SUBJECT: PRINCIPLES OF ENGINEERING (PAPER-I)

TIME ALLOWED: THREE HOURS **MAXIMUM MARKS:** 100

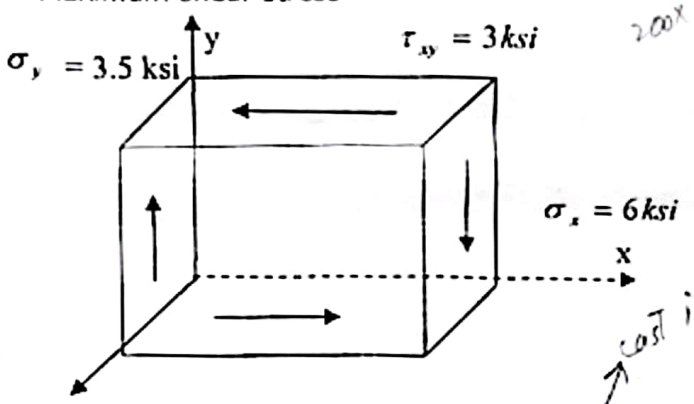
NOTE: Attempt Any FIVE Questions in All. Calculator is Allowed.

Q No.1: a) Define the following:- (5+15=20 Marks)

i) Yield strength;
ii) Ultimate tensile strength
iii) Toughness
iv) Resilience
v) Bauschinger Effect

b) For the state of plane stress shown in figure below, determine

i) Three principle planes and principle stresses
ii) Maximum shear stress



Q No.2: a) Draw the stress-strain diagram for (i) Low carbon steel; (II) Aluminum alloy. Label the diagram for yield strain hardening and rupture points.

b) A steel rod is 2.2 m long and must not stretch more than 1.2 mm when a 8.5 kN load is applied, knowing that E = 200 GPa; determine: (i) the smallest diameter rod that should be used; (ii) the corresponding normal stress caused by the load. (10 + 10 Marks)

Q No.3: a) Differentiate between axial flow pumps and mixed flow pumps.

b) A given pump rotates at a speed of 1000 rpm and at its duty point it generates a head of 12.2 m when pumping water at a rate of 0.0151 m³/s. Calculate the head generated by a similar pump of twice the size when operating under dynamically similar conditions and discharging 0.0453 m³/s. Assume that effect of viscosity are negligible. Also, determine the rotational speed of the second pump as well. (5 + 15 Marks)

Q No.4: A 220-volt series motor takes 50 amperes. Armature resistance 0.1 ohm, series field resistance, 0.08 ohm. If the iron and friction losses are equal to the copper losses at this load, find the b.h.p. and the commercial efficiency (20 Marks)

P.T.O

Q No.5: Use a 230/12 V transformer in a full wave rectifier, draw complete circuit diagram and calculate accurately DC output voltage.

(20 Marks)

Q No.6: a) Steam expands adiabatically in a turbine from 20 bar, 400 °C to 4 bar, 250 °C, calculate:

i) The insentropic efficiency of the process;
ii) The loss of exergy of the system assuming an atmosphere temperature of 15 °C;
iii) The effectiveness of the process.

Neglect changes in kinetic and potential energy.

b) Show on T-S diagram (i) irreverisble adiabatic process for steam; (ii) irreversible adiabatic compression for a perfect gas.

(16+4 Marks)

Q No.7: a) Draw crystal structures of metals; (i) face-centered cubic (fcc); (ii) body-centered cubic (bcc); (iii) hexagonal close packed (hcp).

b) What information can be obtained from an equilibrium diagram? Draw Iron-Carbon equilibrium diagram, showing various phases.

(6+14 Marks)

Q No.8: **Illustrate the following processes with the help of a schematic diagram:**

i) Rolling
ii) Extrusion
iii) Wire-drawing
iv) Forging

(20 Marks)