Hall Ticket No | | | | | | | | | | | Question Paper Code: AME007

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Supplementary) - July, 2018

Regulation: IARE – R16

APPLIED THERMODYNAMICS

Time: 3 Hours **(ME)** **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Explain the working of a 4 stroke CI engine with the help of valve timing diagram. **[7M]**
   (b) Discuss the requirement of cooling and lubrication in an IC engine? **[7M]**
2. (a) Describe the working principle of a 2-stroke SI engine with help of neat diagram. **[7M]**
   (b) What is the function of fuel feed pump of CI engine fuel injection system and explain its working in detail. **[7M]**

UNIT – II

3. (a) What is meant by abnormal combustion and explain the phenomena of knocking in SI engine? **[7M]**
   (b) Explain the effect of various engine parameters on knocking characteristics of SI engine. **[7M]**
4. (a) Detailed the stages of combustion in CI engine with help of p-θ diagram. **[7M]**
   (b) What are the important qualities of SI engine fuel and explain how to rate it? **[7M]**

UNIT – III

5. (a) What are the various methods to determine the brake power of an IC engine and explain about Prony brake method? **[7M]**
   (b) The following details were noted in a test on a 4 cylinder four stroke engine, diameter = 100 mm; stroke = 120 mm; speed of engine = 1600 rpm; fuel consumption = 0.2 kg/min; calorific value of fuel is 44000kJ/kg; difference in tension on either side of the brake pulley is 40 kg; brake circumference is 300 cm. if the mechanical efficiency is 80% calculate, brake power, indicated power, frictional power, brake thermal efficiency and indicated thermal efficiency. **[7M]**
6. (a) Differentiate fan, blower and compressor with its operating conditions. **[7M]**
   (b) A test on a single cylinder, 4 stroke oil engine having a bore of 15 cm and stroke 30 cm gave the following results: speed 300 rpm; brake torque 200 Nm; indicated mean effective pressure 7 bar; fuel consumption 2.4 kg/hour; cooling water flow 5 kg/min; cooling water temperature rise 35^0C; air fuel ratio 22; exhaust gas temperature 410^0C; barometer pressure 1 bar; room temperature 20^0C. Calorific value of fuel is 42000 kJ/kg; Specific heat of exhaust gas 1 kJ/kg and R=0.287kJ/kg.K. Draw up a heat balance in terms of kJ/min. **[7M]**

UNIT – IV

7. (a) Classify rotary compressors and explain the working principle of roots blower. **[7M]**

   (b) A centrifugal blower compresses $4.8m^3/s$ of air from 1 bar and 20^0C to 1.5 bar. The index of compression is 1.5. The flow velocity at inlet and outlet is same and equal to 65 m/s. The inlet and outlet impeller diameters are 0.32 m and 0.62 m respectively. The blower rotates at 8000 rpm. Calculate the work done and blade angles at inlet and outlet. Assume that there is no diffuser and total pressure rise takes place in impeller itself. **[7M]**

8. (a) Describe the construction and working of axial flow compressor. **[7M]**

   (b) Write short notes on the following related to axial flow compressor **[7M]**

   i. Degree of reaction,
   ii. Polytropic efficiency,
   iii. Flow coefficient
   iv. Work coefficient

UNIT – V

9. (a) What is an air refrigeration system and how the Bell-Coleman air refrigeration system works? Explain in detail. **[7M]**

   (b) A refrigerant machine operates between -15^0C and 30^0C and circulates the refrigerant at the rate of 4.5 kg/min. The temperature of refrigerant gas after is entropic compression is 75^0C. Determine

   i. COP of the system **[7M]**
   ii. Ice produced in kg/hour from water at 20^0C and ice at -5^0C
   iii. Quantity of refrigerant entering the compressor in m^3/min.

   Take Specific heat of refrigerant gas = 2.82 kJ/kg K
   Specific heat of ice = 2.1 kJ/kg K
   Specific heat of water = 4.2 kJ/kg K
   Latent heat of ice = 336 kJ/kg
   Use the refrigerant properties listed in Table 1.

Table 1

Ts	Specific volume m^3 kg		Enthalpy kJ/kg		Entropy (kJ/kig K)	
(^oC)	v_f	v_g	h_f	h_g	s_f	s_g
-15	0.00152	0.509	112.3	1426	0.457	5.549
30	0.00158	0.111	32.31	1469	1.204	4.984

10. (a) Draw the neat compact diagram of vapor absorption refrigeration system and explain its working. **[7M]**

    (b) Name three refrigerants that are commonly used in commercial refrigerants. Discuss their merits and demerits. **[7M]**

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