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

CLASS: BE **SEMESTER: VI/ADD**
BRANCH: PRODUCTION ENGG. **SESSION : SP/2019**

SUBJECT : PE6003 MATERIAL DEFORMATION PROCESSES

TIME: 1.5 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 30.
2. Candidates may attempt for all 30 marks.
3. In those cases where the marks obtained exceed 25 marks, the excess will be ignored.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. The missing data, if any, may be assumed suitably.

Q1 (a) Differentiate between direct and indirect extrusion. [2]
(b) What do you understand by hot working processes? List its advantages. [3]

Q2 (a) Explain the concept of strain hardening. What effect does it have on yield strength of a material? [2]
(b) Write the expression of flow stress in case of strain hardening and prove that the strain hardening index 'n' is equal to strain value at UTS [3]

Q3 (a) For a specimen undergoing metal working process $€_x$=0.05 and $€_y$=0.15. Find the value €z. [2]
(b) Explain Bauschinger effect. Depict the process on a stress strain graph. [3]

Q4 (a) Write the strain tensor in terms of displacement function U. [2]
(b) If the displacement field in a 2D planar strain system is given by [3]
U= $2x^2+3y$
V= $3x+2y$
Find the shear strain value γ_{xy}

Q5 (a) The stress state at a point is given by the tensor T as given below. Determine the normal and shear stresses on a plane the normal to which has direction cosines as $1/\sqrt{2}$, 0 and $1/\sqrt{2}$. The stresses are in N/mm^2 [5]

$$\begin{pmatrix} 100 & 50 & 75 \\ 50 & 150 & 25 \\ 75 & 25 & 50 \end{pmatrix}$$

Q6 (a) State and give the expression for Von Mises hypothesis of yielding [2]
(b) Prove that if pure shear stress τ is applied on a specimen, the value at which yielding occurs is given by $\tau = \frac{\sigma}{\sqrt{3}}$. Where σ is the yield strength of material? (Using Von Mises theory). [3]

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