नेपाल रेल्वे कम्पनी लिमिटेड

इञ्जिनियरिङ्ग सेवा, मेकानिकल समूह, अधिकृत सातौं तह (प्राविधिक), मेकानिकल इञ्जिनियर पदको खुला प्रतियोगितात्मक परीक्षाको लागि पाठ्यक्रम

पाठ्यक्रम योजनालाई निम्नानुसारका दुई चरणमा विभाजन गरिएको छ :

प्रथम चरण :– लिखित परीक्षा पूर्णाङ्क :– २००

द्वितीय चरण :– अन्तर्वार्ता पूर्णाङ्क :– ३०

परीक्षा योजना (Examination Scheme)

१.प्रथमचरण: – लिखित परीक्षा **पूर्णाङ्क :– २००**

पत्र	विषय	पूर्णाङ्क	उतीर्णाङ्क	परीक्षा प्रणाली	प्रश्नसंख्याxअङ्क	समय
प्रथम	संस्थागत ज्ञान र सेवा सम्बन्धी (प्राविधिक विषय)	१००	४०	वस्तुगत - बहुवैकल्पिक प्रश्न (MCQ)	५० प्रश्न X २ अङ्क	४५ मिनेट
द्वितीय		१००	४०	विषयगत- छोटो उत्तर आउने प्रश्न	८ प्रश्न X ५अङ्क	३ घण्टा
				विषयगत- लामो उत्तर आउने प्रश्न	६ प्रश्न X १०अङ्क	

२. द्वितीय चरण : –अन्तर्वार्ता **पूर्णाङ्क :– ३०**

विषय	पूर्णाङ्क	परीक्षा प्रणाली
अन्तर्वार्ता	३०	मौखिक

द्रष्टव्य :

१. यो पाठ्यक्रमको योजनालाई प्रथम चरण र द्वितीय चरण गरी दुई चरणमा विभाजन गरिएको छ ।

२. प्रथम र द्वितीय पत्रको पत्रको विषयवस्तु एउटै हुनेछ ।

३. प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।

४. लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुनेछ ।

५. वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नको 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. वस्तुगत बहुवैकल्पिक हुने परीक्षामा परीक्षार्थीले उत्तर लेख्दा अंग्रेजी ठूलो अक्षर (Capital letter) A,B,C,D मा लेख्नुपर्नेछ । सानो अक्षर (Small letter) a,b,c,d लेखेको वा अन्य कुनै सङ्केत गरेको भए सबै उत्तरपुस्तिका रद्द हुनेछ ।

७. बहुवैकल्पिक प्रश्न हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।

८. परीक्षामा सोधिने प्रश्नसंख्या, अङ्क र अङ्कभार यथासम्भव सम्बन्धित पत्र /विषयमा दिइए अनुसार हुनेछ ।

९. विषयगत प्रश्न हुने पत्रका हकमा प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन् । परीक्षार्थीले प्रत्येक खण्डका प्रश्नहरूको उत्तर सोही खण्डको उत्तरपुस्तिकामा लेख्नुपर्ने छ ।

१०. 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 ।

११. प्रथम चरणको परीक्षाबाट छनौट भएका उम्मेदवारलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ ।

१२. पाठ्यक्रम स्वीकृत मिति :– मिति २०८१/१०/२९

नेपाल रेल्वे कम्पनी लिमिटेड
इञ्जिनियरिङ्ग सेवा, मेकानिकल समूह, अधिकृत सातौं तह (प्राविधिक), मेकानिकल इञ्जिनियर पदको खुला प्रतियोगितात्मक परीक्षाको लागि पाठ्यक्रम

प्रथम र द्वितीय पत्र (Paper I & II) :
संस्थागत ज्ञान र सेवा सम्बन्धी (प्राविधिक विषय)

भाग (Part I) –
Service Related (Technical Subject)
खण्ड (Section) – (A)

1. **Fundamentals**
   - 1.1 Material science: basic crystallography, types of materials- ferrous and nonferrous metals, non-metallic materials, alloys and phase diagrams, basics of nano-materials, material selection, mechanical properties and testing, cold working and hot working, corrosion prevention and control, types of steel and heat treatment
   - 1.2 Thermodynamics and heat transfer: thermodynamic systems and processes; properties of pure substance; zeroth, first and second laws of thermodynamics; entropy, irreversibility and availability; analysis of thermodynamic cycles related to energy conversion: Rankine, Otto, diesel and dual cycles; ideal and real gases; compressibility factor; gas mixtures. modes of heat transfer, steady and unsteady heat conduction, thermal resistance, fins, free and forced convection, correlations for convective heat transfer, radiate heat transfer - radiation heat transfer co-efficient; boiling and condensation, heat exchanger performance analysis
   - 1.3 Engineering mechanics: analysis of system of forces, friction, centroid and centre of gravity, dynamics; stresses and strains-compound stresses and strains, bending moment and shear force diagrams, theory of bending stresses- slope and deflection -torsion, thin and thick cylinders, spheres

2. **Mechanisms and Machines**
   - 2.1 Types of kinematics pair, mobility, inversions, kinematic analysis, velocity and acceleration analysis of planar mechanisms, CAMs with uniform acceleration and retardation, cycloidal motion, oscillating followers; vibrations –free and forced vibration of undamped and damped SDOF systems, transmissibility ratio, vibration isolation, critical speed of shafts. gears – geometry of tooth profiles, law of gearing, involute profile, interference, helical, spiral and worm gears, gear trains- simple, compound and epicyclic; dynamic analysis – slider – crank mechanisms, turning moment computations, balancing of revolving & reciprocating masses, gyroscopes – effect of gyroscopic couple on automobiles, ships and aircrafts, governors
   - 2.2 Workshop and manufacturing technology : types of hand tools and workshop equipment used in a mechanical workshop; measuring tools and measurement of precision works; machine tools: lathe, shaper, milling, grinding, drilling machines; metal joining: soldering, brazing, gas welding, arc welding; fits and tolerances; metal cutting operations; casting, metal forming and mechanical joining processes; welding and fabrication; heat treatment of ferrous, non-ferrous metals & their alloys; corrosion and its prevention; sheet metal work

3. **Design of Machine Elements and Drawing**
   - 3.1 Engineering drawings and its concepts: orthographic projection, isometric projection/view, pictorial views, and sectional drawing; drafting tools and equipment; drafting conventions and symbols; techniques of free hand drawing;

drawing - plan section and elevation of building, electrical, plumbing and structural drawings

3.2 Design analysis: types of loads and stresses, design for static and dynamic loading; failure theories; fatigue strength and the s-n diagram; principles of the design of machine elements such as riveted, welded and bolted joints. shafts, spur gears, rolling and sliding contact bearings, brakes and clutches, flywheels

3.3 Design of bearings: hydrodynamic journal bearings, pressure fed and self-contained bearings and rolling contact bearings

3.4 Load lifting devices: selection of steel wire ropes for hoists and cranes, crane hooks, design of hook block, sheaves and rope winding drums

3.5 Pressure vessels: classification, material selection, loads and types of failures.

3.6 Types of projections, production drawings, Computer Aided Design (CAD)

3.7 Design standardization: Importance of standardization, international organizations for standardization

4. **Engines, Refrigeration, Air conditioning, Instrumentation and Measurement**

4.1 Engine: definition, external combustion engine, internal combustion engine- SI and CI engines, engine systems and components, performance characteristics and testing of IC engines; fuels; emissions and emission control; vapour compression refrigeration, refrigerants and working cycles, compressors, condensers, evaporators and expansion devices, other types of refrigeration systems like vapour absorption, vapour jet, thermo electric and vortex tube refrigeration. psychometric properties and processes, comfort chart, comfort and industrial air conditioning, load calculations and heat pumps

4.2 Principles of operation and structure of diesel and electric locomotives

4.3 Instrumentation and measurement **:** errors in measurements, methods of measurement (linear, angular), alignments tests, calibration of measuring instruments

5. **Construction Equipment, Planning and Management**

5.1 Construction equipment, their types and uses: earthmoving equipment, hauling equipment, hoisting equipment, finishing equipment, drilling equipment, blasting equipment, tunneling equipment, pile driving equipment

5.2 Equipment life and replacement procedures: physical life, profit life, economical life, replacement analysis, replacement decision making

5.3 Planning of equipment: equipment selection, fleet standardization, resources management for operation, maintenance and service facilities

6. **Automotive System and Heavy Equipment**

6.1 Components of automobile; transmission system; steering system; suspension system; cooling system; lubrication system; exhaust system; electrical system, fuel system

6.2 Basic knowledge of heavy equipment: loader, bulldozer, grader, excavator, roller, crane & forklift

खण्ड (Section) – (B)

7. **Maintenance Management**

7.1 Maintenance: reliability, maintainability, total life cycle, routine, fixed time, break down 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
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

8. **Railway Track Technology**
8.1 Track geometry and designing of railway track
8.2 Fundamentals of tract structure; different parts of the rail track, their functions and its operation system
8.3 Components of permanent way and their functions; different types of crossings and railway track; safety measures in railways track protection
8.4 Classification of routes, different rail gauges
8.5 Railway major structures: introduction, purpose, classification and types
8.6 Sleepers: function and types of sleepers; handling and laying of sleepers
8.7 Ballast: function and types of ballast, requirement of good ballast
8.8 Rail joints: introduction, function, types of joints and fastening system
8.9 Railway track maintenance: introduction, causes for maintenance, types and tools for railway track maintenance and their functions
8.10 Weld track components, welding equipment and accessories
8.11 Locomotive traction: locomotive power, traction force, resistance force, brake force

9. **Locomotives and Rolling Stocks and Railways Management**
9.1 Concept of locomotive and rolling stock, fundamentals of locomotives and rolling stocks, its development, current technologies and operation principles
9.2 Classification rolling stocks, working principle of locomotives/ rolling stocks
9.3 Rails: function and types of rails
9.4 Classification of train
9.5 Locomotive coupling devices: function, types, composition, types and working principles, coupler and draft gear
9.6 Railways lines, standard rail section and railway alignment
9.7 Railway stations and yards: functions, types and components of railway station
9.8 Firefighting - types of fire, causes of fire, types of fire extinguisher, use of fire extinguisher, prevention of fire
9.9 Safety measures: safety equipment, safety work procedures, immediate actions for accidental issues, security of railway infrastructures: railway security threat, rail system, track and rails

10. **Planning and Management**
10.1 Engineering economics: understanding of project cash flow; discount rate, interest and time value of money; basic methodologies for engineering economics analysis

(discounted payback period, NPV, IRR & MARR); comparison of alternatives, depreciation system and taxation system in Nepal

10.2 Estimating and Costing Valuation and Specification : types of estimates and their specific uses; methods of calculating quantities; key components of estimating norms and rate analysis; preparation of bill of quantities; purpose, types and importance of specification; purpose, principles and methods of valuation

10.3 Project planning and scheduling: project classifications; project life cycle phases; project planning process; project scheduling (bar chart, CPM, PERT); resources levelling and smoothing; monitoring/evaluation/controlling

10.4 Project management: information system; project risk analysis and management; project financing, tendering process and contract management, quality control, productivity, operation cost; land acquisition; labour safety and welfare

10.5 Ethics and professionalism: perspective on morals, codes of ethics and guidelines of professional engineering practice; regulatory environment and legal aspects of engineering profession in Nepal; Nepal Engineering Council (Acts & Regulations)

भाग (Part II) –
Institutional Awareness
खण्ड (Section) – (C)

१. **संस्थागत ज्ञान**

१.१ नेपालमा रेल्वेको इतिहास र विकास

१.२ नेपाल रेल्वे कम्पनी लिमिटेडको परिचय, संगठनात्मक संरचना, उद्देश्य, कार्यक्षेत्र, विद्यमान अवस्था, संभावना र चुनौती

१.३ भौतिक पूर्वाधार तथा यातायात मन्त्रालय, रेल विभाग, नेपाल रेल्वे कम्पनी लिमिटेड र अन्य निकायहरु बीचको अन्तरसम्बन्ध र समन्वय

१.४ रेल यातायात प्रणाली : प्रकार, क्षेत्र र महत्व

१.५ नेपालमा रेल्वे संरचना र पुर्वाधारको विकास, विस्तार तथा रेल यातायात प्रणालीको वर्तमान अवस्था र चूनौती

१.६ नेपालमा रेल सेवा सञ्जालको आवश्यकता र रेल यातायात सञ्चालन सम्बन्धी नीतिगत व्यवस्था

१.७ रेल यातायातको सुरक्षित सञ्चालन तथा रेल यातायात प्रणालीको सुरक्षा व्यवस्थापन

१.८ रेल यातायात प्रणाली र अन्य यातायात प्रणाली बीचको भिन्नता

१.९ रेल यातायात प्रणालीले नेपालको आर्थिक, सामाजिक र सांस्कृतिक क्षेत्रको विकासमा पुऱ्याएको योगदान

१.१० रेल यातायात प्रणालीको अन्तर्राष्ट्रिय आवागमन र व्यापार सहजीकरणमा भूमिका

१.११ नेपाल सरकारले हालसम्म रेल यातायात सम्बन्धमा गरेका द्विपक्षीय सम्झौता सम्बन्धी जानकारी

२. **ऐन, नियम र नीति**

२.१ राष्ट्रिय यातायात नीति, २०५८

२.२ नेपाल रेल्वे ऐन, २०७९

२.३ नेपाल रेल्वे कम्पनी लिमिटेडको प्रबन्धपत्र तथा नियमावली

२.४ नेपाल रेल्वे कम्पनी लिमिटेडको कर्मचारी प्रशासन सम्वन्धी विनियमावली, २०७७

२.५ जग्गा प्राप्ति ऐन, २०३४

२.६ श्रम ऐन, २०७४

२.७ सार्वजनिक खरिद ऐन, २०६३ र सार्वजनिक खरिद नियमावली, २०६४

नेपाल रेल्वे कम्पनी लिमिटेड

इञ्जिनियरिङ्ग सेवा, मेकानिकल समूह, अधिकृत सातौं तह (प्राविधिक), मेकानिकल इञ्जिनियर पदको खुला प्रतियोगितात्मक परीक्षाको लागि पाठ्यक्रम

२.८ आवश्यक सेवा सञ्चालन ऐन, २०१४

प्रथम पत्रको लागि निम्नानुसार प्रश्नहरु सोधिने छ ।

प्रथम पत्र (वस्तुगत)					
भाग	**विषय**	**खण्ड**	**परीक्षा प्रणाली**	**अङ्कभार**	**प्रश्न संख्या**
I	सेवा सम्वन्धी	A	बहुवैकल्पिक प्रश्न (MCQs)	४०	२० प्रश्न x २ अङ्क = ४०
		B		४०	२० प्रश्न x २ अङ्क = ४०
II	संस्थागत ज्ञान	C		२०	१० प्रश्न x २ अङ्क = २०

द्वितीयपत्रको लागि निम्नानुसार प्रश्नहरु सोधिनेछ ।

द्वितीय पत्र (विषयगत)					
भाग	**विषय**	**खण्ड**	**अङ्कभार**	**छोटो उत्तर**	**लामो उत्तर**
I	सेवा सम्वन्धी	A	४०	२ प्रश्न x ५ अङ्क = १०	३ प्रश्न x १० अङ्क = ३०
		B	४०	२ प्रश्न x ५ अङ्क = १०	३ प्रश्न x १० अङ्क = ३०
II	संस्थागत ज्ञान	C	२०	४ प्रश्न x ५ अङ्क = २०	-