GUJARAT TECHNOLOGICAL UNIVERSITY
B.E. Sem-I/II Examination June-July 2011

Subject code: 110006   Subject Name: Elements of Mechanical Engg.
Date:01/07/11   **Total Marks: 70   Time: 10:30 am to 1:00pm**

Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of steam table is permitted.**

Q.1 **(a)** Classify thermodynamic system and give example of each.   **03**
         (b) For adiabatic process derive PV^γ = constant.   **04**
         (c) One kg of gas is compressed polytropically from 150 KPa pressure and 290   **07**
                  K temperature to 750 KPa. The compression is according to law $PV^{1.3}$ =
                  constant. Find :
                  (a) final temperature   (b) work-done   (c) change in internal energy   (d)
                  amount of heat transfer   and (e) change in enthalpy. Take R = 0.287
                  KJ/kgK and Cp = 1.001 KJ/kgK.

Q.2 **(a)** Define : Latent Heat , Degree of superheat , Enthalpy of evaporation   **03**
         (b) Prove that the efficiency of Otto cycle is a function of compression ratio   **04**
                  only.
         (c) Dry saturated steam at 7 bar pressure is expanded to 1 bar following the law   **07**
                  $PV^{1.1}$=constant. Determine   (i) work-done (ii) change in internal energy
                  (iii) heat transferred during the process.

OR

         (c) Air at 15^0 C and 1 bar is compressed adiabatically to 15 bar by an engine   **07**
                  working on Otto cycle. The maximum pressure of the cycle is 40 bar.
                  Calculate (a) air standard efficiency and (b) mean effective pressure. Take
                  Cv = 0.718 kJ/kgK and R = 8.314 kJ/Kmol K

Q.3 **(a)** Prove that the efficiency of Carnot cycle operating between temperatures T_1 **03**
                  and $T_2 = (T_1 - T_2) / T_1$.
         (b) Differentiate Petrol engine and Diesel engine.   **04**
         (c) A 4 cylinder 2-stroke engine develops 30 kW at 2500 rpm. The mean   **07**
                  effective pressure of each cylinder is 800 kPa and mechanical efficiency =
                  80 %. Calculate Brake power and mass flow rate of fuel if L/D = 1.5, Brake
                  thermal efficiency = 28% and calorific value of fuel = 44000 kJ/kg

OR

Q.3 **(a)** Define : Cut off ratio , Swept volume , Boiler efficiency.   **03**
         (b) Explain with neat sketch Bourdon tube type pressure gauge.   **04**
         (c) A boiler produces 5500 kg of steam per hour at 1 bar pressure with dryness   **07**
                  fraction of 0.94 from feed water at 40^0 C. The coal supply rate is 600kg/hr.
                  Determine equivalent evaporation in kg of steam / kg of coal burnt and
                  thermal efficiency of boiler if calorific value of coal is 32000 kJ/kg.

Q.4 **(a)** Name different methods of governing. How they differ from one another?   **03**
         (b) With usual notations prove that volumetric efficiency of reciprocating air   **04**
                  compressor is $1 - C [(P_2 / P_1)^{1/n} - 1]$, where C = clearance volume ratio.
         (c) Classify rotary air compressors. Explain the construction and working of   **07**
                  centrifugal compressor with neat sketch.

OR

Q.4	(a)	Explain Bell-Coleman air refrigeration cycle.	04
	(b)	Write short note on domestic refrigerator.	04
	(c)	Classify centrifugal pumps. With neat sketch explain the function of each part of centrifugal pump.	06
Q.5	(a)	Differentiate brake and clutch. Explain Band brake.	04
	(b)	Explain centrifugal clutch.	04
	(c)	What are belt drives? List various belt drives and explain cross belt drive.	06

OR

Q.5	(a)	Define : Malleability , Compressive strength , Toughness and Brittleness.	04
	(b)	Write similarities between heat transfer and work transfer.	04
	(c)	Write advantages of gaseous fuels over other fuels. Write short note on LPG.	06

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