BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : VI/ADD**
BRANCH: PRODUCTION ENGINEERING **SESSION : SP/19**

SUBJECT: PE6003 MATERIAL DEFORMATION PROCESSES

TIME: 3 Hours **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Write short notes on following [12]
(i) Strain Hardening (ii) Hydrostatic Extrusion (iii) Hot working (iv) True Engg Strain
(V) Kinematic Work Hardening

Q.2(a) Draw stress strain curve for Mild steel. Label all the key points. [2]
Q.2(b) Show that the sum of principal stresses on a plane ($\sigma_1 + \sigma_2$) for 2 D stress system is constant where σx σy τ_{xy} are external applied stress. [4]
Q.2(c) If the displacement field in body is given by [6]
U=0.25 xz +0.30
V=0.33 y^2+ 0.20xy
W=0.40 yz+ 0.5
Find the Strain tensor.

Q.3(a) What is the difference between Engg stress and True Stress? Write their expression also. [2]
Q.3(b) Explain Baushinger effect. Draw the graph depicting baushinger effect and also define the mechanism upon which it is based. [4]
Q.3(c) A mild steel specimen of initial area 20 mm^2 and length 100 mm is extended to 120 mm. Assuming it to be isotropic, find the true strains in length,width and height. If the yield strength of material is given by $\sigma = 400 €^{0.30}$ N/mm^2. Find the total work done. [6]

Q.4(a) Write the statement for Von Mises yield criterion along with its expression. [2]
Q.4(b) Using Von Mises criteria, prove that for if pure shear stress is applied on a specimen, yielding occurs at $\tau = \sigma_0/\sqrt{3}$. [4]
Q.4(c) A metal body is in plastic state under action of following stresses. [6]

$$T = \begin{bmatrix} 20 & 5 & 10 \\ 5 & -8 & 6 \\ 10 & 6 & 22 \end{bmatrix}$$

Determine the yield strength of material in tension and shear according to von mises yield criterion. Stresses are in N/mm^2

Q.5(a) What conditions lead to sticking in the case of forging of a slab? Explain. [2]
Q.5(b) A 200 mm wide, 500 mm long and 10 mm thick strip is compressed between two flat dies in plane strain such that dimension 500 is constant. The coefficient of friction between dies and the strip is 0.1 and yield strength of material in compression is σ_0 = 200 N/mm^2.Determine the mean die pressure and maximum die pressure. [10]

Q.6(a) What are deviator stresses? Explain in brief. [2]
Q.6(b) Explain (i) Coulomb's Friction law and (ii) Constant Friction Law [4]
Q.6(c) Find out maximum reduction of area per pass in cylindrical drawing under cold condition with following effect. [6]
Friction μ= 0.1 and $\alpha=6^0$.

Q.7(a) Explain Explosion forming in brief. [2]
Q.7(b) Find the expression for unaided entry in between two rolls. [4]
Q.7(c) In a single pass rolling operation, a 20 mm thick plate with plate width 100 mm is reduced to 18 mm. The roller radius is 250 mm and roll speed is 10 rpm. The average flow stress is 300 MPa. Find the power required in the process. [6]

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