

मध्यप्रदेश लोक सेवा आयोग

राज्य अभियांत्रिकी सेवा परीक्षा–2022

-::परीक्षा योज्ञा::-

(अ) अंक-योजना :-

| परीक्षा | प्रश्नों की संख्या | पूर्णाक | अवधि |
|--|-----------------------|---------|--------|
| खंड 'अ'— मध्यप्रदेश, राष्ट्रीय एवं अंतर्राष्ट्रीय स्तर का सामान्य ज्ञान तथा कम्प्यूटर का आधारमूत ज्ञान | 50 | 150 | 3 ਬਂਟੇ |
| खंड 'ब'— विषय— संबंधित इंजीनियरिंग विषय (सिविल/मैकेनिकल/इलेक्ट्रिकल/कृषि इंजीनियरिंग) | 100 | 300 | |
| योग | 150 | 450 | |
| साक्षात्कार | _ | 50 | |
| कुल अक | - | 500 | |

(ब) प्रश्न पत्र योजना :--

- 1. परीक्षा का आयोजन एक सत्र में 03 घंटे की अवधि का होगा।
- 2. खंड (अ) विषय— मध्यप्रदेश, राष्ट्रीय एवं अंतर्राष्ट्रीय स्तर का सामान्य ज्ञान तथा कम्प्यूटर का आधारभूत ज्ञान से खंड—'अ' में 50 प्रश्न वस्तुनिष्ठ प्रकार के होंगे तथा खंड—'ब' में विषय से संबंधित प्रश्नपत्र में 100 प्रश्न वस्तुनिष्ठ प्रकार के होंगे। इस प्रकार प्रश्न पत्र में खण्ड 'अ' तथा 'ब' मिलाकर 150 वस्तुनिष्ठ प्रश्न शामिल होंगे। प्रत्येक प्रश्न 03 अंको का होगा, इस तरह प्रश्न पत्र के पूर्णांक 450 अंक होंगे।
- 3. प्रश्न पत्र वस्तुनिष्ठ (बहुविकल्पीय) प्रकार का होगा। प्रत्येक प्रश्न के उत्तर हेतु चार विकल्प (A,B,C,D) होंगे। अभ्यर्थी को उक्त विकल्पों में से सही विकल्प का चयन करना होगा।
- 4. प्रश्न पत्र के दो भाग होंगे— भाग—(अ) सामान्य ज्ञान के प्रश्न पत्र में 40 प्रतिशत अंक एवं भाग—(ब) विषय से संबंधित 40 प्रतिशत अंक पृथक—पृथक प्राप्त करना अनिवार्य होगा। इस प्रकार मेरिट दोनों खंडों के अंकों को जोड़कर बनेगी। परीक्षा में ऋणात्मक मूल्यांकन (3R-W)=प्राप्तांक पद्धित से होगा।

$\{R=$ सही उत्तरों की संख्या, W= गलत उत्तरों की संख्या $\}$

अर्थात् प्रत्येक सही उत्तर के लिये 3 अंक प्रदाय किए जाएँगे एवं प्रत्येक गलत उत्तर के लिए 1 अंक काटा जाएगा।

- 5. प्रश्न पत्र का खंड—"अ" हिन्दी एवं अंग्रेजी दोनों माषाओं में होगा एवं खंड—"ब" इंजीनियरिंग विषय (सिविल/मैकेनिकल/इलेक्ट्रिकल/कृषि इंजीनियरिंग) का प्रश्न—पत्र केवल अंग्रेजी भाषा में होगा।
- 6. साक्षात्कार :-

साक्षात्कार 50 अंकों का होगा। साक्षात्कार हेतु कोई न्यूनतम उत्तीर्णांक निर्धारित नहीं हैं।

(स) चयन-प्रक्रिया :--

- 1) चयन—प्रक्रिया के प्रथम चरण में एक प्रश्न पत्र की ऑफलाइन पद्धति (OMR Sheet आधारित) परीक्षा का आयोजन किया जाएगा।
- 2) परीक्षा उपरान्त परीक्षा में पूछे गए प्रश्नों की प्रावधिक उत्तर कुंजी तैयार कर आयोग की वेबसाइट www.mppsc.mp.gov.in पर प्रकाशित कर 07 दिवस की अवधि में आपित्तयाँ प्राप्त की जाएंगी। इस अवधि के पश्चात् प्राप्त किसी भी अभ्यावेदन पर कोई विचार एवं पत्राचार नहीं किया जाएगा। आपित हेतु दिया गया शुल्क किसी भी स्थिति में वापस नहीं किया जाएगा। प्राप्त आपित्तयों पर आयोग द्वारा गठित विषय—विशेषज्ञ समिति द्वारा आपित्तयों पर विचार कर निम्नांकित कार्यवाही की जाएगी:—
 - 1. ऐसे प्रश्न जिनका प्रावधिक कुंजी में दिए गए विकल्पों में से गलत उत्तर दिया गया हैं और विकल्पों में अन्य विकल्प सही हैं, तब प्रावधिक उत्तर कुंजी को संशोधित किया जाएगा ।
 - 2. प्रश्न पत्र में अनुवाद की भाषा में भिन्नता की स्थिति में केवल हिन्दी अनुवाद ही मान्य होगा।
 - 3. ऐसे प्रश्न जिसका दिए गए विकल्पों में एक से अधिक सही उत्तर है, सभी सही उत्तरों को मान्य किया जाएगा ।
 - 4. ऐसे प्रश्न जिसका दिए गए विकल्पों में एक भी सही उत्तर न हो, प्रश्न को प्रश्न–पत्र से विलोपित किया जाएगा ।
 - 5. विषय—विशेषज्ञ समिति द्वारा समस्त अभ्यावेदनों पर विचार करने के पश्चात् अंतिम उत्तर कुंजी बनाई जाएगी तथा आयोग द्वारा वेबसाइट <u>www.mppsc.mp.gov.in</u> पर प्रकाशित की जाएगी। अंतिम उत्तर कुंजी के प्रकाशन के पश्चात् अभ्यर्थियों के कोई भी आपत्ति/पत्र व्यवहार मान्य नहीं किया जाएगा । विषय—विशेषज्ञ समिति का निर्णय अंतिम होगा ।
 - 6. उपरोक्तानुसार समिति द्वारा विलोपित किए गए प्रश्नों को छोड़कर शेष प्रश्नों के आधार पर अंतिम उत्तर कुंजी के अनुसार अभ्यर्थियों का मूल्यांकन कर परीक्षा—परिणाम घोषित किया जाएगा।
- 3) परीक्षा में प्राप्तांक के गुणानुक्रम के आधार पर विभिन्न प्रवर्गों हेतु विज्ञापित रिक्तियों के अधिकतम 3 गुना तथा समान अंक प्राप्त करने वाले अभ्यर्थियों को साक्षात्कार में अभिलेख प्रस्तुत करने हेतु सफल घोषित किया जाएगा।
- 4) परीक्षा में उत्तीर्ण होने हेतु आवेदक को न्यूनतम 40 प्रतिशत अंक खंड 'अ' तथा खंड —'ब' में पृथक पृथक प्राप्त करना अनिवार्य होगा। मध्यप्रदेश के अधिसूचित अनुसूचित जाति, अनुसूचित जनजाति तथा अन्य पिछड़ा वर्ग, आर्थिक रूप से कमजोर वर्ग एवं निःशक्तजन श्रेणी के आवेदकों को परीक्षा में उत्तीर्ण होने हेतु 10—10 प्रतिशत अंकों की छूट दी जाएगी इस प्रकार उक्त श्रेणी के आवेदकों को परीक्षा में उत्तीर्ण होने हेतु न्यूनतम 30 प्रतिशत अंक खंड 'अ' तथा खंड 'ब' में पृथक—पृथक प्राप्त करना अनिवार्य होगा।

- 5) परीक्षा परिणाम के साथ ही अभिलेख—प्रेषण हेतु अंतिम तिथि निर्धारित कर परीक्षा में सफल अभ्यर्थियों से उनकी अर्हता से संबंधित सभी अभिलेख प्राप्त किए जाएँगे तथा केवल उन्हीं अभ्यर्थियों को साक्षात्कार हेतु आमंत्रित किया जाएगा जो अभिलेखों की सूक्ष्म जाँच उपरान्त अर्ह पाए जाएँगे।
- 6) साक्षात्कार में अनुपस्थित रहने वाले अभ्यर्थियों को चयन के लिये अनर्ह माना जाएगा। साक्षात्कार के लिए आवेदकों को बुलाने के संबंध में आयोग का निर्णयं अंतिम होगा। जिसकी सूचना अभ्यर्थियों को आयोग की वेबसाइट www.mppsc.mp.gov.in पर भी उपलब्ध रहेगी। अभ्यर्थी आयोग की वेबसाइट का समय—समय पर अवलोकन करते रहें।
- 7) उपर्युक्त पदों पर अंतिम चयन प्रतियोगी परीक्षा तथा साक्षात्कार में प्राप्त अंकों के योग के श्रेणीवार गुणानुक्रम आधार पर होगा।
- 8) आयोग की परीक्षा प्रणाली में पुनर्मूल्यांकन/पुनर्गणना का कोई प्रावधान नहीं है। इस विषय में प्राप्त अभ्यावेदनों पर कोई कार्यवाही नहीं की जाएगी।

परीक्षा नियंत्रक

राज्य अभियांत्रिकी सेवा परीक्षा-2022

पाठ्यक्रम

(खण्ड-'अ')-मध्यप्रदेश, राष्ट्रीय एवं अंतराष्ट्रीय स्तर का सामान्य ज्ञान

1. मध्यप्रदेश का इतिहास, संस्कृति एवं साहित्य

- मध्यप्रदेश के इतिहास की महत्वपूर्ण घटनाएँ, प्रमुख राजवंश।
- स्वतंत्रता आन्दोलन में मध्यप्रदेश का योगदान।
- मध्यप्रदेश की कला एवं संस्कृति।
- मध्यप्रदेश की प्रमुख जनजातियाँ एवं बोलियाँ।
- प्रदेश के प्रमुख त्यौहार, लोक संगीत एवं लोक कलाएँ।
- मध्यप्रदेश के प्रमुख साहित्यकार एवं उनकी रचनाएँ।
- मध्यप्रदेश के प्रमुख पर्यटन स्थल।
- मध्यप्रदेश के प्रमुख व्यक्तित्त्व।

2. मध्यप्रदेश का भूगोल

- मध्यप्रदेश के वन, पर्वत तथा निदयाँ।
- मध्यप्रदेश की जलवायु।
- मध्यप्रदेश के प्राकृतिक एवं खनिज संसाधन।
- ऊर्जा संसाधन : परंपरागत एवं गैर परंपरागत।
- मध्यप्रदेश की प्रमुख सिंचाई एवं विद्युत परियोजनाएँ।

3. मध्यप्रदेश की राजनीति एवं अर्थशास्त्र

- मध्यप्रदेश की राजनीतिक व्यवस्था (राज्यपाल, मंत्रिमंडल, विधानसभा)
- मध्यप्रदेश में पंचायतीराज व्यवस्था।
- मध्यप्रदेश की सामाजिक व्यवस्था।
- मध्यप्रदेश की जनानिकी एवं जनगणना।
- मध्यप्रदेश का आर्थिक विकास।
- मध्यप्रदेश के प्रमुख उद्योग।
- मध्यप्रदेश में कृषि एवं कृषि आधारित उद्योग।

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अंतर्राष्ट्रीय, राष्ट्रीय एवं मध्यप्रदेश की महत्त्वपूर्ण समसामियक घटनाएँ

- महत्त्वपूर्ण समसामयिक घटनाएँ।
- देश एवं प्रदेश की प्रमुख खेल प्रतियोगिताएँ एवं पुरस्कार तथा खेल संस्थाएँ।
- मध्यप्रदेश राज्य की प्रमुख जन कल्याणकारी योजनाएँ।
- मध्यप्रदेश के चर्चित व्यक्तित्त्व एवं स्थान।

सूचना एवं संचार प्रौद्योगिकी।

- इलेक्ट्रॉनिक्स, कम्प्यूटर्स, सूचना एवं संचार प्रौद्योगिकी।
- रोबोटिक्स, आर्टिफिशियल इंटेलीजेन्स एवं सायबर सिक्यूरिटी।
- ई-गवर्नेन्स ।
- इंटरनेट तथा सोशल नेटवर्किंग साईट्स।
- ई–कॉमर्स।

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STATE ENGINEERING SERVICE EXAM-2022

(Section-'A')-General Knowledge of Madhya Pradesh, National and International level

1. History culture and literature of M.P.

- Important Historical events and Major dynasties of M.P.
- Contribution of Madhya Pradesh in the Independence movements.
- Art, Architecture and culture of M.P.
- Main Tribes and Dialects of M.P.
- Main festivals, folk music and folk art of M.P.
- Important literary figures of M.P. and their literature.
- Main Tourist places of M.P.
- Important personalities of M.P.

2. Geography of the Madhya Pradesh

- Forest, Mountain and Rivers of M.P.
- Climate of M.P.
- Natural and mineral resources of M.P.
- Energy Resources: Conventional and Non-conventional.
- Main irrigation and Power projects of M.P.

3. Politics and Economy of M.P.

- Political system of M.P. (Governor, Cabinet, Legislative Assembly).
- Panchayati Raj in M.P.
- Social system of M.P.
- Demography and census of M.P.
- Economic development of M.P.
- Main industries of M.P.
- Agriculture and Agri based industries in M.P.

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4. Current events of International, National and M.P.

- Important Contemporaneous events.
- Famous sports competitions; awards and sports institution of the State and country.
- Welfare schemes of M.P. state.
- Famous personalities and Places.

5. Information and Communication Technology

- Electronics, computers, information and communication technology.
- Robotics, artificial intelligence and cyber security.
- E- governance.
- Internet and Social networking site.
- E- Commerce.

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CIVIL ENGINEERING

Unit-1

Structural Analysis:

Stress, plane stress, Strains, plane strain, Mohr's circle of stress and strain, Elastic theories of failure, Principal Stresses, Bending, Shear and Torsion, Determinate and Indeterminate structures, Degrees of Freedom, Static and kinematic Indeterminacy, Principal of Superposition, Virtual Work, Energy theorem, Deflection of Trusses, Redundant Frames.

Unit-2

Steel Structural Design

Factors of Safety and Load Factors. Riveted and Welded connections of members, Design of Tension, Compression and Flexural members, Built-up Beams and Plate Girder Slab and Gusseted Bases for Columns, Design of Roof Trusses, Purling and Coverings, Structural Steel Tubes and their connection, Plastic Design of Continuous Beams and Frames.

Unit-3

Reinforced Concrete Design

Working Stress and Limit State methods for design of Rectangular, T and L Beams, Slabs and Columns Isolated and Combined Footing, Raft Foundation. Overhead, Resting on Ground and Underground Water Tanks, Method and System of Prestressing, Anchorages Losses in Prestress, Design of prestressed Concrete Beams. Principles of pre-stressed concrete design including materials and methods; Earthquake resistant design of structures; Design of Masonry Structure.

Unit-4

Construction Planning and Management

Construction materials, Detailed estimates, specifications, analysis and rates of various works in civil engineering, construction activity, scheduling through CPM and PERT analysis, cost optimization through network construction, Float times, Bar charts, cost analysis and resource allocation, Types of tenders and contract conditions, Analysis of Rates of various types of works; Quality Control, Productivity, Operation Cost; Land acquisition; Labour safety and welfare

Unit-5

Environmental Engineering

Water Demand-Per capita Demand, Population Estimation methods:

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Water Quality Criteria for various uses viz, Domestic and Non-Domestic, Irrigation effects and significance of important parameters and permissible concentration as per relevant standards. Transmission of water. A.C. Pressure pipes, Corrosion of Pipes types and Methods of control systems of distribution and layouts of distribution. Unit Processes and operation of water treatment viz, objectives and Design criteria of sedimentation, Coagulation Flocculation, Chemical Sedimentation. Filtration (Slow sand and Rapid sand), Disinfection and Softening.

Quantity and Characterization of Domestic Sewage significance of B.O.D, C.O.D, D.O., Solids, T.O.C, Effluent Standards, River Standards, Sewage System-Design of Sewers and Storm Sewer, Design of Screens, Grit Chambers, Design of Primary Sedimentation tanks.

Design of Biological Treatment Units viz., Trickling filters, Activated Sludge Treatment and secondary sedimentation tank,

Water Stabilization ponds Aerobic, Anacrobic and Facultative Ponds, design criteria and principles. Sludge Treatment-Digestion and sludge disposal, Septic Tanks-design criteria and working, Self-purification of streams-oxygen sag curve, Types of Pollution-Sources and effects of various pollution viz., water, Air, Land and Noise, Relevant standards, Rural Sanitation, Solid Waste-collection and disposal.

Sewage collection and disposal; Plumbing Systems. Components and layout of sewerage system; Planning & design of Domestic Waste-water disposal system; Sludge management including treatment, disposal and re-use of treated effluents; Industrial waste waters and Effluent Treatment Plants including institutional and industrial sewage management.

Unit-6

Water Resource Engineering

Water Resources in the Globe, Available Fresh Water. Need for Optimum use of Available water, Schemes for Drinking, Irrigation, Hydro Power, and Multipurpose Schemes

Irrigation - Necessity, Scope, Benefits and Effects.

Methods and systems of Irrigation, their efficiencies, Water Distribution and Scheduling techniques. Crop Water Requirements, Evapotranspiration, Consumptive Use, Duty, Delta, Base Period their relation, Quality of Irrigation water.

Hydrology - Hydrological Cycle, Precipitation - Types, Measurement, Raingauge Network,

Analysis of Precipitation Data, Unit Hydrograph, Summation and Synthetic Hydrograph, Design Flood by UH and Frequency Studies.

Ground Water - Classes and Availability of soil moisture, Aquifers- Confined and Unconfined. Open and Tube Wells, Radial Flow in wells, Depuits's Theory, Darcy's Law, Seepage Analysis using Flow Nets, Yield of Wells determination.

Storage Schemes - Reservoir Planning, Capacity, Yield Life, Gravity and Earthen Dams. Forces Acing, Modes of Failures, Stability Criteria, Design.

Spillway, Types, Design of ogee and Syphon Spillway, Energy Dissipation Devices, Stiling basins

Diversion Schemes – Structures on Pervious Formations, Bligh's and Khosla's Theory, Hydraulic Jump, Design of Vertical Drop Weir and Barrage.

Distribution System - Canals-classification, Layout Alignment; Capacity, Design of Canals, Silt Theories, Canal Regulation Structures, Design of Head and Cross Regulators, Canal Falls, Cross Drainage Works and Outlets, Escapes.

Water Logging - Causes, Effects, Remedial Measures, Losses in Canals, Canal lining, Types.

Advantages, Conjunctive use of Surface and Ground Water.

River Training - Objective and Methods, Concepts of Hydropower projects.

Unit-7

Fluid Mechanics

Fluid properties; Dimensional Analysis and Modeling; Fluid dynamics including flow kinematics and measurements; Flow net; Viscosity, Boundary layer and control, Drag, Lift, Open Channel Flow, Pipe Flow, Principles in open channel flow, Flow controls. Hydraulic jump; Surges; Pipe networks.

Unit-8

Railways Engineering

Permanents Way, Sleepers, Rail Fastenings, Ballast, Points and Crossings, different types of Turn and Outs.

Signals and Interlocking River Crossing.

Maintenance of track, Super-elevation, Creep of Rails, Ruling Gradients, Track Resistance.

Tractive Efforts, Curve Resistance.

Unit-9

Highways and Airports

Principles of Highway Planning, Highway Alignments.

Geometrical design, cross-section. Camber, Super-elevation. Horizontal and Vertical curves, Classification of Roads.

Design and Construction of flexible and rigid pavements for Highway and Airfields.

Evaluation of pavement failure and Strengthening Drainage of Roads.

Traffic Engineering: Traffic Surveys, Highway Capacity, Intersections, Rotary Design Elements, signs, signals and Markings.

Selection of Airport Sites, Windrose Diagram and Runway Orientation. Runway and taxiway Geometric and Lightning.

Bridge Engineering - Selection of sites, Design Data collection, Hydraulic Design, Scour Depth for Bridge Foundation, Economic Span.

Type of Road and Railway Bridge, Design load and Forces

Unit-10

Geotechnical Engineering

Index properties of soil, Classification of soils, Clay Minerals.

Capillary Water, Permeability, Factors Affecting permeability, Lab and Field Methods, Permeability of stratified soil deposits.

Seepage Pressure, Quick Sand condition, Flow Nets, its properties and uses.

Stress distribution in soils, Boussinesq's theory. Newmark's chart

Consolidation and settlement: Terzaghi's theory, Consolidation test. Settlement computation. Time settlement curves.

Compaction tests and their significance, factors affecting compaction.

Shear Strength Parameters, Shear Tests, Mohr coulomb's failure theory, Skempton's Pore Pressure coefficients.

Earth Pressure at rest; Active and Passive Pressure, Rankine's and coulombs theory.

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Bearing Capacity, Terzaghi's analysis, factors affecting Bearing Capacity, Plate Load Test.

Stability of Slopes, Sweedish Slip Circle method and Bishop's Simplified method. Stability Number.

Sub-Surface exploration Method, sampling, SPT, DCPT and Static Conc Penetration Test, Electrical Resistivity and Seismic method.

Essential features of Foundations: Types, design, criteria, Rafts

Pile Foundation, Types of piles, Pile Capacity, Pile Load Test, and Group Action. Static/Dynamic formulae.

Ground Improvement techniques, Sand Drains, Soil Stabilization, Geotextiles

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MECHANICAL ENGINEERING (CODE NO. 03)

1. Engineering Mechanics and Mechanics of Solids

Resultant of a force system; Free body diagram and equilibrium; Analysis of axially loaded components; Stress and strain in two dimension; Mohr's circle; Stress-strain-temperature relations; Shear force and bending moment diagrams; Stresses in beams; Torsion of circular shaft; Basic equations of elasticity; Deflection of beams; Buckling of column using Euler's theory; Theories of Failure; Thin pressure vessels.

2. Theory of Machines

Introduction to different types of mechanisms; Analysis of displacement, velocity and acceleration (Maximum four bar links); Inversion of mechanisms; Power transmission by belt drive; Analysis of simple band brakes; Gears: nomenclature, law of gearing, tooth profiles, interference; Epicyclic gear trains; Cam and followers; Balancing of rotating and reciprocating masses; Free and forced vibration of single degree of freedom system with damping; Whirling of shafts; Gyroscopic stability of shafts, ships and aero-plane.

3. Design of Machine Elements

Fundamentals of machine design: design for static loading, design for dynamic loading, and low and high cycle fatigue; Design of bolted, riveted and welded joints; Design of shafts; Design of Helical Springs; Design of rigid and flexible couplings; Design of clutch for uniform pressure and uniform wear.

4. Production Engineering

Chip formation mechanism, chip types, chip control; Tool geometry of single point cutting tool, Merchant's circle force analysis; Cutting tool wear and tool life, wear mechanisms, wear criterion, Taylor's tool life equation, variables affecting tool life; Machinability and its measures, economics of machining; Advanced machining processes such as Abrasive Jet Machining (AJM), Ultrasonic Machining (USM), Electro Chemical Machining (ECM), Electro-Discharge Machining (EDM), Electron Beam Machining (EBM), and Laser Beam Machining (LBM); Limits, fits, and dimensional and geometrical tolerances; Computer vision system based measurement, coordinate measuring machines; Surface roughness terminology, different methods of surface roughness measurement.

. 5. Production Management

Production Planning and Control: Functions, forecasting, routing, operations planning; Gantt chart, work order, dispatching and follow-up; CPM and PERT techniques; inventory Control: purchasing and storing, economic lot size, ABC analysis; Different types of models, formulation of linear programming problems (LPPs), Simplex algorithm, assignment models: transportation problems; Simple queuing problems; Control charts for variables and attributes.

Thermodynamics

Basic Concepts; First Law of Thermodynamics for Open and Closed system; Thermodynamic Properties; Second Law of Thermodynamics; Entropy and Entropy Generation; Availability and Exergy; Gas Power Cycle; Vapor Power Cycle.

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7. Fluid Mechanics and Machines

Basic Concepts; Continuity, Momentum and Energy Equations; Flow through Pipes; Velocity Distribution in Laminar and Turbulent Flow; Non Dimensional Numbers; Boundary Layer on a Flat Plate; Adiabatic and Isothermal Flow of Compressible Fluids; Hydraulic Turbines; Impulse and Reaction Turbine; Velocity Diagram of Hydraulic Turbines; Specific Speed.

- 8. Heat Transfer, Refrigeration and Air Conditioning
 - Basic Laws of Heat Transfer; Overall Heat Transfer Coefficient, Heat Conduction Through Walls and Pipes; Critical Conduction; Heat Transfer Through Fins of Different Types; Dimensionless Numbers; Lumped Body Heat Transfer; Free and Forced Convection; Radiation. Heat Transfer; Concept of Black and Gray Body; View Factor; Heat Exchanger Classification, Effectiveness of Parallel Counter and Cross Flow Heat Exchanger, LMTD and NTU Approach; Fouling Factor.
- 9. Energy Conversion Systems

Theories of Combustion In Compression Ignition and Spark Ignition Engines; Octane Number and Cetane Number; Abnormal Combustion and Shooting; Carburetion and Fuel Injection; Emission from Engine and Their Control; Modern Trends in IC Engines; Classification of Steam Turbines; and Gas Turbines; Pressure and Velocity Compounding; Nuclear Power Plant; Renewable Energy Sources.

...10. Computer Aided Engineering

Introduction to CAD, 2D and 3D Drawing Concepts; Computer Alded Manufacturing NC and CNC Machines, Methods of Part Programming, Elements of Robotics and Automated Material, Handling Systems; FMS and Expert Systems.

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ELECTRICAL ENGINEERING

1. Circuit Theory

Circuit components, Network graphs, Kirchhoff's current law (KCL), Kirchhoff's voltage law (KVL), Circuit analysis methods: Nodal analysis, Mesh analysis, Basic network theorems; Transient analysis: RL, RC, and RLC circuits; Sinusoidal steady state analysis, Resonance, Quality factor, Balanced three-phase circuit analysis. Frequency domain analysis, Laplace's transform, Fourier series (Trigonometric and exponential). Two-port networks and their various parameters; Poles and zeros driving point and transfer function. Passive filter design.

2. Electro-magnetic Field Theory and Materials

Electrostatic and magneto static field, Laplace's and Poisson's equations, Boundary value problems and solutions; Maxwell's equation, Electromagnetic wave propagation: Reflection and refraction of plane waves. Poynting vector, Wave propagation through dielectrics and band-theory; Intrinsic and extrinsic semi-conductors, p-n junction; Solar cells, Superconductivity. Dielectric behavior of materials: Polarization phenomena; Piezo-electric phenomena. Magnetic material, Superconductivity.

3. Measurement and Instrumentation

Error analysis, Measurement of current, Voltage, Power, Energy, Power factor, Resistance, Inductance, Capacitance, and frequency analysis of bridges. Electronic measuring instruments: Multimeter, Cathode ray oscilloscope (CRO), Digital volt meter, Frequency counter, Q-meter transducers, Measurements of non-electrical quantities by electrical methods, Measurement of displacement, Temperature, Velocity, Pressure, Signal conditioning, Data acquisition system.

4. Analog and Digital Electronics

Characteristics and equivalent circuits (for small and large signals concept for diode, bipolar junction transistor (BJT), junction gate field-effect transistor (JFET), and Metal-oxide-semiconductor field-effect transistor (MOSFET) clipping, Clampingand rectifier circuits, Biasing and bias stability. Amplifiers: Single and multi-stage, Differential, Operational, Feedback, and Power. Analysis of amplifiers; Frequency-response of amplifiers. Operational amplifier (OPAMP) circuits. Filters; Sinusoidal oscillators: Criterion for oscillation; Single-transistor and OPAMP configurations. Function generators and waveshaping circuits. Power supplies.

Boolean algebra, Boolean function minimization. Logic gates, Combinatorial circuits: Arithmetic circuits, Code converters, Multiplexers and decoders, Sequential circuit: Latches and flip flops, Counters, Shift registers, Comparators, Timers, Multivibrators, Sample and hold circuits, ADCs and DACs. Semiconductor memories, Logic implementation using programmable devices (ROM, PLA etc.)

5. Power Electronics

Semiconductor power devices: Diode, Transistor, Silicon controlled rectifier (SCR), Triac, Gate turn-off thyristor (GTO), MOSFET and Insulated-gate bipolar transistor (IGBT), Triggering circuits, Gate driver circuits. Phase control rectifiers, Inverters, and DC-DC converters, Bridge convertors: Fully controlled and half controlled, principles of choppers and inverters.

6. Signals and Systems

Representation and classification of signals and systems; Linear time Invariant (LTI) systems; Convolution, impulse response; time-domain analysis of LTI systems based on convolution and differential equations, Fourier transform, Laplace transform, Z transform, transferfunction, sampling of signals, discrete Fourier transform (DFT), fast Fourier transform (FFT), processing of analog signals through discrete time systems.

7. Control System

Fundamental of control systems, block diagram algebra, Signal flow graph and Mason's gain formulae, Linear-time invariant (LTI) systems; Time-domain and frequency-domain response. Proportional, Proportional-integral (PI) and Proportion-integral-derivative (PID) control strategies. Stability analysis; Routh-Hurwitz criterion, Nyquist criterion, Design of lead-lag compensators, State space models, Controllability and observability. Principles of discrete Control systems.

8. Microprocessors and Microcomputers

8 bit microprocessor 8085: Architecture, instructions set, CPU, module design, memory interfacing and I/O, interrupts, PPI 8255.

9. Electromechanical energy conversion, Industrial Drives and Utilisation

Principles of electromechanical energy conversion, Torque and electromotive force (EMF) in rotating machines, characteristics and performance analysis of DC machines and their stating and speed control. Transformers: Principles of operation and analysis, regulation, Three-phase transformer, Three-phase induction machines, and Synchronous machines: Their characteristics and performance analysis, speed control. Special machines: Stepper motors, Brushless DC motors, Switched reluctance motors, Permanent magnet motors, Single phased induction motor (fractional-horsepower motor (FHP) motors): Performance and analysis.

Basic concepts of speed control DC and AC motor drives. Applications of variable speed drives V/f control, Quadrant operation of drives, Concept of cycloconverts and Dual converts fed AC and DC drive.

Rating and characteristic of traction motors, dielectric, and induction heating.

10. Power Systems Analysis and Control, Switch gear and protection

Performance evaluation of overhead transmission lines and cables, fundamentals of active and reactive power transfer, voltage control and power factor correction, Bus admittance and impedance matrices, Load flow study, Economic operation of power system, Symmetrical components, Analysis of symmetrical and unsymmetrical faults, concept of stability, swing curve and equal area criterion, static volt-ampere reactive (VAR) systems, basic concepts of high voltage direct current (HVDC) transmission, series and shunt compensation, flexible alternating current transmission systemFACTS, speed control of generators, tie line control and frequency control.

Principle of over current, differential and distance protection, concept of solid state relays and circuit breakers of various protection schemes for transmission lines, generator and transformer. Protection against surges.

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