Reg. No.												

Question Paper Code	12514

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023

Third Semester

Electronics and Instrumentation Engineering

(Common to Instrumentation and Control Engineering)

20ESME301 - APPLIED THERMODYNAMICS AND FLUID MECHANICS

(Regulations 2020)

Duration: 3 Hours Max. Marks: 100

PART-A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level, CO
1.	State Zeroth law of thermodynamics and its applications.	*2,K1,CO1*
2.	What is meant by thermodynamic equilibrium?	*2,K1,CO1*
3.	Define air standard efficiency.	*2,K1,CO2*
4.	Sketch the p-v and T-s diagram for Otto cycle and mention the salient point.	*2,K2,CO2*
5.	Write the Merits and demerits of the Economizer.	*2,K2,CO3*
6.	Differentiate between kinematic similarity and dynamic similarity.	*2,K2,CO4*
7.	List the types of fluid flow.	*2,K1,CO5*
8.	Write the phenomenon of capillarity. Obtain an expression for capillary rise of a liquid.	*2,K2,CO5*
9.	What is priming? Why is priming needed in centrifugal pumps and not in reciprocating pumps?	*2,K2,CO6*
10.	What is the function of draft-tube?	*2,K2,CO6*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11.	a)	A Carnot cycle is operating between the source temperature of 300ºC and the sink temperature of −23ºC. If the system receives 100 kJ from the source, calculate (i) efficiency of the system; (ii) the net-work transfer; and (iii) heat rejected to the sink.	*13,K3,CO1*
		OR	
	b)	Two Carnot engines operates between 1000 K and 300 K. Determine the intermediate temperature if the work output of First Engine is half that of Second Engine and the thermal efficiency of engines.	*13,K2,CO1*
12.	a)	A diesel engine has air before compression at 280 K and 85kPa, and the highest pressure is 6 MPa. Find the volumetric compression ratio and the mean effective pressure using cold air properties.	*13,K3,CO2*
		OR	

b) Derive the expression for air standard efficiency of Otto cycle with p-V and T-S diagrams. *13,K3,CO2*

13. a) Explain the function of boiler mountings. Can a boiler work without mountings. *13,K2,CO3*

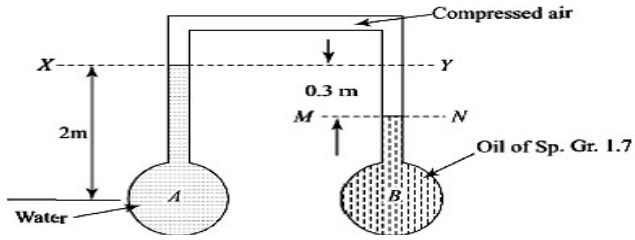
OR

b) Explain with neat sketches the following boiler accessories: *13,K2,CO3*
(i) Injector; (ii) super heater; (iii) Air preheated; (iv) Economizer.

14. 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. *13,K3,CO5*

OR

b) Two pipes A and B are in the same elevation. An inverted U-tube manometer is connected between the two pipes as shown in figure. Water is contained in A and rises to a level of 2 m above it. Pipe B contains an oil of specific gravity 1.7. The inverted U-tube is filled with compressed air at 350kN/m^2 and 20°C. Determine the pressure difference between A and B and the absolute pressure in B. *13,K3,CO5*



15. a) Explain the working principle of impulse turbine. *13,K2,CO6*

OR

b) A single-acting reciprocating pump running at 60rpm, delivers 0.009m^3/s of water. The diameter of the piston is 20cm and stroke length 30cm. Determine the theoretical discharge, coefficient of discharge, slip and the percentage slip of the pump. *13,K3,CO6*

PART - C (1 × 15 = 15 Marks)

16. a) Show that the fractional torque T of a disc diameter D rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by $T = D^5N^2 \rho f(\mu / D^2 N \rho)$. *15,K3,CO4*

OR

b) A 1:20 scale model of a submarine is tested in a wind tunnel to measure the drag on a proposed design. A prototype speed of 5 m/s is desired. What speed should be used in the wind tunnel for the model study? What is the ratio of drag forces between the model and the prototype?The density and viscosity of air are 1.22 kg/m^3 and 1x10^{5}N-s/m^2, respectively and the corresponding values for sea water are 1025 kg/m^3 and 1.5 x 10-3 N-s/m^2, respectively. *15,K3,CO4*