Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– 1st / 2nd EXAMINATION – SUMMER 2014

Subject Code: 2110006 Date:18-06-2014

Subject Name: Elements of Mechanical Engineering

Time:02:30pm to 05:00 pm Total Marks: 70

Instructions:

1. **Question No. 1 is compulsory. Attempt any four out of remaining six questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 (a) Objective Questions **07**

1. Which of the following is not a unit of distance?
(a) Light year (b) Angstrom (c) Mile (d) Carat

2. The specific heat at constant pressure(C_p) of an ideal gas is
(a) Equal to its specific heat at constant pressure
(b) $C_p < C_v$ (c) $C_p > C_v$ (d) $C_p = 2\,C_v$

3. The process of sublimation is found to occur in
(a) Liquid N_2 (b) Solid CO_2 (c) Solid O_2 (d) Air

4. If x_1 and x_2 are the dryness fractions obtained in separating calorimeter and throttling calorimeter respectively, then actual dryness fraction of steam is_____
(a) $x_1 \cdot x_2$ (b) $X_1 + X_2 / 2$ (c) $X_1 + X_2$ (d) $X_1 - X_2$

5. The process of Carnot cycle are
(a) Two isothermal and two constant volume
(b) Two constant pressure and two constant volume
(c) Two isothermal and two isentropic
(d) Two isothermal and two adiabatic

6. A device which is used for pumping water into the boiler is called
(a) Economizer (b) Feed pump
(c) Injector (d) Air preheater

7. Which part used in I.C.Engine to convert reciprocating motion of piston to rotary motion of output shaft
(a) Connecting road (b) Crank shaft (c) Cam shaft (d) Gudgeon pin

(b) Objective Questions **07**

1. Which are of the following is not a rotary pump?
(a) Gear pump (b) Vane pump (c) Screw pump (d) Axial pump

2. Which one of the externally fired boiler.
(a) Babcock and Wilcox (b) Lancashire
(c) Cochran (d) All of the above

3. The chemical formula of R-12 is
(a) CCl_2F (b) $CClF_3$ (c) CCl_2F_2 (d) $CHClF_2$

4. Which types of coupling used to connecting shafts, whose axis are parallel but not in one line?

(a)muff coupling (b)flexible coupling (c)Oldham's coupling (d) flange coupling

5. Compressor in which compression of air from suction pressure to delivery pressure takes place in more than one cylinder is called_____compressor.
(a) Single acting (b) Double acting
(c) Single stage (d) Multi stage

6. The ability of a material to resist fracture due to high impact loads is called
(a)strength (b)stiffness (c) toughness (d) brittleness

7. Which property is called Intensive property?
(a)Kinetic energy (b)viscosity (c)Internal energy (d)magnetization

Q.2 **(a)** **(I)** Write a short-note on bio-fuels. **03**
(II) Explain Specific heat. Give Statements of Zeroth Law and First law of thermodynamics. **04**

(b) 1 kg of air at 9 bar pressure and 80^{o} C temperature undergoes a non-flow work polytropic process. The law of expansion is $PV^{1.1} = C$. The pressure falls to 1.4 bar during process. Calculate (1) Final temperature (2) Work done (3) Change in internal energy (4) Heat exchange. Take R=287 J/kg and $\gamma = 1.4$ for air. **07**

Q.3 **(a)** **(I)** state & Explain Charles's law. **03**
(II) Prove the equation of work done for Isothermal process. **04**

(b) Calculate the internal energy per kg of superheated steam at 10 bar and a temperature of 300^{0}C. Find also change in internal energy if this steam is expanded to 1.4 bar and dryness fraction 0.8. **07**

Q.4 **(a)** Explain Cochran boiler with neat sketch & give its advantages and disadvantages. **07**

(b) Write a short note on Separating calorimeter with its limitations. **07**

Q.5 **(a)** Explain working of four stroke petrol engine with neat sketch & P-V diagram. **07**

(b) A four cylinder two stroke petrol engine with stroke to bore ratio 1.2 develops 35 kW brake power at 2200 rpm. The mean effective pressure in each cylinder is 9 bar and mechanical efficiency is 78 %. Determine (1) Diameter and stroke of each cylinder (2) Brake thermal efficiency (3) indicated thermal efficiency. If fuel consumption 8 kg / hr having C.V=43000 kJ/kg. **07**

Q.6 **(a)** What do you mean by priming of centrifugal pump? Explain single acting reciprocating pump. **07**

(b) An engine operates on the air standard diesel cycle. The conditions at the start of the compression stroke are 353 K and 100 kPa , while at the end of compression stroke the pressure is 4 MPa. The energy absorbed is 700 kJ/kg of air. Calculate (1) the compression ratio (2) the cut-off ratio (3) the work done per kg air (4) the thermal efficiency. **07**

Q.7 **(a)** **(I)** What should be the properties of common refrigerants? **03**
(II) Explain Function and working of Fusible plug used in boiler. **04**

(b) Explain types of belt drive. **07**

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