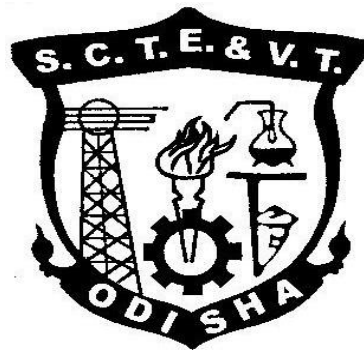


**CURRICULLUM OF  
LEVEL 04; 4th SEMESTER**

**For**

**DIPLOMA VOCATIONAL IN  
INDUSTRIAL TOOL MANUFACTURING**

**(Effective FROM 2023-24 Sessions)**



**STATE COUNCIL FOR TECHNICAL EDUCATION & VOCATIONAL TRAINING,  
ODISHA, BHUBANESWAR**

STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

**TEACHING AND EVALUATION SCHEME FOR LEVEL 04: 4th Semester (D.Voc in Industrial Tool Manufacturing) (wef 2023-24)**

Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
<b>Theory</b>									
1	Th.1	General Foundation Course –II	4	-	-	20	80	3	100
2	Th.2	Material Science and Material	4	-	-	20	80	3	100
3	Th.3	Manufacturing Technology - II	4	-	-	20	80	3	100
4	Th.4	General Mechanical Engineering -I	4	-	-	20	80	3	100
		<i>Total</i>	<i>16</i>			<i>80</i>	<i>320</i>		<i>400</i>
<b>Practical</b>									
5	Pr.1	Material Science Lab	-	-	3	25	50	3	75
6	Pr.2	Mechanical Workshop Practice - II	-	-	3	25	50	3	75
		<i>Total</i>			<i>06</i>	<i>50</i>	<i>100</i>		<i>150</i>
<b>On-Job-Training (OJT)</b>									
		One more QP to be opted from the QPs mentioned in the Level 4 1 <sup>st</sup> semester:	-	-	14	-	200	-	200
		<i>Total</i>			<i>14</i>		<i>200</i>		<i>200</i>
		<b>Grand Total</b>	<b>16</b>		<b>23</b>	<b>130</b>	<b>620</b>		<b>750</b>

Abbreviations: L-Lecturer, T-Tutorial, P-Practical. Each class is of minimum 55 minutes duration

Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%

**SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies/Classes on MOOCS/SWAYAM etc., Seminar and SCA shall be conducted in a section.**

**There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester**

## TH.1. GENERAL FOUNDATION COURSE – II

<b>Theory</b>	<b>3 Periods per week</b>	<b>Examination</b>	<b>3hours</b>
<b>Total Periods</b>	<b>45 Periods</b>	<b>Total Marks</b>	<b>100 Marks</b>

### Topic Wise Distribution of Periods

Sl. No.	Topic	Periods
1	Business Management and Entrepreneurship	10
2	Computational Skills	10
3	Environmental Education	10
4	Rural Development	15

### DETAILED CONTENTS

#### 1.0 Business Management and Entrepreneurship:

- Management of Business,
- Elementary treatment/exposure to basic conceptual frame work of the topic listed below:
  - (a) Basic Function
  - (b) Marketing Management
  - (c) Financial Management
  - (d) Production Management
  - (e) Personnel Management

#### 2.0 Computational Skills:

- Solution of linear equations and their application to problem of commercial mathematics.
- System of linear equations and in equation in two variables.
- Applications in formation of simple linear programming problems
- Statistics: Raw data, bar charts and Histogram; Frequency Tables; Frequency Polygon; Ogive; Menu, Median and Mode of ungrouped and grouped data; Standard Deviation; Introduction to Mortality tables; Price Index etc. Introduction to Computers

#### 3.0 Environmental Education:

- Modernization of agriculture and environment, irrigation, water logging, use of fertilizers, pesticides, soil erosion, land degradation (desertification and deforestation), silting and drying of water resources.
- Rational utilization, conservation and regeneration of environmental resources (soil, air, water, plant, energy, minerals).

#### 4.0 Rural Development:

- Principles and goals of rural development, major problems/constraints in rural development in India

**Syllabus to be covered before IA:** Chapter 1 & 2

### RECOMMENDED BOOKS

1. Environmental Studies, M.P. Poonia & S.C. Sharma, Khanna Publishing House
2. A Textbook of Environmental Sciences, Rimpi Mehani Ne' Chopra, Khanna Publishing House
3. Elements of Mathematical Analysis, R. Agor, Khanna Publishing House

## TH.2. MATERIAL SCIENCE & MATERIALS

<b>Theory</b>	<b>3 Periods per week</b>	<b>Examination</b>	<b>3hours</b>
<b>Total Periods</b>	<b>45 Periods</b>	<b>Total Marks</b>	<b>100Marks</b>

### Topic Wise Distribution of Periods

Sl. No.	Topic	Periods
1	General	2
2	Structure of Metals & Their Deformation	5
3	Metals-Ferrous Metals	8
4	Non-Metallic Materials - Plastic and Other Synthetic Materials	4
5	Non-Metallic Materials - Paints, Enamels, Varnishes and Lacquers	4
6	Non-Metallic Materials - Heat Insulating Materials	7
7	Non-Metallic Materials - Hardware	5
8	Identification & Testing of Metal Alloys	2
9	Heat Treatment of Metals	8

### DETAILED CONTENTS

#### 1.0 General:

- Brief introduction to the subject metallurgy and its scope in engineering field, classification of materials of industrial importance
- Their chemical thermal, electrical, magnetic, mechanical and technological properties and their selection criteria for use in industry

#### 2.0 Structure of Metals & Their Deformation:

- Structure of metals and its relation to their physical, mechanical and technological properties
- Elementary idea of arrangement of atoms in metals, molecular structures, crystal structures and crystal imperfections
- Deformation of metals, effects of cold and hot working operations over them
- Recovery recrystallization and grain growth, solid solutions, alloys and inter metallic compounds, effect of grain size on properties of metals
- Properties And Usage Of: (1) Metals: (a) Ferrous Metals (b) Non Ferrous Metals (2) Non-metallic Materials.

#### 3.0 Metals-Ferrous Metals:

- Classification of iron and steel
- Cast iron types as per I.S. - White, malleable, Grey
- Steels: Classification of steels according to carbon content and according to use as per I.S. Mechanical properties of various steels and their uses
- Availability of steel in market, Its forms and specifications
- Alloy Steel: Effect of alloying various elements, viz Cr, Ni, Co, V,W, Mo, Si, and Mn, on mechanical properties of steel, Common alloy steels, viz, Ni-steel, Ni-Cr-steel, Tungsten steel, Cobalt steel, Stainless Steel, Tool steel - High Carbon Steel, High Speed steel, Tungsten Carbide, Silicon manganese steel, Spring Steel, Heat Resisting alloy Steels etc.

#### 4.0 Non-Metallic Materials - Plastic and Other Synthetic Materials:

- Plastics- Important sources-Natural and Synthetic, Classification, thermo-set and thermoplastic, Various trade names

- Important Properties and engineering use of plastics
- Market forms of Plastics

### **5.0 Non-Metallic Materials - Paints, Enamels, Varnishes and Lacquers:**

- Paints and Enamels-types, its purpose, essential ingredients and their role, characteristics of a good paints and enamel, trade names of some important types of products
- Varnishes-types purpose of varnish, essential ingredients and their role, characteristics, preparation, trade names storage of varnish
- Lacquer- characteristics, preparation and uses

### **6.0 Non-Metallic Materials - Heat Insulating Materials:**

- Classification of Heat Insulating material
- Properties and uses of China clay, Cork, Slag wool, Glass Wool, Thermocole, Puff
- Properties and uses of asbestos as filler material

### **7.0 Non-Metallic Materials - Hardware:**

- General specification, uses and methods of storage of G.I. and C.I. steel, Copper, A.C. pressure conduits, R.C.C. spun, P.V.C. Pipes and their uses
- General sheets specification (I.S.) and uses, Method of storage of G.I. sheets, M.S. sheets
- General specification of pipe fitting

### **8.0 Identification & Testing of Metal Alloys:**

- Selection, specification forms and availability of materials

### **9.0 Heat Treatment of Metals:**

- Elementary concept, purpose
- Iron-carbon equilibrium diagram
- T.T.T. and 'S' curve in steels and its significance
- Hardening, Tempering, Annealing, Normalising and case hardening

**Syllabus covered up to I.A-Chapters 1,2,3,4 &5**

### **RECOMMENDED BOOKS**

1. MATERIAL SCIENCE: RS Khurmi & RS Shedha

### TH.3. MANUFACTURING TECHNOLOGY – II

<b>Theory</b>	<b>3 Periods per week</b>	<b>Examination</b>	<b>3hours</b>
<b>Total Periods</b>	<b>45 Periods</b>	<b>Total Marks</b>	<b>100 Marks</b>

#### Topic Wise Distribution of Periods

SI No.	Topic	Periods
1	General Process	2
2	Welding	8
3	Welding Of Special Materials	5
4	Testing Of Welds & Relevent Welding Codes	5
5	Pattern & Moulding	5
6	Melting & Pouring	4
7	Foundry Practice	7
8	Powder Metallurgy	4

#### DETAILED CONTENTS

##### 1.0 General Process:

- Classification and elementary idea of metal forming processes on the basis of the properties of deformability (Plasticity)
- Fusibility and divisibility viz., Rolling, Forging, Drawing, Extruding, Spinning, Pressing, Punching, Blanking, Welding, Soldering, Brazing, Metal cutting processes- turning, Drilling, Boring, Shaping, Grinding
- Elementary idea of machines used for the above processes

##### 2.0 Welding:

- Weld edge preparation
- Introduction to various welding processes with procedure equipment and applications such as
  - (i) Electric arc welding.
  - (ii) Resistance welding.
  - (iii) Thermit welding (iv) Carbon arc gauging.
  - (v) Metal-Inert-Gas welding (MIG)
  - (vi) Tungsten Inert Gas welding (TIG)
  - (vii) Atomic Hydrogen arc welding
  - (viii) Stud welding
  - (ix) Laser Beam
  - (x) Electron Beam welding,
  - (xi) Explosion welding
- Welding Arcs: Definition, arc initiation, arc structures, types of arc, metal transfer characteristics and influencing parameters, weld bead geometry, various types of electrodes used in various processes

##### 3.0 Welding Of Special Materials:

- Welding of plastics, equipment, filler rods, weldability, procedures and precautions
- Welding of Grey Cast Iron, shielded metal arc gas welding procedures
- Welding of Aluminium, Argon arc and gas welding procedures
- Welding of copper, Brass and Bronze, Gas shielded metallic arc welding, TIG, Oxy-acetylene method

##### 4.0 Testing Of Welds & Relevent Welding Codes:

- Destructive methods

- Nondestructive methods-visual, X-ray, Y-ray, Magnetic particles, fluorescent, penetrant and ultrasonic testing.

### **5.0 Pattern & Moulding:**

- The pattern materials used, Types of pattern allowances and pattern layout, Colour scheme patterns defects, Types of cores and their utility
- Moulding and Pouring: Classification of mould materials according to characteristics, Types of sands and their importance test, parting powders and liquids, Sand mixing preparation, Moulding defects)

### **6.0 Melting & Pouring:**

- Brief idea of refractory material and fluxes, Fuels and metallic materials used in foundry
- Melting furnaces used in foundry such as pit furnace, Tilting and cupola furnaces, their construction and operation, metals and alloys
- Additions to molten metal, Closing and pouring of the moulds
- Coring-up, venting and closing, use of ladles, spur and risers
- Defects due to closing and spurring, Basic idea of fettling operations
- Surface treatment, Salvaging of castings, Factors determining soundness of casting

### **7.0 Foundry Practice:**

- Elementary idea of special casting processes-Shell mould casting, die casing, investment mould casting, centrifugal and continuous casting full mould casting
- Elementary idea of mechanisation of foundries

### **8.0 Powder Metallurgy:**

- Introduction, principle, scope and names of processes. Production of metal powders, compaction, sintering and sizing, Self-lubricated bearings
- Advantages of the process and its limitations (Elementary concept only)

### **Syllabus covered up to I.A-Chapters 1,2 &3**

#### **RECOMMENDED BOOKS**

1. Workshop Technology, Vol. I: BS Raghuvanshi
2. Production Technology, Vol. I: Hazra & Chaudhry

## TH.4. GENERAL MECHANICAL ENGINEERING - I

<b>Theory</b>	<b>3 Periods per week</b>	<b>Examination</b>	<b>3hours</b>
<b>Total Periods</b>	<b>45 Periods</b>	<b>Total Marks</b>	<b>100 Marks</b>

### Topic Wise Distribution of Periods

Sl No.	Topic	Periods
1	Strength of Materials & Power Transmission	10
2	Shear Force & Bending Moment	10
3	Power Transmission: Pulleys, Gears & Shaft	8
4	Hydraulics & Hydraulic Machines	7
5	Water Turbines & Pumps	10

### DETAILED CONTENTS

#### 1.0 Strength of Materials & Power Transmission:

- Stress, strain, elastic constraints
- Stress in circular shaft subjected to pure torsion only
- Riveted and bolted joints

#### 2.0 Shear Force & Bending Moment:

- Elementary idea of Shear force and bending moment for concentrated, uniformly distributed loads on simply supported beam cantilever and overhanging beam
- Simple Shear force and bending moment diagrams
- Relationship between shear force and bending moment

#### 3.0 Power Transmission: Pulleys, Gears & Shaft:

- Classification of Pulleys
- Types of Belts
- Simple calculation of pulley diameter
- Classification of Gears
- Simple calculation of number of teeth and speed
- Power transmission by solid and hollow shaft

#### 4.0 Hydraulics & Hydraulic Machines:

- Properties of fluids
- Pressure of fluid and its measurement
- Flow of fluids, velocity and discharge
- Bernoulli's theorem and its application in venturimeter
- Flow through pipe
- Head loss due to friction

#### 5.0 Water Turbines & Pumps:

- Capacity & Working of Turbines- Pelton and Reaction
- Reciprocating and centrifugal pump

**Syllabus to be covered before IA:** Chapter 1,2 & 3

### RECOMMENDED BOOKS

1. Automobile Mechanics, A.K. Babu, S.C.Sharma, T.R. Banga, Khanna Publishing House



## Pr 1. MATERIAL SCIENCE LAB

<b>Practical</b>	<b>3 Periods per week</b>	<b>Examination</b>	<b>3 hours</b>
<b>Total Periods</b>	<b>45 Periods</b>	<b>Total Marks</b>	<b>75 Marks</b>

### List of Practicals

1. (a) Study of various crystals structures through models BCC, FCC, HCP, tetrahedral and octahedral voids.  
(b) Material identification of, say, 50 common items kept in a box.
2. Specimen preparation for metallographic examination /micro structural examination-cutting, grinding, polishing, etching.
3. Comparative study of microstructures of different given specimens (mild steel, gray C.I., brass, copper etc.)
4. Heat treatment experiments such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after.
5. Study of Microstructure and hardness of steel at different rates of cooling, Microstructure examination of white cast iron.

## Pr 2. MECHANICAL WORKSHOP PRACTICE – II

<b>Practical</b>	<b>3 Periods per week</b>	<b>Examination</b>	<b>3 hours</b>
<b>Total Periods</b>	<b>45 Periods</b>	<b>Total Marks</b>	<b>75 Marks</b>

### List of Practicals

#### 1. Welding Shop Work

Exp-1: Welding practice-gas and electric

Exp-2: Welding for lap joint after preparing the edge

Exp-3: Welding for Butt joint after preparation of the edge

Exp-4: `T' joint welding after preparation of edge.

#### 2. Carpentry

(i) Bridle joint

(ii) Dovetail joint

(iii) Utility article like picture frame, larger peg, Name plate etc.

#### 3. Fitting

(i) Drill a hole in MS Block & tapping the same

(ii) Making a Bolt & Nut by Tap & Die set.

(iii) Utility article-screw driver, Paper weight.

#### 4. Smithy

(i) To make square or hexagonal head bolt

(ii) To make ring with hook

(iii) Utility article-to prepare a fan hook.

#### 5. Tin Smithy, Soldering, Brazing

(i) To prepare different types of joint such as lap joint single seam, double seam & cap joint-hem & wired edge.

(ii) Utility article-waste paper basket or paper tray (iii) Study & sketch stakes/ anvils.

### Reference Books:

1. Elements of Workshop Technology Vol. I: BS Raghuwanshi