

17. **पदों का विकल्प :-**

अभ्यर्थी विवरणिका में प्रावधानित न्यूनतम शैक्षणिक योग्यता के आधार पर उपलब्ध पदों के लिए अधिमानता क्रम में विकल्प दे सकते हैं।

18. **परीक्षा का स्वरूप :-**आयोग द्वारा कम्प्यूटर आधारित परीक्षा (CBT) ली जायेगी तथा किसी विषय की परीक्षा यदि विभिन्न समूहों में लिया जाता है तो अभ्यर्थियों के प्राप्तांक का Normalisation किया जायेगा। कम्प्यूटर आधारित परीक्षा के आधार पर अभ्यर्थियों की मेधा सूची उनके प्राप्तांक के Normalised अंक के आधार पर तैयार किया जायेगा तथा परीक्षाफल प्रकाशन के पश्चात उन्हें Normalised अंक ही दिया जायेगा।

परीक्षा का स्वरूप निम्न प्रकार होगा :-

परीक्षा का स्वरूप एवं पाठ्यक्रम :-परीक्षा एक चरण (मुख्य परीक्षा) में ली जायेगी।

परीक्षा में सभी प्रश्न वस्तुनिष्ठ एवं बहुविकल्पीय उत्तर युक्त होंगे। एक प्रश्न का पूर्ण अंक 3 (तीन) होगा। प्रत्येक सही उत्तर के लिए 3 (तीन) अंक दिये जायेंगे तथा प्रत्येक गलत उत्तर के लिए 1 (एक) अंक की कटौती की जायेगी। प्रश्न-पत्र हिन्दी एवं अंग्रेजी भाषा में होंगे।

- 18.(क) कनीय अभियंता (विद्युत), कनीय अभियंता (असैनिक), कनीय अभियंता (यांत्रिक), कनीय अभियंता (कृषि अभियंत्रण) एवं मोटरयान निरीक्षक के पदों के लिए सीधी नियुक्ति हेतु मुख्य परीक्षा के विषय एवं पाठ्यक्रम :-

कनीय अभियंता (विद्युत), कनीय अभियंता (असैनिक), कनीय अभियंता (यांत्रिक), कनीय अभियंता (कृषि अभियंत्रण) एवं मोटरयान निरीक्षक के पदों के लिए सीधी नियुक्ति हेतु मुख्य परीक्षा के विषय एवं पाठ्यक्रम निम्नवत् होंगे:-

मुख्य परीक्षा :- मुख्य परीक्षा के लिए दो पत्र होंगे। यह परीक्षा दो पालियों में ली जायेगी। प्रत्येक पत्र के परीक्षा की अवधि 2 घंटा की होगी। इसमें निम्न विषय रहेंगे:-

पत्र - 1 : कुल प्रश्न - 120, परीक्षा अवधि - 2 घंटा

(क) सामान्य अभियांत्रिकी	-	80 प्रश्न
(ख) सामान्य ज्ञान	-	40 प्रश्न

पत्र - 2

विषय- अभियंत्रिकी, कुल प्रश्न - 120, परीक्षा अवधि - 2 घंटा

क्रम संख्या	पद/सेवा का नाम	परीक्षा के विषय
1	कनीय अभियंता (विद्युत)	विद्युत अभियंत्रण
2	कनीय अभियंता (असैनिक)	सिविल अभियंत्रण
3	कनीय अभियंता (यांत्रिक)	यांत्रिकी अभियंत्रण
4	कनीय अभियंता (कृषि अभियंत्रण)	कृषि अभियंत्रण
5	मोटरयान निरीक्षक	यांत्रिकी/ऑटोमोबाईल अभियंत्रण

मुख्य परीक्षा का पाठ्यक्रम

पत्र – 1 (सामान्य अभियंत्रिकी)

Civil Engineering Part A -Building Materials, Estimating, Costing and valuation, Surveying, Soil Mechanics, Hydraulics, Irrigation Engineering, Transportation Engineering, Environmental Engineering.

Structural Engineering- Theory of Structures, Concrete Technology, RCC Design, Steel Design.

Electrical Engineering Part B - Basic concepts, Circuit law, Magnetic circuit, AC fundamentals, Measurement and Measuring Instruments, Electrical Machines, Fractional Kilowatt Motors and single phase induction Motors, Synchronous Machines, Generation, Transmission and Distribution, Estimation and Costing, Utilization and Electrical Energy, Basic Electronics.

Mechanical Engineering Part C- Theory of Machines and Machine Design, Engineering Mechanics and Strength of Materials, Properties of pure substances, 1st. Law of Thermodynamics, 2nd. Law of Thermodynamics, Air standard cycle for IC Engines, IC Engine performance, IC Engine Combustion, IC Engine Cooling & Lubrication, Rankine cycle of System, Boilers, Classification, Specification, Fitting and Accessories, Air Compressor and their cycles, Refrigeration cycles, Principle of Refrigeration Plant, Nozzles and Steam Turbines. Properties & Classification of Fluids, Fluid Statics, Measurement of Fluid Pressure, Fluid Kinematics, Dynamics of ideal fluids, Measurement of Flow rate basic principles, Hydraulic Turbines, Centrifugal Pumps. Classification of steels.

सामान्य ज्ञान

(i) सामान्य अध्ययन :-

इसमें प्रश्नों का उद्देश्य अभ्यर्थी के आस-पास के वातावरण की सामान्य जानकारी तथा समाज में उनके अनुप्रयोग के संबंध में उसकी योग्यता की जाँच करना होगा। वर्तमान घटनाओं और दिन-प्रतिदिन की घटनाओं के सूक्ष्म अवलोकन तथा उनके प्रति वैज्ञानिक दृष्टिकोण जैसे मामलों की जानकारी जैसा कि किसी भी शिक्षित व्यक्ति से अपेक्षा की जाती है। इसमें झारखण्ड, भारत और पड़ोसी देशों के सम्बन्ध में विशेष रूप से यथासम्भव प्रश्न पूछे जा सकते हैं।

सम-सामायिक विषय – वैज्ञानिक प्रगति, राष्ट्रीय/अंतर्राष्ट्रीय पुरस्कार, भारतीय भाषाएँ, पुस्तक, लिपि, राजधानी, मुद्रा, खेल-खिलाड़ी महत्वपूर्ण घटनाएँ।

भारत का इतिहास, संस्कृति, भूगोल, पर्यावरण, आर्थिक परिदृश्य, स्वतंत्रता आन्दोलन, भारतीय कृषि तथा प्राकृतिक संसाधनों की प्रमुख विशेषताएँ एवं भारत का संविधान एवं राज्य व्यवस्था, देश की राजनीतिक प्रणाली, पंचायती राज, सामुदायिक विकास, पंचवर्षीय योजना।

झारखण्ड की सभ्यता, संस्कृति, भाषा, स्थान, खान-खनिज, उद्योग, भूगोल एवं इतिहास, राष्ट्रीय आन्दोलन में झारखण्ड का योगदान, साहित्य, विकास योजनाएँ, खेल-खिलाड़ी, व्यक्तित्व, नागरिक उपलब्धियाँ, पुरस्कार, राष्ट्रीय एवं अंतर्राष्ट्रीय महत्व के विषय इत्यादि।

(ii) सामान्य विज्ञान :-

सामान्य विज्ञान के प्रश्न में दिन-प्रतिदिन के अवलोकन एवं अनुभव पर आधारित विज्ञान की सामान्य समझ एवं परिबोध से संबंधित प्रश्न रहेंगे। जैसा कि एक सुशिक्षित व्यक्ति से जिसने किसी विज्ञान विषय का विशेष अध्ययन नहीं किया हो, अपेक्षित है।

(iii) सामान्य गणित :-

इस विषय में सामान्यतः अंक गणित, प्राथमिक बीजगणित ज्यामिति, सामान्य त्रिकोणमिति, क्षेत्रमिति से संबंधित प्रश्न रहेंगे। सामान्यतः इसमें मैट्रिक/10वीं कक्षा स्तर के प्रश्न रहेंगे।

(iv) मानसिक क्षमता जाँच :-

इसमें शाब्दिक एवं गैर शाब्दिक दोनो प्रकार के प्रश्न रहेंगे। इस घटक में निम्न से संबंधित यथासंभव प्रश्न पूछे जा सकते हैं –सादृश्य, समानता एवं भिन्नता, स्थान कल्पना, समस्या समाधान, विश्लेषण, दृश्य स्मृति, विभेद, अवलोकन, संबंध अवधारणा, अंक गणितीय तर्कशक्ति, अंक गणितीय संख्या श्रृंखला एवं कूट लेखन तथा कूट व्याख्या इत्यादि।

(v) कम्प्यूटर का मूलभूत ज्ञान :-

इसमें कम्प्यूटर के विभिन्न उपकरणों एवं संचालन की विधि की जानकारी से संबंधित प्रश्न पूछे जा सकते हैं।

पत्र – 2 (अभियांत्रिकी)

Subject : Civil Engineering

Building Materials:- Physical and chemical properties , classification, standard tests, uses and manufacture/quarrying of materials e.g. building Stones, silicate based materials, cement, asbestos products, timber and wood based products, laminates, bituminous materials, paints, varnishes.

Estimating, Costing and Valuation- Estimate, glossary of technical terms, analysis of rates, methods and unit of measurement, Item of works- Earth work, Brick work (Modular and traditional bricks), RCC work, Shuttering, Timber work, Painting, Flooring, Plastering. Boundary wall, Brick building, Water Tank, Septic Tank, Bar Bending Schedule, Center line method, Mid- section formula, Trapezoidal formula, Simpson's rule. Cost estimate of Septic tank, flexible pavements, Tube well, isolate and combined footing, Steel Truss, Piles and pile- caps. Valuation- value and cost, scrap value, salvage value, assessed value, sinking fund, depreciation and obsolescence, methods of valuation.

Surveying: Principles of surveying, measurement of distance, chain surveying, working of prismatic compass, compass traversing, bearings, local attraction, plane table surveying, theodolite traversing, adjustment of theodolite. Leveling, Definition of terms used in leveling, contouring, curvature and refraction corrections, temporary and permanent adjustment of dumpy level, methods of contouring, uses of contour map, tachometric survey, curve setting, earth work calculation, advanced surveying equipments.

Soil Mechanics:- Origin of soil, phase diagram, Definitions- void ratio, porosity, degree of saturation, water content, specific gravity of soil grains, unit weights, density index and inter relationship of different parameters, Grain size distribution curves and their uses. Index properties of soils, Atterberg's limits, ISI soil classification and plasticity chart. Permeability of soil, coefficient of permeability, determination of coefficient of permeability, Unconfined and confined aquifers, effective stress, quick sand, consolidation of soils, Principles of consolidation, degree of consolidation, pre- consolidation pressure, normally consolidated soil, e-log p curve, computation of ultimate settlement. Shear strength of soils, direct shear test, Vane shear test, Tri axial test. Soil compaction, Laboratory compaction test, Maximum dry density and optimum moisture content, earth pressure theories, active and passive earth pressure, Bearing capacity of soils, plate load test, standard penetration test.

Hydraulics- Fluid properties, hydrostatics, measurement of flow, Bernoulli's theorem and its application, flow through pipes, flow in open channel, weirs, flumes, spillways, pumps and turbines.

Irrigation Engineering:- Definition, necessity, benefits, effect of irrigation, types and methods of irrigation, Hydrology- Measurement of rainfall, run off coefficient, rain gauge, losses from precipitation- evaporation, infiltration etc. Water requirement of crops, duty, delta and base period, Kharif and Rabi crops, Command Area, Time factor, Crop ratio, Overlap allowance, irrigation efficiencies. Different types of canals, types of canal irrigation, losses of water in canals. Canal lining- types and advantages. Shallow and deep tube wells, yield from a well. Weir and barrage, failure of weirs and permeable foundation, Slit and Scour, Kennedy's theory of critical velocity. Lacey's theory of uniform flow. Definition of flood, causes and effects, methods of flood control, water logging, preventive measure. Land reclamation, Characteristics of affecting fertility of soils, purposes, methods, description of land and reclamation processes. Major irrigation projects in India.

Transportation Engineering: Highway Engineering- cross sectional elements, geometric design, types of pavements, pavement materials- aggregates and bitumen, different tests, Design of flexible and rigid pavements- Water bound Macadam(WBM) and Wet Mix Macadam(WMM), Gravel Road, Bituminous construction, Rigid Pavement Joint, pavement maintenance, Highway drainage, Railway Engineering- Components of permanent way- sleepers, ballast, fixtures and fastening, track geometry, points and crossings, track junctions, stations and yards. Traffic Engineering- Different Traffic Survey, speed- flow- density and their inter relationship, intersections and interchanges, traffic signals, traffic operation, traffic signs and marking, road safety.

Environmental Engineering:- Quality of water, source of water supply, purification of water, distribution of water, need of sanitation, sewerage system, circular sewer, oval sewer, sewer appurtenances, sewage treatment. Surface water drainage. Solid waste management- types, effects, engineered management system. Air pollution- pollutants, causes, effects, control. Noise pollution- cause, health effect, control.

Structural Engineering: Theory of structures- Elasticity constants, types of beams- determinate and indeterminate, bending moment and shear force diagram of simply supported, cantilever and over hanging beams. Moment of area and moment of inertia for rectangular and circular sections, bending moment and shear stress for tee, channel and compound section, chimneys, dams and retaining walls, eccentric loads, slope deflection of simply supported and cantilever beams, critical load and columns, Torsion of circular section.

Concrete Technology: Properties, Advantages and uses of concrete, cement aggregates, importance of water quality, water cement ratio, workability, mix design, storage, batching, mixing, placement, compaction, finishing and curing of concrete, quality control of concrete, hot weather and cold weather concreting, repair and maintenance of concrete structure.

RCC Design: RCC beam flexural strength, shear strength, bond strength, design of singly reinforced and double reinforced beam, cantilever beams. T- beams, lintels. One way and two way slabs, isolated footing. Reinforced brick works, columns, staircases, retaining wall, water tanks (RCC design questions may be based on both Limit State and Working Stress method).

Steel Design: Steel design and construction of steel columns, beams, roof, trusses, plate, girders.

Subject : Mechanical Engineering

Theory of Machines and Machine Design:- Concept of simple machine, Four bar linkage and link motion, Flywheels and fluctuation of energy, Power transmission by belts- V- belt and Flat belts, Clutches- Plate and Conical clutch, Gears- Types of Gears, gear profile and gear ratio calculation, Governors- Principles and classification, Riveted joint, Cams, Bearings, Friction in collars and pivots.

Engineering Mechanics and Strength of Materials- Equilibrium of Forces, Law of motion, Friction, Concepts of stress and strain, Elastic limit and elastic constants, Bending moments and shear force diagram, Stress in composite bars, Torsion of circular shafts, Buckling of columns- Euler's and Rankin's theories, Thin walled pressure vessels.

Thermal Engineering- Properties of pure substances:- p-v & P-T diagrams of pure substance like H₂O, Introduction of steam table with respect to steam generation process; definition of saturation, wet and super heated status, Definition of dryness fraction of steam, degree of superheat of steam. h-s chart of steam(Mollier's Chart).

1ST. Law Thermodynamics: Definition of stored energy and internal energy, 1st. law of Thermodynamics of cyclic process, Non Flow Energy Equation, Flow Energy & Definition of Enthalpy, Condition for Steady State, Steady Flow; Steady State Steady Flow Energy Equation.

2nd. Law of Thermodynamics:- Definition of Sink, Source Reservoir of Heat, Heat Engine, Heat pump and Refrigerator, Thermal efficiency of heat engines and co- efficient of performance of Refrigerators. Kelvin –Plank & Clausius Statement of 2nd. Law of Thermodynamics. Absolute or Thermodynamic Scale of Temperature, Clausius Integral, Entropy, Entropy change calculation of ideal gas processes. Carnot Cycle & Carnot Efficiency , PMM-2 ; definition and it's impossibility .

Air Standard Cycles for IC Engine:- Otto cycle; plot on P- V, T-S Planes, Thermal Efficiency, Diesel Cycle ; plot on P-V , T-S planes; Thermal Efficiency.

IC Engine Performance, IC Engine Combustion , IC Engine Cooling & Lubrication.

Rankin cycle of steam:- Simple Rankine Cycle plot on P-V, T-S, h-s planes, Rankine cycle efficiency with and without pump work.

Boilers; Classification; Specification; Fitting & Accessories: Fire tubes and water tubes boilers.

Air Compressors & their cycles; Refrigeration cycles; Principle of Refrigeration Plant; Nozzles & Steam Turbines.

Fluid Mechanics and Machinery.

Properties and Classification of Fluid: Ideal & real fluids, Newton's law of viscosity, Newtonian and Non Newtonian fluids, compressible and incompressible fluids.

Fluid Statics:- Pressure at a point.

Measurement of fluid pressure: Manometers, U tubes, inclined tube.

Fluid Kinematics: Stream line, laminar and turbulent flow, external and internal flow, continuity equation.

Dynamics of ideal fluids:- Bernoulli's equation, Total head, Velocity head, Pressure head, Application of Bernoulli's equation.

Measurement of flow rate Basic Principles:- Venturimeter, Pilot tube, Orifice meter.

Hydraulic Turbines:- Classifications, Principles.

Centrifugal Pumps:- Classification, Principle, Performance.

Production Engineering.

Classification of Steels: mild steel and alloy steel, Heat treatment of steel, Welding- Arc welding, Gas Welding, resistance Welding, Special welding Techniques i.e. TIG, MIG, etc. (Brazing & Soldering), Welding defects and Testing; NDT, Foundry & Casting- methods, defects, different casting processes, Forging, Extrusion etc. Metal cutting principles, cutting tools, Basic principles of machining with (i) Lathe (ii) Milling (iii) Drilling (iv) shaping (v) Grinding, Machines, tools & manufacturing processes.

Subject: विद्युत अभियांत्रिकी (Electrical Engineering)

मूल धारणा : प्रतिरोध की धारणाएँ, प्रेरकत्व, धारिता, एवं उनको प्रभावित करने वाले विभिन्न कारक। धारा, वोल्टेज, विद्युत, ऊर्जा की धारणा एवं उनकी इकाईयाँ।

परिपथ नियम : किरचौफ का नियम, जाल प्रमेयों का प्रयोग करते हुए सरल परिपथ विलयन।

चुंबकीय परिपथ : गालक की धारना, एम एम एफ, प्रतिष्टम्भ, विभिन्न प्रकार के चुंबकीय पदार्थ, विभिन्न विन्यास यथा सीधा, वर्तुल, परिनालिकीय आदि के चालक के लिए चुंबकीय परिकलन। विधुत-चुंबकीय प्रेरण, स्वप्रेरण तथा अन्योन्य प्रेरण।

AC मूल सिद्धांत : तात्कालिक, शिखर, प्रत्यावर्त्ती तरंगों के R.M.S. तथा औसत मूल्य, ज्वावक्रीय तरंग रूप का निरूपण, R.L और C वाला समान्तर AC परिपथ, अनुवाद, टंकी परिपथ, बहुकली तंत्र-तारा एवं डेल्टा संबंधन, त्रि-प्रावस्था विधुत, R-L और R-C परिपथ का DC और ज्वावक्रीय अनुक्रिया।

मापन एवं मापक यंत्र : विधुत (एकल प्रावस्था एवं त्रि प्रावस्था, सक्रिय एवं पुनः सक्रिय दोनों) एवं ऊर्जा का मापन, त्रि-प्रावस्था विधुत मापन की 2 वाटमापी विधि। बारंबारता एवं कला-कोण का मापन। आम्मीटर एवं वोल्टमापी (चल तेल और चल लो ह दोनों प्रकार), परिसर, वाटमापी का विस्तार, बहुमापी, मेगर, ऊर्जा मीटर AC सेतु। CRO का उपयोग, संकत जनित्र, CT,PT एवं उनके उपयोग। पृथ्वी दोष अभिज्ञान।

वैधुत यंत्र : (क) DC यंत्र-निर्माण, DC मोटर और जनित्र के मूल सिद्धांत, उनकी विशेषताएँ, DC मोटर का गति नियंत्रण और प्रवर्तन। ब्रेक मोटर विधि, DC यंत्रों का क्षय व दक्षता। (ख) 1 प्रावस्था और 3 प्रावस्था रूपान्तरण - निर्माण, प्रचालन के सिद्धांत, तुल्यमान परिपथ, वोल्टता नियमन, O.C और S.C परीक्षण, क्षय एवं दक्षता। वोलटेज, बारंबारता तथा तरंग रूप के क्षय के प्रभाव। 1 प्रावस्था एवं 3 प्रावस्था ट्रांसफॉर्मरों का समानांतर परिचालन। ऑटोट्रांसफॉर्मर। (ग) 3 प्रावस्था प्रेरणी मोटर, घुर्णी चुंबकीय क्षेत्र, प्रचालन के सिद्धांत, तुल्यमान परिपथ, ऐंठन-गति अभिलक्षण, 3 प्रावस्था प्रेरणी मोटर का प्रवर्तन एवं चाल नियंत्रण। ब्रेक अभिलक्षण पर वोल्टता एवं बारंबारता के प्रभाव।

खंडश : किलोवाट मोटर और एकल प्रावस्था प्रेरणी मोटर : विशेषताएँ और प्रयोग तुल्यकालिक मशीन- 3 प्रावस्था, इ०एम०एफ० आर्मेचर प्रतिक्रिया, वोल्टेल नियंत्रण, दो प्रत्यावर्त्तित्रों का समांतर प्रचालन, तुल्यकालिकता, सक्रिय और प्रतिघाती शक्ति का नियंत्रण तुल्यकालिक मोटर की स्टार्टिंग और उनका प्रयोग। उत्पादन, संरक्षण और वितरण - अलग-अलग प्रकार के विधुत केन्द्र, उद्धार गुणक, विविधता अनुपात, माँग घटक, उत्पादन लागत, विधुत केन्द्रों का आपसी कनेक्शन, विधुत गुणक सुधार, विभिन्न प्रकार के सूतक, दोषों का प्रकार, सममित दोषों के शार्ट सर्किट धारा, स्विचगियर- परिपथ वियोजक, तेल और वायु द्वारा चाप विलोम का सिद्धांत, एच आर सी पयूज, भू-रिसाव/अति धारा आदि के प्रति सुरक्षा। बकोल्ज रिले, जनित्रों और ट्रांसफार्मर्स की सुरक्षा की मर्ज- प्राइस प्रणाली, फीडर्स और बस बार्स की सुरक्षा, तड़ित् निर्वतक, विभिन्न संचारण और वितरण प्रणाली, चालक पदार्थों की तुलना, विभिन्न प्रणालियों की सक्षमता, रज्जु- अलग-अलग प्रकार के रज्जु, रज्जु कोटि निर्धारण और अनुमतांक निम्न गुणक।

निर्धारण और लागत : तपानुशीतन योजना का निर्धारण, मशीनों का प्रतिष्ठापन और संगत आई इ नियम, भूसंपर्क व्यवहार और आई इ नियम।

वैधुत ऊर्जा का उपयोग : प्रदीप्ति, वैधुत तापन, वैधुत वेल्डन, विधुत लेपन, विधुत परिचालन और मोटर्स।

मूलभूत इलैक्ट्रॉनिक्स : विविध इलैक्ट्रॉनिक साधनों का कार्यचालन उदाहरण के लिए पी०एन० जंक्शन डायोड, ट्रांजिस्टर (एन पी एन और पी एन पी का पी प्रकार), वी जे टी और जे एफ इ टी। इन साधनों का प्रयोग करते हुए साधारण परिपथ।

Agricultural Engineering (कृषि अभियंत्रण)

Surveying and leveling: Hydrology, water resources in India; Efficiency in water. use; Irrigation system and equipment- components of drip and sprinkler irrigation system, water conveyances and associated efficiency; Soil-plant-water relationship; Estimation of evaporation and water requirements of crop; Water harvesting and use- farm ponds and reservoirs, command area development, land use capability classification, soil erosion and its control, land shaping and grading equipment and practices, salt balance and reclamation of saline and alkaline soils, hydraulic structures,, ground water development, wells and pumping equipment, drainage of irrigated and humid areas.

Importance of farm equipments and role of mechanization in enhancing productivity and profitability of Indian agriculture; Analysis of forces, design and production of farm machinery and power units; Mechanics tillage and traction operation, repair and maintenance of farm machines and equipments, farm engines; tractors and power tillers, tractor stability and operators comfort, field capacity and cost analysis; test codes and procedure; safety and ergonomic principles: Renewable energy source of energy, role of energy in economic development; solar, wind and bio-energy; biogas plants and gasifiers; biofuels from biomass: collection, characterization and storage of biomass, solar cookers & solar refrigerators.

Biochemical and engineering properties of biological materials; Quality control and safety of raw and finished products; Principles, practices and equipments for drying, milling, separation and storage of agricultural produce and by-products, material handling equipments and operations, farmstead planning; heating and cooling load calculation, seed processing practices and equipments: Food preservation methods and products development: refrigeration and air conditioning: cold stores, waste management, cost analysis and food processing plants layout, feasibility reports; Protected cultivation- green house technology, types of green houses.

Subject : Automobile Engineering

THERMAL ENGINEERING

- I. Concepts and Terminology:
- II. First Law of Thermodynamics:
- III. Second law of Thermodynamics:
- IV. Principles of Steam Turbine and Nozzle:
- V. Thermodynamic Cycles and Air Compressor:

MANUFACTURING PROCESS

- I. Foundry, Sand Moulding & Core making
- II. Melting furnaces and casting defects:
- III. Welding processes:
- IV. Introduction and classification of machine tool:
- V. Drilling, Shaper and Milling Machine:

APPLIED MECHANICS

- I. Force System Fundamentals
- II. Equilibrium
- III. Centroid and Moment of inertia
- IV. Friction:
- V. Simple Machines:

MECHANICAL ENGINEERING MATERIALS

- I. Engineering materials and their properties:
- II. Crystal imperfections:
- III. Ferrous and Non Ferrous Materials and alloys
- IV. Iron Carbon system:
- V. Heat Treatment:

MACHINE DRAWING

- I. Limits, Fits and Tolerances:
- II. Details to Assembly: 1. Introduction. 2. Couplings – Universal couplings & Oldham's Coupling 3. Bearing – Foot Step Bearing & Pedestal Bearing, 4. Lathe tool Post, 5. Machine vice, 6. Screw Jack.
- III. Assembly to Details: 1. Introduction – 2. Pedestal Bearing, 3. Lathe Tail Stock, 4. Drilling Jig 5. Piston & connecting rod 6. Gland and Stuffing box Assembly, 7. Fast & loose pulley, Bolt, nut and threads, Screws and rivet.

STRENGTH OF MATERIALS

- I. Basic Concepts:
- II. Principal Planes and Stresses:
- III. Bending Moment and shearing forces :
- IV. Bending, slope and deflection of beams:
- V. Torsion & Vibration:

FLUID MECHANICS AND MACHINES

- I. Properties of fluid:
Density, Specific gravity, Specific Weight, Specific Volume, Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity, Vapour Pressure, Compressibility,, laws of viscosity, Hydrostatic and Pascal's law
- II. Fluid Pressure & Pressure Measurement:
- III. Fluid Flow and Measurement:
- IV. Flow through Pipes
- V. Dimensional and Model Analysis

AUTOMOTIVE ENGINE

- I. Introduction:
Basic units, major components of engine, mechanism of operation, Four-Stroke and two – Stroke Petrol and diesel engine, their applications, specification of Auto – engines, classification of automobile engine.
- II. Constructional details of automotive engine :
- III. Combustion Phenomenon:
- IV. Fuel Feed System Engine:
- V. Cooling systems & lubricating system:

AUTOTRONICS

- I. Basic Electrical and Safety
- II. Generator, Alternator, Regulator and Starting motor
- III. Ignition system
- IV. Lighting, lamp, Horn, Gauges and wiring
- V. Electronics – Computer Applications in Automobile

COMPUTER PROGRAMMING

- I. Programming techniques and overview of c language:
- II. Operators and Expressions:
- III. Decision making and branching: If statement (if, if-else, else-if ladder, nested if-else), Switch case statement, break statement, goto.
Decision making and looping: while, do, do-while statements for loop, continue statement
- IV. Arrays and Strings:
- V. Functions:
Pointers:- Understanding pointers, declaring and accessing pointers, Pointers arithmetic, pointers and arrays.

THEORY OF MACHINE

- I. Mechanisms
- II. Motion Analysis
- III. Flywheel & Belt
- IV. Gears
- V. CAM & Balancing

QUALITY CONTROL

- I. Concept of Quality
- II. Statistical concepts and Reliability
- III. Control Charts for Variables and Attributes
- IV. Acceptance Sampling by attributes
- V. Total Quality Management and ISO 9000 Quality System

AUTOMOTIVE EQUIPMENT AND MAINTENANCE

- I. Inspection of cylinder
- II. Inspections of Crankshaft
- III. Transmission maintenance
- IV. Body Maintenance
- V. Carburetors Adjustment

AUTOMOTIVE DESIGN

- I. Standardization in Automobile system design
- II. Design consideration
- III. Design OF Bearing, Sliding contact bearing
- IV. Design of Gear box
- V. Design of I.C Components

MOTOR VEHICLE TECHNOLOGY

- I. Clutch
- II. Gear Box, Propeller and Differential Shaft
- III. Transmission System
- IV. Front Axle & Steering
- v. Miscellaneous Automobile System

INDUSTRIAL ENGINEERING

- I. Production Functions and Forecasting
- II. Facility Layout and Engineering Economy
- III. Inventory Control
- IV. Concept of JIT, Lean Manufacturing & Group Technology

AUTOMOTIVE EMISSION AND CONTROL SYSTEM

- I. Introduction to automotive pollution
- II. Principle of production of exhaust gases
- III. Emission control systems
- IV. Principle methods of exhaust gas analysis
- V. LPG and CNG conversion

SPECIAL PURPOSE VEHICLES AND EQUIPMENT

- I. Introduction
- II. Tractors
- III. Constructional Working Features and Instrumentation
- IV. Mobile Crane
- V. Special Purpose Vehicles

MECHATRONICS

- I. Introduction and Mechatronics elements
- II. Processors /controllers
- III. Drives and mechanisms of an automated system
- IV. Hydraulic system
- V. Pneumatic system

HEATING VENTILATION AND AIR CONDITIONING (ELECTIVE)

- I. Introduction
- II. Refrigerants
- III. Cooling and Heat load Estimations
- IV. Design of Air distribution systems
- V. Ventilation and Exhaust system

18.ख) स्ट्रीट लाईट इंस्पेक्टर एवं पाईप लाईन इंस्पेक्टर के पदों के लिए सीधी नियुक्ति हेतु मुख्य परीक्षा के विषय एवं पाठ्यक्रम

स्ट्रीट लाईट इंस्पेक्टर एवं पाईप लाईन इंस्पेक्टर के पदों के लिए सीधी नियुक्ति हेतु मुख्य परीक्षा के विषय एवं पाठ्यक्रम निम्नवत् होंगे :-

मुख्य परीक्षा :- मुख्य परीक्षा के लिए एक पत्र होगा। यह परीक्षा एक पाली में ली जायेगी। पत्र के परीक्षा की अवधि 3 घंटा की होगी। इसमें निम्न विषय रहेंगे:-

पत्र – 1 : कुल प्रश्न – 180, परीक्षा अवधि – 3 घंटा

- | | | |
|--|---|------------|
| (क) सेवा/संवर्ग/पद के लिए गठित सेवा/ संवर्ग नियमावली में परीक्षा से संबंधित विषय | – | 120 प्रश्न |
| (ख) सामान्य ज्ञान | – | 60 प्रश्न |

परीक्षा के विषय

क्रम संख्या	पद/सेवा का नाम	परीक्षा के विषय
1.	स्ट्रीट लाईट इंस्पेक्टर	विद्युत व्यवसाय
2.	पाईप लाईन इंस्पेक्टर	प्लम्बिंग व्यवसाय

मुख्य परीक्षा का पाठ्यक्रम

Street Light Inspector (Electrician Trade)

Scope of the electrician trade. Safety rules and safety signs. Types and working of fire extinguishers. First aid safety practice. Hazard identification and prevention. Personal safety and factory safety. Response to emergencies e.g. power failure, system failure and fire etc. Concept of Standards and advantages of BIS/ISI. Trade tools specifications. Introduction to National Electrical Code-2011.

Allied trades: Introduction to fitting tools, safety precautions. Description of files, hammers, chisels hacksaw frames, blades, their specification and grades. Marking tools description and use. Types of drills, description & drilling machines. Various wooden joints.

Marking tools: Calipers Dividers, Surface plates, Angle plates, Scribes, punches, surface gauges Types, Uses, Care and maintenance.

Sheet metal tools: Description of marking & cutting tools. Types of rivets and riveted joints. Use of thread gauge. Description of carpenter's tools Care and maintenance of tools. Fundamentals of electricity, definitions, units & effects of electric current. Conductors and insulators. Conducting materials and their comparison. Joints in electrical conductors. Techniques of soldering. Types of solders and flux.

Underground cables: Description, types, various joints and testing procedure. Cable insulation & voltage grades Precautions in using various types of cables.

Ohm's Law: Simple electrical circuits and problems. Kirch off's Laws and applications. Series and parallel circuits. Open and short circuits in series and parallel networks. Laws of Resistance and various types of resistors. Wheatstone bridge; principle and its applications. Effect of variation of temperature on resistance. Different methods of measuring the values of resistance. Series and parallel combinations of resistors. Magnetic terms, magnetic materials and properties of magnet. Principles and laws of electro-magnetism. Self and mutually induced EMFs.

Electrostatics: Capacitor- Different types, functions, grouping and uses. Inductive and capacitive reactance, their effect on AC circuit and related vector concepts. Comparison and Advantages of DC and AC systems. Related terms frequency, Instantaneous value, R.M.S. value Average value, Peak factor, form factor, power factor and Impedance etc. Sine wave, phase and phase difference. Active and Reactive power. Single Phase and three-phase system. Problems on A.C. circuits. Advantages of AC poly-phase system. Concept of three-phase Star and Delta connection. Line and phase voltage, current and power in a 3 phase circuits with balanced and unbalanced load. Phase sequence meter. Chemical effect of electric current and Laws of electrolysis. Explanation of Anodes and cathodes. Types of cells, advantages / disadvantages and their applications. Lead acid cell; Principle of operation and components. Types of battery charging, Safety precautions, test equipment and maintenance. Basic principles of Electro- plating and cathodic protection. Grouping of cells for specified voltage and current. Principle and operation of solar cell. I.E. rules on electrical wiring. Types of domestic and industrial wirings. Study of wiring accessories e.g. switches, fuses, relays, MCB, ELCB, MCCB etc. Grading of cables and current ratings. Principle of laying out of domestic wiring. Voltage drop concept. PVC conduit and Casing-capping wiring system. Different types of wiring - Power, control, Communication and entertainment wiring. Wiring circuits planning, permissible load in sub- circuit and main circuit. Estimation of load, cable size, bill of material and cost. Inspection and testing of wiring installations. Special wiring circuit e.g. godown, tunnel and workshop etc. Importance of Earthing.

Plate earthing and pipe earthing methods and IEE regulations. Earth resistance and earth leakage circuit breaker. Laws of Illuminations. Types of illumination system. Illumination factors, intensity of light. Type of lamps, advantages/ disadvantages and their applications. Calculations of lumens and efficiency. Classification of electrical instruments and essential forces required in indicating instruments. PMMC and Moving iron instruments. Measurement of various electrical parameters using different analog and digital instruments. Measurement of energy in three phase circuit. Errors and corrections in measurement. Loading effect of voltmeter and voltage drop effect of ammeter in circuits. Extension of range and calibration of measuring instruments. Working principles and circuits of common domestic equipment and appliances. Concept of Neutral and Earth. Working principle, construction and classification of transformer. Single phase and three phase transformers. Turn ratio and e.m.f. equation. Series and parallel operation of transformer. Voltage Regulation and efficiency. Auto Transformer and instrument transformers (CT & PT). Method of connecting three single phase transformers for three phase operation. Types of Cooling, protective devices, bushings and termination etc. Testing of transformer oil. Materials used for winding and winding wires in small transformer.

Pipe Line Inspector (Plumbing Trade)

Importance of safety and general precautions required for the trade. Importance of the trade. Types of work to be done by trainees in the institute. Scope of a plumbing work. Types of services have to plan. Basic Bench fitting. Plumber's common hand tools - names, description and material from which they are made. Description, types and uses of holding device, hammers & cold chisels, cutting tools. Description of simple fitting operations hack sawing, punching and filing. Types of files used commonly. Marking instruments and their use of simple drilling machine. Method of using drills. Description of simple bench drilling Machine. Description of Grinding and Chisel. Description of different types of locking and fastening devices. About different types of pipes-GI, CI, DI, PVC/ CPVC, PPR, AC and HDPE etc. About different Types of Pipe Fittings:- Socket, Elbow, Tee, Union, Bend, Cap, Plug, Cross, Ferrule etc. About different types of Thread cutting.

Carpenter works :- Description and uses of Carpenter's hand tools used for simple operations such as marking, sawing, planing and making simple joints. Common types of wood- their description and use.

Gas Welding :- Purpose of Gas welding. Method of gas welding. Safety precautions to be observed - Methods of soldering and brazing - fluxes used & Types of fluxes precautions to be observed. Hard & soft solders -their properties, composition and uses.

Mason's works :- Names and description of Mason's hand tools and their uses. Method of making holes in walls and floors. Types of tools used and various Processes. Concept of bricks, lime and cement. Preparation of mortars with various materials of varying composition. Common brick joints. Description of bonds. Scaffolding & plastering. Define Plain cement concrete, RCC and its proportion, Grades of coarse aggregate and fine aggregate, Knowledge of waterproofing compound. Knowledge of Building Plan and Cross section of wall. Identify plumbing services required for each type of building according to usage. Description of plumber tools and Equipment- Ratchet brace,

Threading die, Pipe wrench, Sliding wrench, Spanner set, Chain Wrench etc. and their safety Care & use of tools. Pipes of different kinds Method of Pipe bending in different dia. Plumbing Symbols and Code for Tools & Materials on water line. Equipment and tools for hot gas welding and electric hot plate for PPR pipe joints. Types of fittings for different joints & different pipes.:- CI,HCI,AC,AC Pressure, DI, GI Pipes. Joints:- Flange joint, Socket joint with lead, Detachable joint, Socket & Spigot joints etc. Description of pipe fittings. Methods of joining and their uses. Precautions to be taken while fixing. Different kinds of Joints, Fittings and Materials in joining pipes :- PVC/CPVC, PPR and HDPE etc.

Composition of Water :- Sources of water. Hard & Soft water, temporary hardness & permanent hardness. Impurities of water—organic and inorganic impurities. Water purification stages and methods. Static water pressures and measurement of pressures. Bursting pressure, Expansion of water on freezing and heating. Bernoulli's principles Pascal's law. Pressure of water on the sides of cistern or tank. Water hammer in pipes. Use of hummed and asbestos pipes of different sizes. Method of laying out pipes alignment and joining. Description of various pipe joints- straight, Branch, Taft and blow, Expansion joints. Solders and fluxes used in joints. Description of Plumber's materials Lead, tin, Zinc, solder, copper, red lead etc. and their uses. Water supply system of a small town. Description and types of pumps viz. suction pump, Centrifugal pump etc. Contamination of water in a well. Description of pipe dies, their uses, care and precaution. Metric specification of various pipes. Standard pipe threads. Method employed for bending, Joining and fixing PVC pipe. Joining material for water and gas pipes. Use of blow lamp. Inspection chamber, septic tank, description of drains, cesspools, soak pits etc. Types of traps layout of drainage system Method of bending pipes by hot and cold process. Method of testing drainage lines Method of dismantling and renewal of the valves and pipes. Leaks in pipes and noises in plumbing. Installation of water meters. Air lock in pipes and its removal.

Description of cocks & valves-their types, materials & advantages for particular work. Erecting rain water and drainage pipe system, Installation of sanitary fittings, inspection and testing of water supply system. -Pipe alignment and slope. -Prevention of water hammer. Storage tanks for general water supply propose. Test for water supply pipes. Description of sanitary fittings, general points to be observed when choosing sanitary Method of bending galvanized mand other heavy pipes.

Domestic drainage system:- General layout, one pipe system, specifications of Materials required. Method of testing leakage. Different types of traps, ventilation, antisiphonage and sinks. About Fire hydrants and their fittings.

Concept of heat and Temperature. Method of transmission of heat. Heating system by different thermal units. Domestic hot and cold water. General layout, specification of materials required and Connection of pipes to mains. Tracing leakage. Repairs to service main. Domestic boilers and Geysers. Method of ventilating pipe. Precaution against air Poisoning. Fixing of solar water system. Plumbing and sanitary symbols and plumbing codes for all tools and materials Sensor system for urinals and was basin, etc. Corrosion-causes and remedies, prevention. Corrosion due to electrolytic action. Effect of water and frost on materials. Layout of pipes as per drawing. Analysis quantity measurement and abstract rate of plumbing and sanitary work.

Bill of Quantity and Estimation :- Preparation of bill of quantity. Preparation of Estimation.

सामान्य ज्ञान

स्ट्रीट लाईट इंस्पेक्टर एवं पाईप लाईन इंस्पेक्टर के पदों के लिए सामान्य ज्ञान का पाठ्यक्रम कनीय अभियंता (विद्युत), कनीय अभियंता (असैनिक), कनीय अभियंता (यांत्रिक), कनीय अभियंता (कृषि अभियंत्रण) एवं मोटरयान निरीक्षक के पदों के लिए निर्धारित सामान्य ज्ञान के पाठ्यक्रम के समान होगा।

19. मुख्य परीक्षा के आधार पर मेधा सूची का निर्माण :

(i)(क) कनीय अभियंता (विद्युत), कनीय अभियंता (असैनिक), कनीय अभियंता (यांत्रिक), कनीय अभियंता (कृषि अभियंत्रण) एवं मोटरयान निरीक्षक के लिए:-

आयोग द्वारा आयोजित मुख्य परीक्षा के उपरांत प्रश्न पत्र 1 एवं 2 के विषयों के प्राप्तांक के योगफल के आधार पर सामान्य मेधा-सूची (Common Merit List) तैयार की जायेगी और मेधा-सह-विकल्प (Merit-cum-Option) के आधार पर कोटिवार रिक्त पदों की संख्या के अनुसार अभ्यर्थियों का चयन किया जायेगा।

(ख) स्ट्रीट लाईट इंस्पेक्टर एवं पाईप लाईन इंस्पेक्टर के पदों के लिए:-

आयोग द्वारा आयोजित मुख्य परीक्षा के उपरांत प्रश्न पत्र 1 के विषय के प्राप्तांक के आधार पर सामान्य मेधा-सूची (Common Merit List) तैयार की जायेगी और मेधा के आधार पर कोटिवार रिक्त पदों की संख्या के अनुसार अभ्यर्थियों का चयन किया जायेगा।

(ii) मेधा-सूची में एक से अधिक उम्मीदवारों के प्राप्तांक समान (Equal Marks) रहने पर मेधा का निर्धारण उम्मीदवारों की जन्म तिथि के आधार पर किया जायेगा तथा अभ्यर्थी, जिनकी उम्र ज्यादा होगी, उन्हें अपेक्षाकृत ऊपर स्थान मिलेगा। यदि एक से अधिक उम्मीदवारों के प्राप्तांक और जन्म तिथि समान पायी जाती है, तो ऐसी स्थिति में उनके डिप्लोमा/तकनीकी एवं अन्य विशिष्ट योग्यता परीक्षा में प्राप्त अंकों के आधार पर वरीयता का निर्धारण किया जायेगा, अर्थात् डिप्लोमा/तकनीकी एवं अन्य विशिष्ट योग्यता परीक्षा में अधिक अंक प्राप्त करने वाले उम्मीदवार को मेधाक्रम में ऊपर रखा जायेगा।

(iii) मेधा के आधार पर अनारक्षित पद के लिये तैयार मेधा सूची में समान मापदंड पर आरक्षित वर्ग के अभ्यर्थी के आने की स्थिति में उक्त अभ्यर्थी की गणना अनारक्षित वर्ग के अनुमान्य पदों के विरुद्ध की जायेगी और उनके नाम के सामने उनका आरक्षण वर्ग भी वही होगा। इस सम्बन्ध में राज्य सरकार से प्राप्त अद्यतन निर्देशों का पालन किया जायेगा।

(iv) परीक्षा में निम्न न्यूनतम अर्हतांक से कम अंक पाने वाले अभ्यर्थियों को मेधा-सूची में शामिल नहीं किया जायेगा:-

(I) अनारक्षित	- 40 (चालीस) प्रतिशत
(II) अनुसूचित जाति/अनुसूचित जनजाति एवं महिला	- 32 (बत्तीस) प्रतिशत
(III) अत्यन्त पिछड़ा वर्ग -(अनुसूची-1)	- 34 (चौत्तीस) प्रतिशत
(IV) पिछड़ा वर्ग अनुसूची-2	- 36.5 (साढ़े छत्तीस) प्रतिशत
(V) आदिम जनजाति	- 30 (तीस) प्रतिशत
(VI) आर्थिक रूप से कमजोर वर्ग (EWS)	- 40 (चालीस) प्रतिशत