Assistant Apprenticeship Adviser, Directorate of Vocational Education & Training, Maharashtra Education Service, Gr.-B (Technical)
सहायक प्रशिक्षणार्थी सल्लागार, व्यवसाय शिक्षण व प्रशिक्षण संचालनालय, महाराष्ट्र शिक्षण सेवा, गट-ब, (तांत्रिक)

परीक्षेचे टप्पे : लेखी परीक्षा - २०० गुण, मुलाखत - ५० गुण

विषय व सांकेतांक	माध्यम	गुण	प्रश्नसंख्या	कालावधी	दर्जा	प्रश्नपत्रिकेचे स्वरुप
विहित विषयावर आधारित -९७८	इंग्रजी	२००	१००	एक तास	पदवी	वस्तुनिष्ठ बहुपर्यायी

अंतिम गुणवत्ता यादी ही वस्तुनिष्ठ परीक्षेतील व मुलाखतीतील एकत्रित गुणांवर आधारीत राहील.

-: अभ्यासक्रम :-

विषयाशी संबंधीत घटक (विषय सांकेतांक -९७८) या विषयामध्ये खालील घटक व उपघटकांचा समावेश

Sr. No.	MECHANICAL & ELECTRICAL ENGINEERING
1	**APPLIED THERMODYNAMICS:** Thermodynamic Concepts, First Law of Thermodynamics, One dimensional Flow of Compressible Fluid, Second Law of Thermodynamics, Availability, Properties of Steam.
2	**STRENGTH OF MATERIALS:** Simple Stress and Strain, S. F. and B. M. in Beams, Simple Theory of Bending, Shear Stress in Beams, Simple Theory of Torsion, Bending moment combined with Torsion and Axial Loads, Principal Stresses, Deflection of Beams, Strain Energy, Theories of failure.
3	**MATERIAL SCIENCE :** Strain Hardening, Constitution of Alloys, Iron-Carbon Equilibrium Diagram, Heat-Treatment of Steels, Cast Irons, Introduction to International Standards/Codes, Non-Ferrous Metals and Alloys, Fatigue Failure, Creep, Alloy Steels, Strengthening mechanism, Powder Metallurgy
4	HEAT TRANSFER: conduction, convection & radiation, emissivity, heat exchangers, mass transfer (mechanism, fick's law of diffusion, isothermal evaporation of water into air, convective mass transfer).
5	**MACHINE DESIGN & VIBRATION** : Design consideration in castings & forgings, theories of failure, Design for static loadings, Design against fluctuating loads, Design of shafts, Design of springs, Design of belts. Free un-damped single degree of freedom vibration system, Free damped single degree of freedom vibration system, Free un-damped multi degree of freedom vibration system, forced single degree of freedom vibration system, vibration measuring system, rotor dynamics, balancing.
6	**MECHATRONICS**: Introduction to mechatronics, overview of microprocessors (8085), hydraulic& pneumatic system in automation, PLC in automation, transient response, root locus concepts.
7	**THEORY OF MACHINES :** Basic Kinematics, Special Mechanisms, Velocity Analysis of mechanisms, Acceleration analysis of Mechanism, Static and dynamic force analysis, Flexible connector mechanisms, Spur gear mechanism, Gear Trains, Cam Mechanism, clutches, brakes dynamometer, gear trains, cam & follower.

8	**PRODUCTION PROCESS** : Metal Casting Process, Forming Processes, Welding and Joining Processes, Powder Metallurgy, Moulding with polymers, Non Destructive Techniques, CNC machines, Metal Cutting & Tool Engineering, Surface Finish, Cutting Tool Materials, Coolants, Design of Cutting Tools or Tool design
9	**FLUID MECHANICS** : Fluid Kinematics, Fluid Dynamics, Real fluid flows, Boundary Layer Flows Compressible Fluid flow, Hydraulic Machinery (Turbines, Pumps, compressors)**.**
10	**MEASUREMENT & METROLOGY**: Static characteristics, Displacement, strain measurement, measurement of angular velocity, pressure measurement, temperature measurement, vacuum measurement, acceleration measurement, metrology.
11	**MANUFACTURING PLANNING AND CONTROL :** Manufacturing Planning and control System, Forecasting, Planning Function, Planning for Material requirements, Scheduling & Sequencing, Project management, Advanced concepts in production planning.
12	**ELECTRICAL MACHINES :** Direct Current machines Direct Current motors, DC machines 3 phase Transformers,3 phase Induction machines ,Single phase Induction motor ,Synchronous machines, Permanent magnet machines, Brushless D.C machines, Stepper motor, Tacho generators, Synchros & resolvers, & AC servo motors. Induction Generators.
13	**POWER SYSTEM :** Single phase and three phase Overhead line construction, improvement. Underground Cables, Tariff, Indian Electricity Rules-2003 – General Introduction. Distribution System, Distribution substation, Earthing of Substation
14	**CONTROL SYSTEMS:** Objectives, Concept of feedback and Automatic Control linear and nonlinear systems. Elementary concepts of sensitivity and robustness. Types of control systems: Servomechanisms and regulators, examples of feedback control systems. Control system component Potentiometer, synchros, resolvers, position encoders, D.C. and A.C. tacho-generators, actuators. Time domain analysis: PI, PD and PID control.
15	**ELECTRICAL DRIVES:** Electrical drive: Concept, classification, parts and advantages of electrical dive. Dynamics of Electrical Drives: Types of Loads, Components of load toques, Fundamental torque equations. Motor power rating: Thermal model of motor for heating and cooling, classes of motor duty, DC motor drives: Single phase, three phases fully controlled and half controlled rectifier fed DC drives, Induction motor drives: Stator voltage variation by three phase controllers, chopper resistance in Stepper motor, Switched Reluctance motor drive Industrial application: Drive consideration for Textile mills, Steel rolling mills, Cement mills, Paper mills, Machine tools. Cranes & hoist drives.
16	**POWER GENERATION ECONOMICS:** Cost of power generation, Domestic, Commercial, Industrial etc. Concept of load factor, diversity factor, demand factor. Electricity Tariff Subsidization and Cross subsidization. Availability tariff of generation companies. Pool tariff of transmission companies. Availability based tariff. Economics of Power Generation- Unit commitment solution, Dispatch – Transmission loss formulae and its application in economic load scheduling. Computational methods in economic load scheduling. Active and reactive power optimization. State estimation and load forecasting
17	**ELECTRICAL AND ELECTRONICS MEASUREMENT:** Analog, electrodynamometer, measurement of medium resistance, low, and high resistances. Megger Potentiometers, DC potentiometer AC potentiometers. Electro-dynamic & induction type AC energy meter, testing of Energy meters. Cathode Ray Oscilloscope, Digital voltmeter, Sensors & Transducers: strain gauge, LVDT, temperature transducers, Flow measurement using magnetic flow measurement.

18	**ELECTRICAL MACHINE DESIGN :** **Fundamental Aspects of Electrical Machine Design**: Design factors, limitation in design, modern trends in design of electric machines, modern machine manufacturing techniques. Temperature rise, cooling and thermal grading (classification) of insulations. **Principles of Magnetic circuit design**: Design of Electromagnets: Design of Transformer, Design of three phases Induction motor
19	**CONVENTIONAL AND NON-CONVENTIONAL POWER GENERATION :** **Thermal power plant –** Law of Thermodynamics. Analysis of steam cycle-Carnot, Rankine, Reheat cycle and Regenerative cycle. Layout of power plant Lay out of pulverized coal burners, fluidized bed combustion, coal handling systems, ash handling systems. Forced draught and induced draught fans, boiler feed pumps, super heater regenerators, condensers, boilers, de-aerators and cooling towers. **Hydro power plant –** Rainfall, run off and its measurement hydrograph, flow duration curve, reservoir storage capacity, classification of plants-run off river plant, storage river plant, pumped storage plant, layout of hydroelectric power plant, turbine-pelton, Kaplan, Francis(Francis) **Nuclear power plant -**Introduction of nuclear engineering, fission, fusion, nuclear material, thermal fission reactor and power plant - PWR BWR ,liquid metal fast breeder, reactors, reactor control, introduction to plasma technology **Diesel and gas turbine power plant-** General layout, Advantages and disadvantages, component, performance of gas turbine power plant, combined heat power generation.
20	**POWER GENERATION USING NON-CONVENTIONAL ENERGY SOURCES :** **Solar Energy -** Solar concentrators and tracking; Dish and Parabolic trough concentrating generating systems, Central tower solar thermal power plants; Solar Ponds. Basic principle of power generation in a PV cell ; Band gap and efficiency of PV cells solar cell characteristics, Manufacturing methods of mono- and poly-crystalline cells; Amorphous silicon thin film cells. **Wind Energy -** Basic component of WEC, Types of wind turbine-HAWT,VAWT, Performance parameters of wind turbine, Power in wind, Wind electric generators, wind characteristics and site selection; Wind farms for bulk power supply to grid. **Fuel Cell -**Introduction to fuel cell, principle of operation of fuel cell, Types of fuel cell

****