

**B.Tech. Civil (Construction Management) /  
B.Tech. Civil (Water Resources Engineering) /  
B.Tech. (Aerospace Engineering)**

**Term-End Examination**

00983

**December, 2018**

**ET-201(B) : ENGINEERING THERMODYNAMICS**

*Time : 3 hours*

*Maximum Marks : 70*

*Note : Answer any five questions. All questions carry equal marks. Use of steam tables and scientific calculator is permitted.*

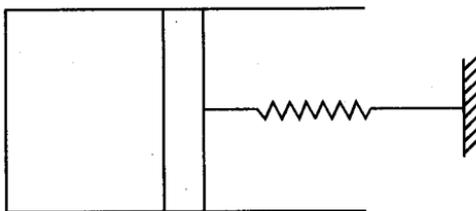
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1. (a) Define thermodynamic system. Explain its types with suitable examples. 7
  - (b) Define thermal equilibrium. State and explain the Zeroth law of thermodynamics. 7
  2. (a) Derive the equation for the work done in Isothermal process. 7
  - (b) Explain the Joules experiment with neat sketch. 7

3. (a) Define thermodynamic reversibility. Under what conditions is a process said to be reversible? Explain.

7

(b) A piston-cylinder device as shown in Figure 1 contains a gas at 200 kPa and  $0.0015 \text{ m}^3$ . At this initial state, the spring does not exert any force on the piston. Now the gas is heated to double its volume. The pressure at this state is 600 kPa. Draw the P-V diagram for the process. Also, calculate the work done by the gas.

7



*Figure 1*

4. (a) Explain the Kelvin-Planck statement of the second law of thermodynamics.

7

(b) The efficiency of a Carnot engine rejecting heat to a cooling pond at  $28^\circ \text{C}$  is 30%. If the cooling pond receives  $1050 \text{ kJ/min}$ , what is the power developed by the cycle in kW? Also find the temperature of the source.

7

5. (a) Describe a simple vapour compression refrigeration cycle with the help of block diagram. 7
- (b) A four-cylinder engine working on Otto cycle has a swept volume of  $2000 \text{ cm}^3$  and the clearance volume in each cylinder is  $60 \text{ cm}^3$ . Determine the cycle efficiency. If the air at the beginning of the compression stroke is at  $100 \text{ kPa}$  and  $300 \text{ K}$  and the maximum cycle temperature is  $1650 \text{ K}$ , determine the mean effective pressure of the cycle. 7
6. (a) Explain the phenomenon of the heat transfer by convection. State Newton's law of cooling. 7
- (b) What is a steam condenser ? State its function. 7
7. (a) Define entropy. Explain the principle of increase of entropy. 7
- (b) Define COP of a refrigerator. Prove that  $\text{COP}_{\text{HP}} = 1 + \text{COP}_{\text{ref}}$  7

8. Write short notes on any **four** of the following :

$$4 \times 3 \frac{1}{2} = 14$$

- (a) Intensive and extensive properties of thermodynamics
  - (b) Inter cooling
  - (c) Heat pump
  - (d) Throttling process
  - (e) Cooling tower
  - (f) Open system
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