906 Register No.:

April 2019

Time – Three hours
(Maximum Marks: 75)

(N.B: (1) Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory. Answer any FOUR questions from the remaining in each PART – A and PART – B

(2) Answer division (a) or division (b) of each question in PART – C.

(3) Each question carries 2 marks in PART – A, 3 marks in Part – B and 10 marks in PART – C.

(4) Use of Steam tables and Mollier charts are permitted.)

PART – A

1. Define point function. Give two examples.
2. State Boyle's law and Charles' law.
3. What is Octane number? What is its significance?
4. Define the term free air delivered.
5. State any two liquid fuels used for rocket propulsion.
6. Name the impurities present in feed water.
7. Define (i)Boiler efficiency (ii)Boiler power.
8. Calculate the internal latent heat of 1 kg of dry saturated steam under a pressure of 15 bar.

PART – B

9. Define the terms system, boundary and surroundings.
10. State and explain the Kelvin Planck statement of the second law of thermodynamics.
11. Draw the actual p-V diagram of Otto cycle and indicate the various strokes.
12. What is detonation? State the various factors that influence detonation.
13. Explain with a neat sketch the working of a vane blower.
14. Compare the reciprocating air compressor with the rotary compressor.

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15. What is meant by boiler mountings? Name any three mountings.

16. Steam is at a pressure of 8 bar absolute and 0.8 dry. This is reheated to 12 bar absolute and 300°C. Find the change in enthalpy.

PART – C

17. (a) 0.35m^3 of air at 22°C and under atmospheric pressure is heated at constant volume to a temperature of 100°C. Determine (i)Mass of air, (ii)The final pressure, (iii)Heat transfer, (iv)The change in internal energy, (v)The work done (vi)the change in enthalpy and (vii)The change in entropy. Assume $C_p = 1.0\ kJ/kg\ K$ and $C_v = 0.717\ kJ/kgK$.

(Or)

(b) 0.675 kg of a gas at 14 bar and 280°C is expanded to four times the original volume according to the law $pv^{1.32} = constant$. Determine (i)The initial and final volumes of the gas, (ii)The final pressure and temperature of the gas, (iii)The work done and heat transfer of the gas and (iv)The change in entropy. Assume R=287 J/kgK and γ=1.4.

18. (a) A perfect heat engine working on a Carnot cycle converts 1/6th of the heat input into work. When the temperature of the sink is reduced by 62°C, the efficiency is doubled. Find the temperature of the sink and the source.

(Or)

(b) In an Otto engine the pressure and temperature at the beginning of compression are 1 bar and 37°C respectively. Calculate the theoretical efficiency of this cycle if the pressure at the end of adiabatic compression is 15 bar. Peak temperature during the cycle is 2000K. Determine (i)Heat supplied per kg of the air, (ii)The work done per kg of air and (iii)The pressure at the end of adiabatic expansion. Take γ=1.4 and $C_v = 0.717\ kJ/kgK$.

19. (a) Explain with a neat sketch the working of a ram-jet. State its applications and advantages.

(b) Estimate the power consumption of a single stage double acting reciprocating air compressor, given the following particulars.

Cylinder diameter	- 280 mm
Stroke	- 200 mm
Clearance volume	- 3% of stroke volume
Delivery pressure	- 7.5 bar
Suction pressure	- 1 bar
Speed	- 350 rpm

The compression and expansion curves follow the law $pV^{1.3}$ = constant.

(Or)

20. (a) One kg of water at 95°C is heated under a constant pressure of 17.5 bar absolute until it is converted into steam with dryness fraction 0.98. Determine the change in volume, change in enthalpy, change in entropy, change in internal energy, the work done and heat added.

(Or)

(b) Steam at 10 bar and 0.925 dry is contained in a vessel of volume 1m^3. The delivery valve is opened and the steam is blown off. The period of blowing is so regulated that the total heat per kg of steam in the vessel remains constant during the blowing off period and pressure drops to 5 bar. Estimate the mass of steam blown off.

21. (a) Explain with a neat sketch the working of Lamont boiler and state its demerits.

(Or)

(b) In a boiler trial, the following observations were made:

Pressure of steam	-	10 bar absolute.
Steam generated	-	540 kg per hr.
Fuel used	-	65 kg per hr.
Moisture in fuel	-	2% by weight.
Mass of flue gasses	-	9 kJ/kg of fuel.
Temperature of the flue gases	-	325°C
Temperature of the boiler house	-	28°C
Feed water temperature	-	50°C
Dryness fraction of steam	-	0.95
Mean specific heat of flue gases	-	1.005 kJ/kgK.
Calorific value of fuel	-	34000 kJ/kg.

Determine the equivalent evaporation from and at 100°C and craw up a heat balance sheet for the boiler.