

**DETAILED SYLLABUS FOR THE POST OF  
JUNIOR INSTRUCTOR (ARITHMETIC-CUM-DRAWING)**

**INDUSTRIAL TRAINING**

*(Category Nos: 006/2022)*

**(TOTAL MARKS – 100)**

	MODULE 1	Marks(10)
<b>I.</b>	<b>Unit, Fractions</b>	<b>2</b>
1	Classification of Unit System	
2	Fundamental and Derived Units F.P.S, C.G.S, M.K.S and SI Units	
3	Measurement Units and Conversion	
4	Factors, HCF, LCM and Problems	
5	Fractions - Addition, Subtraction, Multiplication and Division	
6	Decimal Fractions - - Addition, Subtraction, Multiplication and Division	
8	Solving Problems by using calculator	
<b>II.</b>	<b>Square Root: Ratio and Proportions, Percentage</b>	<b>3</b>
1	Square and Square Root	
2	Simple problems using calculator	
3	Application of Pythagoras Theorem and related problems	
4	Ratio and Proportions	
5	Direct and Indirect proportion	
6	Percentage	
7	Changing percentage to decimal	
<b>III.</b>	<b>Material Science</b>	<b>3</b>
1	Types of metals	
2	Physical and Mechanical Properties of metals	
3	Types of ferrous and non-ferrous metals	
4	Introduction of iron and cast iron	
5	Difference between iron and steel, alloy steel and carbon steel	
6	Properties and uses of rubber, timber and insulating materials	

IV.	<b>Mass, Weight, Volume, and Density</b>	<b>2</b>
1	Mass, volume, density, weight & specific gravity	
2	Related problems for mass, volume, density, weight & specific gravity	
	<b>MODULE 2</b>	<b>Marks(10)</b>
<b>I,</b>	<b>Speed and Velocity, Work Power and Energy</b>	<b>3</b>
1	Rest, motion, speed, velocity, difference between speed and velocity, acceleration and retardation	
2	Related problems on speed and velocity	
3	Potential energy, Kinetic Energy and related problems	
4	Work, power, energy, HP, IHP, BHP and efficiency	
<b>II.</b>	<b>Heat &amp; Temperature and Pressure</b>	<b>4</b>
1	Concept of heat and temperature, effects of heat, difference between heat and temperature	
2	Scales of temperature, Celsius, Fahrenheit, Kelvin and Conversion between scales of temperature	
3	Temperature measuring instruments, types of thermometer, pyrometer and transmission of heat - Conduction, convection and radiation	
4	Co-efficient of linear expansion and related problems with assignments	
5	Problem of Heat loss and heat gain with assignments	
6	Thermal conductivity and insulators	
7	Boiling point and melting point of different metals and Nonmetals	
8	Concept of pressure and its units in different system	
<b>III.</b>	<b>Basic Electricity</b>	<b>3</b>
1	Introduction and uses of electricity, molecule, atom, how electricity is produced, electric current AC, DC and their comparison, voltage, resistance and their units	
2	Conductor, Insulator, types of connections- Series and Parallel,	
	Ohm's Law, relation between VIR & related problems	
3	Electrical power, energy and their units, calculation with assignments	
4	Magnetic induction, self and mutual inductance and EMF generation	
5	Electrical Power, HP, Energy and units of electrical energy	

<b>MODULE 3</b>		<b>Marks(10)</b>
<b>I.</b>	<b>Mensuration</b>	<b>4</b>
1	Area and perimeter of square, rectangle and parallelogram	
2	Area and Perimeter of Triangle	
3	Area and Perimeter of Circle, Semi-circle , circular ring, sector of circle, hexagon and ellipse	
4	Surface area and Volume of solids- cube, cuboids, cylinder, sphere and hollow cylinder	
5	Finding lateral surface area , total surface area and capacity in liters of hexagonal, conical and cylindrical shaped vessels	
<b>II.</b>	<b>Levers and Simple Machines</b>	<b>3</b>
1	Simple machines, Effort and load, mechanical advantage, velocity ratio, efficiency of machine, relation between efficiency, velocity ratio and mechanical advantage	
2	Lever and its types	
<b>III.</b>	<b>Trigonometry</b>	<b>3</b>
1	Measurement of Angle, Trigonometrical Ratios, Trigonometric Table	
2	Trigonometry-Application in calculating height and distance (Simple Applications)	
<b>MODULE 4</b>		<b>Marks(10)</b>
<b>I.</b>	<b>Friction</b>	<b>3</b>
1	Advantages and disadvantages, Laws of friction, co-efficient of friction, angle of friction, simple problems related to friction	
2	Friction - Lubrication	
3	Co- efficient of friction, application and effects of friction in workshop practice	
<b>II.</b>	<b>Centre of Gravity</b>	<b>2</b>
1	Centre of gravity and its practical application	
<b>III.</b>	<b>Area of cut - out regular surfaces and area of irregular surfaces</b>	<b>3</b>
1	Area of cut - out regular surfaces - circle, segment and sector of circle	
2	Related problems of area of cut - out regular surfaces - circle, segment and sector of circle	

3	Area of irregular surfaces and application related to shop problems	
<b>IV.</b>	<b>Algebra</b>	<b>2</b>
1	Addition, Subtraction, Multiplication & Divisions	
2	Algebra - Theory of indices, Algebraic formula, related problems	
	<b>MODULE 5</b>	<b>Marks 10</b>
<b>I.</b>	<b>Elasticity</b>	<b>3</b>
1	Elastic, plastic materials, stress, strains and their units and young modulus	
2	Ultimate stress and working stress	
<b>II.</b>	<b>Heat Treatment</b>	<b>4</b>
1	Heat treatment and advantages	
2.	Different heat treatment process - Hardening, Tempering, Annealing, Normalising, Case Hardening	
<b>III.</b>	<b>Profit and Loss</b>	<b>2</b>
1	Simple problems on profit & loss	
2	Simple and compound interest	
<b>IV.</b>	<b>Estimation and Costing</b>	<b>1</b>
1	Simple estimation of the requirement of material etc., as applicable to the trade	
2	Problems on estimation and costing	
	<b>MODULE 6</b>	<b>Marks(15)</b>
<b>I.</b>	<b>Engineering Drawing - Introduction</b> Introduction to Engineering Drawing and Drawing Instruments - <ul style="list-style-type: none"> <li>• Conventions</li> <li>• Viewing of engineering drawing sheets.</li> <li>• Method of Folding of printed Drawing sheet as per BIS SP: 46-2003</li> </ul>	<b>1</b>

II.	<b>Drawing Instrument</b> <ul style="list-style-type: none"> <li>Drawing board, T-square, Drafter (Drafting M/c), Set squares, Protector, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc, pencils of different grades, Drawing pins/ Clips.</li> </ul>	<b>1</b>
III.	<b>Free hand drawing of -</b> <ul style="list-style-type: none"> <li>Lines, polygons, ellipse etc.</li> <li>Geometrical figures and blocks with dimension</li> <li>Transferring measurement from the given object to the free hand sketches.</li> <li>Solid objects - Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone with dimensions.</li> <li>Free hand drawing of hand tools and measuring tools, simple fasteners (nuts, bolts, rivets etc.) trade related sketches</li> </ul>	<b>10</b>
IV.	<b>Lines</b> <ul style="list-style-type: none"> <li>Definition, types and applications in drawing as per BIS: 46-2003</li> <li>Classification of lines (Hidden, centre, construction, extension, Dimension, Section)</li> <li>Drawing lines of given length (Straight, curved)</li> <li>Drawing of parallel lines, perpendicular line • Methods of Division of line segment</li> </ul>	<b>3</b>
<b>MODULE 7</b>		<b>Marks(10)</b>
I.	<b>Drawing of Geometrical figures:</b> Definition, nomenclature and practice of - <ul style="list-style-type: none"> <li>Angle: Measurement and its types, method of bisecting.</li> <li>Triangle: different types</li> <li>Rectangle, Square, Rhombus, Parallelogram.</li> <li>Circle and its elements</li> <li>Different polygon and their values of included angles. Inscribed and circumscribed polygons</li> </ul>	<b>4</b>

II.	<b>Lettering &amp; Numbering -</b> <ul style="list-style-type: none"> <li>• Single Stroke, Double Stroke, Inclined.</li> </ul>	<b>2</b>
III.	<b>Dimensioning and its Practice</b> <ul style="list-style-type: none"> <li>• Definition, types and methods of dimensioning (functional, non- functional and auxiliary)</li> <li>• Position of dimensioning (Unidirectional, Aligned)</li> <li>• Types of arrowhead</li> <li>• Leader line with text</li> <li>• Symbols preceding the value of dimension and dimensional tolerance.</li> </ul>	<b>2</b>
IV.	<b>Sizes and layout of drawing sheets</b> <ul style="list-style-type: none"> <li>• Selection of sizes</li> <li>• Title Block, its position and content</li> <li>• Item Reference on Drawing Sheet (Item list)</li> </ul>	<b>2</b>
<b>MODULE 8</b>		<b>Marks(15)</b>
I.	<b>Method of presentation of Engg. Drawing</b> <ul style="list-style-type: none"> <li>• Pictorial View</li> <li>• Orthographic View</li> <li>• Isometric View</li> </ul>	<b>3</b>
II.	<b>Symbolic representation - different symbols used in the trades</b> <ul style="list-style-type: none"> <li>• Fastener (Rivets, Bolts and Nuts)</li> <li>• Bars and profile sections</li> <li>• Weld, Brazed and soldered joints</li> <li>• Electrical and electronics element</li> <li>• Piping joints and fitting</li> </ul>	<b>4</b>
III.	<b>Projections</b> <ul style="list-style-type: none"> <li>• Concept of axes plane and quadrant</li> <li>• Orthographic projections</li> <li>• Method of first angle and third angle projections (definition and difference)</li> <li>• Symbol of 1<sup>st</sup> angle and 3<sup>rd</sup> angle projection in 3<sup>rd</sup> angle.</li> </ul>	<b>4</b>

IV.	Orthographic projection from isometric projection	<b>4</b>
<b>MODULE 9</b>		<b>Marks(6)</b>
I.	Construction of scales and diagonal scales, Conic sections (Ellipse and Parabola)	<b>1</b>
II.	Sketches of nuts, bolt, screw thread, different types of locking devices Sketches of foundation ,Double nut, Castle nut, Pin, etc.	<b>1</b>
III.	Rivets and rivetted joints, welded joints	<b>1</b>
IV.	Sketches of pipes and pipe joints	<b>1</b>
V.	Assembly view of Vee blocks, Bush & Bearing, Different types of Coupling viz., Muff coupling, Half Lap Coupling, Flange coupling, etc. Simple work holding device Drawing details of two mating blocks and assembled view	<b>1</b>
VI.	Sketch of shaft and pulley, belt, gear, gear drives	<b>1</b>
<b>MODULE 10</b>		<b>Marks(4)</b>
I.	Sign and Symbols of Electrical, Electronics and related trades,	
	Sketch of Electrical and Electronics/ trade related components	<b>1</b>
II.	Electrical and Electronics wiring diagram/ trade related Layout diagram	
	Electrical earthing diagram - Drawing the schematic diagram of plate and pipe earthing.	<b>1</b>
III.	Electrical, Electronics/ trade related circuit diagram	<b>2</b>
	Block diagram of Instruments/ equipment of related trades	

**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**