C14-M-**304**

4252

BOARD DIPLOMA EXAMINATION, (C-14)

MARCH /APRIL-2019

DME - THIRD SEMESTER EXAMINATION

BASIC THERMODYNAMICS

Time: 3 hours Max. Marks: 80

PART-A

10x3=30M

Instructions: 1) Answer **all** questions.
2) Each question carries **three** marks.
3) Answers should be brief and straight to the point.

1) State the first law of thermodynamics and give its mathematical representation.

2) A tank containing air is stirred by a paddle wheel. The work input to the tank is 1000 KJ, and heat transferred from the tank is 400 KJ. Calcalute the change in internal energy.

3) State the Clausius statement of Second law of thermodynamics.

4) State the following laws
(a) Joule law and (b) Regnault's law

5) State the terms invovled in the equation $Cp = \frac{\gamma R}{\gamma - 1}$

6) Represent Isentropic process on P-v and T-s Diagram.

7) Define the term Entropy and write its mathematical expression.

8) List out any six desired characteristics of fuel.

9) Write down any three advantages and disadvantages of liquid fuels over solid fuels.

10) Find higher and lower calorific values of given coal having C=90%, H_2 =5%, S=1% and the remaining is ash by mass.

PART-B

5x10=50M

Instructions: 1) Answer any **five** questions.
2) Each question carries **ten** marks.
3) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11) A system undergoes a cycle composed of four processes and the energy transfers are tabulated below

Process	Q(kj/min	W(kj/min)	du(kj/min)
1-2	550	230	-
2-3	230	-	380
3-4	-500	-	-
4-1	0	70	-

(a) Complete the table and
(b) Determine the rate of work in kW.

12) (a) A closed system executes a process during which 10 KJ of heat is supplied to system. Find the change in internal energy under the following conditions
(i) 5 KJ of work is done on the system
(ii) 2.5 KJ of work is done by the system.

(b) Carbon dioxide (Molecular weight =44) occupies a tank of 100°C. If the volume of the tank is 0.5m^3 and the pressure is 500 kPa. Determine the mass of the gas in the tank.

13) 2.5 kg of an ideal gas is expanded from a pressure of 700 KPa and volume 1.5 m^3 to a pressure of 140 KPa and volume of 4.5 m^3. The change in internal energy is 500 KJ. Specific heat at constant volume for the gas is 0.719 KJ/ kg-k. Determine
(a) Gas constant and
(b) Initial and final temperatures.

14) 1 kg of air at 1 bar and 27°C compressed polytropically to a pressure of 15 bar, and air temperature rises to 227°C. Determine
(a) The polytropic index
(b) The final volume
(c) The work compression and
(d) The amount of heat rejected from the air Assume R=0.287 KJ/kg.k

15) 0.12m^3 of air at 1.5 MPa and 1500°C expands adiabatically to 175 KPa. Find the
(i) Final temperature and
(ii) Workdone
Take C_P =1.005 KJ/kg.K:C_v = 0.717 KJ/kg.K

16) 1 kg of air expands isothermally at a constant temperature of127°C. Find the work done if the initial pressure is 207 KN/m^2 and the final pressure is 69 KN/m^2. Assume R=0.287 KJ/kg.K.

17) Explain the working principle of junkers gas calorimeter with a neat sketch.

18) The composition of a fuel on mass basis as follows C=90%, H_2=3.5%,O_2=1%,S=0.5% and N_2=5%.

(a) Calculate the minimum air required for complete combustion of 1kg of this fuel.

(b) The composition of dry fuel gases on mass basis considering 50% of excess air is supplied.

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