GOVT POLYTECHNIC BOLANGIR

Department of Mechanical Engineering

LESSON PLAN: 2025-26

Name of the Faculty: Rasmi Ranjan Jena (Lecturer Stage-I)

Subject: Tool Engineering -TH5(b) (MEPE204)(b)
Program: Diploma in Mechanical Engineering Semester: **4th** Total Contact Hours: **45**
Total Marks: **100** Assessment: Progressive –30, End Term – 70
Credits: 3

COURSE OBJECTIVES:

After completion of the course, the students will be able to

1.Illustrate concepts, principles and procedures of tool engineering

2. Classify and explain various tools and tool operations

3. Select proper tool and a die for a given manufacturing operation to achieve highest productivity.

4. Estimate tool wear and tool life

5. Identify different types of Forming Dies.

UNIT-I: Metal Cutting, Cutting Fluids & Tool Wear (10 Classes)

Class No.	Topic	Sub topics to be Covered	Teaching Aids / Activities	COs
1	Introduction to Metal Cutting	Definition of metal cutting,Mechanics of metal cutting,Importance in manufacturing	Chalk & board	CO1
2	Mechanics of Metal Cutting	Cutting action,Deformation zones,Role of cutting tool	PPT, Chalk & board	CO1
3	Cutting Forces in Metal Cutting	Cutting force components,Merchant circle diagram (concept only),Significance of forces	PPT, Chalk & board	CO1
4	Chip Formation	ypes of chips: continuous, discontinuous, built-up edge,Factors affecting chip formation	PPT, Chalk & board	CO1
5	Shear Angle & Chip Thickness Ratio	Chip thickness ratio,Shear angle,Simple numerical problems	PPT, Chalk & board	CO1 & CO4
6	Types of Metal Cutting Processes	Orthogonal cutting,Oblique cutting,Form cutting	PPT, Chalk & board	CO2
7	Cutting Tools & Tool Requirements	Requirements of cutting tools,Tool materials (brief overview),Tool geometry (introductory)	PPT, Chalk & board	CO3
8	Cutting Fluids	Types of cutting fluids,Characteristics,Applications	PPT, Chalk & board	CO3

9	Tool Wear	Types of tool wear: flank, crater, nose wear,Causes of tool wear	PPT, schematic diagram	CO3
10	Tool Life	Tool life concept,Tool life equations (Taylor's equation),Factors affecting tool life	PPT, schematic diagram	CO4
UNIT-II:Machinability, Tool Materials & Cutting Tool Geometry (10 Classes)				
11	Introduction to Machinability	Definition of machinability,Importance in manufacturing	PPT, Chalk & board	CO2
12	Factors Affecting Machinability	Work material properties,Tool material,Cutting parameters,Cutting fluid	PPT, Chalk & board	CO2
13	Machinability Index	Meaning of machinability index,Standard reference material,Comparison of materials	Chalk & board	CO2
14	Tool Materials – Classification	Carbon tool steels,HSS,Cemented carbides,Ceramics,Superhard materials	Chalk & board	CO2
15	Tool Material Characteristics & Applications	Properties of tool materials,Selection based on operation,Applications	Chalk & board	CO4
16	Heat Treatment of Tool Steels	Hardening,Tempering,Annealing (brief),Purpose of heat treatment	Chalk & board	CO1
17	Carbide Tips & Ceramic Coatings	Specification of carbide tips,ISO designation,Types of ceramic coatings (TiN, TiC, Al_2O_3)	PPT, Chalk & board	CO2 &CO3
18	Cutting Tool Geometry – Single Point Tool	Parts of single point cutting tool,Tool angles and nomenclature	PPT, Chalk & board	CO2
19	Geometry of Multi-point Cutting Tools	Drill geometry,Reamer geometry	PPT, Chalk & board	CO2
20	Milling Cutter Geometry	Milling cutter types,Geometry of milling cutters,Applications	PPT, Chalk & board	CO2 &CO3
UNIT-III:Types of Dies & Punch–Die Mountings (8 Classes)				

21	Introduction to Press Tools & Dies	Meaning of press tools,Functions of dies,Classification overview	PPT, cut-section images	CO3
22	Simple Die	Construction,Working principle,Applications	PPT, Chalk & board	CO3
23	Compound Die	principle,Advantages & applications Diagrams	PPT, Chalk & board	CO3
24	Progressive Die	Construction,Sequence of operations,Strip layout concept	PPT, discussion	CO2 & CO3
25	Combination Die	Construction,Working principle,Difference from compound die	PPT, Chalk & board,Models	CO2
26	Punch & Die Mountings – I	Pilots,Strippers,Stock guides	Real component / PPT	CO2 & CO3
27	Punch & Die Mountings – II	Feed stop,Guide pins & guide bushes,Pressure pads	PPT, Chalk & board	CO2 & CO3
28	Safety & Control Devices	Knock outs,Misfeed detectors,Functions & applications	PPT, Chalk & board	CO3 & CO4
UNIT-IV:Die Design Fundamentals (10 Classes)				
29	Introduction to Die Design	Meaning of die design,Importance in mass production,Overview of die operations	PPT, Chalk & board	CO4
30	Die Operations – Shearing Processes	Steady flow of steam,Energy conversion in nozzle,Assumptions	PPT, Chalk & board	CO4
31	Die Operations – Cutting & Forming	Heat drop concept,Derivation of exit velocity equation,Assumptions	PPT, Chalk & board	CO4
32	Die Operations – Forming Processes	Blanking,Piercing,Shearing, Cropping	Chalk & board	CO4
33	Die Set & Die Shoe	Notching,Lancing,Coining,Embossing	Chalk & board	CO4
34	Die Area & Die Layout	Stamping,Curling,Drawing,Bending,Forming	Chalk & board	CO4

35	Clearance in Blanking & Piercing	Importance of clearance,Clearance calculation for blanking,Clearance calculation for piercing	PPT, Chalk & board	CO4
36	Strip Layout	Strip layout for blanking,Types of layouts,Pitch calculation	PPT, discussion	CO2 & CO3
37	Material Utilization Factor	Meaning of material utilization,Calculation,Improvement methods	PPT, Chalk & board	CO3 & CO4
38	Numerical Problems & Revision	Clearance problems,Strip layout problems,Material utilization problems	PPT, Chalk & board	CO3 & CO4
UNIT-V: Forming Dies, Drawing & Other Tools (7 Classes)				
39	Introduction to Forming Dies & Bending	Definition of forming operations,Bending methods,Types of bending dies	PPT, Chalk & board	CO5
40	Bending Calculations	Bend allowance,Spring back,Spanking (coining),Development of blank length	PPT, Chalk & board	CO5
41	Bending Pressure & Accessories	Bending pressure calculation,Pressure pads,Purpose and applications	PPT, Chalk & board	CO5
42	Drawing Operations	Drawing operations,Metal flow during drawing,Variables affecting metal flow	PPT, Chalk & board	CO5
43	Drawing Die Calculations & Types	Calculation of drawing blank size,Single action dies,Double action dies,Combination dies	PPT, Chalk & board	CO5
44	Fundamentals of Other Tools – I	Pressure die casting dies,Metal extrusion dies	Chalk & board	CO5
45	Fundamentals of Other Tools – II	Injection molding dies,Forging dies,Plastic extrusion dies	PPT, Chalk & board	CO5

Signature of Faculty

22.12.25

Signature Of HoD

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