

Total No. of Questions : 12]

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[4061]-110

F. E. Examination - 2011

BASIC MECHANICAL ENGINEERING

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 100

Instructions :

- (1) Answer **any one** question from each unit.
- (2) Answers to the **two sections** should be written in **separate answer-books**.
- (3) Black figures to the right indicate full marks.
- (4) Neat diagrams must be drawn wherever necessary.
- (5) Use of electronic pocket calculator is allowed.
- (6) Assume suitable data, if necessary.

SECTION - I
UNIT - I

- Q.1) (A) What do you understand by Property of a System ? Distinguish between Extensive and Intensive Properties of a System ? [04]
- (B) Explain the following terms concerning Thermodynamic Systems : [06]
- (a) Polytropic Process
 - (b) Throttling Process
- (C) A certain gas occupies a space of 0.3m^3 at a pressure of 2 bar and a temperature of 77°C . It is heated at constant volume, until the pressure is 7 bar. Determine : [06]
- (a) temperature at the end of the process
 - (b) mass of the gas
 - (c) change in internal energy
 - (d) change in enthalpy
- Assume $c_p = 1.005 \text{ kJ/kgK}$; $c_v = 0.712 \text{ kJ/kgK}$; and $R = 287 \text{ J/kgK}$.

OR

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- Q.2) (A) Explain the significance of First and Second Law of Thermodynamics by giving suitable examples. [06]
- (B) A cold storage is to be maintained at -5°C while the surroundings are at 35°C . The heat leakage from the surroundings into the cold storage is estimated to be 29 kW. The actual C.O.P. of the refrigeration plant is one-third of an ideal plant working between the same temperatures. Find the power required to drive the plant. [06]
- (C) Define the following : [04]
- (a) Heat Engine
 - (b) Heat Pump

UNIT - II

- Q.3) (A) Explain with a neat diagram the working cycle of Open Cycle Gas Turbine. [06]
- (B) Describe with a block diagram and state the applications of the following : [10]
- (a) Single Acting Reciprocating Pump
 - (b) Reciprocating Air Compressor

OR

- Q.4) (A) Explain the working principle of Split Air Conditioner with a neat labelled diagram. [06]
- (B) How does the Internal Combustion Engines are classified ? List out the advantages and disadvantages of a Two Stroke Cycle Engine over a Four Stroke Cycle Engine. [10]

UNIT - III

- Q.5) (A) Derive an expression for heat conduction through an infinitely long hollow cylinder. [06]

- (B) A 20 mm external diameter copper wire is used to carry heated water, the external surface of the pipe is subjected to a convective heat transfer coefficient of $h = 6 \text{ W/m}^2\text{K}$, find the heat loss by convection per meter length of the pipe when the external surface temperature is 80°C and the surroundings are at 20°C . Assuming the black body radiation, what is the heat loss by radiation ? [06]
- (C) Explain the working of a Steam Power Plant with a neat sketch. [06]

OR

- Q.6) (A) What is Thermal Resistance ? Explain the Electrical Analogy for heat transfer through a two layer composite slab. [06]
- (B) An industrial freezer is designed to operate with an internal air temperature of -20°C when the external temperature is 25°C and the internal and external heat transfer coefficients are $12 \text{ W/m}^2\text{K}$ and $8 \text{ W/m}^2\text{K}$ respectively. The walls of the freezer are composite construction, comprising of an inner layer of plastic ($k = 1 \text{ W/mK}$, and thickness of 3mm), and an outer layer of stainless steel ($k = 16 \text{ W/mK}$ and thickness of 1mm). Sandwiched between these two layers is a layer of insulation material with $k = 0.07 \text{ W/mK}$. Find the width of the insulation that is required to reduce the convective heat loss to 15 W/m^2 . [08]
- (C) State the advantages and disadvantages of Nuclear Power Plants. [04]

SECTION - II

UNIT - IV

- Q.7) (A) Explain the following with a neat labelled diagrams : [06]
- Woddruff Key
 - Flat Saddle Key
 - Gib Head Key
- (B) Distinguish between Kinematic Pair and Kinematic Chain with an example for each. [06]
- (C) What are the advantages and disadvantages of Belt Drives ? [04]

OR

- Q.8)** (A) What is a Clutch ? Explain with a neat diagram the working of a Single Plate Clutch. [07]
(B) What is a Brake ? How brakes are classified ? Explain with a neat diagram the working of Shoe Brake. [09]

UNIT - V

- Q.9)** (A) Explain the steps to be followed in design process with a neat flow chart. [06]
(B) Define the following Mechanical Properties of Metals : [04]
(a) Malleability
(b) Resilience
(c) Toughness
(d) Hardness
(C) Write a short note on Ergonomic Considerations in Design. [06]

OR

- Q.10)** (A) Explain the basic Sand Casting Process with a neat labelled diagram. [06]
(B) Explain the following with neat diagrams : [06]
(a) Perforating
(b) Angle Bending
(c) Notching
(C) Distinguish between Welding and Brazing. [04]

UNIT - VI

- Q.11)** (A) Explain with neat diagrams, any four Metal Cutting Operations performed on a Lathe Machine. [08]
(B) Draw a neat labelled diagram of a Reciprocating Power Saw. [06]
(C) What are the advantages and disadvantages of CNC Machines ? [04]

OR

- Q.12)** (A) Explain with neat diagrams, any three Machining Operations performed on a Drilling Machine. [06]
(B) Explain in brief the basic elements of a CNC Machine Tools. [06]
(C) Draw neat labelled diagrams for the following Machining Operations performed on a Milling Machine : [06]
(a) Keyway Milling
(b) Plain Milling