

**Competency Based Curriculum**

Of

**(Workshop Calculation & Science)**

For

**CRAFTSMAN TRAINING SCHEME (CTS)**

**Redesigned in 2019  
Version 1.2**

Developed by



Government of India  
Ministry Skill Development and Entrepreneurship  
Directorate General Training  
**CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE**  
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## LEARNING OUTCOMES WITH ASSESSMENT CRITERIA

LEARNING OUTCOME	ASSESSMENT CRITERIA
1. Demonstrate basic mathematical concept and principles to perform practical operations.	Solve different problems like phase angle, etc. with the help of a calculator.
	Demonstrate conversion of Fraction to Decimal and vice versa.
	Explain BCD code, conversion from decimal to binary and vice-versa, all other conversions.
2. Understand and explain basic science in the field of study including simple machine.	Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, centre of gravity, friction.
	Explain levers and its types.
	Explain relationship between Efficiency, velocity ratio and Mechanical Advantage.
	Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.
	Solve simple problems on lifting tackles like crane-Solution of problems with the aid of vectors.

**Revised Syllabus**  
**Workshop Calculation & Science - 1<sup>st</sup> year (Common for all**  
**Engineering trades under CTS)**

Syllabus		Time in Hrs
<b>I.</b>	<b>Unit, Fractions</b>	<b>4</b>
	<ul style="list-style-type: none"> <li>• Classification of Unit System</li> <li>• Fundamental and Derived Units F.P.S, C.G.S, M.K.S and SI Units</li> <li>• Measurement Units and Conversion</li> <li>• Factors, HCF, LCM and Problems</li> <li>• Fractions – Addition, Subtraction, Multiplication and Division</li> <li>• Decimal Fractions - – Addition, Subtraction, Multiplication and Division</li> <li>• Solving Problems by using calculator</li> </ul>	
<b>II.</b>	<b>Square Root: Ratio and Proportions, Percentage</b>	<b>6</b>
	<ul style="list-style-type: none"> <li>• Square and Square Root</li> <li>• Simple problems using calculator</li> <li>• Application of Pythagoras Theorem and related problems</li> <li>• Ratio and Proportions</li> <li>• Direct and Indirect proportion</li> <li>• Percentage</li> <li>• Changing percentage to decimal</li> </ul>	
<b>III.</b>	<b>Material Science</b>	<b>8</b>
	<ul style="list-style-type: none"> <li>• Types of metals</li> <li>• Physical and Mechanical Properties of metals</li> <li>• Types of ferrous and non-ferrous metals</li> <li>• Introduction of iron and cast iron</li> <li>• Difference between iron and steel, alloy steel and carbon steel</li> <li>• Properties and uses of rubber, timber and insulating materials</li> </ul>	
<b>IV.</b>	<b>Mass, Weight, Volume, and Density</b>	<b>4</b>
	<ul style="list-style-type: none"> <li>• Mass, volume, density, weight &amp; specific gravity</li> <li>• Related problems for mass, volume, density, weight &amp; specific gravity</li> </ul>	
<b>V.</b>	<b>Speed and Velocity, Work Power and Energy</b>	<b>12</b>
	<ul style="list-style-type: none"> <li>• Rest, motion, speed, velocity, difference between speed and velocity, acceleration and retardation</li> <li>• Related problems on speed and velocity</li> <li>• Potential energy, Kinetic Energy and related problems with related problems</li> <li>• Work, power, energy, HP, IHP, BHP and efficiency</li> </ul>	

<b>VI.</b>	<b>Heat &amp; Temperature and Pressure</b>	<b>12</b>
	<ul style="list-style-type: none"> <li>• Concept of heat and temperature, effects of heat, difference between heat and temperature</li> <li>• Scales of temperature, Celsius, Farenhieght, Kelvin and Conversion between scales of temperature</li> <li>• Temperature measuring instruments, types of thermometer, pyrometer and transmission of heat - Conduction, convection and radiation</li> <li>• Co-efficient of linear expansion and related problems with assignments</li> <li>• Problem of Heat loss and heat gain with assignments</li> <li>• Thermal conductivity and insulators</li> <li>• Boiling point and melting point of different metals and Nonmetals</li> <li>• Concept of pressure and its units in different system</li> </ul>	
<b>VII.</b>	<b>Basic Electricity</b>	<b>12</b>
	<ul style="list-style-type: none"> <li>• Introduction and uses of electricity, molecule, atom, how electricity is produced, electric current AC, DC and their comparison, voltage , resistance and their units</li> <li>• Conductor, Insulator, types of connections- Series and Parallel,</li> <li>• Ohm’s Law, relation between VIR &amp; related problems</li> <li>• Electrical power, energy and their units, calculation with assignments</li> <li>• Magnetic induction, self and mutual inductance and EMF generation</li> <li>• Electrical Power, HP, Energy and units of electrical energy</li> </ul>	
<b>VIII.</b>	<b>Mensuration</b>	<b>10</b>
	<ul style="list-style-type: none"> <li>• Area and perimeter of square, rectangle and parallelogram</li> <li>• Area an Perimeter of Triangle</li> <li>• Area and Perimeter of Circle, Semi-circle , circular ring, sector of circle, hexagon and ellipse</li> <li>• Surface area and Volume of solids- cube, cuboids, cylinder, sphere and hollow cylinder</li> <li>• Finding lateral surface area , total surface area and capacity in liters of hexagonal, conical and cylindrical shaped vessels</li> </ul>	
<b>IX.</b>	<b>Levers and Simple Machines</b>	<b>6</b>
	<ul style="list-style-type: none"> <li>• Simple machines, Effort and load, mechanical advantage, velocity ratio, efficiency of machine, relation between efficiency, velocity ratio and mechanical advantage</li> <li>• Lever and its types</li> </ul>	
<b>X.</b>	<b>Trigonometry</b>	<b>6</b>
	<ul style="list-style-type: none"> <li>• Measurement of Angle, Trigonometrical Ratios, Trigonometric Table</li> <li>• Trigonometry-Application in calculating height and distance (Simple Applications)</li> </ul>	
	<b>Total</b>	<b>80</b>

**Workshop Calculation & Science-2<sup>nd</sup> year**  
**( Common for all Engineering trades under CTS )**

#	Title of Syllabus	Time (Hrs.)
<b>I.</b>	<b>Friction</b>	<b>10</b>
	<ul style="list-style-type: none"> <li>• Advantages and disadvantages, Laws of friction, co-efficient of friction, angle of friction, simple problems related to friction</li> <li>• Friction – Lubrication</li> <li>• Co- efficient of friction, application and effects of friction in workshop practice</li> </ul>	
<b>II.</b>	<b>Centre of Gravity</b>	<b>6</b>
	<ul style="list-style-type: none"> <li>• Centre of gravity and its practical application</li> </ul>	
<b>III.</b>	<b>Area of cut – out regular surfaces and area of irregular surfaces</b>	<b>14</b>
	<ul style="list-style-type: none"> <li>• Area of cut – out regular surfaces – circle, segment and sector of circle</li> <li>• Related problems of area of cut – out regular surfaces – circle, segment and sector of circle</li> <li>• Area of irregular surfaces and application related to shop problems</li> </ul>	
<b>IV.</b>	<b>Algebra,</b>	<b>12</b>
	<ul style="list-style-type: none"> <li>• Addition, Subtraction, Multiplication &amp; Divisions</li> <li>• Algebra – Theory of indices, Algebraic formula, related problems</li> </ul>	
<b>V.</b>	<b>Elasticity</b>	<b>8</b>
	<ul style="list-style-type: none"> <li>• Elastic, plastic materials, stress, strains and their units and young modulus</li> <li>• Ultimate stress and working stress</li> </ul>	
<b>VI.</b>	<b>Heat Treatment</b>	<b>8</b>
	<ul style="list-style-type: none"> <li>• Heat treatment and advantages</li> <li>• Different heat treatment process – Hardening, Tempering, Annealing, Normalising, Case Hardening</li> </ul>	
<b>VII.</b>	<b>Profit and Loss</b>	<b>12</b>
	<ul style="list-style-type: none"> <li>• Simple problems on profit &amp; loss</li> <li>• Simple and compound interest</li> </ul>	
<b>VIII.</b>	<b>Estimation and Costing</b>	<b>10</b>
	<ul style="list-style-type: none"> <li>• Simple estimation of the requirement of material etc., as applicable to the trade</li> <li>• Problems on estimation and costing</li> </ul>	
	<b>Total</b>	<b>80</b>

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