R16

Code No: 135BP

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, May/June - 2019
THERMAL ENGINEERING – I
(Mechanical Engineering)

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)	List out the differences between the SI engine and CI engine.	[2]
b)	What is valve overlap period? Explain its significance.	[3]
c)	List out various factors influencing delay period.	[2]
d)	Discuss about indirect injection combustion chambers.	[3]
e)	Define isothermal efficiency of air compressor.	[2]
f)	List out the advantages of reciprocating compressors	[3]
g)	Why the axial compressors are more suitable for gas turbines? Explain.	[2]
h)	Explain the concept of slip factor in centrifugal compressor.	[3]
i)	What is COP of refrigeration system? Explain the importance.	[2]
j)	What are the commonly used refrigerants in vapour compression system?	[3]

PART - B

(50 Marks)

2.a) Why the actual cycle efficiency is much lower than the air standard cycle efficiency? List the major losses in the actual engine.
b) What are the important requirements of fuel injection system in a C.I Engine? [5+5]

OR

3.a) Describe the evaporative cooling system with a neat sketch.
b) Describe the working of pressure feed lubrication system with a neat sketch. [5+5]

4.a) Discuss the various methods for improving the anti-knock quality of an SI engine.
b) With the help of graph, explain the factors which influence the flame speed in an S.I.engine. [5+5]

OR

5.a) What is Physical delay? Discuss the factors that affect the delay period in a C.I. engine.
b) Explain the phenomenon of knock in CI engine and compare it with SI engine knock. [5+5]

6.a) Explain Rope brake dynamometer to determine the brake power of an engine?

b) The following date was recorded during testing of a four stroke cycle gas engine. Area of indicator diagram = 900 mm^2; Length of indicator diagram = 70 mm; spring scale = 0.3 bar/mm; Diameter of piston = 200 mm; Length of stroke = 250mm; Speed = 300 rpm. Determine i) Indicated mean effective pressure ii) Indicated power. [5+5]

OR

7.a) Derive the expression for work done when compression is isentropic for a single stage reciprocating air compressor.

b) A single acting two stage reciprocating air compressor compresses 4.5 kg of air per minute from 1.013 bar and 15^0 C through a pressure ratio of 9. The intercooling is perfect and the law of compression and expansion $PV^{1.3}$ = constant. Assuming the clearance volumes of both stages 5% of their swept volume and the speed of compressor 300 rpm, calculate the indicated power and the cylinder swept volume. [5+5]

8.a) With a neat sketch explain the working of roots blower and derive the expression for roots efficiency.

b) A centrifugal air compressor having isentropic efficiency of 70% receives air at 17^0C. If the outer diameter of the blade tip is 1 m and the compressor runs at 5000 rpm find:(i) The temperature rise of the air and (ii) the static pressure ratio. [5+5]

OR

9.a) What is degree of reaction? Derive the expression for degree of reaction for axial flow compressor.

b) A multistage axial compressor is required for compressing air at 293 K through a pressure ratio of 5 to 1. Each stage is to be 50% reaction and the mean blade speed 275 m/s, flow coefficient 0.5, and stage loading factor 0.3, are taken, for simplicity, as constant for all stages. Determine the flow angles and the number of stages required if the stage efficiency is 88.8%. Assume C_P =1.005 kJ/kg K and γ= 1.4 for air. [5+5]

10.a) Explain the working of Vapour compression refrigeration system with a neat diagram.

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 10^0C at the end of end of compression. The specific heat of ammonia is 2.16 kJ/kgK. Calculate net refrigeration effect, work required and coefficient of performance. [5+5]

OR

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

b) A Bell-Coleman refrigerator works between 4 bar and 1 bar pressure limits. After compression, the cooling water reduces the air temperature to 17^0C. What is the lowest temperature produced by the ideal machine? Compare the coefficient of performance of this machine with that of the ideal Carnot cycle machine working between the same pressure limits, the temperature at the beginning of compression being -13^0 C. [5+5]

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