R13

Code No: 114DU

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year II Semester Examinations, May - 2016

THERMAL ENGINEERING-I

(Common to ME, AME)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Differentiate two stroke and four stroke engines. [2]
b) Draw the valve time diagram of a 4-stroke diesel engine. [3]
c) How can you rate the fuels? [2]
d) Why compression ratio is restricted to maximum 12 in case of petrol engines? [3]
e) Define volumetric efficiency of reciprocating compressor. [2]
f) What is the effect of clearance on the performance of reciprocating compressor? [3]
g) During steady flow compression process of a gas with a mass flow rate of 2 kg/s, increase in specific enthalpy is 15 kJ/kg and decrease in kinetic energy is 2 kJ/kg. The rate of heat rejection to the environment is 3 kW. What is the power needed to drive the compressor? [2]
h) Explain the importance of volumetric efficiency of a compressor. [3]
i) What is the minimum amount of work input to a refrigerator which convert 1 kg of water at 293 K into ice at 268 K while maximum COP of refrigerator is 10. [2]
j) What are the reasons for R-12 is replaced by R-134 -a? [3]

PART-B

(50 Marks)

2.a) Briefly discuss the various factors which affect the ignition timing in SI engine.
b) Explain TCI ignition system with a neat sketch. [4+6]

OR

3.a) What are the functional requirements of an injection system? Discuss them.
b) With a neat diagram bring out clearly the working principle of a pneumatic governer. [4+6]

4.a) Explain the various factors that influence the flame speed.
b) With the help of a neat diagram explain the working principle of indirect injection combustion chamber of a C.I. engine? [4+6]

OR

5.a) What is delay period and what are the various factors that affect the delay period?
b) Bring out clearly the process of combustion in C.I. Engines and also explain the various stages of combustion. [4+6]

6.a) Develop an expression for the calculation of indicated power of an engine.

b) A 4 cylinder, 4 stroke gasoline engine having a bore of 80 mm and stroke of 90 mm has a compression ratio of 8. The relative efficiency is 65% when indicated fuel specific consumption (ifsc) is 200 gm/kwhr. Estimate:

i) Calorific value of fuel

ii) Corresponding fuel consumption, given that indicated mean effective pressure (imep) is 7.5 bar and speed is 2000 RPM. [4+6]

OR

7.a) Schematically explain the use of the study of heat balance of an engine?

b) A 4 cylinder, gasoline engine operates on 4 stroke cycle. The bore of each cylinder is 90 mm and the stroke is 110 mm. The clearance volume per cylinder is 60 C.C. At a speed of 3500 RPM, the fuel consumption is 18 kg/hr and the torque developed is 140 N-m. Calculate i) Brake power ii) Bmep iii) Brake thermal efficiency if the calorific value of the fuel is 42,000 kJ/kg iv) relative efficiency on a brake power basis assuming the engine works on the constant volume cycle. [4+6]

8.a) Derive an expression for efficiency of a root blower in terms of pressure ratio and ratio of specific heats.

b) A rotary air compressor compresses 100 kg of air/minute from 1.2 bar and 293 K to 4.8 bar. Find the power required to drive the compressor, if the compression is isentropic and follows $pv^{1.3}$=constant. [4+6]

OR

9.a) Define “pre whirl”. Explain its effect on the impeller of a centrifugal pump.

b) Compare the work inputs required for roots blower and a vane type compressor having the same induced volume of 0.03 m^3 per revolution, the inlet pressure being 1.013 bar and the pressure ratio 1.5 to 1. For vane type, assume the initial compression takes place through half the pressure range. [4+6]

10.a) What are the desirable properties of an ideal refrigerant? Explain.

b) In a 15 TR ammonia refrigeration plant, the condensing temperature is 25^0 C and evaporating temperature is -10^0 C. The refrigerant ammonia is sub cooled by 5^0 C before passing through the throttle valve. The vapor leaving the evaporator is 0.97 dry. Find COP and power required to drive the plant? Take C_{Pl} = 4.6 kJ/kg-K, C_{PV} =2.8 kJ/k g-K respectively. [4+6]

OR

11.a) Explain the working principle of Libr-Water vapor absorption refrigeration system with a neat sketch.

b) The bore and stroke of a single cylinder, single acting reciprocating compressor using R-134-a refrigerant are 100 mm and 80 mm respectively. The compressor runs at 1500 RPM. If the condensing temperature is 40^0C and evaporator temperature. a) 10^0 C b) -10^0 C.

Find the following:

i) Mass of refrigerant circulated per minute

ii) refrigerating capacity

iii) power per ton of refrigeration

iv) Total power required to drive the compressor. Determine the changes in results when the compression index is 1.25 and clearance factor is 5%? [4+6]

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