

B.E. MECHANICAL ENGINEERING SECOND YEAR SECOND SEMESTER EXAM 2025**SUBJECT: MANUFACTURING PROCESSES****Time: 3 Hours****Full Marks: 100**

Assume any relevant data, if necessary. Symbols in the Question Paper carry their usual meanings. Figures in the margin indicate full marks. All Parts of any one question must be answered together. Answer strictly to the point.

ANSWER ANY FIVE QUESTIONS

Q1. a) Define 'core', 'core prints' and 'chaplets' and discuss with adequate figures.

b) If the pattern is to be made of aluminium for the casting of plain carbon steel of dimension 200 mm × 100 mm × 100 mm, calculate the dimensions of the wooden pattern, which is to be used for making the aluminium pattern. Assuming shrinkage allowance only. Consider shrinkage allowance for the plain carbon steel and aluminium as 21 mm/m and 13 mm/m respectively.

c) Find out the GFN from the following sand testing data:

Sieve No.	6	12	20	30	40	50	70	100	140	200	270	Pan
Retained weight %	--	--	--	2.0	4.7	7.3	14.8	16.2	3.4	1.1	0.2	0.1
Multiplier	3	5	10	20	30	40	50	70	100	140	200	300

Also draw the histogram of percentage retained in each sieve.

d) 'Molten metal stored in a riser should be solidified last' - discuss clearly.

5+6+6+3 = 20

Q2. a) State any three common green sand casting defects. Give their causes and remedies.

b) Drawing a neat and explanatory diagram discuss about the function of an electric induction furnace.

c) A sphere, a cube and a cylinder with a height equal to its diameter have the same volume. Which one should be used as a riser? Justify your answer considering solidification times of each.

d) Is it possible to obtain a sound casting of a solid bar by centrifugal casting? Give reasons in support of your answer.

5+7+5+3 = 20

Q3. a) Drawing a neat diagram discuss about different portions of an anvil, mentioning their functions as well as materials.

b) What is meant by 'draft in rolling'? Drawing an adequate diagram prove the relationship amongst the draft, roll radius and projected length.

[Turn over

c) A solid cylindrical slug of 1020 steel is 150 mm in diameter and 100 mm high. The height is reduced to 50% by cold, open die forging operation. Assuming a coefficient of friction of 0.2 calculate the forging force needed at the end of stroke. True stress vs. True strain curve is given in Fig.1.

6+6+8 = 20

Q4. a) State the similarities and differences between direct extrusion and drawing. What is the purpose of a dummy block in extrusion?

b) What is the purpose of the land in a drawing die? Is there a limit to the size of the land that should be used? Explain your answer.

c) Why it is necessary to provide proper clearance between the punch and die in a shearing operation? What is the necessity of the ironing process in sheet metal work?

d) Determine the die and punch sizes for blanking and piercing a circular disc of 20 mm diameter from a C20 steel sheet whose thickness is 1.5 mm. Also, calculate the punching and stripping force. Consider the shear strength of annealed C20 steel is 294 MPa and stripping constant as 0.024.

5+5+4+6 = 20

Q5. a) How a corrosion resistant electrode is specified as per ASTM standard?

b) "Establishment of arc in between the electrodes can be explained either by electrical theory or electron theory" – explain, stating clearly the two theories.

c) What are the parameters that control the weld quality in manual metal arc welding (also called as SMAW)?

d) In a given arc welding operation, the power source is at 20 V and current at 300 A. If the electrode travel speed is 6 mm/s, calculate the cross-sectional area of the joint. Heat required to melt the steel is 10 J/mm³. Assume the efficiency as 0.80.

4+8+3+5 = 20

Q6. a) How submerged arc welding is different from the inert gas shielded metal arc welding process?

b) What are the differences between TIG and MIG (or GMAW) welding processes?

c) What is an arc blow? Explain with a neat sketch the causes of the arc blow, its effects on welding and the methods of reducing the arc blow problem.

d) With a schematic diagram explain the working procedure of Electron-Beam Welding (EBW).

3+3+6+8 = 20

Q7. a) What is the basic difference between additive manufacturing and rapid prototyping?

b) What are the cleaning and finishing operations in additive manufacturing processes? Why are they necessary?

c) With a neat sketch briefly explain fused deposition modelling (FDM) or stereolithography (STL) process.

3+5+12 = 20

OR

Q7. a) Deduce the expression of coefficient of spread as given by Tomlinson and Stringer.

b) What is 'deep drawing operation' and 'hot draw bench'? How the total force requirement in deep drawing can be calculated? Discuss with adequate formula and explaining the legends involved therein.

c) What is meant by the term 'pancaking' in forging?

$$8+(2+1+6)+3 = 20$$

Q8. Write short notes on (any four):

- Properties of moulding sand
- Shell moulding process
- Match plate pattern and gated pattern
- Hydrostatic extrusion
- Coining and embossing.
- DCSP and DCRP and their specific applications
- Upset butt welding

$$5 \times 4 = 20$$

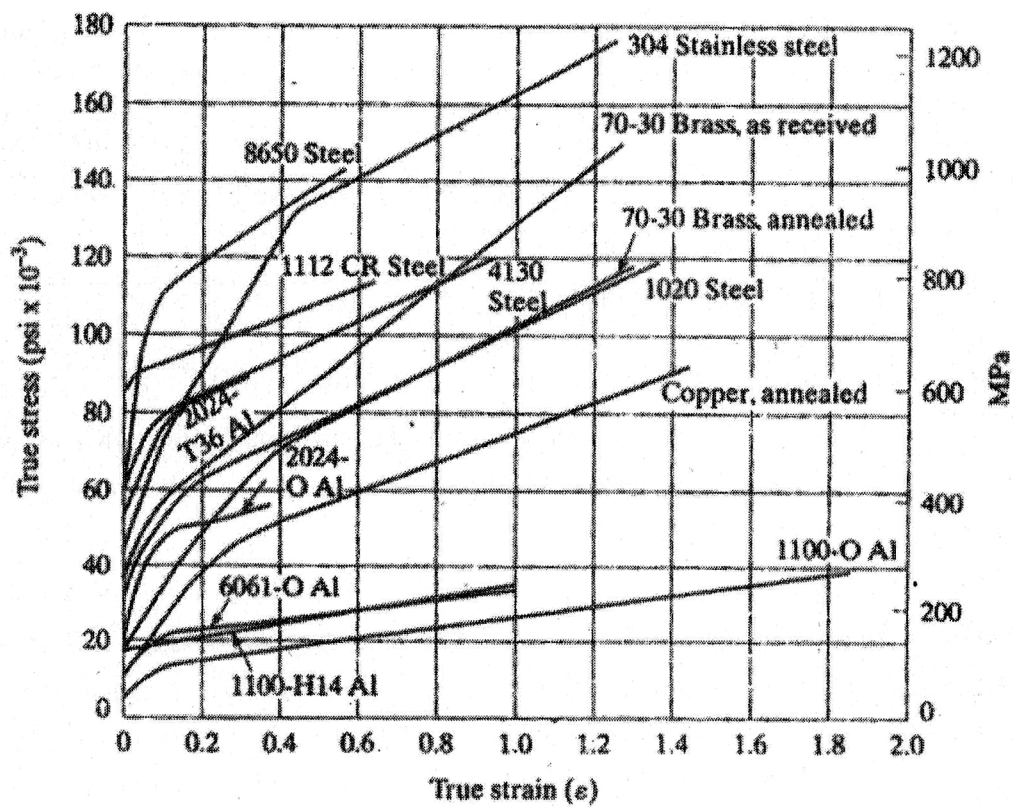


Fig.1. True stress -vs- True strain curve, in connection with question 3 (c).

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