काठमाडौंउपत्यकाखानेपानी लिमिटेड

प्राविधिक सेवा, ईलेक्ट्रो मेकानिकल समूह, ५ तह, ओभरसियरपदको खुल्लातथा समावेशि र आन्तरीक प्रतियोगितात्मकलिखित परीक्षाको पाठ्यक्रम

१. प्रथम चरण :लिखित परिक्षाको योजना(Examination Scheme)

पत्र	बिषय	प्रश्न संख्या x अंकभार	प्रश्न संख्या	परिक्षा प्रणाली	समय	पूर्णाङ्क	उत्तिर्णाङ्क
प्रथमपत्र	सेवा सम्बन्धी: Elctro-Mechanical Engineering	५०x२=१००	५०	बस्तुगत वहुउत्तर	१ घण्टा	१००	४०

२. द्वितीय चरण : अन्तर्वार्ता योजना

विषय	पूर्णाङ्क	परीक्षा प्रणाली
व्यक्तिगतअन्तर्वार्ता	२०	मौखिक

द्रष्टव्य : उम्मेदवारहरुले ध्यानदिनुपर्ने कुराहरु

१. लिखित परीक्षाको माध्यमनेपाली/अग्रेजीदुबै हुन सक्नेछ ।

२. प्रथम चरणको लिखित परीक्षाबाट छनौट भएकाउम्मेदवारहरु मात्र द्वितिय चरणको अन्तर्वार्तामा सम्मिलितहुनपाउनेछन् ।

३. पाठ्यक्रममाभएकायथा सम्भव सबै पाठ्यांशहरुबाट प्रश्न सोधिनेछ । पाठयक्रमका इकाईहरु बाट सोधिने प्रश्नहरुको संख्या सम्बन्धित इकईहरुमै उल्लेख गरियको छ।

४. यस पाठ्यक्रममा जेसुकै लेखिएको भएतापनि पाठ्यक्रममा परेका ऐन, नियमहरु परीक्षाको मितिभन्दा ३ महिना अगाडि (संशोधनभएकावा संशोधनभई हटाईएकावाथप गरी संशोधनभई) कायम रहेकालाई यस पाठ्क्रममा परेको सम्झनु पर्दछ ।

५. यस भन्दा अगाडि लागु भएको माथिउल्लेखित समूहको पाठ्यक्रमखारेज गरिएको छ ।

६. पाठयक्रम लागु मिति२०७४आश्विन

काठमाडौंउपत्यकाखानेपानी लिमिटेड

प्राविधिक सेवा, ईलेक्ट्रो मेकानिकल समूह, ५ तह, ओभरसियरपदको खुल्लातथा समावेशि र आन्तरीक प्रतियोगितात्मकलिखित परीक्षाको पाठ्यक्रम

प्रथमपत्र

सेवा सम्बन्धीःElectrical & Mechanical

A. Electrical Part

1. Electric Circuit (2x2=4)

Definition, Unit, Explanation and Applications of Ohm's Law, Connection of resistors in series, parallel and series parallel combination. Single phase two wire system, three phase four wire systems.

2. Electro Magnetism and Electro Statics. (1x2 =2)

Definition and formation of hysteretic loop, force on a current carrying conductor placed in magnetic field, Self Inductance, Factors affecting the inductance of coil, Capacitor, Factors affecting the capacitance of capacitor, Time constant (T=RC).

3. A.C. Fundamentals (3x2=6)

Comparison between A.C. & D.C Voltage and current, Generation A.C. Frequency. Angular velocity, phase & phase difference, A.C. Circuit with R.L.C. use of J-operator in circuit analysis.

Fundamental principles of Star and Delta connection of Three phase Windings, Effect of unbalanced load in three phase system, Voltage drop, Principles and applications of Super Position Theorem, Thevenis's theorem and Norton's theorem.

Objective of earthing of power system, Causes of Over voltages and its protection, Neutral earthing, Body earthing, Lightning Arrestors – Types, Ratings and characteristics, applications & locations.

Basic concept of Power Factor and methods of its improvement.

4. Principles of A.C Transformer (2x2=4)

Operating principle, connecting load, No load operation, Reactance, Losses and Efficiency, Cooling, Parallel operation of single phase and Three phase transformer, Tap changing, Noises and Temperature Rise. Current Transformer and Potential Transformer, operating principle and characteristics with their application

Sizing of distribution transformer for a water pumping station.

5 Ammeters and voltmeters (1x2=2)

Principle of operation of Power factor meter, General concept of measurement of Power, Energy, Frequency. Resistance measurement.

6 Principle of operation of D.C. Motor-Types, Torque, Losses and efficiency, speed control, speed-torque characteristics. (1x2=2)

7 Introduction and types of single phase A.C. Motor (Motors and their characteristics for particular service-Domestic use.) (2x2=4)

8 Introduction, Types, Constructional details and principle of operation of Synchronous Generator (Alternator) and Synchronous Motor, Parallel operation and Synchronizing of Alternator. (2x2=4)

9 Fundamentals of Protection Systems (3x2=6)

Fuses, MCB Isolators, Contactors, Circuit Breakers-Classification, Construction Operating principle, fire protection, Surge voltage protection, grounding.

10 Importance of Communication in power system. (2z2=4)

11 Principles of cost estimate for distribution system for domestic illumination. Basic electrical estimates and design. (2x2=4)

12 Three phase induction motor (4x2=8)

Construction principle of operation, torque speed characteristics, stand still and running condition, methods of starting

B <u>Mechanical Part:</u>

1. **Work shop technology and Metrology (3x2=6)**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, Are 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 (4x2=8)

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 Claudius 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: Carrot cycle, Otto cycle, diesel Cycle, Brayton cycle, Rankin 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. Hydrodynamics and Hydrodynamic Machines (10x2=20)

3.1Water turbines: Pelton, Francis, Kaplan and Cross flow (Working principle and Characteristic)
3.2 Pumps: Positive Displacement Pumps, Rotodynamic Pumps (Working principle and Characteristic), Pumps with free water , Injection Pump, Hydraulic ram,
3.3 Concept of Water Hammer, Formula of Joukowsky. Protection against Water Hammer.
3.4. Concept of Net Positive Suction Head (NPSH) and Cavitation in Pump.
3.5. System Curve and Pump Performance Curve. Selection of Pump for a Water System.

4. Material Science and Metallurgy (2x2=4)

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
4.4 Cold Working and Hot working
4.5 Types of steel
4.6 Phase Transformation and Heat treatment: Iron-carbon equilibrium diagram, Hardening. Tempering, Annealing, Normaliaing

5. Machine Component Design and Drawing (2x2=4)

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: Strenght, 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

6. **Industrial Engineering and Management (2x2=4)**

6.1Role 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. Energy Resources (2x2=4)

7.1 Energy consumption scenario of Nepal

7.2 Solar energy and its applications: Solar thermal, solar photovoltaic

7.2 Biomass energy

7.4 Hydroelectricity