



Name :
Roll No. :
Invigilator's Signature :

CS/M. Tech (PE)/SEM-1/PEM-102/2011-12

2011

ADVANCES IN JOINING AND FORMING PROCESS

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words
as far as practicable.*

Answer *five* questions taking at least one from each Group.

GROUP – A

Answer minimum 1 question out of the following

1. a) Deduce the expression for three dimensional (3 – D) Mohr Circle and from the expression clearly draw the circles with labels. 8
- b) Discuss the failure criteria given by Von-Mises and Tresca. 4
- c) Write three dimensional equilibrium equation for stress taking body forces in consideration. 2

2. a) A stress Tensor is given by,

$$T_{ij} = \begin{pmatrix} 10 & 4 & -6 \\ 4 & -6 & 8 \\ -6 & 8 & 14 \end{pmatrix} MPa$$

From the stress tensor, determine

- i) stress invariants
- ii) principal stress
- iii) the direction of largest principal stress. 3 + 6 + 2



- b) Deduce Hencky's Equation for slip lines. 3
3. a) A cylindrical lead alloy bittet of 50 mm diameter and 100 mm length is extruded to a final diameter of 25 mm by using a direct extrusion process. The average tensile yield stress for the alloy is 12 N/mm^2 Estimate the maximum force required and fraction of the total power lost in friction for this operation. 8
- b) Deduce the necessary mathematical formulae to solve the above problem. 6
4. a) A strip of lead with initial dimension $24 \text{ mm} \times 24 \text{ mm} \times 150 \text{ mm}$ is forged between two flat dies to a final size of $6 \text{ mm} \times 96 \text{ mm} \times 150 \text{ mm}$. If the co-efficient of friction between the job and dies is 0.25, determine the maximum forging force. The average yield stress of lead in tension is 7 N/mm^2 . 8
- b) Deduce 2-D compatabity equation for strain. 2
- c) The following displacement field represents the deformation of a body in a given domain :
- $$\hat{u} = [x^2i + (x+3)j + 10K] \times 10^{-2}m$$
- What is the displacement of the point originally at the position $\hat{r} = (j + k) m$ in undeformed geometry ? What is the new position vector ? 4

GROUP - B

Answer minimum 1 question out of the following

5. a) Explain the role of temperature in metal forming operation. 4
- b) Give in detail with reasons the beginning and finishing temperature of metal working operations. 6
- c) What is warm working ? When is it applied ? Give examples. 4



6. a) Describe briefly the rapid solidification techniques. 6
 b) Why is squeeze casting called liquid forging. 4
 c) List three basic requirements for a good rolling lubricant. 4
7. a) List the various techniques of material removal processes other than mechanical energy. 4
 b) Give a brief description of Electrical discharge machining (EDM). 4
 c) What is thermomechanical processing ? Give an example of the process and its methodology. 4
 d) What is super plastic forming ? Give its advantages. 2
8. Write short notes on any *two* of the following : 2 × 7
 i) Production of seamless pipe
 ii) Rheocasting
 iii) High energy rate forming
 iv) Advantages of powder metallurgy processes.

GROUP - C

Answer minimum 1 question of the following.

9. a) What are meant by cathode space and anode space in an electric arc ?
 b) Select the proper power source for MMAW. Justify your selection with the V-I characteristics of the power source and electric welding arc.
 c) Discuss TIG welding process with the help of necessary sketch(es). Write its advantages and applications.

3 + 6 + 5



10. a) Very thin foils are to be joined. Explain the process for this purpose. Give illustrative sketch. 6 + 5 + 3
- b) What are rutile coating and cellulosic coating ? Explain them and write their uses.
- c) What is distortion in welding ? Explain. 6 + 5 + 3
11. a) Sketch and discuss the common defects in butt welds.
- b) Write short notes on guided bend and controlled bend tests of welded joints.
- c) Determine the change in welding current if the arc length changes from 4 mm to 5 mm for the power source with V-I characteristics
- $$V = 30 + \frac{I^{1.05}}{50}$$
- The arc length (l) and arc voltage (V) are related by the expression $V = 20 + 4 l$. 5 + 5 + 4
12. a) What is creep resistance resistant steel ? Give an idea about some well known composition of the same. Briefly explain about preheat and post weld treatment of the creep resistance steels.
- b) Give a classification of welding process for thermoplastic polymers.
- c) Discuss about the welding of composites. 5 + 3 + 6
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