

15803

Roll No. _____

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15803

M. Tech. I Sem. (Main) Exam., Dec. - 2018

Metal Forming

1MEPE3 Metal Forming

Time: 3 Hours

Maximum Marks: 100

Min. Passing Marks: 33

Instructions to Candidates:

Attempt any five questions. Marks of questions are indicated against each question. Draw neat and comprehensive sketches wherever necessary to clearly illustrate your answer. Assume missing data suitable if any and specify the same. Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL

2. NIL

Q.1 (a) Determine the invariants of the stress tensor and the octahedral stresses for the case of uniaxial state of stress. [12]

(b) What stress-strain relationship is commonly employed in plasticity problems of elasto-plastic materials? Explain. [8]

Q.2 State two yield criteria used in metal working problems. How do they differ from each other? State also the experimental justification in support of each. [20]

Q.3 (a) Prove that the angle between two slip lines of one family at points where they are cut by a slip line of the other family is constant along their lengths. [10]

(b) Draw and explain the slip lines networks that have been proposed in the field of metal cutting. [10]

Q.4 Explain the concept of upper bound in estimating loads in metal forming problems. Apply the above method to get the average pressure between a pair of smooth parallel plates compressing a non-work hardening material in plane strain. [20]

- Q.5 (a) Evaluate the press capacity necessary for forging a 1 m long cylindrical bloom to hexagonal section with approximately 0.33 m side, if the yield stress is initially 440 kg/cm² but increases to 680 kg/cm² at the end of the operation. Assume: (i) that the bloom is partially lubricated so that $\mu = 0.3$, (ii) that there are no lubrication. What maximum pressures would be expected? [20]
- Q.6 (a) Obtain the expression for the radial drawing stress in a deep drawing operation making suitable assumptions. [12]
- (b) Discuss the various defects observed in deep drawing process. [4]
- (c) Discuss the importance of 'drawing ratio.' [4]
- Q.7 Calculate the drawing load for 40% reduction of area 25 mm \times 6 mm annealed steel strip, using 6 mm radius dies and compare this with the load using straight tapered dies: (a) of the same entry angle, and (b) of the same mean angle. Assume $\mu = 0.1$. The contribution of redundant work may be neglected. Derive the formulae use. [20]
- Q.8 (a) Differentiate between high energy rate forming and conventional process. [6]
- (b) Explain briefly the general requirement for an explosive forming facility. [6]
- (c) Classify explosive forming technique. Explain stand-off operations in brief. [8]

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