FURTHER DETAILS REGARDING MAIN TOPICS OF PROGRAMME NO. 11/2016 (Item No. 11)

FOREMAN(CENTRAL WORKSHOP)

MEDICAL EDUCATION DEPARTMENT

(CATEGORY No.340/2014)

MECHANICAL ENGINEERING

MODULE – I

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 ON PATTERN - shrinkage, draft, machining, distortion, and rapping allowances. FORGING 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 (various methods only) - Importance of Jigs and fixtures - NON

CONVENTIONAL MACHINING PROCESS - USM, EDM, ECM (advantages and applications only)

MODULE – II

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 contracta – 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's formula (simple problems). Turbines - classification, Impulse and reaction turbines, classification of reaction turbines, use of draft tube, working of pelton wheel 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 friction (simple problems).

MODULE – III

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 SOURCE OF ENERGY - solar energy – solar cells, solar cooker- flat plate collector for power generation (working only). WIND ENERGY - working of wind mills. Principle of working of tidal power plants. MANAGEMENT - meaning of management, Taylor's scientific management, contribution of FW Taylor, Hentry Fayol's principle of management. 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).

MODULE – IV

Differentiate IC and EC engine, working four stroke petrol and diesel engine, two stoke 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 of radiator and thermostat. GOVERNING OF IC ENGINES - quantity governing, quality governing, hit and miss governing. TRANSMISSION SYSTEMS - function of clutch, flywheel, gear box, propeller shaft and differential. 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). REFRIGERATION - purpose of refrigeration, unit of refrigeration, concept of cop. Working of air refrigeration system based on reversed Carnot cycle and Bell Coleman cycle. Cop of Carnot cycle (simple problems). Working of vapour compression refrigeration system. PSYCHOMETRIC PROCESSES - sensible heating, sensible cooling, humidification, dehumidification, heating and humidification, cooling and dehumidification. (explanation only)

ELECTRICAL AND ELECTRONICS ENGINEERING

Module V

MEASURING INSTRUMENTS - General classification - Absolute and secondary instruments – Classification of secondary instruments – Indicating, integrating and recording type - Essentials of indicating instruments – Deflecting torque – Controlling torque - Damping torque - Constructional details and working principle - Permanent magnet moving coil instruments - Moving iron type (both attraction and repulsion type) instruments - Working principle of dynamometer - Voltmeter - Ammeter - Rectifier type instruments – Voltmeter - Ammeter - Extension of range – Use of shunts and multiplier Simple problems – Multi range instruments – General errors in instruments and their remedy - identification of instruments – Multimeter - Analogue - Digital – Digital voltmeters – Applications - **TRANSDUCERS** – Measurement of physical quantities using transducers – Classifications – Commonly used transducers – Strain gauges – Semiconductor strain gauges – LVDT – Capacitance transducers – Piezoelectric transducers – Description and field of applications - Sensors – Proximity switch - Reed switch.

EFFECT OF TEMPERATURE ON RESISTANCE - Temperature co-efficient of resistance – Simple problems - Calculation of Resistance of a conductor - Voltage source - Current source and its conversion - Dependent and independent source - Linear and non linear circuit - Unilateral and bilateral circuit - Passive and active circuit - Voltage

and current division in a branch of a DC network - Electric power and energy in D.C. Circuits - Simple problems - Network Theorems - Kirchoff' Laws - Super position theorem - Thevenin's theorem - Norton's theorem - Simple problems

Module VI

SINGLE PHASE AC CIRCUITS - Series A.C circuits - AC through R L, R C, and R, L C circuits – active, Reactive and Apparent power, Power factor, Resonance in R-L-C series circuits, problems in series circuits (In polar and rectangular form). **TRANSFORMER** – Definition – Working principle – Faraday's laws of electromagnetic induction – Construction – Core type – Shell type – Concept – Ideal transformer – E.M.F equation – Voltage transformation ratio – Polarity test on a single phase transformer - Simple problems – Transformer on no load – No load parameters – Efficiency – Losses - Transformer tests – Open circuit test – Short circuit test – Transformer rating – Regulation – Definition – Simple problems – All-day efficiency – **AUTO TRANSFORMER** – Copper saving – Comparison with two winding transformer – **INSTRUMENT TRANSFORMERS** – Current transformers – Potential transformers.

ECONOMICS OF POWER COST OF GENERATION– Fixed and running cost – Interest – Depreciation - Total annual cost Maximum demand - Average demand and load factor (daily and annual) - Diversity factor of generation - Types of tariff.

Module VII

D. C GENERATOR – Theory and working – Parts – Classifications based on field connections – E.M.F equation – Losses in a D.C generator - Armature reaction – Commutation – Generator characteristics - Critical resistance – Critical speed – **D.C MOTOR** – Classifications - Theory and working – Torque – Armature torque – Shaft torque – Speed regulation – Speed control of shunt motors – Necessity of a starter – Three point starter – Four point starter – Applications **- STEPPER MOTORS** – Step angle – Applications - **SINGLE PHASE INDUCTION MOTORS** – Theory , working and construction - capacitor start type – Applications – **A.C GENERATORS** - Construction and working - Classification - Salient pole - Turbo types -

FUSES – Fusing element – Rated current of fuse element - Fusing factor - Factors affecting current carrying capacity of fuse elements - Prospective current of a circuit - cut off – pre-arcing time - Arcing time and-operating time of fuses - Inverse current characteristics – Classification of fuses - Description of expulsion - Cartridge fuses - characteristic of HRC fuses - Cut off current and time current -characteristics of HRC fuses - Rupturing capacity - selection of HRC fuse - advantages and disadvantages of HRC fuses.

DESIGN OF ILLUMINATION - Terms used in illumination – Laws of illumination - Various lighting schemes – Illumination levels for various places – Space Height ratio – Utilization Factor - Depreciation Factor - Maintenance Factor – Design of lighting schemes for various rooms – Arrangement of lamps – Simple problems

Module VIII

DIGITAL CIRCUITS -Number system - Binary – Hexadecimal conversions – BCD – Binary addition- subtraction – multiplication and division - 1's and 2's compliment – Usage for subtraction - **LOGIC GATES** - Basic gates – Symbol –Truth table – AND, OR, NOT – EXOR gate universal gate – NAND & NOR Logic families – TTL, ECL, CMOS, - Advantages - Disadvantages – comparison – **POWER DEVICES** - UJT – Application - Construction & operation of N -channel and P- channel JFET with characteristics- JFET compared with BJT- MOSFET -Differentiate JFET, MOSFET, and IGBT-Symbols - Operations and characteristics of diac, triac, SCR – Constructional features – Operation – Transistor analogy – Characteristics – Specifications – Holding current – Latching current – Gate current - Turn on time – Turn off time - Different methods of turn on – different methods of turning off - SCR – snubber circuits - SCR applications in power control .

RECTIFIERS, REGULATORS & WAVE SHAPING - Half wave - full wave(Centre tap and bridge type) rectifiers using diodes – Wave forms – Peak Inverse voltage - Ripple factor – Regulation & efficiency -Comparison of different types of rectifiers - Filters – Different types - Capacitor input - Inductor input & π filter.

GENERAL KNOWLEDGE AND CURRENT AFFAIRS AND RENAISSANCE IN KERALA

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.