



**GOVT.TOOL ROOM & TRAINING CENTRE
SEMESTER: FOURTH**

Course: DIPLOMA IN TOOL & DIE MAKING

Syllabus -Theory and practical Subjects

SL. NO	CODE	SUBJECTS	Contact Hours/Week	Contact Hours/Semester
1	DTDM-IVS401	Production Technology – IV (Grinding)	3	64
2	DTDM-IVS402	Press Tool Theory-I	3	64
3	DTDM-IVS403	Material Technology-II	3	64
4	DTDM-IVS404	Jigs & Fixtures Theory & Design	4	94
Practical				
5	DTDM-IVS405	CNC Programming & Operation	3	64
6	DTDM-IVS406	CAD Lab - II	3	64
7	DTDM-IVS407	Work Shop – IV	21	386

Scheme of Examination

Course: DIPLOMA IN TOOL & DIE MAKING

Sl. No	Sub. Code	Subjects	Contact Hours per Week	Exam Duration	Scheme of Examination				Total Marks	Min marks for passing
					Exam		Internal Assessment			
					Max	Min	Max	Min		
					Marks	Marks	Marks	Marks		
1	DTDM-IVS401	Production Technology – IV (Grinding)	3	3	100	50	20	10	120	60
2	DTDM-IVS402	Press Tool Theory-I	3	3	100	50	20	10	120	60
3	DTDM-IVS403	Material Technology-II	3	3	100	50	20	10	120	60
4	DTDM-IVS404	Jigs & Fixtures Theory & Design	4	4	100	50	20	10	120	60
Practical										
5	DTDM-IVS405	CNC Technology	3	3	100	50	20	10	120	60
6	DTDM-IVS406	CAD Lab - II	3	3	100	50	20	10	120	60
7	DTDM-IVS407	Work Shop – IV	21	10	900	540	100	60	1000	600
Total			40		1600	890	240	130	1840	1020

PRODUCTION TECHNOLOGY-IV (GRINDING)

SUBJECT CODE: DTDM-IVS401

Learning goals for Production Technology-IV

On completion of this subject, the trainees will be able to:

- Explain the operations on various types of grinding machines, Tool and Cutter Grinder and non-conventional machines like Electric discharge machines, Jig grinding machines etc.
- Explain safety precautions to be followed on the above machines
- Calculate the various cutting parameters and machining time on the above machines
- Explain the use of appropriate tool and work holding devices, auxiliary attachments for the above machines
- Explain and select proper cutting tools for a particular operation on the above machines

PRODUCTION TECHNOLOGY-IV (GRINDING)

Contact Hrs. /Week: 3

Contact Hrs. / Semester: 64

SPECIFIC INSTRUCTIONAL OBJECTIVES:

1. GRINDING

- Types and part description, specification
- Grinding wheels – abrasives, bonds (silicate, vitrified, shellac), grit, grade, structure and specification, super abrasives like CBN, Ceramic grinding wheels
- Wheel selection – types of wheels, work material, surface finish, profile, machine type, coolant
- Wheel shapes – straight, cup, saucer, flange cup, cutting off, dish, tapered, double cup etc
- Wheel mounting – sound check, preparation of wheel, requirement of flanges, flange diameter, tightening wheel on flange, cardboard, rubber, compressive washers, safety precautions
- Wheel balancing – reason for balancing, methods, static and dynamic balancing
- Wheel dressing – purpose of dressing, types of dressers, cooling during dressing, depth of cut, RPM of wheel, selection of dressers and their speed.
- Use of coolant – purpose, types, filtering of coolants, requirements of a good coolant
- Auxiliary equipment – Magnetic bed, laminated blocks, V block, sine bar, sine table, demagnetizing unit
- Surface grinding operations – wheel selection, cutting parameters, right angle grinding, grinding of thin components and edges
- Cylindrical grinding – wheel selection, guidelines for OD, ID and plunge cut grinding
- Profile grinding operations – selection of wheels, radius dressing, tangent dresser, sine dresser, double sided dresser, optical dresser, pantograph dresser etc
- Cutting speed, rpm, feed, depth of cut, machining time, different units, calculations and problems
- Safety precautions in grinding

2. JIG GRINDING

- Jig grinding machine and its construction, applications of JG, OD and ID grinding, profile grinding
- Safety precautions in jig grinding

3. TOOL AND CUTTER GRINDING

- Tool and cutter grinding machine – construction and applications, various spindles, spindle head, tail stock, OD and ID grinding, spiral grinding
- Safety precautions in tool and cutter grinding

4. ELECTRIC DISCHARGE MACHINING

- Concept of EDM
- Application and principles
- Advantages and disadvantages
- Electrode- metallic and non-metallic materials, requirements of a good electrode material
- Dielectric fluid – need and their requirements
- Process description, material removal rate, polarity of work and electrode, pulse time and temperatures, voltage and current during sparking, their effects on the surface and MRR
- Spark gap and its importance, determination of spark gaps for roughing and finishing operations, factors on which the spark depends
- General problems and trouble shooting in EDM.
- EDM machine – construction, table, working head, motors, spindle, dielectric tank
- Electrode clamping – fixing with screws, glue, soldering etc
- Flushing – purpose and methods of flushing
- Safety precautions in EDM.

REFERANCE BOOKS:

1. Basic machine shop practice by Tejwani
2. Workshop technology by Chapman
3. Technology of Machine tools by Krar and Oswald
4. Westermann tables
5. All about machine tools by Gerling
6. Production Technology by Hazra Choudhary
7. Production technology by R.K.Jain

PRESS TOOL THEORY – I

SUBJECT CODE: DTDM-IVS402

Contact Hrs. /Week: 2

Contact Hrs. / Semester: 64

Learning goals Press Tool Theory- I:

At the end of the subject, the trainee will be able to know:

- Explain the different types of press tool operations
- Explain shearing theory and action
- Describe and calculate cutting clearance between punch and die
- Calculate cutting and stripping force and methods to reduce them
- Explain the principles of fine blanking
- Design and draw an optimum strip lay out for the given component drawing
- Explain the materials, calculations and specifications of various elements of a press tool and their functions
- Explain the mounting methods of punches
- Describe different types of strippers, stoppers and pilots
- Calculate centre of pressure
- Explain progressive, compound, fine blanking, combination, shaving, lancing and trimming tools and their applications

PRESS TOOL THEORY – I

Contact Hrs. /Week: 2

Contact Hrs. / Semester: 64

SPECIFIC INSTRUCTIONAL OBJECTIVES:

1. INTROCUCTION TO TOOLING.

- Introduction
- Purpose, applications and advantages
- Types

2. TYPES OF PRESS TOOLS.

- Basic description of different types of press tools, their applications

3. ELEMENTS OF A PRESS TOOL.

- Different parts of a press tool
- Materials, functions and their importance

4. THEORY OF SHEARING.

- Shearing action on metal
- Plastic deformation
- Penetration
- Fracture

5. CUTTING CLEARANCE.

- Necessity of clearance
- Calculation of clearance
- Effects of insufficient, sufficient and optimum clearance
- Misalignment between punch and die
- Land and angular clearance
- Problems

6. CUTTING FORCE.

- Calculation of cutting force
- Methods of reducing the cutting force

7. STRIP LAYOUT.

- Unit stock and stock strip
- Types of strip layout
- Economic strip layout
- Problems

PRESS TOOL THEORY – I

8. PUNCH AND DIE.

- Introduction
- Basic requirement of a die
- Types of dies - solid and split type
- Types of punches
- Classification of punches
- Mounting of punches
- Materials for punches and dies
- Heat treatment methods
- Methods of manufacture of punch and die

9. STRIPPER.

- Functions
- Types and applications

10. STOPPER.

- Functions
- Types and applications

11. PILOT.

- Functions
- Types and applications

12. CENTRE OF PRESSURE.

- Meaning
- Importance in design
- Calculation of COP by analytical and graphical methods

13. DIE SETS.

- Elements of a die set
- Types of die sets
- Accuracy and manufacture
- Applications of different types

14. PROGRESSIVE DIES.

- Introduction
- Pitch and pitch punch
- Advantages and disadvantages
- Classification
- Design considerations

15. COMPOUND DIES.

- Introduction
- Applications
- Construction
- Comparison with a progressive die

REFERANCE BOOKS:

1. Tool and die maker by Mahajan
2. Design fundamentals by Pacquin
3. Tool design by Donaldson
4. Basic die design by Osterguard
5. Advanced die design by Osterguard
6. Fundamentals of Tool Design By SME
7. Press Tools and Press Work By Waller

MATERIAL TECHNOLOGY -II

SUBJECT CODE: DTDM-IVS403

Contact Hrs./Week: 4

Contact Hrs. / Semester: 64

1. Alloying elements

- 1.1 Purpose
- 1.2 Types
- 1.3 Manganese
- 1.4 Molybdenum
- 1.5 Nickel
- 1.6 Invar
- 1.7 Tungsten
- 1.8 Stainless steels
- 1.9 High speed steels
- 1.10 IS Codification of Steels

2. I.C. diagrams

- 2.1 Introduction
- 2.2 Hypo-eutectoid & hyper- eutectoid
- 2.3 AC1 & AC3 lines
- 2.4 Reactions: eutectoid eutectic Peritectic

3. Heat Treatment of Steels

- 3.1 Definition, purpose, Stages
- 3.2 Heat Treatment of process
- 3.3 Hardening
- 3.4 Tempering
- 3.5 Normalizing
- 3.6 Annealing
- 3.7 Austempering
- 3.8 Martempering

4. TTT Curves and Quenching

- 4.1 Time, temperature & transformation
- 4.2 S – curves, C- curves
- 4.3 Transfer austenite to marten site
- 4.4 Quenching media
- 4.5 Quenching defects

5. Defects in Heat Treatment

- 5.1 Cracks
- 5.2 War page
- 5.3 Scaling
- 5.4 Distortion

6. Surface hardening of steel

- 6.1 Pack method
- 6.2 Carburising media

- 6.3 Penetration depth
- 6.4 Cyanide method
- 6.5 Direct quenching
- 6.6 Nitriding
- 6.7 Ammonia
- 6.8 Induction hardening
- 6.9 High frequency current
- 6.10 Flame hardening
- 6.11 Water quenching
- 6.12 Oil quenching

7. Hardness testing methods

- 7.1 Brinell
- 7.2 Ball penetration
- 7.3 Precautions
- 7.4 Applications
- 7.5 Vickers
- 7.6 Diamond
- 7.7 Rockwell
- 7.8 A-scale
- 7.9 B- scale
- 7.10 C- scale
- 7.11 SHORE scleroscope method

8. Classification of Steels

- 8.1 General structural steels
- 8.2 Case hardening
- 8.3 Flame & induction hardening steels
- 8.4 Through hardening steels
- 8.5 Cold rolled carbon steels
- 8.6 Hot rolled carbon steels
- 8.7 Spring steels
- 8.8 Free cutting steels
- 8.9 Black bars
- 8.10 Tool & die steels and their Applications

JIGS & FIXTURES (THEORY& DESIGN)

SUBJECT CODE: DTDM-IVS404

Learning goals Jigs & Fixtures

- Students demonstrate their knowledge in various Jigs and Fixtures, its design, clamping methods and design and drawing of jigs and fixtures.

- Subject aims at making the students learn jigs and fixtures, Locating methods, clamping methods and guiding elements etc.

JIGS & FIXTURES (THEORY& DESIGN)

Contact Hrs. /Week: 4

Contact Hrs. / Semester: 94

SPECIFIC INSTRUCTIONAL OBJECTIVES: THEORY

1. INTRODUCTION

- Definition of jigs and fixtures and their importance in industry
- Inter-changeability
- Difference between jigs and fixtures
- Design considerations for jigs and fixtures
- Elements of jigs & fixture
- Materials
- Advantages and disadvantages
- Applications

2. LOCATION

- Definition and choice of location
- Degrees of freedom, 3-2-1 principle
- Types of locators
 - Locating methods and chip removal
 - Locating by Flat surface , support pads & pins
 - Conical locators (Fixed & Adjustable)
 - Diamond locators
 - V Locators (Fixed& Adjustable)
- Redundant location
 - Errors caused in locating
- Fool proofing

3. CLAMPING

- Definition and need
- Requirements of a good clamping system
- Types of clamping
 - Plate or strap clamp, Solid clamp with heel pin, Sliding clamps, slotted clamp, pivoted clamps, latch clamps, swing clamps, Quick action clamps, multiple clamps & Power clamps.

4. GUIDING ELEMENTS

- Introduction
- Classification of drill bushes
- Types of bushes
 - Fixed bush, Liner bush, Slip bush, Threaded bush
- Special bushes
 - Headed & Headless bushes, shaped bush, extended bushes.
- Materials and hardness requirements

5. TYPES OF JIGS

- Introduction
- Constructional features
- Elements of a jigs
- Types of jigs
 - Solid jig
 - Post jig
 - Pot jig
 - Turn over jig
 - Latch jig
 - Box jig
- Indexing Device – Liner & Rotary indexing
- Design considerations
- Jigs design for some simple components

6. TYPES OF FIXTURES

- Introduction
- Constructional features
- Elements of a fixtures
- Setting blocks and tenons
- Types of fixtures
 - Milling fixtures – Indexing fixtures
 - Turning fixtures
- * Grinding fixtures
- Design considerations
- Fixture design for some simple components

JIGS & FIXTURE DESIGN

SPECIFIC INSTRUCTIONAL OBJECTIVES: DESIGN

1. Design of locating elements
2. Design of Tool guiding devices like Drill Bushes for different types of jigs (fixed, Renewable and slip renewable bushes)
3. Design of Drill Jigs
 - a) Plate/template jig
 - b) Box Jig
 - c) Leaf Jig
 - d) Indexing jig
4. Design of Clamps
5. Milling Fixture
6. Turning fixture

REFERENCE BOOKS:

1. Introduction to jig and Tool Design - M H A KEMPSTER
2. Jigs and fixtures – T M H GRANT
3. Hand Book of Fixture Design – FRANK W WILSON
4. Jigs and Fixture and gauges for Limited Production
5. Hand Book of Jigs & Fixture Design - BOYES
6. Jigs and fixture – JOSHI.