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BOARD DIPLOMA EXAMINATION, (C-09)
MARCH/APRIL - 2019
DIPLOMA IN MECHANICAL ENGINEERING
THERMAL ENGINEERING-I
THIRD SEMESTER EXAMINATION

Time: 3 Hours **Total Marks: 80**

PART - A (10 x 3 = 30 Marks)

Note 1:Answer all questions and each question carries 3 marks

2:Answers should be brief and straight to the point and shall not exceed 5 simple sentences

1. From the equation $dH=mC_p (T_2-T_1)$, what do you mean by 'dH' and 'C_P'?
2. Obtain the unit of 'R_u' from characteristic gas equation.
3. 1 kg of an ideal gas is contained in a rigid cylinder at 305^0K. If 21.1 kJ of heat is added to the gas, determine the final temperature. Take R = 0.317 kJ/kg^{0}K and $\gamma = 1.26$
4. A constant volume chamber of 0.4m^3 capacity contains 2kg of a gas at 10^0C. Heat is transferred to the gas until the temperature is 100^0C. Find change in entropy. Take C_p=1.973 kJ/kg^{0}K and C_v=0.1511 kJ/kg^{0}K.
5. Write Dulong's formula for HCV. What is the significance of '9270' in the formula?
6. LCV = HCV – Ms 2466 KJ/Kg. What is the significance of '2466' in the above formula?
7. Determine the air standard efficiency of Otto cycle when the compression ratio is 7.
8. Determine the specific entropy of superheated steam at 12bar and 310^0C.
9. Calculate the change in entropy from wet steam of 0.75 dry to dry saturated steam at a pressure of 7 bar.
10. A refrigeration system requires 1.5KW per ton of refrigeration find the COP of the system.

PART - B (5 x 10 = 50 Marks)

Note 1:Answer any five questions and each question carries 10 marks

2:The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer

11. A fluid is kept in a cylinder by a spring loaded frictionless piston so that the pressure in the fluid is a linear function of the volume as indicated by law P=a + bv. If the fluid changes from initial state of 170 kPa, 0.03m^3 to final state of 400kpa, 0.06m3 with no work other than that done by the piston. Find the direction and magnitude of the work.
12. One kg of air occupies 0.5 m^3 at 2bar and 427^0C. It is then compressed isothermally to a final volume of 0.1m^3. Calculate (a) pressure at the end of compression (b) work done during compression (c) change in internal energy (d) heat transfer
13. The values of specific heats at constant volume and constant pressure of an ideal gas are 0.73 kJ/kg^{0}K and 0.98kJ/kg^{0}K respectively. If one kg of this fuel is heated at constant pressure from 30^0C to 250^0C, calculate
    (a) The heat added (b) Ideal work done (c) Change in internal energy
14. A flue gas consists of 18% CO_2, 3% CO, 5% O_2 and 80% N_2 by volume. Convert this volumetric analysis to mass analysis.

15. An engine operates on Otto cycle with the following data
Maximum temperature = 1200 ºC
Exhaust temperature = 427 ºC
Ambient conditions = 1bar and 27 ºC.
Find the compression ratio, maximum pressure and efficiency

16. Dry and saturated steam is cooled in a closed vessel with volume $3m^3$ from initial pressure 9bar to final pressure 1 bar, Find (a) Mass of steam (b) Final condition of steam (c) Heat transferred

17A. A gas air fuel supplied to an engine has a gas constant of $0.7kJ/kg^0K$ and its pressure is measured as 80 mm water gauge when the barometer reading is standing at 760 mm Hg. The temperature of the fuel is 30^0C. Find the volume per kg of fuel.

B. An engine working on the Carnot cycle has maximum and minimum temperature of 1300ºC and 300ºC. Determine the efficiency and the heat supply per minute when the output is 20 KW.

18A. The capacity of a refrigerator is 150 TR. Determine the quantity of ice produced at -3ºC within 24hrs when water is supplied at a temperature of 15ºC. Take specific heat of ice = 2.1 KJ/Kgº K

B. A cold storage is supplied with 3000Kg of fish at 26ºC. The fish has to be cooled to -9ºC .The freezing points of fish is -3ºC.
Specific heat of fish above freezing point = 3 KJ/Kgº K
Specific heat of fish below freezing point = 1.25 KJ/Kgº K
Latent heat of freezing of fish = 210KJ/Kgº K.
If the capacity of the plant is 15 tons, how long it will take to cool the fish.

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