# PREFACE

Directorate General of Training (DGT) under the Ministry of Skill Development and Entrepreneurship (MSDE) is the apex body in the country as regards planning, formulating and prescribing norms, standards, procedures and guidelines in respect of various vocational training schemes of which Craftsmen Training Scheme (CTS) implemented in ITI's is the most important. Prescribing well designed curriculum and putting in place appropriate assessment and certification procedure are among the vital aspects of vocational training.

DGT vide its communication No. MSDE(GT)-19/03(02)/2022-CD dated 5<sup>th</sup> April 2022 conveyed its decision to simplify the syllabus related to **Workshop Calculation & Science (WCS)** and **Engineering Drawing (ED)** by merging these subjects with Trade Theory subject of all engineering trades.

Taking note of this latest development, this book has been prepared which comprises of essentials of WCS and ED as per the latest notified syllabus for 2-year engineering trades. This covers primarily all main topics of WCS and ED for first and second year of training. While simplified and illustrated topic summary matter has been kept to the minimum, a rich bank of Multiple-Choice Questions both on WCS and ED (1000 MCQs) has been included in accordance with what trainees are likely to face in the trade test. A special mention has to be made here about the Explanatory Notes added along with key to MCQs. This will immensely help trainees not only to pick correct options but also understand necessary related explanation.

We sincere hope that trainees will find this book very much helpful to adjust with the latest change in syllabus related to WCS and ED. We would welcome suggestions for further improvement of this book in its subsequent editions.

—Author

# **CONTENTS**

## **1ST YEAR PART-1**

### WORKSHOP CALCULATION AND SCIENCE

#### (Pages 1-68)

Square and Square Roots, Symbol of Root, Method of Finding Out the Square, Root of a Number, Pythagoras Theorem, Percentage, Ratio, Proportion

- 5. SPEED, VELOCITY, WORK, POWER AND ENERGY .... 15 Speed, Acceleration, Mechanical Work, Power, Energy
- 6. HEAT & TEMPERATURE AND PRESSURE
   21

   Heat, Temperature, Units of Heat, Measurement of Temperature, Pyrometer, Heat Transfer, Physical Properties of Metals and Non-Metals, Pressure, Barometer, Pressure Gauges, Solid Pressing on Confined Fluid, Caused by Gravity
   28

   7. BASIC ELECTRICITY
   28

   Electricity, Forms of Electricity, Static Electricity, Capacitor, Farad Amount of Capacitance, Current Electricity, Ohm's Law, Electrical Power, Electrical Circuits, Alternating Current, Magnetic Induction
   33

   9. SIMPLE MACHINES
   38

   Lever, Classes of Levers
   39
  - Trigonometrical Formulae, Trigonometrical Tables

Appendix : 1st Year Model Papers 1 to 10 (Annual A.I.T.T. Exam – As per NSQF) ....... 41–68

## 1ST YEAR PART-2

### **ENGINEERING DRAWING**

(Pages 69–136)

l	1.	INTRODUCTION TO ENGINEERING DRAWING		5.	VIEWS AND PROJECTIONS Orthographic Projection, First-angle Projection, Third-angle Projection, Isometric Projection	79
I.	2.	DIMENSIONING	1	6. 7	READING OF JOB DRAWINGS	
I.	3.	LINES AND LETTERING	i.	7. 8.	FREE HAND SKETCHES	
I	4.	DRAWING OF GEOMETRICAL FIGURES			Marking and Measuring Tools, Hand Tools, Cutting Tools, Precision Instruments and Gauges, Sheet Metal Tools and Equipments, Electrical Tools, Accessories and Wire Joints, Some Important Electrical Symbols, Welding, Tools, Equipments etc., Refrigeration and Air Conditioning Tools, Equipments etc., Automobile Components	

Appendix : 1st Year Model Papers 1 to 10 (Annual A.I.T.T. Exam – As per NSQF) ...... 105–136

## 2ND YEAR PART-1

#### WORKSHOP CALCULATION AND SCIENCE

(Pages 1-39)

- 1. FRICTION
   1

   Types of Friction, Laws of Friction, Advantages and Disadvantages of Friction, Reducing Friction
   1

   2. LUBRICATION
   3

   Engine Lubrication, Need for Lubrication, Purpose of Lubrication System, Desirable Properties of a Lubricant
   3

   3. CENTRE OF GRAVITY
   4

   Centroid, Methods of Finding Out Centre of Gravity of Figures, Centre of Gravity of Certain, Geometrical Considerations, Centre of Gravity Calculations
  - 4. AREA OF REGULAR AND IRREGULAR SURFACES ..... 6 Examples

- 5. ELASTICITY......9 Stress, Strain

Appendix : 2nd Year Model Papers 1 to 10 (Annual A.I.T.T. Exam – As per NSQF) ...... 15–39

	2ND YEAR PART-2							
			ENGINEERING DRAWI (Pages 40–111)					
I	1.	FASTENERS Nuts, Bolts, Screw Threads, Simplified Representation As Per the SP-46-2003		I.	5.	PIPES AND PIPE JOINTS		
L	2.	MACHINE FOUNDATION	47	l.	Types of Sectio 7. ELECTRICA Electrical Symb	SECTIONAL VIEWS		
I.	3.	RIVETS AND RIVETED JOINTS		8		ELECTRICAL AND ELECTRONICS		
I	4.	WELDING AND WELDED JOINTS Basic Weld Symbols, Supplementary Weld Symbols, A Welding Symbol		I		Electrical Symbols, Logic Gates READING OF DRAWINGS70		

V