

MASTER OF PRODUCTION ENGG EXAMINATION, 2017
2nd Semester

ADVANCED MATERIAL FORMING, TOOLS AND DIE DESIGN

Time: Three hours

Full Marks 100

Answer any **five** questions
All parts of a question (a, b etc.)
should be answered at one place.

- 1 (a) What is meant by statically admissible stress field?
(b) State the lower bound theorem and explain why load predicted by lower bound theorem is always lower than actual working load.
(b) Estimate the upper bound bending moment required to cause plastic bending of a single notched bar.

3+5+12
- 2 (a) Derive Hencky slip line equations.
(b) Draw the slip line field and hodograph for 50% inverted extrusion in plane strain with un-lubricated 180° die and determine extrusion pressure.

10+10
- 3 (a) Derive the relationship between tensile and shear yield stress.
(b) Explain redundant work in material forming operation.
(c) Write down the different methods of estimation of working load in plastic deformation.
(d) Draw the Mohr circle and find out the principal stresses and slip lines at the interface with Coulomb friction and perfectly rough interface.

6+4+4+6
- 4 (a) Draw the slip line field for smooth wedge indentation of a semi-infinite block and draw the hodograph and determine the dimensionless indentation pressure $p/2k$.
(b) Draw a slip line field for piercing by a flat faced punch with suitable clearances at the sides and show the hodograph and determine the dimensionless indentation pressure $p/2k$.
(c) What are the advantages and disadvantages of compression and tensile testing?

7+7+6
- 5 (a) Fig. 5(a) shows the upper bound field for drawing through a wedge shaped die. Determine the drawing stress $t/2k$; when the die is perfectly rough. Semi die angle and fractional reduction of

[Turn over

(2)

area are 40° and 0.56 respectively.

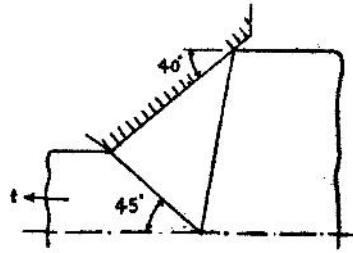


Fig. 5(a)

- (b) Determine the Lee and Shaffer's lower bound cutting force in orthogonal metal cutting operation. Compare this solution graphically with the Ernst and Merchant upper bound solution.

10+10

- 6 Show how the design of the die and punch assembly for sheet metal operations plays an extremely important role in reducing the operation time and cost. To illustrate your answer show neat sketches of : (i)Compound die and punch assembly and (ii) Progressive die and punch assembly for a particular component.

20

- 7 (a) Discuss about the basic design features of DROP FORGING dies using neat sketch of a typical drop forging die set.
(b) Explain why angular clearance is provided on die in a simple blanking/piercing die and punch assembly. Also explain why die and punch corners are provided with radius in deep drawing operation, where they are not provided in blanking/piercing operation. Show neat sketches of the die and punch shapes for both the operations

10+10