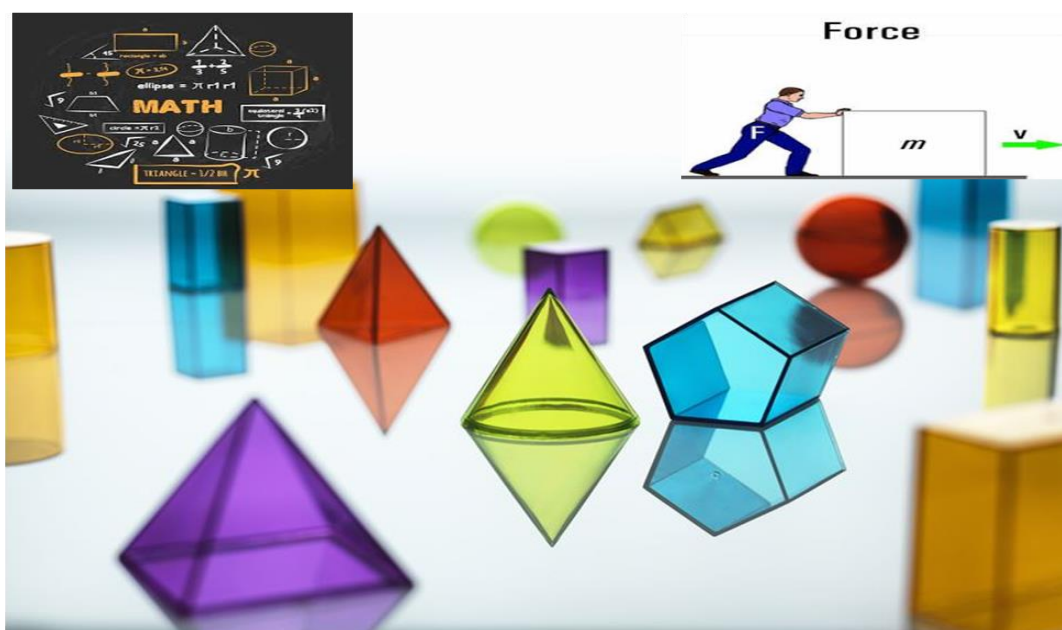GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

**COMPETENCY BASED CURRICULUM**

# WORKSHOP CALCULATION & SCIENCE

**FOR CRAFTSMEN TRAINING SCHEME (CTS)**



**Designed in 2019**

**Developed By**

**CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE**

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# CONTENTS

# RATIONALE

Core skills enhance knowledge, Analytical ability, problem solving ability, understanding or comprehending drawings & designs and also enriches on scientific principles. At the same time, it creates the base for achieving Hard skills. To carry out any skill related task the know how about basic science & related calculation is essential as it helps in scientific way of executing the task.

Presently the employers want not only simple execution of assigned task but also give weightage on Innovative ideas in workplace along-with problem solving. A person can stimulate innovative ideas and solve problems if he possesses basic core skill such as (Calculation and Science). More importantly the productivity of a person also enhances and gives confidence to person to perform task competently.

Recognizing this importance, the core skills (Workshop Calculation and science) made an integral part of all Engineering Trade run under DGT. The content of Workshop Calculation and science is common for first year for all Engineering Trades. The content of 2nd year is also made common for all Engineering Trades having duration of more than one year.

# GENERAL INFORMATION

| | | |
|---|---|---|
| 1. | **Name of the subject** | **WORKSHOP CALCULATION & SCIENCE** |
| 2. | **Applicability** | CTS - For all engineering trades |
| 3. | **Hours of Instruction** | 80 Hrs for 1st Year & 80 Hrs for 2nd Year |
| 4. | **Examination** | The examination for the subject will be held at the end of each year. |
| 5. | **Marks Distribution** | Full marks – 50<br>Pass Marks - 17 |
| 6. | **Instructor Qualification** | B.Voc/Degree in Engineering from AICTE/ UGC recognized Engineering College/ University with one year Experience in the relevant field.<br>OR<br>03 years Diploma in Engineering from AICTE/ recognized Board of Technical Education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.<br>OR<br>NTC/ NAC in any one of the engineering trades with three years' experience in the relevant field.<br><br>**Essential Qualification:**<br>National Craft Instructor Certificate (NCIC) in relevant trade<br>OR<br>NCIC in RoDA or any of its variants under DGT. |
| 7. | **Minimum Age** | **14 years as on first day of academic session.** |

# LEARNING OUTCOMES AND 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. |
| | |

# WORKSHOP CALCULATION & SCIENCE – I

## (Common for CTS Engineering trades during 1st year)

| Sl. No. | Syllabus | Time in hrs. |
|---|---|---|
| **I.** | **Unit, Fractions** | **4** |
| 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 | |
| **II.** | **Square Root: Ratio and Proportions, Percentage** | **6** |
| 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 | |
| **III.** | **Material Science** | **8** |
| 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.** | **Mass, Weight, Volume, and Density** | **4** |
| 1 | Mass, volume, density, weight & specific gravity | |
| 2 | Related problems for mass, volume, density, weight & specific gravity | |
| **V.** | **Speed and Velocity, Work Power and Energy** | **12** |
| 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 with related problems | |
| 4 | Work, power, energy, HP, IHP, BHP and efficiency | |
| **VI.** | **Heat &Temperature and Pressure** | **12** |

| | | |
|---|---|---|
| 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 | |
| **VII.** | **Basic Electricity** | **12** |
| 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 | |
| **VIII.** | **Mensuration** | **10** |
| 1 | Area and perimeter of square, rectangle and parallelogram | |
| 2 | Area an 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 | |
| **IX.** | **Levers and Simple Machines** | **6** |
| 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 | |
| **X.** | **Trigonometry** | **6** |
| 1 | Measurement of Angle, Trigonometrical Ratios, Trigonometric Table | |
| 2 | Trigonometry-Application in calculating height and distance (Simple Applications) | |
| | **Total** | **80** |

# WORKSHOP CALCULATION & SCIENCE – I

## (Common for CTS Engineering trades during 2ndYear)

| Sl. No. | Title of Syllabus | Time in hrs. |
|---|---|---|
| I. | **Friction** | 10 |
| 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 | |
| II. | **Centre of Gravity** | 6 |
| 1 | Centre of gravity and its practical application | |
| III. | **Area of cut – out regular surfaces and area of irregular surfaces** | 14 |
| 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 | |
| IV. | **Algebra,** | 12 |
| 1 | Addition, Subtraction, Multiplication & Divisions | |
| 2 | Algebra – Theory of indices, Algebraic formula, related problems | |
| V. | **Elasticity** | 8 |
| 1 | Elastic, plastic materials, stress, strains and their units and young modulus | |
| 2 | Ultimate stress and working stress | |
| VI. | **Heat Treatment** | 8 |
| 1 | Heat treatment and advantages | |
| 2. | Different heat treatment process – Hardening, Tempering, Annealing, Normalising, Case Hardening | |
| VII. | **Profit and Loss** | 12 |
| 1 | Simple problems on profit & loss | |
| 2 | Simple and compound interest | |
| VIII. | **Estimation and Costing** | 10 |
| 1 | Simple estimation of the requirement of material etc., as applicable to the trade | |
| 2 | Problems on estimation and costing | |
| | **Total** | **80** |