

GUJARAT TECHNOLOGICAL UNIVERSITY

BE-7 SEMESTER – OLD PAPER – S22 TO S25 – QUESTION BANK

Subject Name & Code:

Metal forming analysis- 3171921

Unit 1: Introduction and Fundamental Concepts

Repeated Questions:

1. **State the general advantages (and limitations) of metal forming.**
 - Appeared in: WIN 23 (Q1a, 03 Marks), SUM 25 (Q1a, 03 Marks)
2. **Define/Differentiate: Hot forming, Cold forming, Warm forming.**
 - Appeared in: SUM 22 (Q1a, 03 Marks), WIN 24 (Q5a-OR, 03 Marks)
3. **Draw and explain a typical stress-strain diagram for a ductile material.**
 - Appeared in: SUM 23 (Q1c, 07 Marks), WIN 23 (Q2c, 07 Marks), SUM 25 (Q1c, 07 Marks)
4. **Define: Flow stress, Strain Hardening, Strain rate.**
 - Appeared in: SUM 23 (Q1a, 03 Marks), SUM 25 (Q2a, 03 Marks)
5. **Explain the Forming Limit Diagram/Curve.**
 - Appeared in: WIN 22 (Q1c, 07 Marks), WIN 23 (Q1b, 04 Marks), SUM 24 (Q2c, 07 Marks), WIN 24 (Q3b-OR, 04 Marks), SUM 25 (Q5b, 04 Marks)

Other Important Questions:

- What do you understand by the forming of metal? (SUM 24, Q1a, 03 Marks)
- What is recrystallization? State its importance in metal forming. (SUM 24, Q1b, 04 Marks)
- How do you represent the strain hardening effect? (SUM 25, Q1b, 04 Marks)
- Give the classification of metal forming processes and its advantages. (SUM 23, Q1b, 04 Marks)
- Explain the effect of (1) strain rate (2) Temperature on metal forming process. (SUM 24, Q3a, 03 Marks)
- Discuss the effect of temperature on yield strength. (SUM 23, Q4a-OR, 03 Marks), (WIN 23, Q5b-OR, 04 Marks)
- Describe the effects of work hardening on the mechanical properties of a material. (SUM 22, Q2b, 04 Marks), (WIN 24, Q5b-OR, 04 Marks)

Unit 2: Theory of Plasticity

Repeated Questions:

1. **Explain the Two-Dimensional Mohr's circle method for stress analysis.**
 - Appeared in: SUM 22 (Q1c, 07 Marks), SUM 24 (Q1c, 07 Marks), WIN 22 (Q2c, 07 Marks), WIN 24 (Q4b, 04 Marks), SUM 25 (Q2c, 07 Marks)
2. **Derive the relationship between Yield strength in Shear and Tension as per Tresca's and Von Mises' hypotheses.**
 - Appeared in: SUM 23 (Q3c, 07 Marks for Tresca), SUM 23 (Q3c-OR, 07 Marks for Von Mises), WIN 23 (Q1c, 07 Marks for Tresca)
3. **Explain Isotropic and Kinematic work hardening.**
 - Appeared in: SUM 24 (Q4c-OR, 07 Marks), WIN 22 (Q5c, 07 Marks), SUM 25 (Q2c-OR, 07 Marks)
4. **Describe the Upper Bound and Lower Bound theorems.**
 - Appeared in: SUM 22 (Q2c, 07 Marks), SUM 24 (Q3c, 07 Marks), WIN 24 (Q4c-OR, 07 Marks), SUM 25 (Q5c, 07 Marks)

Other Important Questions:

- Define Principal planes & stresses. (SUM 25, Q2b, 04 Marks)
- Define (i) Yield strength (ii) Plasticity. (SUM 25, Q2a, 03 Marks)
- Explain briefly about the Tresca yield criteria. (WIN 23, Q1c, 07 Marks)
- What you know about Isotropic and Kinematic work hardening? (SUM 24, Q4c-OR, 07 Marks) [*Similar to Q3 above*]
- Explain idealized stress-strain relations in plastic deformations. (From Syllabus)

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

Repeated Questions:

1. **State and prove Hencky's first theorem for Slip Lines.**
 - Appeared in: SUM 22 (Q2c-OR, 07 Marks), SUM 24 (Q2c-OR, 07 Marks), WIN 22 (Q3c-OR, 07 Marks), WIN 24 (Q5c, 07 Marks), SUM 25 (Q5c-OR, 07 Marks)
2. **What are slip lines? / Explain the theory of slip lines.**
 - Appeared in: WIN 22 (Q5a, 03 Marks), SUM 24 (Q4c, 07 Marks)

Other Important Questions:

- Explain Hencky's first theorem concerning slip lines in metal forming. (SUM 24, Q2c-OR, 07 Marks) [*Similar to Q1 above*]
- Discuss the slip line and upper bound method for the extrusion process. (WIN 23, Q2c-OR, 07 Marks)
- Introduction to (i). Theory of slip lines, (ii). upper bound theorem and (iii). lower bound theorem. (From Syllabus)

Unit 4: Forging Processes

Repeated Questions:

1. **Differentiate between Open die forging and Closed die forging.**
 - Appeared in: SUM 23 (Q2a, 03 Marks), SUM 25 (Q3b, 04 Marks), WIN 23 (Q5c-OR, 07 Marks)
2. **How is Impression die forging different from Closed die forging?**
 - Appeared in: SUM 23 (Q3b, 04 Marks), WIN 22 (Q4a-OR, 03 Marks), SUM 25 (Q3b, 04 Marks)
3. **Explain various forging operations/defects with neat sketches.**
 - Appeared in: SUM 22 (Q3c, 07 Marks), WIN 23 (Q5a, 03 Marks), WIN 24 (Q5c-OR, 07 Marks)

Other Important Questions:

- Explain the forging process with classification. (SUM 25, Q3a, 03 Marks)
- Elaborate on board drop hammers used in forging. (SUM 24, Q2b, 04 Marks)
- Why is friction essential in the forging process? (SUM 22, Q2a, 03 Marks), (WIN 24, Q4a-OR, 03 Marks)
- Define for forging: (1) Flash (2) Gutter (3) Draft (4) Parting line. (SUM 24, Q3b-OR, 04 Marks)
- **Numerical:** Determine the forging load for given billet data. (WIN 22, Q4c, 07 Marks)
- Explain the upset forging process. (WIN 22, Q5c, 07 Marks)
- What is upset forging? (WIN 23, Q4b-OR, 04 Marks)
- Analysis of compression of a circular disc with the slab method. (WIN 23, Q4c-OR, 07 Marks)
- Derive the equation for the rate of work done due to deformation for compression of a strip. (SUM 22, Q3c-OR, 07 Marks), (SUM 25, Q3c, 07 Marks)

Unit 5: Extrusion & Wire Drawing Processes

Repeated Questions:

1. **Differentiate between Direct and Indirect extrusion.**
 - Appeared in: SUM 23 (Q3a-OR, 03 Marks), SUM 22 (Q3a-OR, 03 Marks), WIN 23 (Q3b, 04 Marks), SUM 25 (Q4a, 03 Marks), WIN 24 (Q3b, 04 Marks)
2. **What are the benefits of Hydrostatic extrusion?**
 - Appeared in: SUM 23 (Q3b-OR, 04 Marks), SUM 22 (Q3b, 04 Marks), WIN 24 (Q3a-OR, 03 Marks)
3. **Define: (i) Dry drawing (ii) Wet drawing (iii) Tube drawing.**
 - Appeared in: SUM 23 (Q4a, 03 Marks), WIN 22 (Q5a, 03 Marks), WIN 23 (Q4a-OR, 03 Marks), WIN 24 (Q5a, 03 Marks)
4. **Give a list of methods for calculating extrusion load and explain any one.**
 - Appeared in: SUM 23 (Q2c-OR, 07 Marks), WIN 24 (Q1c, 07 Marks)

Other Important Questions:

- Explain the Extrusion and Wire Drawing processes in brief. (SUM 23, Q2c, 07 Marks)
- Discuss the different defects in extrusion processes. (SUM 23, Q2b, 04 Marks)
- Write a short note on (1) hydrostatic extrusion and (2) Impact extrusion. (SUM 24, Q3c-OR, 07 Marks)
- Explain hydrodynamic extrusion in wire drawing. (SUM 25, Q4c-OR, 07 Marks)
- Discuss the materials used for making wire drawing dies. (SUM 23, Q4b, 04 Marks), (SUM 24, Q4a, 03 Marks), (WIN 23, Q5a-OR, 03 Marks), (WIN 24, Q4a, 03 Marks)
- Sketch a cross-section of a tungsten carbide wire drawing die. (WIN 22, Q3b, 04 Marks)
- Explain the Wire Drawing process with a sketch. (WIN 23, Q3a-OR, 03 Marks)

Unit 6: Rolling Processes

Repeated Questions:

1. **Discuss various rolling defects.**
 - Appeared in: SUM 23 (Q4b-OR, 04 Marks), WIN 22 (Q2b, 04 Marks), WIN 23 (Q4b, 04 Marks), SUM 25 (Q3a-OR, 03 Marks), WIN 24 (Q2b, 04 Marks)
2. **Define angle of bite and discuss its effect.**
 - Appeared in: WIN 23 (Q4a, 03 Marks), SUM 22 (Q4b-OR, 04 Marks), SUM 25 (Q3b-OR, 04 Marks), WIN 24 (Q3a, 03 Marks)
3. **Derive the formula for Rolling Load using the slab method.**
 - Appeared in: WIN 22 (Q3c, 07 Marks), WIN 23 (Q4c, 07 Marks), WIN 24 (Q2c-OR, 07 Marks), SUM 25 (Q3c-OR, 07 Marks)
4. **Draw different types of rolling mills.**
 - Appeared in: WIN 22 (Q2a, 03 Marks), WIN 23 (Q2a, 03 Marks)

Other Important Questions:

- How is contact length affected by elastic deformation of rolls? (WIN 22, Q1b, 04 Marks)
- Explain (1) absolute draught (2) relative draught (3) co-efficient of elongation. (SUM 24, Q3a-OR, 03 Marks)
- Define in rolling: (1) Absolute draught (2) Absolute spread (3) Absolute elongation. (WIN 22, Q3a-OR, 03 Marks)
- Discuss the analysis of strip rolling. (SUM 22, Q4c-OR, 07 Marks), (WIN 24, Q4c, 07 Marks)
- Derive an equation for the projected arc length. (SUM 23, Q4c-OR, 07 Marks)

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

Repeated Questions:

1. **Differentiate between Blanking and Punching.**
 - Appeared in: SUM 23 (Q5a, 03 Marks), WIN 23 (Q3a, 03 Marks), SUM 22 (Q5a, 03 Marks), SUM 25 (Q4b-OR, 04 Marks)
2. **Explain the Spring back effect in bending.**
 - Appeared in: SUM 23 (Q5b-OR, 04 Marks), WIN 23 (Q2b, 04 Marks), SUM 22 (Q5b, 04 Marks), WIN 24 (Q5b, 04 Marks), SUM 25 (Q5b-OR, 04 Marks)
3. **What is Drawability? List factors affecting it.**
 - Appeared in: SUM 23 (Q5b, 04 Marks), SUM 22 (Q4a, 03 Marks), WIN 23 (Q5c, 07 Marks)
4. **State the difference between Compound and Progressive dies.**
 - Appeared in: WIN 22 (Q5a-OR, 03 Marks), WIN 23 (Q5b-OR, 04 Marks), WIN 24 (Q1b, 04 Marks), SUM 25 (Q4a-OR, 03 Marks)
5. **What do you understand about Anisotropy of sheet metal? How do you measure it?**
 - Appeared in: SUM 23 (Q5c-OR, 07 Marks), WIN 22 (Q2c-OR, 07 Marks), SUM 22 (Q5c-OR, 07 Marks), WIN 24 (Q3c, 07 Marks)

Other Important Questions:

- Define for press work: (1) Notching (2) Nibbling (3) Slitting (4) Perforating.
 - Appeared in: SUM 23 (Q5a-OR, 03 Marks), WIN 24 (Q1a, 03 Marks), SUM 24 (Q5b, 04 Marks)
- Explain various operations performed on sheet-metal press machines. (WIN 23, Q3c, 07 Marks), (WIN 24, Q3c-OR, 07 Marks)
- Discuss stresses developed in the deep drawing process. (SUM 23, Q5c, 07 Marks), (WIN 24, Q2c, 07 Marks)
- Define Nesting and explain its use. (SUM 24, Q5b, 04 Marks), (SUM 22, Q5b-OR, 04 Marks)
- What is bending? Explain bend angle and bend allowance. (SUM 24, Q2a, 03 Marks)
- **Numerical:** Calculate the blank diameter for a shell. (SUM 24, Q4a, 03 Marks)
- **Numerical:** Calculate the bending force for an aluminium sheet. (SUM 24, Q4a-OR, 03 Marks)
- **Numerical:** A steel washer... find work done and shear to be ground. (SUM 24, Q5c, 07 Marks) - **This is a important numerical problem.**
- Explain the Forming Limit Diagram (FLD). [*Also covered in Unit 1*]
- Explain clearance in sheet metal operations. (SUM 25, Q5a-OR, 03 Marks)
- What do you understand by shear on punch and die? (WIN 24, Q2a, 03 Marks), (WIN 22, Q4c-OR, 07 Marks)
