

Total No. of Questions : 12]

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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

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- 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-Planck and Clausius Statement of Second Law of Thermodynamics. [08]
- Also show that efficiency of Heat Engine is always less than unity.
- (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. [08]
- Give examples of :
- (1) Impulse Turbine
- (2) Reaction Turbine [04]
- (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.

Assumming the steady state condition, determine :

(1) Ouside surface temperature for first layer

(2) Thermal conductivity of third layer

(3) Overall heat trasfer 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