

**डिप्लोमा स्तर संयुक्त प्रतियोगिता परीक्षा –2017**  
**प्रारम्भिक परीक्षा का पाठ्यक्रम**

**प्रश्न पत्र – 1 (भाषा ज्ञान)**

**(क) हिन्दी भाषा का ज्ञान :-**

(i) हिन्दी अनुच्छेद पर आधारित प्रश्न

(ii) हिन्दी व्याकरण पर आधारित प्रश्न

इस विषय में हिन्दी अपठित अनुच्छेद (unseen Passage) तथा हिन्दी व्याकरण पर आधारित प्रश्न रहेंगे।

**(ख) अंग्रेजी भाषा ज्ञान :-**

(i) अंग्रेजी अनुच्छेद पर आधारित प्रश्न

(ii) अंग्रेजी व्याकरण पर आधारित प्रश्न

इस विषय में अंग्रेजी अपठित अनुच्छेद (unseen Passage) तथा अंग्रेजी व्याकरण पर आधारित प्रश्न रहेंगे।

**पत्र – 2 (सामान्य ज्ञान)**

**(क) 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।

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

- (ग) सामान्य गणित – इस विषय में सामान्यतः अंक गणित, प्राथमिक बीजगणित, ज्यामिति, सामान्य त्रिकोणमिति, क्षेत्रमिति से सम्बन्धित प्रश्न रहेंगे। सामान्यतः इसमें मैट्रिक/10वीं कक्षा स्तर के प्रश्न रहेंगे।
- (घ) मानसिक क्षमता जाँच – इसमें शाब्दिक एवं गैर शाब्दिक दोनों प्रकार के प्रश्न रहेंगे। इस घटक में निम्न से सम्बन्धित यथा सम्भव प्रश्न पूछे जा सकते हैं – सादृश्य, समानता एवं भिन्नता, स्थान कल्पना, समस्या समाधान, विश्लेषण, दृष्य समृति, विभेद अवलोकन, सम्बद्ध अवधारणा, अंक गणितीय तर्कशक्ति, अंक गणितीय संख्या श्रृंखला एवं कूट लेखन तथा कूट व्याख्या इत्यादि।
- (ङ) कम्प्यूटर का मूलभूत ज्ञान (Basic Knowledge of Computer):– इसमें कम्प्यूटर के विभिन्न उपकरणों एवं संचालन की विधि की जानकारी के सम्बन्धित प्रश्न पूछे जा सकते हैं।

## मुख्य परीक्षा

मुख्य परीक्षा में अभियांत्रिकी से संबंधित दो पत्र होंगे। पाठ्यक्रम निम्नवत् है:-

प्रश्न पत्र 1 सामान्य अभियांत्रिकी (General Engineering)

### For Motor Vehicle Inspector

#### Paper -1

#### General Engineering

#### (Mechanical Engineering & Automobile Engineering)

#### Part-1

- (a) **Civil Engineering** - Building Materials , Estimating , Costing and valuation, Surveying, Soil Mechanics, Hydraulics, Irrigation Engineering, Transportation Engineering, Environmental Engineering.
- (b) **Structural Engineering**- Theory of Structures, Concrete Technology, RCC Design, Steel Design.
- (c) **Electrical Engineering** - 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.
- (d) **Mechanical Engineering** - Theory of Machines and Machine Design, Engineering Mechanics and Strength of Materials, Properties of pure substances, 1<sup>st</sup>. Law of Thermodynamics, 2<sup>nd</sup>. 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.

## **Paper 2**

### **Mechanical Engineering & Automobile Engineering**

**(Section A is compulsory. Candidate can choose either of the Section B or Section C**

#### **Section-A**

1. **Engineering Mechanics** : Force, Equilibrium, Friction, Centroid and Centre of Gravity, Simple Lifting Machine.
2. **Strength of Materials** : Stress and strain, Strain energy, Shearing force and bending moment, moment of inertia, Principal planes and stresses, slope and deflection. Direct and bending stresses, Columns, Torsion and thin cylinders.
3. **Manufacturing Technology**: Forging, Press Working, Welding, Turning, Drilling. Boring, Broaching, Finishing and super finishing, Gear production as well as NC-CNC and non conventional machining methods.
4. **Theory of Machines** : Kinematics and Dynamics of machines, Role of Friction, Different Power Devices and power transmission equipments such as governors, gyroscopes etc., Applications of Cams, Balancing of Rotating Mass.
5. **Hydraulics** : Fluids and Their properties. Laminar and Turbulent flow, Bernoulli's Equation, Fluid pressure. Pascal's Law, Fluid Flow and its Measurement, Flow through Pipes.
6. **Thermal Engineering** : Sources of energy: Conventional and Non conventional, Laws of Thermodynamics, Principle and Working of Heat Engines, Air Compressors. Air Standard Cycles, Steam Boiler, Steam Condenser & Steam Turbine.
7. (a) **Automobile Engines** : Theory, working and constructional features of C.I. and S.I. engines, Combustion phenomena and various ignition systems, Fuels and Lubricants, Performance and Testing of I.C.Engines, Pollution control.  
(b) **Auto Electrical System and Autotronics** : Automobiles battery, Ignition System, Charging System, Current and Voltage Regulation of Alternator, PLC, Transducers, Sensores, Actuators and their applications in automobiles.
8. **Machine Design**: Design of simple Machine Element like Cotter Joint, Knuckle Joint, Lever, Shafts, Keys and Couplings, Design of Spring, Bearing and Gears

## Section B

### **Mechanical Engineering**

1. **Mechanical Engineering Material:** Engineering Material and their Properties, Ferrous, Non-Ferrous Metals and Alloys, Heat Treatment of Steel,, Non-Metallic material, Testing of Material .
2. **Hydraulic Machinery:** Impact of Jet, Hydraulic turbines, Hydraulic pumps: Centrifugal, Reciprocating and other types, Hydraulic control circuits.
3. **Refrigeration and Air Conditioning :** Refrigerator and Heat Pump, COP, Vapour compression and vapour absorption refrigeration systems. Refrigerants, Psychrometry, Air conditioning and its applications.
4. **Industrial Engineering:** Types of production, plant layouts, Process Planning, Work study, Statistical quality control, Metrology.

## Section-C

### **Automobile Engineering-**

1. **Automobile Systems:** Vehicle layout, Transmission system, Braking systems, ABS, Steering and suspension system. Chassis Frame and Body engineering.
2. **Vehicle Maintenance:** Performance of vehicles, Engine Electricals and Electronics, Workshop layout, Repairing and servicing, Emission measurements and control techniques, Trouble shooting of Engine and Transmission System.
3. **Transport Management:** Elements of transport and its operations, Motor Vehicle Act, Motor Vehicles Insurance, Taxation and registration of vehicles, Licensing of Drivers, Estimation and valuation of vehicles, Traffic Signs, Central Motor Vehicle Act - 1988 & Central Motor Vehicle Rules - 1989.
4. **Earth Moving Machinery:** Tractor dozer, Dragline, Clamshell, Cranes, Loaders, Excavator, Scraper and Grader.

## For Mines Inspector

### Paper -1

#### General Engineering (Only for Mining Engineering)

- (a) **Engineering Mechanics:** Basic concepts, Force, Resolution and Composition of forces, Equilibrium, Friction, Centroid and Center of gravity, Kinetics, Work, Power and Energy, Simple lifting Machines, Transmission of power by Belt and Rope, Strength of Material, Moment of Inertia, Shear force and Bending Moment.
- (b) **Electrical Engineering :**
- (i) **Electric Circuit:** Resistance, Current, Voltage, Work, Power and Energy, Ohm's Law, AC Current, Storage Batteries.
  - (ii) **DC Machines:** Construction, Principles of operation, Load Characteristics of Series, shunt and compound generator and motors, Motor starter and Speed control
  - (iii) **AC Motors:** Construction, Principles of operation, Types of AC motors, Method of starting, Speed control of Induction motor, Universal Motor.
  - (iv) **Single Phase Transformer:** Construction, Principles of operation, Types of Transformer, Efficiency, and Regulations, Auto Transformer.
  - (v) **Power Supply System:** Transmission and distribution of Electrical power by overhead lines and cables, Types of cable.
- (c) **Mechanical Engineering**
- Units and Dimensions, Engineering Materials, Break and Clutches, Internal Combustion Engine, Air Compressor, Hydraulics and Hydraulic machines, Heat Treatment of Iron & Steel.

### Paper-2

#### Mining Engineering

**General Geology:-** Scope of geology, Origin of Earth, Age of Earth, Interior of Earth, Continental drift, Isostasy, Erosion & weathering, River & wind erosion, Earth quake, Volcano, Strike & Dip, Folds, Faults, Unconformity, Joints and cleavages, Outlier and Inlier, Process of formation of landforms,

**Paleontology:-** Classification of animal and plant kingdom, Mode of preservation of fossils, Uses of fossils,

**Stratigraphy:-** Geological time-scale, Physiographic Division of India, Archean & Dharwar System, Cuddapah System, Vindhya System, Gondwana super group, Deccan traps.

**Mineralogy:-** Elements of crystallography, Characteristic symmetry elements, Elements of crystal system, Definition of Mineral, Classification of Mineral, Physical and chemical properties of Minerals.

**Petrology:-** Rocks cycle and characteristics of various rock types, classification, Structure, occurrence & uses of Igneous Rocks, sedimentary Rocks & Metamorphic Rocks.

**Coal Geology:-** Physical & chemical properties, Origin, occurrence and distribution, Ranks of coal, Banded constituents of coal, Structural features of coal seam, Commercial classification of coal.

**Geological Maps:-** Drawing & Description of Geological section of maps, Characteristics of contour line.

**Economic Geology:-** Elements of economic geology, Process of ore formation of economic Mineral deposits with examples, Study of Metaliferous deposits of India-, Fe, Cu, Mg, Al, Au, Pb, & Zn, Metallogenic/ Mineralogenetic provinces of India, Petroleum Geology,

**Mine Economics:** - Mineral Industry, Sampling, Salting, Valuation & Description, Ore Dressing, Inventory Control, Mine leasing procedure,

**Mining Technology:-** Introduction to mining & Mineral, Mining Terminology & Definition, Explosives & Accessories, Shot firing, Drilling patterns, Face preparation for shot firing, Solid blasting, Safety in shot firing operation. Method of Working-Coal :- Steel support, Steel arches, Board & Pillar method, Open cast method, Long wall in working coal, Long wall Mining, Subsidence in Mining, Precautions, While working near Restricted/fire/waterlogged areas/below depillared goaf.

**Engineering Geology :-** Geology of Dam sites & Associated Reservoirs, tunnels, Hill slopes and Rock Cuttings, Geographical information system & Remote sensing, Ground water and Hydrology, Introduction to rock Mechanics, Rock Mass Properties, Rock testing, Rock, Burst and Bumps, Monitoring ground Movement, Ground Control, Mine air, Mine Climate, Natural Ventilation, Artificial Ventilation, Distribution & coursing of Air in Mines, Ventilation Survey, Method of working non-coal :- Underground Development, Unsupported Stopping Methods, Supported & Caving Methods, Shaft Sinking, Special method of Shaft Sinking, Boring,

**Open cast Mining :-** Introduction, opening of deposit, Opencast mining machinery, Open cast explosive, Blasting Practice in open cast mines, Environmental Aspects of open cast mines,

**Mine Surveying :-** Introduction to surveying, Plane and Geodetic surveying, Chain Surveying, Compass Surveying, Plane table Surveying, Leveling, Contouring, Subsidence survey, Planes & Sections, Theodolite, Theodolite Traversing, Geodetic Triangulation,

Tachometric Surveying, Setting out curves, Underground Surveys, Stope Survey, Advances in mining surveying, Dip & Fault problems,

**Mine Environment :-** Mine Fires, Sampling of Mine Atmosphere & Interpretation, Fire Damp Explosion, Coal Dust Explosion, Inundation, Mine Rescue,

**Mining Machinery :-** Transport of core, Winding in Shaft, Wire Ropes, Mine pumps, Coal cutting Machine, Electric power supply, Gate end box,

**Mine Management Legislation and Safety:** - Mines Act, Mines Rules, Coal Mines Regulations, Mine Accidents, Management, Inspection Procedure, Mines Recue Rules,

## **Paper-1 (General Engineering)**

### **For Junior Engineer Civil/ Mechanical/Electrical**

**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, 1<sup>st</sup>. Law of Thermodynamics, 2<sup>nd</sup>. 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.

## Paper 2

### 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 it's 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.

# Paper 2

## 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 H<sub>2</sub>O, 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).

**1<sup>ST</sup>. Law Thermodynamics:** Definition of stored energy and internal energy, 1<sup>st</sup>. 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.

**2<sup>nd</sup>. 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 2<sup>nd</sup>. 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.

## Paper 2

### **विषय: 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 धारणा, एम एम एफ, प्रतिष्टम्भ, विभिन्न प्रकार के चुंबकीय पदार्थ, विभिन्न विन्यास यथा सीधा, वर्तुल, परिनालिकीय आदि के चालक के लिए चुंबकीय परिकलन। विद्युत-चुंबकीय प्रेरण, स्वप्रेरण तथा अन्योन्य प्रेरण।

**AC मूल सिद्धांत :** तात्कालिक, शिखर, प्रत्यावर्ती 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 विद्युत, R-L और R-C परिपथ का DC और ज्वावक्रीय अनुक्रिया।

**मापन एवं मापक यंत्र :** विद्युत (एकल प्रावस्था एवं त्रि प्रावस्था, सक्रिय एवं पुनः सक्रिय दोनों) एवं ऊर्जा का मापन, त्रि-प्रावस्था विद्युत 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।

**वैद्युत 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। वोल्टेज, 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 आर्मचर प्रतिक्रिया, वोल्टेल नियंत्रण, दो प्रत्यावर्तित्रों का समांतर प्रचालन, तुल्यकालिकता, सक्रिय और प्रतिघाती शक्ती का नियंत्रण तुल्यकालिक मोटर की स्टार्टिंग और उनका प्रयोग। उत्पादन, संरक्षण और वितरण – अलग-अलग प्रकार के विद्युत केन्द्र, उद्भार गुणक, विविधता अनुपात, माँग घटक, उत्पादन लागत, विद्युत केन्द्रों का आपसी कनेक्शन, विद्युत 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 फ्यूज, 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।