## PUBLISHER'S NOTE

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

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 of Electrician group. 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 (1400 MCQs) has been included in accordance with what trainees are likely to face in the trade test. MCQs from recent exam papers have been given to help students prepare and face All India Trade Test in the coming years with more confidence.

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.

# **CONTENTS**

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

### **WORKSHOP CALCULATION AND SCIENCE**

(Pages 1-94)

	<ol> <li>2.</li> <li>3.</li> <li>5.</li> </ol>	UNITS, FRACTIONS, SQUARE ROOTS	1	8. 9.	Temperature Measuring Instruments, Pyrometer, Thermo-Couple, Thermo Electric Pyromether, Radiation Pyrometer  BASIC ELECTRICITY							
_	Appendix: 1st Year Model Papers 1 to 10 [Annual A.I.T.T. Exam – NSQF (Level–5)] 79–94											
		1ST YEA	R P	PAF	RT–2							
	1.	INTRODUCTION TO ENGINEERING DRAWING AND DRAWING INSTRUMENTS		5–10								

Materials, Drawing Materials, Construction of Accurate Drawing

3. FREE-HAND DRAWINGS......107

Introduction, Scope of Free Hand Sketching in Engineering Field, Material for Free Hand Sketching, Essential Suggestion, Freehand

Sketching, Hand Tools

Contents

	4.	DRAWING OF GEOMETRICAL FIGURES112		7.	SYN
		Type of Angles, Plain Geometry, Circle, Plain Figures, Triangles, Quadrilaterals, Polygons, Drawing Angles, Drawing Triangles, Drawing Quadrilaterals, Rhombus, Drawing of Circles			Mate Comp Conve
	5.	LETTERING & NUMBERING — SINGLE STROKE 122		•	DE 4
_		Introduction, Lettering, Types of Lettering, Lettering Characteristics, Spacing in Single Stroke, Lettering Gothic, Gothic Lettering		ŏ.	REA DIA

### 6. DIMENSIONING PRACTICE ......125

Introduction, General Rules of Dimensioning, Types of Dimensioning, Dimensioning System, Methods of Dimensioning Some Important Figures, Method of Dimensioning, Leader, Arrow Head, Arrow Heads, Letters and Symbols, Some Important Notes

7. SYMBOLIC REPRESENTATION .......130

Materials Conventions, Equipment/Instrument/Engineering,
Components/ Engineering Process, Conventions, Material

Components/ Engineering Process, Conventions, Material Conventions and their Symbols, Conventions Used for Electrical and Electronic Elements

#### 

How to Read Circuit Diagrams, Simple Circuit Diagram, Circuit Symbols and Physical, Components, Circuit Diagram Connections, Circuit Diagram Connections and Crossing Wires, Parallel Circuit Example, Series Circuit Example, Some Circuit Diagram Rules, Block Diagrams, Wiring Diagrams, Electronic Components in Schematics, Mechanical Devices, Passive Devices, Resistors, Capacitors, Inductors, Active Devices, Diodes, Transistors, Transistor Differential Amplifiers, Thyristors, Operational Amplifiers, Basic Digital Gates, Common Digital Integrated Circuits

Appendix: 1st Year Model Papers 1 to 8 (Annual A.I.T.T. Exam – As per NSQF) ........... 151–169

### 2ND YEAR PART-1

#### **WORKSHOP CALCULATION AND SCIENCE**

(Pages 170-226)

1. FRICTION—LUBRICATION ......170

Friction, Advantages of Friction, Disadvantages of Friction, Methods of Reducing Friction, Normal Reaction, Limiting Friction, Friction – Lubrication, Gravity Feed, Force Feed/Pressure Feed, Oil, Grease Gun and Grease Cups, Oil Pump Method, Splash Lubrication, Types of Grease Guns, Lubrication to Exposed Sildeways, Lubricate Bearings, Hints for Lubricating Machines, Cutting Fluids, Functions, Advantages, Properties of a Good Cutting Fluid, Types of Cutting Fluids, Straight Mineral Oil, Chemical Solution (Synthetic Oil), Compounded or Blended Oil, Fatty Oil, Soluble Oil (Emulsified oil)

2. ALGEBRA ......177

Algebra Fundamentals, Careful Consideration of Subject Items, Addition and Subtraction, Multiplication and Division, Algebraic Formulae and Applications, Factorization, Simple Equations, Quadratic Equations, Simultaneous Equations, Algebra Fundamentals, Algebraic Formulae and Applications, Simple Equations, Simultaneous Equations

3. ELASTICITY......189

Elasticity, What is Elasticity of a Metal?, What is an Elastic Material?, What is the Difference between Plasticity and Elasticity?, What are Examples of Elastic Materials?, What is Plastic Material?, What is a Plastic Material Example?, Simple Stresses and Strains, Stress and Strain, Different Types of Stresses, Young's Modulus or Modulus of Elasticity, Yield Point, Stress-Strain Graph, Elasticity, Simple Stresses and Strains

4. PROFIT AND LOSS......193

Profit and Loss, Discount, Simple and Compound Interest, Simple Interest, Compound Interest, Profit and Loss, Simple and Compound Interest

5. ESTIMATION AND COSTING ......203

Appendix: 2nd Year Model Papers 1 to 10 [Annual A.I.T.T. Exam – NSQF (Level–5)] ....... 207–226

### 2ND YEAR PART-2

ENGINEERING DRAWING (ELECTRICAL GROUP)

(Pages 227-254)

Model Papers 1 to 8 [ELECTRICAL ENGINEERING DRAWING]
(Annual A.I.T.T. Exam – As per NSQF) .......227–254