

FURTHER DETAILS REGARDING MAIN TOPICS OF

PROGRAMME No. 11/2019 (Item No.25,26,27)

JUNIOR INSTRUCTOR(INSTRUMENT MECHANIC)

INDUSTRIAL TRAINING

(Category No.548/2017,092/2018,406/2017)

- (I)** Safety precautions to be observed, Elementary First aid, Environmental
- 1** Pollution related to the trade, Basic hand tools, Types, Classification, use and Metal cutting fundamentals. Measuring instruments, Marking tools, Fasteners and Fastening devices. Gauge blocks, Sine bar, Dial Indicators, Vernier Callipers, Micrometers, Thickness gauges.
 - 2** Elements and types of Screw threads used in instruments, Calculation of Drill Size.
Types of tubes used in instrumentation. Tube cutter. Flaring tools, Swedging Tools. Pipe bending, Straightening, Thread cutting and methods of Installation.
 - 3** Atom, Molecule, compound and mixtures. Physical and chemical changes. Acids Base, Salts and their properties. Molecular weight, Equivalent weight and Atomic weight. Metals and Non metals. Atomic structure, Valency, Classification of Elements.
 - 4** Water, Hard water and Soft water. Causes and removal of hardness. Corrosion – causes and prevention. Allotropy of Hydrogen.
 - 5** Introduction to Physics. Scalar and Vector quantities. Triangle and Parallelogram Law of forces. Newton's Law of motion.
Friction, Laws of Friction. Advantages and Disadvantages of friction. Elasticity. Hooke's law. Types of Modulus of elasticity. Determination of Young's Modulus.
Electrolysis. Faraday's laws of Electrolysis. Thermodynamics. First law of Thermodynamics.
 - 6** Electrical components. Conductor, Semiconductor and insulator. Standard wire gauge. Introduction to electricity. Static electricity. Current, Voltage, Potential difference. EMF, Resistance, DC and AC Circuits. Uses of multi meter. Resistor and resistivity. Definition and purpose of Soldering and De soldering. Soft soldering. Types of soldering irons. Wheatstone bridge.
 - 7** Ohm's Law and Kirchoff's Law. Series and Parallel circuits. Primary and Secondary cells. Construction and maintenance of batteries. Maintenance free Batteries. Switches and types.
Magnet and magnetism. Magnetic properties. Electromagnetism. Faraday's Law of Electromagnetic induction. Relays, solenoids and Circuit breakers. Their

working.

(II) Inductors and inductance. Various types. Factors affecting Inductance. Types of

1 Induction. Inductors in series and parallel.

Capacitance. Types of capacitors. Unit. Factors affecting capacitance. Charge and energy stored in capacitors. Capacitors in series and parallel. RC Time constant.

AC Impedance. Inductive reactance. Capacitive reactance. Resonance in RLC Circuits.

AC and DC Generators. Construction and working. EMF equation.

Lenz's Law, Flemings Left and Right hand Rules.

AC and DC motors. Different types of motors.

2 Transformers- Principle and different types. Transformer ratio.

Current, Instrument, Potential Transformers

3 Electrical measuring instruments. Absolute and Secondary Instruments.

Essentials of Electrical measuring instruments. Types of controlling ,damping, And Defecting torques. Characteristics of Electrical measuring instruments.

Principle and working of PMMC Meter.

Converting galvanometer in to Ammeter and Voltmeter. Range extension of Voltmeter and Ammeter. Meter resistance and FSD Identification.

4 Ohm meter – construction and working. Different types. Construction and

Working of megger. Advantages and disadvantage of Ohmmeters.

MI Instruments- working principle, construction and working. Advantages and disadvantages.

5 Moving iron meter – construction and working. Different types. Construction and Working of Moving iron meter Advantages and disadvantages.

Electrodynamo meter - construction and working. Different types. Construction and Working of Moving iron meter Advantages and disadvantages

Induction type meters - construction and working. Different types. Energy meters Ampere hour meter, Power factor meter. Phase sequence Indicator,

(II) Semiconductors- Intrinsic and Extrinsic, PN Junction diode, characteristics,

1 Applications, Special semiconductor diodes.

Transistors- NPN and PNP Transistors, Biasing and applications.

Introduction to FET and MOSFET.

Rectifiers- Half wave and Full wave. Voltage amplifiers. Filters of different types.

Voltage regulators-Zener , Shunt, Series, variable and IC regulators.

2 Power supply units- SMPS and UPS.

Oscillators- working principle and working of different types of oscillators.

Operational amplifiers- Principle, working and use of different types of Operational amplifiers.

3 Basic digital ICs – functions and applications.

Basics of adders, counters and registers.

Basics of A/D, D/A converter.

Digital meters. Frequency meter, Phase measuring meter, Digital capacitance meter.

4 Introduction to Computer. Familiarisation of different types of soft wares and Multimedia systems.

5 Computer hardware- Functions and use of different computer parts.

Input ,output and peripheral equipments.

Different types of Printers.

Modems, Data Interface, ADC and DAC.

(IV) Principles of Hydraulics, Hydrostatic pressure, Pascal’s law, Transmission of

1 Fluid power, Fluid flow in pipes.

2 Bernoulli’s Principle, Effect of heat on liquids.

Hydraulic fluids-Types and Properties.

3 Viscosity and Viscosity index.

Definition of PH, PH Scale, Measurement of PH.

PH Indicators and controllers.

4 Types of electrodes used for PH measurement.

Relation between PH and mV.

5 Pneumatic principles, Primary and Secondary air treatment.

Methods of treatment. Contamination of air and its removal.

6 Various types of Air filter regulators, features.

Humidity and its effects.

7 Air flow piping dimensions, connections and safety factors.

8 Modes of heat transfer. Determination of thermal conductivity.

(V) Scope and necessity of Instrumentation. Fundamentals of measurement systems.

1 Calibration and calibration standards. Basic and secondary standards, working standards.

Units of various physical quantities.

Instrument characteristics – Static and Dynamic characteristics.

Types of errors in Instruments.

- 2 Stress and Strain management.
Principle, working and application of strain gauges .
Load cells, LVDT, RVDT.
Advantages and disadvantages.
 - 3 Principle of pressure in liquids and gases. Units of pressure in different systems.
Definition and units of volume, density and specific gravity.
Types of pressure – absolute pressure, atmospheric and vacuum pressures and their relationships.
Barometers and manometers – Types and applications.
Types of pressure sensing elements- Bourdon tube, Diaphragms, Capsules and Bellows. Their advantages and limitations.
Pressure switches- Types and applications.
Electrical pressure transducers – Potentiometric , Capacitive , Strain gauge, Piezoelectric pressure transducers.
Differential pressure transducers.
Types of pressure transmitters. Principle and construction of different electronic Transmitters.
Pressure safety valves. Pressure switches.
Classification of Transmitters.
 - 4 Basic properties of Flow. Units of flow rate and quantity of flow.
Factors affecting flow rate . Types of Flow meters –Head. Variable area and Quantity area flow meters.
Principles of open channel flow, weirs, notches and flumes. Various shapes and their applications.
Variable area flow meter – Rotameter – Principle , construction and working.
Various shapes of float, materials used for body and float. Factors affecting the Performance of rotameter.
Turbine flow meter, magnetic flow meter, vortex flow meter, ultrasonic flow meter, Thermal mass flow meter, Coriolis flow meter, advantages and disadvantages.
- (VI) Level measurement – Types of level measurement – solid and liquid, mechanical**
- 1 and electrical type, surface sensing gauges, storage tank gauges, sight glasses, magnetic gauges, displacement gauges, level switches. Pressure head instruments, Air purge systems, liquid purge systems, Force balance diaphragm system.
 - 2 Conductivity and capacitance method for measuring liquid level, Level Indicators, capacitance Probes, zero and span adjustments. Sonic level detectors,
 - 3 Various methods used for solid level measurement such as using weight, Ultrasonic method, using capacitance probe etc.
 - 4 Temperature measurement – Temperature, heat, specific heat, change of physical State, Different scales of Temperature, Industrial application of temperature measuring instruments with compensatory link and precautions to be taken.

Liquid expansion type, solid expansion type, Gas expansion type thermometers.

- 5 Electrical method – Thermistor, Thermocouples, RTD. Principle, construction, Working, advantages and disadvantages. Temperature Indicators.
Non contact method – definition, effects of emittance, temperature, radiated energy, wavelength.
Types- Optical and radiation pyrometers. Applications, Limitations.
 - 6 Converters – Principle, construction and operation of I to P and P to I Converters.
 - 7 Recorders – Principle, construction and working. Installation and use of Pneumatic and electronic recorders. Strip chart, circular chart and paperless Recorders
- (7)** Controllers – Analog and Digital, Open loop, Closed loop, Feed back control
- 1 System,
 - 2 Modes of control system – ON-OFF Control system, its operation and function. Advantages and disadvantages. Cascade ratio control system. Control wiring Diagrams.
 - 3 Principles of Electronic and Pneumatic controllers. Control lag, Step and Frequency response. Other various types of Controllers.
 - 4 Proportional, Integral and Derivative action, Proportional, PI and PID Controllers, Principle, construction and operation.
 - 5 Final control elements in process loops, Actuators, control valves, Types of control valves- Global valve, cage valve, butterfly valve, ball valve, Sliding valve, diaphragm valve, split body valve, capacitive and inductive type of valves, Proximity, IR, Micro, limit switches. solenoid valve.
 - 6 Piping and fitting, Air flow, Piping dimensions, safety factors, Piping Connections, metallic and non metallic tubing's used in instrumentation.
 - 7 Directional control valves.
Classification and uses.
- (VIII)** Smart devices – HART Transmitters, Application and advantages. Calibration of
- 1 Hart devices, Analog and digital controllers, advantages and disadvantages.
 - 2 Introduction to Programmable controllers – Characteristics, limitations, method of developing these controllers. Types of PLC input and output devices. Difference between DCS and PLC.
 - 3 Fundamentals of SCADA and DCS, History of DCS development. Basic Architecture, Advantages and disadvantages. Applications.

- 4 Terminology, RTU, Central monitoring station, Types of communication. Master and Slave controllers. Field instruments and types.
- 5 Field bus, Features, architecture, working. Work station, Human Machine Interface. Field bus interfacing modules. Gateway, Network manager, Field bus devices. Remote transmission panel, Ethernet Electronic Description Language. Device Description. Field bus power supply and its functions.
- 6 Introduction to Digital and Multi drop communication protocol. Features, advantages and disadvantages.

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