV method, Future value analysis, IRR method

8.4 Benefit and Cost Analysis: Cost benefit ratio, breakeven analysis

8.5 Corporate tax system in Nepal

8.6 Depreciation and its type

9. Professional Practice 5%

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

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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
1.5 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 perations, 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 ater turbines: Pelton, Francis, Kaplan and Cross flow (Working principle and Characteristic)

3.2 pumps: Centrifugal pump and Reciprocating pump (Working principle and haracteristic), Hydraulic ram

3.3 IC Motors: Shunt field, Series field and Compound field motors, Torquespeed characteristics

3.4 IC Generators: Shunt, Series and Compound field machines, oltage/speed/load characteristics, Effects of variable load, variable torque

3.5 Thchronous 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

द्वितीय पत्रको एकाईहरुको प्रश्नसंख्या निम्नानुसार हुनेछ

द्वितीय पत्रका खण्ड	A	B	C	D
द्वितीय पत्रका एकाई	1	2	3	4
प्रश्न संख्या	3	2	3	2