

Total No. of Questions : 12]

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[3561]-205

F. E. (Semester - II) Examination - 2009

BASIC MECHANICAL ENGINEERING

(June 2008 Course)

Time : 3 Hours]

[Max. Marks : 100

Instructions :

- (1) Answer to the two sections should be written in separate books.
- (2) Black figures to the right indicate full marks.
- (3) Neat diagrams must be drawn wherever necessary.
- (4) Your answers will be valued as a whole.
- (5) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (6) Assume suitable data, if necessary.

SECTION - I

UNIT - I

- Q.1) (A) Prove that Internal Energy is a property of the System. [04]
(B) What do you understand by Reversible and Irreversible Process. State the causes which make any process Irreversible. [06]
(C) A system contains 0.15 m^3 of air at 5 bar and 350 K. A reversible adiabatic expansion takes place till the pressure falls to 1 bar. The gas is then heated at constant pressure till enthalpy increases by 70 kJ.

Calculate :

- (1) Work done in individual process
- (2) Index of expansion if the above processes are replaced by a single reversible polytropic process giving the same initial and final states.

Take for air

$$C_p = 1.005 \text{ kJ/kgK}$$

$$C_v = 0.718 \text{ kJ/kgK}$$

$$R = 0.287 \text{ kJ/kgK}$$

[08]

OR

- Q.2)** (A) State similarities and differences between Work Transfer and Heat Transfer. [04]
- (B) State the limitations of first Law of Thermodynamics. Give Kelvin-Plank and Claussius Statement of Second Law of Thermodynamics.
- Also show that efficiency of Heat Engine is always less than unity. [08]
- (C) A household refrigerator with a COP of 1.8 removes heat from the refrigerated space at a rate of 90 kJ/min.

Determine :

- (1) The electric power consumed by the refrigerator.
- (2) The rate of heat transfer to the kitchen air. [06]

UNIT - II

- Q.3)** (A) Explain the principle of Impulse and Reaction Turbine with neat sketches.
- Give examples of :
- (1) Impulse Turbine
- (2) Reaction Turbine [08]
- (B) What is meant by following terms related to compressors ? [04]
- (1) Single Acting
- (2) Double Acting
- (3) Pressure Ratio
- (4) Free Air delivery
- (C) Give differences between Petrol and Diesel Engines. [04]

OR

- Q.4)** (A) Explain with neat sketch working of Window Air Conditioning System. How does Split Air Conditioner differ from Window Air Conditioner ? [08]
- (B) Give functions of any four mountings in relation with boiler. [04]
- (C) Write a short note on Air Motor alongwith sketch. [04]

UNIT - III

- Q.5)** (A) What is Thermal Resistance ? Explain electrical analogy for heat transfer through two layer composite slab. [04]
- (B) Explain Hydroelectric Power Plant with neat sketch. [06]

- (C) An insulated steam pipe having diameter of 5 cm is to be covered with two layers, of insulating material M_1 and M_2 each having a thickness of 3 cm.

The thermal conductivity of one material M_1 is 4 times that of the other M_2 .

Assuming that inner and outer surface temperatures of composite insulation are fixed.

Find :

What arrangement would give less heat loss rate, M_1 near the pipe surface and M_2 as outer or viceversa ?

[06]

OR

Q.6) (A) Write desirable properties of Insulating Material. [04]

(B) Draw a neat labelled sketch of Nuclear Power Plant. [04]

(C) A furnace wall is made up of three layers of thickness 250 mm, 100 mm and 150 mm with thermal conductivities of first two materials as 1.65 W/m°C and 9.2 W/m°C respectively. Hot gases temperature in the furnace is 1250°C and inside convection coefficient is 25 W/m² °C.

Inside surface temperature is maintained at 1100°C and outside surface is exposed to air at 25°C with a convection coefficient of 12 W/m² °C.

Assuming the steady state condition, determine :

(1) Outside surface temperature for first layer

(2) Thermal conductivity of third layer

(3) Overall heat transfer coefficient.

[08]

SECTION - II

UNIT - IV

Q.7) (A) Compare Belt Drive with Chain Drive. [04]

(B) Explain with neat sketch the working of Governor. What is the difference between Flywheel and Governor. [06]

(C) What do you mean by an inversion of Four Bar Chain mechanism. Write a note on Geneva Mechanism with a neat sketch. [06]

OR

Q.8) Explain with neat sketches :

[16]

- (a) Woodruff Key
- (b) Single Plate Clutch
- (c) Ball Bearing
- (d) Bevel Gear

Also give applications for each of the above elements.

UNIT - V

Q.9) (A) Differentiate between Electric Arc Welding and Electric Resistance welding. State the applications. Also list various equipments used in are Welding Set up. **[06]**

(B) Draw neat sketches of Shearing, Bending, Squeezing and Drawing in the context of sheet metal working. **[06]**

(C) Write notes on : **[06]**

(1) Factors to be considered while selecting proper material.

(2) Factor of safety and parameters affecting selection of factor of safety.

OR

Q.10) (A) Explain the importance of Aesthetic and Ergonomic considerations in design. **[06]**

(B) Discuss the properties and typical applications of low carbon steel, ceramic and cast iron. **[06]**

(C) What are various steps in Design Procedure ? Explain. **[06]**

UNIT - VI

Q.11) (A) Explain in short any four operations on Lathe Machine along with sketches. **[08]**

(B) Explain along with block diagram, the functions of various parts of Pillar type Drilling Machine. **[08]**

OR

Q.12) (A) What are the advantages and disadvantages of CNC Machines over Conventional machines. **[04]**

(B) Explain : **[06]**

(1) Face Milling Operation

(2) End Milling Operation

Draw neat sketches.

(C) Write short notes : **[06]**

(1) Surface Grinding

(2) Cylindrical Grinding