a2zpapers.com

Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐ Total No. of Pages : 03

Total No. of Questions : 09

B.Tech. (Sem.–1st,2nd)

ELEMENTS OF MECHANICAL ENGINEERING

Subject Code : BTME-101 (2011 & 2012 Batch)

Paper ID : [A1107]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION - B & C. have FOUR questions each.**
3. **Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.**
4. **Select atleast TWO questions from SECTION - B & C.**

SECTION-A

l. Write short notes on :

(a) Convert 0.5 *bar* of pressure into

i) *mm* of *Hg*

ii) *m* of water.

(b) What is the concept of continuum? How will you define density and pressure using this concept?

(c) Why does free expansion have zero work transfer?

(d) A Carnot engine with a fuel burning device as source and a heat sink cannot be treated as a reversible plant. Explain.

(e) Why does entropy remain constant in a reversible adiabatic process?

(f) What is an air standard cycle? Why are such cycles conceived?

(g) What do you understand by section modulus?

(h) Explain centroidal axis and axis of symmetry with the help of an example.

www.a2zpapers.com www.a2zpapers.com
Download free old Question papers gndu, ptu hp board, punjab board

a2zpapers.com

(i) Explain the terms machinability and maleability.

(j) Explain different types of technological properties of materials.

SECTION B

2. i) Why would the name "thermostatics" be more appropriate than thermodynamics as applied to the science of thermal engineering? (2)

   ii) An ideal gas requires 1150 *kj/kg* of heat to raise its temperature from 20°C to 100°C, when heated at constant pressure. When heat is supplied to the same gas at constant volume, the heat requirement is 825 *kJ* for the same temperature range. Determine specific heat at constant pressure, specific heat at constant volume and adiabatic exponent. (6)

3. i) How is polytropic exponent determined and within what limits it can change? (2)

   ii) A gas of mass 1.5 *kg* undergoes a quasi-static expansion which follows a relationship $p = a + bV$, where a and b are constants. The initial and final pressures are 1000 *kPa* and 200 *kPa* respectively and the corresponding volumes are $0.20m^3$ and $1.2m^3$. the specific internal energy of the gas is given by the relation

   $u = 1.5pv - 85$ *kj/kg*

   Where p is the *kPa* and v is m^3/kg. Calculate the net heat transfer and the maximum internal energy of the gas attained during expansion. (6)

4. Air flows steadily at a rate of 0.4 *kg/s* through an air compressor, entering at 6*m/s* with a pressure of 1 *bar* and a specific volume of $0.85 m^3/kg$, and leaving at 4.5 *m/s* with a pressure of 6.9 *bar* and a specific volume of $0.16 m^3/kg$. The internal energy of the air leaving is *88 kJ/kg* greater than that of the air entering. Cooling water in the jacket surrounding the cylinder absorbs heat from the air at the rate of 59 W. Calculate the power required to drive the compressor and the inlet and outlet cross-sectional area. (8)

www.a2zpapers.com www.a2zpapers.com
Download free old Question papers gndu, ptu hp board, punjab board

a2zpapers.com

5. i) A reversible heat engine interacts with three thermal reservoirs at 750K, 650K and 550K respectively. The engine absorbs 2400*kJ/min* of energy as heat from the reservoir at 750K and does 400*kJ/min* of net work. Determine the magnitude and direction of heat interactions of the engine with other two reservoirs. (4)

ii) A reversible engine operates between a source at 1200K and two sinks, one at 400K and another at 300K. The heat rejected at both the sinks is same. Determine the thermal efficiency of the engine. (4)

SECTION-C

6. An ideal Diesel cycle using air as the working fluid has a compression ratio of 16 and a cutoff ratio of 2. The intake conditions are 100 *kPa*, 20°C, and 2000cm^3. Using the cold air standard assumptions, determine

i) the T and P at the end of each process

ii) the net work output

iii) thermal efficiency

iv) the mean effective pressure (4×2)

7. In order to check the validity of the second law, m_1 *kg* of water at temperature T_1 is isobarically mixed with m_2 *kg* of water at temperature T_2 ($T_1 > T_2$). Determine the change in the entropy of the universe and find an expression for the same for equal mass of water. Also prove that the change is necessarily positive. (8)

8. i) Locate the centroid of a T-section 10 *cm* x 10 *cm* x 2 *cm.* (4)

ii) Find the mass moment of inertia of circular ring of radius R and mass M. (4)

9. i) Give a neat sketch of the theoretical and actual pV diagrams for a four stroke Petrol engine. Describe briefly the factors which account for deviations between these plots. (4)

ii) What is cast iron? What are its uses? What is the effect of carbon, silicon, sulphur and phosphorus on its properties? (4)

www.a2zpapers.com www.a2zpapers.com
Download free old Question papers gndu, ptu hp board, punjab board