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Code No: 114DU

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, May - 2015
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) How the fuel injection system function in CI Engine? [2M]
b) What is the importance of valve and port timing diagrams of I C Engines. [3M]
c) What are different power loss resources during combustion of SI Engine? [2M]
d) Explain the importance of heat release rate in the combustion process of CI Engine. [3M]
e) What is the method adopted to measure air fuel ratio of an I C Engine. [2M]
f) Why multi stage compression is required? Explain. [3M]
g) What is dynamic compressors? Explain the significance. [2M]
h) Why the axial compressors are more suitable for gas turbines? Explain. [3M]
i) What is COP of refrigeration system? Explain the importance. [2M]
j) What are the commonly used refrigerants in vapour compression system? [3M]

PART-B

(50 Marks)

2.a) Describe the optimum opening position of exhaust vale to reduce the exhaust blow down loss in S I Engine.
b) From the point of view of fuel air cycle analysis how does fuel air ratio effect the efficiency, maximum power, temperature and pressure of the cycle. [5+5]

OR

3.a) Draw the diagram of A/F ratio versus throttle opening for different operating conditions of simple carburetor and explain salient features.
b) What are the limitations of simple carburetor and how to rectify them? Explain. [5+5]

4.a) Discuss the effect of turbulence and compression ratio on the combustion characteristics in S.I. Engine.
b) What is the instrument used for the measurement of knocking? Explain the influence of operating parameters on knocking in S.I.Engine. [5+5]

OR

5.a) How to create turbulence in C.I. Engine combustion chamber in order to get better mixing air fuel? Explain in detail.
b) What are different additives to be added in C.I.Engine? Explain the use of additives. Describe the influence of these additives on performance. [5+5]

6.a) A single cylinder, four-stroke gas engine has a bore of 180 mm and a stroke of 330 mm and is governed on the hit and miss principle. When running at 400 rpm at full load indicator card are taken which give a working loop mean effective pressure of 6 bar and a pumping loop mean effective pressure of 0.4 bar. Diagrams fro the dead cycle give a mean effective pressure of 0.6 bar. When running on no load a mechanical counter recorded 50 firings strokes per minute. Calculate at the full load with regular firing, brake power and the mechanical efficiency of the engine.

b) Differentiate among fans, blowers and compressors. [8+2]

OR

7.a) A six-cylinder four-stroke, direct-injection oil engine is to deliver 120 kW at 1600 rpm. The fuel to be used has a calorific value of 43 MJ/kg and its percentage composition by mass is carbon 86%, hydrogen13%, and non combustibles 1%. The absolute volumetric efficiency is assumed to 80%, the indicated thermal efficiency 40% and the mechanical efficiency 80%. The air consumption to be 110% in excess of that required for theoretically correct combustion. i) Estimate the volumetric composition of dry exhaust gas, ii) Determine the bore and stroke of the engine, taking a stroke to bore ratio as 1.5. Assume the volume of 1 kg of air at the given conditions as $0.77m^3$.

b) Explain the working principle of vane type rotary compressor along with a diagram. [8+2]

8.a) 20 m^3 of air per second at 1 bar 15^oC is to be compressed in a centrifugal compressor through a pressure ratio of 1.5:1. The compression follows the law $PV^{1.5}$ = constant. The velocity of flow at inlet and out let remains constant and is equal to 60 m/s. If the inlet and outlet impeller diameters are 0.6 m and 1.2 m respectively and rotates at a speed of 5000 rpm. Find (i) the blade angles at inlet and outlet of the impeller, and the angle at which the air from the impeller enters the casing; (ii) breadth of impeller blade at inlet and outlet.

b) Define and discuss the terms power input factor and adiabatic coefficient with respect to the rotary compressor. [7+3]

OR

9.a) Air at 1.01325 bar and 288 K enters an axial flow compressor stage with an axial velocity of 150 m/s. There are no inlet guide vanes. The rotor stage has a tip diameter of 60 cm and a hub diameter of 50 cm and rotates at 100 rps. The air enters the rotor and leaves the stator in the axial direction with no change in its velocity or radius. The air is turned through 30.2^0 as it passes through the rotor. Assume a stage pressure of 1.2, calculate power required and degree of reaction.

b) What is the importance of velocity triangles in power generation? Explain. [7+3]

10.a) Explain the important parameters influence the performance of air refrigeration system.

b) An ammonia refrigeration plant operates between a condenser temperature of 42^0C and an evaporator temperature of -2^0C. The vapour is superheated with a degree of superheat 10^0 C at the end of end of compression. The specific heat of ammonia is 2.16 kJ/kg K. Calculate net refrigeration effect, work required and coefficient of performance. [2+8]

OR

11.a) Differentiate between vapour compression refrigeration system with vapour absorption refrigeration system.

b) In an open type of refrigerating installation, 1000 kg of atmospheric air are circulated per hour. The air is drawn from the cold chamber at temperature 7^{o}C and 1 bar and then compressed isentropic ally to 5 bars. It is cooled at this pressure to 27^{o}C and then led to the expansion where it expands isentropically down to atmospheric pressure and is discharged to cold chamber. Find the followings. i) Heat extracted from cold chamber per hour. ii) Heat rejected to cooling water per hour. iii) C.O.P of the system. Take for air γ =1.4 and C_p =1 kJ/kg K. [3+7]

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