



A. D. Patel Institute of Technology (ADIT)  
Internal Examination  
First Semester 2008-09  
First Level Mechanical Engineering

Subject Code: ME101 Date: 24-09-2008  
Subject Name: Elements of Mechanical Engineering Time: 8 to 9 a.m.  
Level: First Total Marks: 20

Notes:

- 1) Assume suitable data if required
- 2) Figures to the right indicate maximum marks

- Q: 1 Answer the following questions. (Any four, each of two marks) (08)
- (i) Derive the SFEE with diagram.
  - (ii) State the name of different solid fuels and liquid fuels.
  - (iii) Derive the equation of workdone in adiabatic process.
  - (iv) State Ideal Gas law, Boyle's law, Charle's law and Avogadro's law.
  - (v) Derive the equation of workdone for Air standard Diesel cycle.
- Q: 2 A mass of air has an initial pressure of  $1.3 \text{ MN/m}^2$ , volume  $0.014 \text{ m}^3$  and temperature  $135^\circ \text{C}$ . It is expanded until its final pressure is  $275 \text{ kN/m}^2$  and its volume becomes  $0.056 \text{ m}^3$ . Determine, (02)
- (a) mass of air
  - (b) the final temperature
- Take  $R = 0.287 \text{ kJ/kgK}$ .
- Q: 3 A gas has an initial pressure, volume and temperature of  $140 \text{ kN/m}^2$ ,  $0.012 \text{ m}^3$  and  $100^\circ \text{C}$ , respectively. The gas is compressed to a final pressure of  $2.8 \text{ MN/m}^2$  and volume of  $0.0012 \text{ m}^3$ . Determine, (04)
- (a) index of compression if compression is assumed to follow the law  $p v^n = C$ .
  - (b) the final temperature of gas
  - (c) the work transfer
  - (d) the change in I.E. of the gas
- Take  $R = 0.287 \text{ kJ/kgK}$  and  $C_v = 0.717 \text{ kJ/kgK}$ .
- Q: 4 Find out Internal Energy of 1 kg of steam at a pressure of 10 bar when the condition of steam is (a) 95% dry steam (b) superheated steam with degree of superheat  $40^\circ \text{C}$ . Take  $C_p = 2.26 \text{ kJ/kgK}$ . Neglect volume of water. (03)
- (OR)**
- Q: 4 Following observations were taken from a combined separating and throttling calorimeter. Find dryness fraction of a steam. (03)
- Water separated = 2 kg.  
Steam discharged from throttling calorimeter = 5 kg.  
Temperature of steam after throttling =  $110^\circ \text{C}$ .

Initial pressure = 12 bar absolute.  
 Barometer pressure = 760 mm Hg.  
 Final pressure = 1.05 bar  
 Assume  $C_{ps} = 2.1 \text{ kJ/kgK}$ .

- Q: 5 One kg of air is taken through an OTTO cycle. At the commencement of the adiabatic compression, the pressure and temperature are 1.03 bar and  $100^\circ \text{C}$ , respectively. The adiabatic compression has volume ratio 6:1. The maximum pressure of the cycle is 34.5 bar. Determine for the cycle, (03)
- (a) pressure and temperature at the end of adiabatic compression  
 (b) The workdone
- Take  $R = 0.287 \text{ kJ/kgK}$ ,  $\gamma = 1.4$

Standard water and steam tables

p (bar)	t ( $^\circ\text{C}$ )	$v_f$ ( $\text{m}^3/\text{kg}$ )	$v_g$ ( $\text{m}^3/\text{kg}$ )	$h_f$ (kJ/kg)	$h_{fg}$ (kJ/kg)	$h_g$ (kJ/kg)	$s_f$ (kJ/kgK)	$s_g$ (kJ/kg K)
1.01325	100	0.001044	1.6730	419.1	2256.9	2676.0	1.307	7.355
1.05	101	0.001045	1.6181	423.3	2254.3	2677.6	1.318	7.343
10	179.9	0.001127	0.19430	762.6	2013.6	2776.2	2.138	6.583
12	188	0.001139	0.16321	798.4	1984.3	2782.7	2.216	6.519