GUJARAT TECHNOLOGICAL UNIVERSITY

BE-7 SEMESTER – OLD PAPER – S22 TO S26 – QUESTION BANK

Subject Name & Code: Metal Forming Analysis - 3171921

Chapter 1: Fundamentals of Metal Forming

Repeated Questions:

1. Introduction & Types of Forming:

- **Q.** State the general advantages (and limitations) of metal forming. **(WINTER 2023, 3 Marks; SUMMER 2025, 3 Marks)**
- **Q.** Define/Differentiate: Hot forming, Cold forming, Warm forming. **(SUMMER 2022, 3 Marks; WINTER 2024, 3 Marks OR; WINTER 2025, 3 Marks OR)**

2. Stress-Strain Behaviour & Work Hardening:

- **Q.** Draw and explain a typical stress-strain diagram for a ductile material. **(SUMMER 2023, 7 Marks; WINTER 2023, 7 Marks; SUMMER 2025, 7 Marks; WINTER 2025, 3 Marks)**
- **Q.** Define: Flow stress, Strain Hardening, Strain rate. **(SUMMER 2023, 3 Marks; SUMMER 2025, 3 Marks)**
- **Q.** How do you represent the strain hardening effect? **(SUMMER 2025, 4 Marks; WINTER 2025, 3 Marks)**
- **Q.** Describe the effects of work hardening on the mechanical properties of a material. **(SUMMER 2022, 4 Marks; WINTER 2024, 4 Marks OR)**
- **Q.** Discuss the effect of temperature on yield strength. **(SUMMER 2023, 3 Marks OR; WINTER 2023, 4 Marks OR)**

3. Forming Limit Diagram:

- **Q.** Explain the Forming Limit Diagram/Curve. **(WINTER 2022, 7 Marks; WINTER 2023, 4 Marks; SUMMER 2024, 7 Marks; WINTER 2024, 4 Marks OR; SUMMER 2025, 4 Marks; WINTER 2025, 4 Marks)**

Other Important Questions:

1. Metal Forming – General Concepts:

- **Q.** What do you understand by the forming of metal? **(SUMMER 2024, 3 Marks)**
- **Q.** Give the classification of metal forming processes and its advantages. **(SUMMER 2023, 4 Marks)**
- **Q.** What is recrystallization? State its importance in metal forming. **(SUMMER 2024, 4 Marks)**
- **Q.** Explain the effect of (1) strain rate (2) Temperature on metal forming process. **(SUMMER 2024, 3 Marks)**

Chapter 2: Stress Analysis, Yield Criteria and Work Hardening

Repeated Questions:

1. Stress Analysis & Yield Criteria:

- **Q.** Explain the Two-Dimensional Mohr's circle method for stress analysis. **(SUMMER 2022, 7 Marks; SUMMER 2024, 7 Marks; WINTER 2022, 7 Marks; WINTER 2024, 4 Marks; SUMMER 2025, 7 Marks)**
- **Q.** Derive the relationship between Yield strength in Shear and Tension as per Tresca's and Von Mises' hypotheses. **(SUMMER 2023, 7 Marks - Tresca; SUMMER 2023, 7 Marks OR - Von Mises; WINTER 2023, 7 Marks - Tresca)**

2. Work Hardening & Bound Theorems:

- **Q.** Explain Isotropic and Kinematic work hardening. **(SUMMER 2024, 7 Marks OR; WINTER 2022, 7 Marks; SUMMER 2025, 7 Marks OR; WINTER 2025, 7 Marks)**
- **Q.** Describe the Upper Bound and Lower Bound theorems. **(SUMMER 2022, 7 Marks; SUMMER 2024, 7 Marks; WINTER 2024, 7 Marks OR; SUMMER 2025, 7 Marks; WINTER 2025, 7 Marks OR)**

Other Important Questions:

1. Stress & Yield Basics:

- **Q.** Define Principal planes & stresses. **(SUMMER 2025, 4 Marks)**
- **Q.** Define (i) Yield strength (ii) Plasticity. **(SUMMER 2025, 3 Marks)**
- **Q.** Explain briefly about the Tresca yield criteria. **(WINTER 2023, 7 Marks)**
- **Q.** What you know about Isotropic and Kinematic work hardening? [Similar to the repeated question above] **(SUMMER 2024, 7 Marks OR)**

2. Stress-Strain Relations & Yield Criteria Representation:

- **Q.** Explain idealized stress-strain relations in plastic deformations. **(From Syllabus)**
- **Q.** Briefly explain the 2-Dimensional Graphical representation of Von Mises' and Tresca's yield criteria for plastic deformation. **(WINTER 2025, 7 Marks OR)**

Chapter 3: Analysis Methods (Slip Line, Upper/Lower Bound)

Repeated Questions:

1. Slip Line Theory:

- **Q.** State and prove Hencky's first theorem for Slip Lines. **(SUMMER 2022, 7 Marks OR; SUMMER 2024, 7 Marks OR; WINTER 2022, 7 Marks OR; WINTER 2024, 7 Marks; SUMMER 2025, 7 Marks OR; WINTER 2025, 7 Marks)**
- **Q.** What are slip lines? / Explain the theory of slip lines. **(WINTER 2022, 3 Marks; SUMMER 2024, 7 Marks)**

Other Important Questions:

1. Slip Line & Bound Methods:

- **Q.** Explain Hencky's first theorem concerning slip lines in metal forming. [Similar to the repeated question above] **(SUMMER 2024, 7 Marks OR)**
- **Q.** Discuss the slip line and upper bound method for the extrusion process. **(WINTER 2023, 7 Marks OR)**
- **Q.** Introduction to (i) Theory of slip lines, (ii) upper bound theorem and (iii) lower bound theorem. **(From Syllabus)**

Chapter 4: Forging Processes

Repeated Questions:

1. Types of Forging & Operations:

- **Q.** Differentiate between Open die forging and Closed die forging. **(SUMMER 2023, 3 Marks; SUMMER 2025, 4 Marks; WINTER 2023, 7 Marks OR; WINTER 2025, 4 Marks)**
- **Q.** How is Impression die forging different from Closed die forging? **(SUMMER 2023, 4 Marks; WINTER 2022, 3 Marks OR; SUMMER 2025, 4 Marks)**
- **Q.** Explain various forging operations/defects with neat sketches. [Diagram given – refer to the original question papers of S22 / W23 / W24 / W25] **(SUMMER 2022, 7 Marks; WINTER 2023, 3 Marks; WINTER 2024, 7 Marks OR; WINTER 2025, 4 Marks)**

2. Friction & Analysis of Forging:

- **Q.** Why is friction essential in the forging process? **(SUMMER 2022, 3 Marks; WINTER 2024, 3 Marks OR)**
- **Q.** Analysis of compression of a circular disc with the slab method. **(WINTER 2023, 7 Marks OR; WINTER 2025, 7 Marks OR)**
- **Q.** Derive the equation for the rate of work done due to deformation for compression of a strip. **(SUMMER 2022, 7 Marks OR; SUMMER 2025, 7 Marks)**

Other Important Questions:

1. Forging Process & Equipment:

- **Q.** Explain the forging process with classification. **(SUMMER 2025, 3 Marks)**
- **Q.** Elaborate on board drop hammers used in forging. **(SUMMER 2024, 4 Marks)**
- **Q.** Define for forging: (1) Flash (2) Gutter (3) Draft (4) Parting line. **(SUMMER 2024, 4 Marks OR)**
- **Q.** With neat sketch explain the steps of close die forging process. [Diagram given – refer to the original question paper of W25] **(WINTER 2025, 7 Marks OR)**

2. Upset Forging & Friction:

- **Q.** Explain the upset forging process. **(WINTER 2022, 7 Marks)**
- **Q.** What is upset forging? **(WINTER 2023, 4 Marks OR)**
- **Q.** Why friction measurement is necessary in forming process? **(WINTER 2025, 4 Marks)**

3. Forging (Numerical):

- **Q.** Numerical: Determine the forging load for given billet data. **(WINTER 2022, 7 Marks)**

Chapter 5: Extrusion & Wire Drawing Processes

Repeated Questions:

1. Extrusion:

- **Q.** Differentiate between Direct and Indirect extrusion. **(SUMMER 2023, 3 Marks OR; SUMMER 2022, 3 Marks OR; WINTER 2023, 4 Marks; SUMMER 2025, 3 Marks; WINTER 2024, 4 Marks; WINTER 2025, 4 Marks OR)**
- **Q.** What are the benefits of Hydrostatic extrusion? **(SUMMER 2023, 4 Marks OR; SUMMER 2022, 4 Marks; WINTER 2024, 3 Marks OR)**
- **Q.** Give a list of methods for calculating extrusion load and explain any one. **(SUMMER 2023, 7 Marks OR; WINTER 2024, 7 Marks)**
- **Q.** Discuss the different defects in extrusion processes. **(SUMMER 2023, 4 Marks; WINTER 2025, 3 Marks)**

2. Wire Drawing:

- **Q.** Define: (i) Dry drawing (ii) Wet drawing (iii) Tube drawing. **(SUMMER 2023, 3 Marks; WINTER 2022, 3 Marks; WINTER 2023, 3 Marks OR; WINTER 2024, 3 Marks; WINTER 2025, 3 Marks)**
- **Q.** Discuss the materials used for making wire drawing dies. **(SUMMER 2023, 4 Marks; SUMMER 2024, 3 Marks; WINTER 2023, 3 Marks OR; WINTER 2024, 3 Marks)**
- **Q.** Explain the Wire Drawing process with a sketch. **(WINTER 2023, 3 Marks OR; WINTER 2025, 3 Marks OR)**

Other Important Questions:

1. Extrusion – General & Special:

- **Q.** Explain the Extrusion and Wire Drawing processes in brief. **(SUMMER 2023, 7 Marks)**
- **Q.** Write a short note on (1) hydrostatic extrusion and (2) Impact extrusion. **(SUMMER 2024, 7 Marks OR)**

2. Wire & Strip Drawing:

- **Q.** Explain hydrodynamic extrusion in wire drawing. **(SUMMER 2025, 7 Marks OR)**
- **Q.** Sketch a cross-section of a tungsten carbide wire drawing die. **(WINTER 2022, 4 Marks)**
- **Q.** Explain the analysis of Strip Drawing process with usual notations. **(WINTER 2025, 7 Marks)**

Chapter 6: Rolling Processes

Repeated Questions:

1. Rolling Defects, Angle of Bite & Mills:

- **Q.** Discuss various rolling defects. **(SUMMER 2023, 4 Marks OR; WINTER 2022, 4 Marks; WINTER 2023, 4 Marks; SUMMER 2025, 3 Marks OR; WINTER 2024, 4 Marks)**
- **Q.** Define angle of bite and discuss its effect. **(WINTER 2023, 3 Marks; SUMMER 2022, 4 Marks OR; SUMMER 2025, 4 Marks OR; WINTER 2024, 3 Marks; WINTER 2025, 3 Marks OR)**
- **Q.** Draw different types of rolling mills. **(WINTER 2022, 3 Marks; WINTER 2023, 3 Marks)**

2. Rolling Analysis:

- **Q.** Derive the formula for Rolling Load using the slab method. **(WINTER 2022, 7 Marks; WINTER 2023, 7 Marks; WINTER 2024, 7 Marks OR; SUMMER 2025, 7 Marks OR)**
- **Q.** Discuss the analysis of strip rolling. **(SUMMER 2022, 7 Marks OR; WINTER 2024, 7 Marks)**

Other Important Questions:

1. Rolling Terminology & Processes:

- **Q.** Explain in detail Terminology of rolling with neat sketch. [Diagram given – refer to the original question paper of W25] **(WINTER 2025, 7 Marks)**
- **Q.** List various flat rolling processes and discuss any two. **(WINTER 2025, 4 Marks OR)**
- **Q.** Explain (1) absolute draught (2) relative draught (3) co-efficient of elongation. **(SUMMER 2024, 3 Marks OR)**
- **Q.** Define in rolling: (1) Absolute draught (2) Absolute spread (3) Absolute elongation. **(WINTER 2022, 3 Marks OR)**

2. Rolling Analysis:

- **Q.** How is contact length affected by elastic deformation of rolls? **(WINTER 2022, 4 Marks)**
- **Q.** Derive an equation for the projected arc length. **(SUMMER 2023, 7 Marks OR)**

Chapter 7 & 8: Sheet Metal Forming (Operations, Dies, Bending, Deep Drawing)

Repeated Questions:

1. Sheet Metal Operations & Dies:

- **Q.** Differentiate between Blanking and Punching. **(SUMMER 2023, 3 Marks; WINTER 2023, 3 Marks; SUMMER 2022, 3 Marks; SUMMER 2025, 4 Marks OR)**
- **Q.** State the difference between Compound and Progressive dies. **(WINTER 2022, 3 Marks OR; WINTER 2023, 4 Marks OR; WINTER 2024, 4 Marks; SUMMER 2025, 3 Marks OR)**
- **Q.** Define for press work: (1) Notching (2) Nibbling (3) Slitting (4) Perforating. **(SUMMER 2023, 3 Marks OR; WINTER 2024, 3 Marks; SUMMER 2024, 4 Marks)**
- **Q.** Explain various operations performed on sheet-metal press machines. **(WINTER 2023, 7 Marks; WINTER 2024, 7 Marks OR; WINTER 2025, 7 Marks)**
- **Q.** Define Nesting and explain its use. **(SUMMER 2024, 4 Marks; SUMMER 2022, 4 Marks OR)**
- **Q.** What do you understand by shear on punch and die? **(WINTER 2024, 3 Marks; WINTER 2022, 7 Marks OR)**

2. Bending & Deep Drawing:

- **Q.** Explain the Spring back effect in bending. **(SUMMER 2023, 4 Marks OR; WINTER 2023, 4 Marks; SUMMER 2022, 4 Marks; WINTER 2024, 4 Marks; SUMMER 2025, 4 Marks OR; SUMMER 2026, 3 Marks)**
- **Q.** What is Drawability? List factors affecting it. **(SUMMER 2023, 4 Marks; SUMMER 2022, 3 Marks; WINTER 2023, 7 Marks)**
- **Q.** What do you understand about Anisotropy of sheet metal? How do you measure it? **(SUMMER 2023, 7 Marks OR; WINTER 2022, 7 Marks OR; SUMMER 2022, 7 Marks OR; WINTER 2024, 7 Marks)**
- **Q.** Discuss stresses developed in the deep drawing process. **(SUMMER 2023, 7 Marks; WINTER 2024, 7 Marks; SUMMER 2026, 7 Marks)**

Other Important Questions:

1. Press Work – Theory:

- **Q.** Explain clearance in sheet metal operations. **(SUMMER 2025, 3 Marks OR)**
- **Q.** Explain blanking and piercing with neat sketch. [Diagram given – refer to the original question paper of W25] **(WINTER 2025, 3 Marks)**
- **Q.** Define (1) punching (2) Nibbling (3) Lancing (4) Notching for press work. **(SUMMER 2026, 4 Marks)**
- **Q.** Explain the Forming Limit Diagram (FLD). **(Also covered in Chapter 1)**

2. Bending & Deep Drawing:

- **Q.** What is bending? Explain bend angle and bend allowance. **(SUMMER 2024, 3 Marks)**
- **Q.** Discuss defects in deep drawing process. **(WINTER 2025, 4 Marks)**
- **Q.** Discuss Anisotropy and its effects in deep drawing. **(WINTER 2025, 4 Marks OR)**

3. Sheet Metal (Numerical):

- **Q.** Numerical: Calculate the blank diameter for a shell. **(SUMMER 2024, 3 Marks)**
- **Q.** Numerical: Calculate the bending force for an aluminium sheet. **(SUMMER 2024, 3 Marks OR)**
- **Q.** Numerical: A steel washer... find work done and shear to be ground. [Important numerical problem] **(SUMMER 2024, 7 Marks)**
- **Q.** A circular blank of 30 mm diameter is to be cut from 2 mm thick 0.1C steel sheet. Determine the die and punch size, and also estimate the punch force and stripping force needed. You may

assume the following for steel: tensile strength 410 MPa, shear strength 310 MPa. **(SUMMER 2026, 7 Marks)**

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