

**DETAILED SYLLABUS FOR THE POST OF TECHNICAL SUPERVISOR IN  
TRAVANCORE SUGARS AND CHEMICALS LTD.**

**(Cat.No. :693/2023)**

**(Total Marks- 100)**

**Module 1: Fluid Mechanics (5 Marks)**

Definition of fluid, properties of Fluid, Pascal's Law, Hydrostatic law, Measurement of pressure, Total pressure, center of pressure, Buoyancy, Meta centre, Metacentric height, types of fluid flow, discharge, continuity equation, Euler's equation, Bernoulli's equation, Venturi meter, orifice meter, pitot tube, flow through Orifices, notches and weirs, Reynolds experiments, major and minor losses, Darcy Weisbach equation, Chezy's formula, water hammer, vapour pressure

**Module 2: Hydraulic machines: (5 Marks)**

Impact of jet, jet Propulsion, Hydraulic turbines such as Pelton turbine, Francis and Kaplan turbines and its various efficiencies, draft tube, uses, different types, Specific speed, unit quantities, Governing of turbines, Centrifugal pumps and Reciprocating pumps, cavitation, effect of cavitation, Slip, positive and negative slips, reason for slip, Indicator diagram

**Module 3: Thermodynamics (5 Marks)**

Thermodynamic systems, thermodynamic properties, Intensive and extensive properties, path, process like reversible, Cyclic, quasi static, Zeroth law of thermodynamics, Enthalpy, entropy, specific heats, First law, second law, gas laws such as Boyle's law, Charles' law, Avogadro's law, Joule's law, Carnot cycle, Air standard efficiency, Mechanical efficiency, overall efficiency, Otto cycle, Diesel cycle.

**Module 4; Thermal Engineering & Power plant Engineering (5 Marks)**

Fuels, combustion of fuels, Calorific values, lower calorific values, Upper calorific values, Bomb calorimeter, gas calorimeter, minimum air and excess air required for combustion of fuels, stem, wet, dry and super-heated steam, Rankine cycle, Brayton cycle, steam turbines, Gas turbines, steam nozzles, compounding, velocity, pressure, and velocity-pressure compounding. Impulse and Reaction turbines, advantages and disadvantages of both

**Module 5: Mechanics and Strength of Materials (5 Marks)**

Centre of gravity, centroid, Moment of inertia, parallel axis theorem,

Perpendicular axis theorem, beams, types of beams and different types of loads acting on the beams

Simple stresses and strains, Hook's law, elastic constants, Factor of safety, linear stress and strain, lateral stress and strain, Poisson's ratio, Thermal stress and strains, composite bar, Mohr's circle, Shear force and bending moments, torsion of shafts, thin and thick cylinders, Columns and struts.

**Module 6: Engineering Materials (5 Marks)**

Metals and Nonmetals, Alloys and alloy materials, Heat treatments, Upper critical temperature and lower critical temperature, Heat treatments and various heat treatment and surface hardening processes, composition and properties and uses of various steels, plastics and other newer engineering materials

**Module 7: Manufacturing process and Production Engineering (5 Marks)**

Elementary ideas about various basic workshop practices of Carpentry, foundry, sheet metal, welding, smithy and Fitting and various tools using in each sections Machine tools like lathe, shaper, planer, milling, drilling and slotting machines and its operations, Cutting tools, Tool materials, cutting speed, feed, depth of cut, tool nomenclature, tool life, shaper mechanisms

**Module 8: Engineering Drawing and Machine design (5 Marks)**

First angle projection method and its symbol, projection of points and line in four quadrants, construction of various conic sections like ellipse, parabola and hyperbola, Development of surfaces, section of solids, Isometric and oblique projections. Design of joints, threaded fasteners, keys, cotters, couplings, transmission system, belt, rope, gear, chain drives, and Open belt and cross belt, length of the belts. Welded joints and Riveted joints and its strength and various efficiencies

**Module 9: I.C Engines and Steam boilers (5 Marks)**

Engines, Heat engines, S.I & C.I engines, detonation and knocking, Fuel injection, Air fuel ratio, compression ratio, Octane number, Cetane number, steam boiler, water tube and fire tube boilers like Cochran and Babcock and Wilcox boiler, modern high pressure boilers like La Mont boiler, Benson boiler Boiler accessories and mountings

**Module 10: Heat transfer and Refrigeration (5 Marks)**

3 modes of heat transfer such as conduction convection and radiation and its governing laws such as Fourier law, Newton's law of cooling, Stefan-Boltzmann's law, Refrigeration, Heat Engine, refrigerator and heat pump, COP, ton of refrigeration, properties of refrigerant. Psychometric and psychometric chart

### **Module 11 (5 Marks)**

#### Fundamentals of Electricity

Voltage, current, resistance, energy, power-definitions and units, ohm's law-statement, simple problems related to ohm's law, power and energy, Resistance in series and parallel-simple problems. Kirchhoff's laws-KCL and KVL

### **Module 12 (5 Marks)**

#### Electrostatics and electromagnetism

Laws of electrostatics, permittivity, electric flux, flux density, potential, potential difference  $\pm$  equations and simple problems, Lightning phenomenon, potential gradient, dielectrical strength, capacitors in series and parallel, energy stored in a capacitor. Coulomb's law, permeability, magnetic flux, flux density, reluctance, mmf, Faraday's law of electromagnetic induction, Lenz's law. self inductance, mutual inductance, energy stored in an inductor, Fleming's laws

### **Module 13 (5 Marks)**

#### Fundamentals of AC systems

Generation of ac voltage, equation of voltage, Basic terms-amplitude, frequency, cycle, time period, average value, instantaneous value, rms value, form factor, peak factor- equations and related simple problems, ac through resistance, inductance and capacitance, star and delta connections in 3 phase ac systems-line and phase relationship in star and delta systems.

### **Module 14 (5 Marks)**

#### Measurements and measuring instruments

Various types of electrical measuring instruments- voltmeter, ammeter, energy meter, wattmeter, single phase and three phase power measurement, measurement of resistance, inductance and capacitance, power factor meter, synchroscope, TOD meter, CRO, insulation megger and earth megger, multimeter, CT and PT.

### **Module 15 (5 Marks)**

#### Safety, first aid, batteries and solar cell

Basic safety requirements, electric shock-requirement for avoiding shock, first aid, installation, care and maintenance of batteries and solar cells, determination of total number of cells required for a given power requirements.

### **Module 16 (5 Marks)**

#### Wiring Accessories

Various wiring systems

Wires-single strand and multistrand, current ratings. Fuses- cartridge and HRC.

Switches- SPST, SPDT, TPTT, ICDP, ICTP, Toggle switch, Limit switch, safety devices- MCB,ELCB,RCCB,electrical illumination,Earthing-Pipe and Plate earthing.

### **Module 17 (5 Marks)**

#### DC Machines

Dc generator- construction, working, classification, emf equation, wave and lap windings, characteristics, simple problems.

Dc motor- construction, working, types, emf equation, torque-simple problems, various starters, speed control, testing, MG set.

### **Module 18 (5 Marks)**

#### Ac Machines

Transformer-construction, principle, types, emf equation, transformation ratio, losses and efficiency, all day efficiency-simple problems

Three phase induction motor- principle, construction, types, slip, torque, losses, efficiency, power stages, speed control, three phase motor starters.

Alternators- construction, principle, emf equation, losses and efficiency,

Three phase synchronous motor.

Single phase and FHP motors-single phase induction motor, universal motor, ac series motor, servomotor, stepper motor, split phase motor.

### **Module 19 (5 Marks)**

#### Digital Electronics

Number systems, Logic gates- AND, OR, NOT, NAND, NOR, De-Morgan's theorems, half adder, full adder, flip-flops, shift registers, counters, ADC, DAC, Soldering Techniques.

### **Module 20 (5 Marks)**

#### Power Electronics

Half wave and full wave rectifiers with and without filters, UJT relaxation oscillator, FET, JFET, Triac, Diac, IGBT, SCR, operation and maintenance of inverter, regulated dc power supply, battery charger, UPS.

***NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper***