

| પ્રાથમિક કસોટીનો અભ્યાસક્રમ<br>પ્રશ્નપત્ર-૧ |  |
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| માધ્યમ: ગુજરાતી                             | કુલ ગુણ- ૧૦૦   |
| ૧   | ભારતની ભૂગોળ- ભૌગોલિક, આર્થિક, સામાજિક, કુદરતી સંસાધન અને વસ્તી અંગેની બાબતો- ગુજરાતના ખાસ સંદર્ભ સાથે   |
| ૨   | ભારતનો સાંસ્કૃતિક વારસો- સાહિત્ય, કલા, ધર્મ અને રચાપત્યો- ગુજરાતના ખાસ સંદર્ભ સાથે   |
| ૩   | ભારતનો ઇતિહાસ- ગુજરાતના ખાસ સંદર્ભ સાથે  |
| ૪   | ભારતની અર્થવ્યવસ્થા અને આયોજન  |
| ૫   | ભારતીય રાજનીતિ અને ભારતનું બંધારણ:<br>(૧) આમુખ<br>(૨) મૂળભૂત અધિકારો અને હુકમો<br>(૩) રાજ્યનીતિના માર્ગદર્શક સિદ્ધાંતો<br>(૪) સંસદની રચના<br>(૫) રાષ્ટ્રપતિની સત્તા<br>(૬) રાજ્યપાલની સત્તા<br>(૭) ન્યાયતંત્ર<br>(૮) અનુસૂચિત જાતિ, અનુસૂચિત જનજાતિ અને સમાજના પછાત વર્ગો માટેની બેગવાઈઓ<br>(૯) એટર્ની જનરલ<br>(૧૦) નીતિ આયોગ<br>(૧૧) પંચાયતી રાજ<br>(૧૨) નાણા પંચ<br>(૧૩) બંધારણીય તથા વૈધનિક સંસ્થાઓ- ભારતનું ચૂંટણી પંચ, સંઘ લોક સેવા આયોગ, રાજ્ય લોક સેવા આયોગ, કોમ્પ્રોલર એન્ડ ઓડિટર જનરલ, કેન્દ્રીય સતર્કતા આયોગ, લોકપાલ તથા લોકાયુક્ત અને કેન્દ્રીય માહિતી આયોગ |
| ૬   | સામાન્ય બૌદ્ધિક ક્ષમતા કસોટી   |
| ૭   | સામાન્ય વિજ્ઞાન, પર્યાવરણ અને ઈન્ફર્મેશન એન્ડ કોમ્યુનિકેશન ટેકનોલોજી   |
| ૮   | ખેલ જગત સહિત રોજબરોજના પ્રાદેશિક, રાષ્ટ્રીય અને આંતરરાષ્ટ્રીય મહત્વના બનાવો  |

Syllabus of Preliminary Test

Paper-1

Medium: Gujarati

Total Marks- 100

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| 1 | Geography of India- Physical, Economic, Social, Natural Resources and population related topics- with special reference to Gujarat   |
| 2 | Cultural heritage of India- Literature, Art, Religion and Architecture- with special reference to Gujarat  |
| 3 | History of India with special reference to Gujarat   |
| 4 | Indian Economy and Planning  |
| 5 | <u>Indian Polity and the Constitution of India:</u><br>(1) Preamble<br>(2) Fundamental Rights and Fundamental Duties<br>(3) Directive Principles of State Policy<br>(4) Composition of Parliament<br>(5) Powers of the President of India<br>(6) Powers of Governor<br>(7) Judiciary<br>(8) Provisions for Scheduled Castes, Scheduled Tribes and backward classes of the society<br>(9) Attorney General<br>(10) NITI Aayog<br>(11) Panchayati Raj Institutions<br>(12) Finance Commission<br>(13) Constitutional and Statutory Bodies: Election Commission of India, Union Public Service Commission, State Public Service Commission, Comptroller and Auditor General, Central Vigilance Commission, Lokpal and Lokayukta, Central Information Commission |
| 6 | General Mental Ability   |
| 7 | General Science, Environment and Information & Communication Technology  |
| 8 | Daily events of Regional, National and International Importance including Sports   |

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**Syllabus for the preliminary test for the recruitment on the post of  
Mechanical Engineer, Class-II under the Directorate of Government**

**Printing and Stationary**

**Marks – 200**

**Questions – 200**

**Medium - English**

**1. THERMODYNAMICS:**

- Fundamentals-Thermodynamic systems and control Volume, Thermodynamic Properties, Process and state, Exact and Inexact differentials, Work, Temperature, thermal equilibrium and Zeroth law, heat, Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, behavior of ideal and real gases, saturated states, Identification of states & determination of properties, Mollier's chart.
- First Law for Cyclic & Non-cyclic processes, Concept of total energy E, Various modes of energy, Internal energy and Enthalpy.
- Second law of thermodynamic, direct and reverse heat engines, thermal efficiency and COP, Kelvin-Planck and Clausius statements, reversible process, Carnot cycle, Absolute temperature scale.
- Clausius inequality, Definition of entropy S, Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes, Principle of increase of entropy;
- Thermodynamic cycles - Basic Rankine cycle; Basic Brayton cycle; Basic vapor compression cycle and comparison with Carnot cycle.

**2. HEAT-TRANSFER:**

- Introduction to three modes of heat transfer, heat balance equation- Steady one dimensional solution for conduction heat transfer, concept of conduction and film resistances, critical insulation thickness, lumped system approximation and Biot number, heat transfer through pin fins- Two dimensional conduction solutions for both steady and unsteady heat transfer, Heissler charts.
- Heat convection, basic equations, boundary layers- Forced convection, external and internal flows- Natural convective heat transfer- Dimensionless parameters for forced and free convection heat transfer-Correlations for forced and free convection- Approximate solutions to laminar boundary layer equations (momentum and energy) for both internal and external flow- Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.

- Interaction of radiation with materials, definitions of radiative properties, Stefan Boltzmann's law, black and gray body radiation, Wien's displacement law
- Introduction mass transfer, Similarity between heat and mass transfer.

### **3. STRENGTH OF MATERIALS:**

- Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresses-elastic constants and their relations- volumetric, linear and shear strains- principal stresses and principal planes- Mohr's circle, Poisson's Ratio.
- Beams and type's transverse loading on beams- shear force and bend moment diagrams- Types of beam supports, simply supported and over- hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads.
- Moment of inertia about an axis and polar moment of inertia, deflection of a beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems.

### **4. ENGINEERING MECHANICS:**

Free-body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations, collisions.

### **5. KINEMATICS AND THEORY OF MACHINES:**

- Classification of mechanisms-Basic kinematic concepts and definitions- Degree of freedom, mobility- Grashof's law, Universal Joint-Rocker mechanisms Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.
- Pumps and Motors, Compressors.

### **6. ENGINEERING MATERIALS:**

Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials. Young's modulus, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery.

## **7. MANUFACTURING PROCESSES:**

- Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding, Welding and weld Testing, Classifying Welding process, Fusion versus non-fusion, Pressure versus non-pressure, Energy source of welding, other basis for classification and sub-classification.
- Heat treatment process-Annealing, tempering, normalizing and spheroidising,
- Unconventional Machining Processes: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters (5)Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, wire EDM; Electro-chemical machining (ECM), etchant & maskant, process parameters, MRR and surface finish. Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining.

## **8. METROLOGY AND INSPECTION:**

Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.

## **9. REPRODUCTION TECHNIQUES:**

Classification and handling of originals for reproductions: Classification line, tone, halftone, suitability for different printing processes. Transparency- choosing, evaluating, content requirement, Balance and Exposure level, Characteristics of different originals and precautions and techniques in handling them for reproduction. Difficult line originals - lines originals with colour, line originals with line and screen; line originals with broken effect. Light and Colours: Basic colours theory, Additive and Subtractive colours, Colours analysis, Applications of colours theory. Basic concept of light. Optical-equipment and accessories, Photographic material and chemistry of photography, Types of Illuminations, Halftone photography, Tone and Correction, negative/positive shooting straight reversal and lateral reversal, Colour separation.

**10. PRINTING PROCESSES:**

Development of offset process: Lithographic Principles, Surfaces, Properties. Principles of offset printing. Parts of single colour sheet-Fet offset printing machine, Classification, Characteristics and Applications of plate, Blanket, rollers, ink, pre make ready and make ready, Study of operating sequences of offset printing machine for various types of jobs, Printability. Printing problems and their remedies, Introduction of screen printing process, Stencil preparations in screen process printing, Screen printing of various varieties of jobs, Relief printing process / letter press.

**11. GRAPHIC DESIGN:**

Design and Originals, Tools for Layoutman, Colours, Art work preparation, Layout, Design by computer techniques (Introduction): Corel Draw software, Illustrator software, Photoshop software, and PageMaker software, Application of different software in one design (printing product). Video image processing, Modern developments in graphic creations.

**12. IMAGE CARRIER:**

Different types of metals: Characteristics of zinc, aluminium, copper, chromium, different metals suitable for surface preparation, Surface treatment to the plate: Knowledge related to graining machine, Environmental condition: Chemical hazards and safety precaution, light, temperature, ventilation, Equipments for plate making chemistry of sensitizing and desensitizing, Study of various image carriers for different printing processes: Engraving block. Flexo plates. Gravure cylinders. Offset plates. (Classification) Screen preparation film assembly: Layout and page-making, Image correction. Bimetal and Multimetal plate process, Image carrier - Gravure, Flexo, Water-soluble photosensitive resin plate, and Diffusion transfer plates: Reflex plates, Projection plates, Automatic plate processing machines, Computer to plate technology.

**13. PREVENTIVE MAINTENANCE:**

Knowledge related to cleaning and lubrication in printing processes, Knowledge related Printing Equipment and Machines, Corrosion and its prevention, Maintenance of printing Equipment and machines, Preventive maintenance of printing machines, Safety in printing industry, Erection of machines and Equipment used in printing industry, Environmental pollution in printing industry

**14. IMAGE GENERATION & CORRECTION:**

Colour separation, Halftone screening work, Inherent errors of Trichromatism, Colour correction, Knowledge related to reproduction by electronic scanning, Brief study of drum scanners, Originals for scanning, Quality Control, Designing softwares, Film processing , Role of internet in printing industry, Role of multimedia in printing industry.

**15. BINDING & FINISHING PROCESSES:**

Equipment and Machines, Binding materials, Adhesives securing operations, various binding jobs, ware-house operations and maintenance, Forwarding operations, Decorative processes, Miscellaneous binding: Various categories of binding jobs, Introduction to loose leaf binding, Adhesive binding, Stationary binding, Rebinding, Coating.

**16. QUALITY CONTROL IN PRINTING:**

Substrates & their properties and applications: Paper, Board, Wrapping paper, Metal, Ceramic, Plastic, Materials for papermaking, fibers, sizing, filling, coating, pulp etc., Pulp manufacturing process, Paper manufacturing process: Sketch of paper mfg. machine, Water mark, Wire mark, Calendaring, Surface Sizing, Physical characteristics of paper, Ink manufacturing systems, Drying methods of ink (oxidation, evaporation, absorption, precipitation, heat curing, uv curing), Characteristics of ink, test photographic films: Visual defects on print products, Inspect product: Uses of reflection densitometer, Comparison of multicolor job with print control strip.

**17. PRINTER'S MANAGEMENT AND COSTING - ESTIMATING:**

Structural and organization chart of a printing press, Division of labour, Functional process, Method of control, Delegation of powers and authority, Managerial and supervising structure in a printing press , Purchase procedure for new material, Factory and printing related acts and laws, Marketing and sales management, Work measurement and methods study, Project report, Costing, Estimating, Accountancy.

**18. FLEXO-GRAVURE PRINTING:**

Introduction to gravure printing, gravure image preparation: Gravure printing techniques: single/multicolour gravure printing: problems, causes and remedies in gravure printing, Flexo printing, Flexo image preparation: Quality control in Flexo printing.

- 19. GUJARAT STATE PURCHASE POLICY, 2016, STORE MANAGEMENT AND INVENTORY CONTROL METHODS, PRINTING AND STATIONARY MANUAL, BASIC KNOWLEDGE REGARDING CONFIDENTIAL PRINTING, INDUSTRIAL DISPUTES ACT, 1947, FACTORY ACT, 1948, APPRENTICE ACT, 1961.**
  
- 20. CURRENT TRENDS AND RECENT ADVANCEMENTS IN THE PRINTING AND MECHANICAL FIELD.**