B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Third Semester

Electronics and Instrumentation Engineering

20ESME301 – APPLIED THERMODYNAMICS AND FLUID MECHANICS

Regulations - 2020

(Use of Steam Tables and Mollier Diagram is permitted)

Duration: 3 Hours   Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)
Answer ALL Questions

		Marks	K–Level	CO
1.	The enthalpy of a substance(denoted by h), is defined as	1	K1	CO1
	(a) h=u-pv (b) h=u+pv (c) h=-u+pv (d) h= -u-pv			
2.	All natural processes are	1	K1	CO1
	(a) Reversible (b) Irreversible (c) Isothermal (d) None			
3.	The gas turbine works on	1	K1	CO2
	(a) Rankine cycle (b) Otto cycle (c) Carnot cycle (d) Brayton cycle			
4.	In Brayton cycle, heat added at	1	K1	CO2
	(a) Constant temperature (b) Constant volume			
	(c) Constant pressure (d) Constant enthalpy			
5.	Lancashire boiler has _____ internal flue tubes.	1	K1	CO3
	(a) One (b) Two (c) Three (d) Four			
6.	Which of the following is not boiler accessory?	1	K1	CO3
	(a) Economizer (b) Safety valve (c) Air pre-heater (d) Super-heater			
7.	The similarity between model and prototype with the same shape is known as	1	K1	CO4
	(a) Geometric similarity (b) Kinematic similarity			
	(c) Dynamic similarity (d) Conditional similarity			
8.	The square root of the ratio of inertia force to surface tension is known as	1	K1	CO4
	(a) Mach number (b) Froude number (c) Reynold's number (d)Weber number			
9.	What is the atmospheric pressure at sea level?	1	K1	CO5
	(a) 98.1 N/cm^2 (b) 9.81 N/cm^2 (c) 101.3 kN/m^2 (d) Zero			
10.	The inlet passage of water entry is controlled by	1	K1	CO6
	(a) Head race (b) Gate (c) Tail race (d) Pump View			

PART - B (12 × 2 = 24 Marks)
Answer ALL Questions

		Marks	K–Level	CO
11.	Write down the sign conventions for heat and work transfers.	2	K2	CO1
12.	Write the expression for COP of a heat pump and a refrigerator.	2	K2	CO1
13.	Define air standard efficiency.	2	K1	CO2
14.	Write the different processes involved in Otto Cycle.	2	K2	CO2
15.	Explain the functions of : (i) Economizer; (ii) Super Heater.	2	K2	CO3
16.	What are the assumptions made in air standard cycle?	2	K1	CO3
17.	Determine the dimension of the following quantities: (i) Discharge ; (ii) Force.	2	K2	CO4
18.	Identify the dimensional homogeneity for the equation v=u+at.	2	K2	CO4
19.	List out the various types of fluid flow.	2	K1	CO5
20.	Define Capillarity.	2	K1	CO5
21	What is impulse turbine?	2	K1	CO6
22.	What is the function of draft-tube?	2	K1	CO6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create   **14083**

PART - C (6 × 11 = 66 Marks)
Answer ALL Questions

23. a) The velocity and enthalpy of a fluid at the inlet of a certain nozzle are 60 m/sec and 3000 kJ/kg respectively. The enthalpy at the exit of the nozzle is 2762 kJ/kg respectively. The nozzle is horizontal and there is negligible heat loss from it. Find (i) the velocity of the fluid at the exit of the nozzle, (ii) Mass flow rate, if the inlet area is 0.1m^2 and the specific volume is 0.187 m^3/kg. (c) Exit area of the nozzle if the specific volume at the exit of the nozzle is 0.498 m^3/kg.   *11   K2   CO1*

OR

   b) Two Carnot engines operates between 1200 K and 400 K. Find the intermediate temperature if both the engines (a) beget the same work output and (b) operate with the same thermal efficiency.   *11   K2   CO1*

24. a) Deduce an expression to find the air standard Diesel power cycle efficiency with necessary layout and T S diagram.   *11   K3   CO2*

OR

   b) An engine working on Otto Cycle has a volume of 0.45 cubic meter, Pressure 0.1 MPa and temperature 303 K at the beginning of compression stroke. At the end of compression stroke, the pressure is 11 bar and 201 KJ of heat is supplied at constant volume, Calculate the following: a) Pressure, Temperature and Volume at salient points in the cycle b) Efficiency and c) Mean effective pressure.   *11   K3   CO2*

25. a) Explain the construction and working of following,
   i) Water level indicator ii) Pressure gauge iii) Feed check value iv) Blow of cock   *11   K3   CO3*

OR

   b) A boiler generates 14000 kg of steam at 7 bars during a period of 24 hrs and consume 1250 kg of coal whose CV = 30000 kJ/kg. Taking the enthalpy of steam coming out of boiler = 2507.7 kJ/kg and water is supplied to the boiler at 40^{0}C. Calculate: (a) efficiency of the boiler (b) Equivalent evaporation per kg of coal.   *11   K3   CO3*

26. a) Efficiency η of a fan depends on the density ρ, the dynamic viscosity of the fluid μ, the angular velocity ω, diameter D of the rotor and the discharge Q. Express η in terms of dimensional parameters.   *11   K3   CO4*

OR

   b) The pressure drop in an aero-plane model of size 1/10 of its prototype is 80 N/cm^2. The model is tested in water. Calculate the corresponding pressure drop in the prototype. Take density of air = 1.24 kg/m^3. The viscosity of water is 0.01 poise while the viscosity of air is 0.00018 poise.   *11   K3   CO4*

27. a) A hydraulic press has a ram of 30 cm diameter and a plunger of 5 cm diameter. Find the weight lifted by the hydraulic press when the force applied at the plunger is 400 N.   *11   K1   CO5*

OR

   b) State Bernoulli's theorem and assumptions for steady flow of an incompressible fluid.   *11   K1   CO5*

28. a) Explain the working principle of double acting reciprocating pumps with neat diagram in detail.   *11   K2   CO6*

OR

   b) Explain the working principle of reaction turbine with neat sketches   *11   K2   CO6*

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create   **14083**