# FURTHER DETAILS REGARDING MAIN TOPICS OF PROGRAMME No. 12/2016 (Item No. 6)

# TECHNICAL SUPERVISOR

# KERALA ARTISANS DEVELOPMENT CORPORATION LIMITED

**(CATEGORY No.658/14)**

**ELECTRICAL ENGINEERING**

## MODULE - I

### A C FUNDAMENTALS AND TRANSFORMERS

Generation of alternating emf, emf equation of alternating voltage instantaneous value maximum value, average value, rms value of alternating quantity, inductance, capacitance, and impedance in AC circuits. RLC series and parallel circuits. Calculation of active power, reactive power, apparent power, and power factor in single phase AC circuits. Three phase power generation. Three phase AC Circuits- Star&Delta connection, voltage and current relation, expression for three phase power. Three phase power measurement using three wattmeter and two wattmeter method.

Faraday's laws of electromagnetic induction. Self induced emf&mutually induced emf. Construction and working principle of transformer, Emf equation of transformer. Classification of transformers based on construction and function. Working principle of auto transformer. Differentiate the welding transformer and power transformer.

## MODULE-II

### DC MACHINES AND AC MACHINES

Construction and working of DC generator. Classification of DC generators. Emf equation of DC generators. Characteristics of DC generators. Working principle of DC motors. Different types of DC motors. Back emf in DC motors. Equation for armature torque in DC motors. Necessity of starters in DC motors- 3 point starter and 4 point starter. Characteristics of DC motors. Applications of DC motors. Applications of permanent magnet DC motors.

Construction and working of AC generators. Classification of AC generators, working principle of three phase induction motor types of induction motors -squirrel cage and slip ring, Applications of three phase induction motors, Method of starting of three phase induction motors. Principle of working of single

phase induction motors. Different types of single phase induction motors, Uses of single phase induction motor.

## MODULE III

### LEAD ACID CELL, MEASURING INSTRUMENTS & UTILISATION

Construction and working of Lead acid cell. Method of charging and discharging of lead acid cell. Efficiency and rating of batteries. Various aspects for the maintenance of lead acid cell.

Classification of instruments based on function, construction, and methods of measurement, Deflecting torque, Controlling torque, Damping torque, Construction and working of permanent magnet moving coil instruments, construction and working of moving iron instruments(both attraction and repulsion type).Principle and working of dynamometer type wattmeter, Current transformers and potential transformers.

Principle of heat production from electric power, Industrial applications of electric heating, Different types of electric heating-induction heating and dielectric heating.working of Arc furnaces and induction furnaces.

## MECHANICAL ENGINEERING

## MODULE –IV

**PROPERTIES OF MATERIALS** - Mechanical properties, physical properties, thermal properties , electrical properties and chemical properties**.**

**TESTING OF MATERIALS** – destructive and non destructive testing. **MEASURING INSTRUMENTS**–Precision and non precision instruments. (definition and name only) vernier caliper, micrometer, vernier height gauge and depth gauge,

**CLASSIFICATION OF GAUGES** – Plug gauge, ring gauge , snap gauge, screw pitch gauge, feeler gauge and standard wire gauge.

**COMPARATORS** - mechanical, Electrical and optical comparators. (working only) .

**WELDING** – Classification welding, advantages and limitations of welding, principle of arc welding, arc welding machines such as DC generator and AC transformers(working only).

**GAS WELDING** – oxy-acetylene welding (description only),gases used types of flames(uses)other welding such as sub-merged arc welding, MIG and TIG welding. (description only)

**DEFECTS OF WELDING** – causes and remedies of the defects, Soldering and brazing (brief description).

**FOUNDRY** – uses of different foundry tools, types of moulding sand, properties of moulding sand, different moulding processes such as bench moulding, pit moulding, floor moulding and sweep moulding,

**ALLOWANCES OF PATTERN**- Shrinkage, draft,machining,distortion, and.rapping allowances.

**FOREIGN OPERATIONS** - upsetting , drawing down, setting down punching, welding and cutting (description only).

**FITTING** – tools used in fitting(files, punches, vice, chisels, hammers, surface plate, surface gauge , V-Block, combination set, drills, calipers, taps and dies, reamers(uses of these tools).

**METALS AND ALLOYS** – Types of cast iron, properties, application of cast iron. List the various types of steels such as low carbon steels, medium carbon steel, stainless steel, and high carbon steel and magnetic steel, Brief explanation of non – ferrous metals and alloys of aluminum and copper. Heat treatment – annealing, normalizing, hardening, tempering, case hardening.(description only). **METAL CUTTING** – difference between orthogonal and oblique cutting, cutting speed, feed depth of cut(definition only), and properties of various cutting tool materials.

**LATHE** – Types of lathes, lathe parts, specifications, operations on lathe such as turning, taper turning, facing, boring, drilling, threading and reaming. Tool and work holding devices used in lathe- Uses of shaping slotting and planning machines – Gear manufacturing (varies methods only)- Importance of Jigs and fixtures.

## MODULE – V

**PROPERTIES OF FLUIDS** –_Density, specific weight, specific volume, specific gravity(simple problems).

**FLUID PRESSURE AND ITS MEASUREMENTS-**___Define pressure, atmospheric pressure, absolute pressure and gauge pressure, Pascal's law. Pressure measurement by piezo meter tube, simple manometer and differential manometer, (simple problems). Statement of Bernoulli's Theorem, Bernoulli's equation, continuity equation, working of venturimeter, orifice meter and pitot tube (simple problems).

**ORIFICES –** Types of orifices – vena contracts- coefficient of contraction, coefficient of velocity, coefficient of discharge(simple problems).

**NOTCHES**– Rectangular Notch, Triangular Notch, discharge over notches(Simple problems) .

**LOSSES OF HEAD IN PIPES** –Major and minor losses –loss of energy due to friction – Darcy's formula for loss of head in pipes, Chezy'a formula (simple problems). Turbines – classification, Impulse and reaction turbines, classification of reaction turbines, use of draft tube , working of pelton whell and Francis turbine.

**PUMPS** – Different types of pumps(working only), function of air vessels,foot valve and strainer, slip of a pump.

**STRESS AND STRAIN** – Definition of stress, strain, longitudinal strain, lateral strain, Poisson's ratio, factor of safety, statement of hook's law(simple problems).

**FRICTION**- Types of friction, laws of friction, definition of angle of friction, co-efficient of friction and limiting of friction(simple problems).

## MODULE - VI

**BOILER_–** Define boiler, function of boiler- classification of boiler, comparison boiler specifications, Boiler mountings and boiler accessories(working and functions only).

**PROPERTIES OF STEAM** - Wet steam, dry steam, super heating steam, and dryness fraction(definition only). Working of steam engine, function of steam nozzles, working of steam turbines, classification steam turbines.

**COMPOUNDING OF STEAM TURBINES** - Velocity compounding, pressure compounding, pressure velocity compounding – purpose of compounding.

**STEAM CONDENSERS** – Jet condensers and surface condensers (working only. **POWER PLANTS** – Types of power plants such as hydroelectric, thermal, nuclear and diesel power plants.

**RENEWABLE DIFFERENT TYPES OF OWNERSHIP** – Sole proprietorship, partnership, private limited company, public limited company(brief description).

**ORGANIZATIONAL STRUCTURE** – Line organization, functional organization, line and staff organization.

**OBJECTIVES OF TRAINING** – Explain the methods of training.

**WAGES** – Importance of good wage plan, types of wages, wage payment systems

**INCENTIVES** - Straight piece rate system, time rate system, piece rate system with guaranteed minimum wage-differential piece rate system(explanation only) Differentiate IC and EC engine, working four stroke petrol and diesel engine, two stroke petrol and diesel engine, comparison of petrol and diesel engine, comparison of four stroke and two stroke engine. Functions of carburetor and fuel injector.

**IGNITION SYSTEMS** – Working of coil ignition, magneto ignition system and electronic ignition system.

**CLASSIFICATION OF COOLING SYSTEMS** – Air cooling and water cooling, functions and radiator and thermostat

**FUNDAMENTALS OF THERMODYNAMICS** – Concept of system – open, closed, isolated system. Intrinsic properties and extrinsic properties – Laws of thermodynamics and laws of perfect gases – Thermodynamic processes – constant volume process, constant pressure process, adiabatic process, and isothermal process (explanation only).

**AIR STANDARD CYCLES** – Otto cycle, diesel cycle, dual combustion cycle, Carnot cycle(brief explanation with PV diagram).

## ELECTRONICS ENGINEERING

## MODULE- VII

## BASIC ELECTRONICS

PN Junction, behaviour of PN Junction in forward bias and reverse bias. Zener diode-working, applications. Rectifiers-half wave and full wave rectifiers.

Filters-different types. Zener regulator, regulator ICs. Clipping circuits, clamping circuits. Applications of clippers and clampers. RC integrator&differentiator circuits, applications. Bipolar junction transistors –PNP&NPN. Different configurations. Different regions in the characteristics of CE&CB configurations, loadline, operating point, concept of α and β relation between them. Applications of transistors . JFETS and MOSFETS. Working principle. Comparison of BJT and JFET.

## MODULE – VIII

## ELECTRONICS CIRCUITS

Amplifiers –CB&CE amplifiers. Amplifier coupling schemes. Voltage and power amplifiers. Comparison between voltage and power amplifiers. Types of feedback in amplifiers. Oscillators-conditions for oscillation, classification of oscillators. RC phaseshift oscillator, wein bridge oscillator, hartely oscillator, colpitt's oscillator, crystal oscillator. Multivibrators –types . Working of astable, monostale and bistable multivibrators. Schmit trigger working , Definition of UTP, LTP, hysteresis.

***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.***