વર્ક આસીસ્ટન્ટ(મીકેનીકલ) ની સ્પર્ધાત્મક લેખિત પરીક્ષાનો સિલેબસ

(કુલ માર્ક્સ-૧૦૦) (માધ્યમ:-ગુજરાતી)

Part-A **Technical Knowledge** **(80 Marks)**

- **Fluid Mechanics:-**
- Definition of fluid, Newton's law of viscosity, Units and dimensions- Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, manometry, buoyancy, forces on submerged bodies, stability of floating bodies, fluid acceleration, fluid statics, momentum and energy, Control volume- application of continuity equation and momentum equation, Incompressible flow, Bernoulli's equation and its applications. Exact flow solutions in channels and ducts, Couette and Poisuielle flow, laminar flow through circular conduits and circular annuli; Darcy Weisbach equation, friction factor, Moody's diagram. Elementary turbulent flow,
- Flow through pipes, head losses in pipes, bends and fittings, Types of Pipes.
- Centrifugal pumps, working principle, work done by the impeller, performance curves - Cavitations in pumps Reciprocating pump - working principle
- Classification of water turbines, heads and efficiencies, velocity triangles- Axial, radial and mixed flow turbines- Pelton wheel, Francis turbine and Kaplan turbines, working principles - draft tube-Specific speed, unit quantities, performance curves for turbines - governing of turbines.
- Types of Pumps, Pump viscosity, Centrifugal, NPSH, Pump curves, Progressive cavity, Screw pumps, Rope Pump, Submersible, Vertical turbine, Coupling section, Motor section, Well Section, Hydraulic Principles, General pumping fundamental. Spillways-Types of spillway based on most prominent features, Spillway Crest Gates
- **I.C. Engines:-**
- Combustion in SI and CI engines, Combustion stages, Combustion chambers and abnormal combustion. Fuel supply systems in SI and CI engines, carburetors, Port fuel injection; direct injection and Common rail injection. Ignition system, Lubrication system and Cooling system. Testing of IC engines. Engine emissions and control.

- Air-standard Otto, Diesel and dual cycles. Engine Management, Engine System, Engine Mapping, Open Loop Engine Controls Systems, Closed loop Engine Control System, Additional Engine Management System, lean burn engine control. Complete Vehicle Control System,.
- Engine diagnostics, Troubles and Tune-up, Engine service.
- **Strengths 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 types 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,
- Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical springs. Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure.
- Euler's Theory of columns, Energy methods, Thermal Stress, Strain Gauge and rosettes, Testing of Materials with Universal testing Machine, Testing of Hardness and Impact Strength.
- **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.
- **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;
- Hardness: Rockwell, Brinell and Vickers and their relation to strength. Static failure theories: Ductile and brittle failure mechanisms, Maximum normal stress,

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- Mohr-Coulomb and Modified Mohr-Coulomb; Fracture mechanics: Introduction to Stress- intensity factor approach and Griffith criterion. Fatigue failure: High cycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, effects of mean stress using the Modified Goodman diagram;
- Introduction to non-destructive testing (NDT)
- **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
- Basic Knowledge of Unconventional Machining Processes

- **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, ; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.
- Pumps and motors, Compressors.
- Basic of All Power Transmission System
- **Thermodynamics:-**
- Fundamentals- thermodynamic systems and control Volume; Thermodynamic Properties, Process and state; Exact and Inexact differentials; Work- Thermodynamic definition; Temperature, Definition of thermal equilibrium and Zeroth law; Definition of heat; Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Properties of pure substances, behavior of ideal and real gases; Definitions of 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 - Definitions of direct and reverse heat engines; Clausius inequality Thermodynamic cycles - Basic Rankine cycle; Basic Brayton cycle; Basic vapor compression cycle and comparison with Carnot cycle.
- **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.
- Interaction of radiation with materials, definitions of radiative properties, Stefan Boltzmann's law, black and gray body radiation, Wien's displacement law

Part-B General Knowledge & Basic Computer Knowledge: - (20 Marks)

- Current Affairs
- States and Capitals in India
- Indian Culture
- History of India
- Government Schemes
- Sports
- Science & Technology
- Gujarat Literature
- Constitution of India
- Basic Knowledge of Computer (MS Office; MS Excel; MS Power point)

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