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BT-104

Roll No. ....

B. TECH (ECE, MAE, E & EE, E & IE, AE,  
NST, S & AE), B. TECH (MAE) + M. TECH  
AUTOMOBILE ENGINEERING (DD), B. TECH  
(ECE & MAE) + MBA DUAL DEGREE  
PROGRAMMES, B. TECH + M. TECH (NS & T) -  
DD & B. TECH (AE) + M. TECH (A) - DD  
FIRST SEMESTER END TERM EXAMINATION :  
NOVEMBER - 2012

ELEMENTS OF MECHANICAL ENGINEERING

Time : 3 Hrs.

Maximum Marks : 70

Note: Attempt questions from all sections as directed.

SECTION - A (30 Marks)

Attempt any 5 questions.

Each question carries 6 marks.

1. A heat engine draws in air at 1 bar and 300K. The maximum pressure and temperature values are 70 bar and 2000 K respectively. Determine the air standard efficiency if the engine works on Diesel cycle.
2. Define following terms

(i) Thermal Energy Reservoirs

P.T.O.

(ii) Refrigerator

(iii) Heat Pump

3. A gas undergoes a thermodynamic cycle consisting of the following processes : (1) Process 1-2: Constant pressure  $p=1.4$  bar,  $V_1=0.028$  m<sup>3</sup>,  $W_{1-2}=10.5$  kJ. (2) Process 2-3: Compression with  $pV = \text{const}$ ,  $U_3 = U_2$ . (3) Process 3-1: Constant volume,  $U_1 - U_3 = -26.4$  kJ. There are no significant changes in KE and PE. (a) Sketch the cycle on a p-V diagram. (b) Calculate the net work for the cycle in kJ. (c) Calculate the heat transfer for process 1-2.
4. What is casting? Describe various pattern allowances in casting process.
5. What is forging? Explain press forging with neat sketch.
6. Derive the following relationship -  $E = 3 K[1-2 \mu]$ .

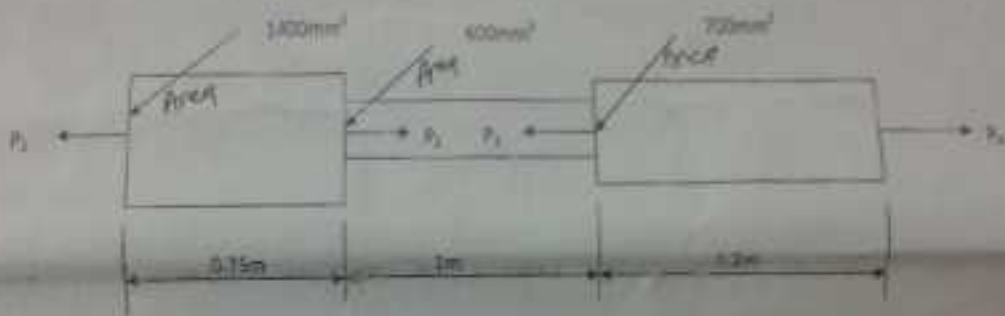
**SECTION - B (20 Marks)**

*Attempt any two questions.*

*Each question carries 10 marks.*

7. What is the steady flow process and control volume approach? Derive the steady flow energy equation (SFEE). Apply SFEE for nozzle and turbine?

8. What is welding? Classify the welding process. And explain the different types of flames used in oxyacetylene gas welding with the help of neat sketches. Also mention the temperatures of the different flames.
9. A member ABCD is subjected to point loads  $P_1$ ,  $P_2$ ,  $P_3$  and  $P_4$  as shown in the figure given below :



Calculate the force  $P_3$  necessary for equilibrium if  $P_1 = 120$  kN,  $P_2 = 220$  kN,  $P_4 = 160$  kN. Determine also the net change in length of the member. Take modulus of elasticity  $E = 200$  GN/m<sup>2</sup>.

**SECTION - C** (20 Marks)  
(Compulsory)

10. (a) Define the following terms :

- |                 |                   |
|-----------------|-------------------|
| (i) Ductility   | (ii) Hardness     |
| (iii) Stiffness | (iv) Malleability |
- (6)

P.T.O.

- (b) State the Kelvin Plank and Clausius statements of second law of thermodynamics and establish the equivalence between them. (8)
- (c) A nozzle is a device for increasing the velocity of a steadily flowing stream. At the inlet to a certain nozzle the enthalpy of the fluid passing is 2000 kJ/kg and the velocity is 60 m/s. At the discharge end the enthalpy is 2762 kJ/kg the nozzle is horizontal and there is negligible heat loss from it.
- (a) Find the velocity at exit from the nozzle (b) if the inlet area is  $0.1 \text{ m}^2$  and the specific volume at inlet is  $0.187 \text{ m}^3/\text{kg}$ , find mass flow rate (c) if the specific volume at the nozzle exit is  $0.498 \text{ m}^3/\text{kg}$ . Find the exit area of the nozzle. (6)