CBCS SCHEME

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BAG401

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2024
Thermodynamics and Fluid Mechanics

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	**a.**	Define open system closed system and isolated system. i) Reversible and Irreversible process ii) Intensive and extensive property	**10**	**L3**	**CO1**
	b.	The equation $R_t = R_0(1 + \alpha T)$ is used to a resistance thermometer in which R_t and R_0 are the resistance value at t°C and 0°C respectively. The thermometer is calibrated by immersing in boiling water (100°C) and boiling sulphur (445°) and the indicated resistance values are 14.70hms and 29.7 ohms respectively. Determine fluid temperature when resistance thermometer reads 25 ohms.	**10**	**L3**	**CO1**
		OR			
Q.2	**a.**	Prove work and heat path function, similarities and dissimilarities between work and heat.	**10**	**L2**	**CO2**
	b.	A gas contained in a cylinder fitted with a piston loaded with a small number of weights is at 1.32 bar pressure and $0.3m^3$ volumes. The gas heated until the volume increases to $0.1m^3$. Calculate the workdone by the gas in the following process i) Pressure remains constant ii) Temperature remains constant iii) $PV^{1.23} = C$ during process show that process on P-V diagram.	**10**	**L3**	**CO2**
		Module – 2			
Q.3	**a.**	State and derive the expression for SFEE equation for a cyclic process.	**10**	**L3**	**CO2**
	b.	Argon gas enters steadily an adiabatic turbine at 900KPa and 450°C with a velocity of 80m/s and leaves at 150KPa with a velocity of 150m/s. The inlet area of the turbine is $50cm^2$. If the power output of the turbine is 250kW. Determine the exit temperature of the argon. Take R = 0.2081kJ/Kg K, C_p = 0.5203 kJ/Kg K.	**10**	**L3**	**CO2**
		OR			
Q.4	**a.**	Prove that violation of Kelvin Planck statement leads to violation of Clausius statement and violation of Clausius statement implies violation of Kelvin-Planck statement.	**10**	**L3**	**CO3**
	b.	A heat pump working on the Carnot cycle takes in heat from a reservoir at 5°C and delivers heat from a reservoir at 60°C. The heat pump is driven by a reversible heat engine which takes in heat from a reservoir at 840°C and rejects heat to a reservoir at 60°C. The reversible heat engine also drives a machine that absorbs 30kW. If the heat pump extracts 17kJ/s from the 5°C reservoir, determine : i) The rate of heat supply from the 840°C source ii) Rate of heat rejection to the 60°C sink.	**10**	**L3**	**CO3**

Module – 3					
Q.5	**a.**	State the properties of fluid for the following terms : i) Specific gravity ii) Weight density iii) Viscosity iv) kinematic viscosity v) Bulk modulus and compressibility.	**10**	**L1**	**CO1**
	b.	An inverted U-tube manometer is connected two horizontal pipe A and B through which water is flowing. The vertical distance between the axis of these these pipes is 30cms. When an oil of sp.gravity 0.8 is used as a gauge fluid, the vertical heights of water column in the two limbs of the inverted manometer are found to be the same and equal to be 35cms. Determine the difference of pressure between the pipes.	**10**	**L3**	**CO2**
OR					
Q.6	**a.**	Derive an expression for total pressure and center of pressure for the vertical plane surface submerged under water.	**10**	**L2**	**CO1**
	b.	A rectangular pantoon 10m long, 7m broad and 2.5m deep weight 686.7kW. If carries on its upper deck an empty boiler of 6m diameter weighting 586.6kN. The center of gravity of the boiler and the pantoon are at their respective center salon a vertical line. Find the metacentric height weight density of sea water is 10.104kN/m^3.	**10**	**L3**	**CO1**
Module – 4					
Q.7	**a.**	Using Euler's equation, derive the expression for Bernoulli's equation.	**10**	**L2**	**CO2**
	b.	Water at 15ºC flows between two large parallel plated at distance of 1.6mm apart. Determine : i) The maximum velocity ii) pressure drop per unit length iii) Shear stress at the walls of the plates if the average velocity is 0.2m/s. The viscosity of water at 15ºC is given as 0.01poise.	**10**	**L3**	**CO4**
OR					
Q.8	**a.**	Derive the equation for Darcy equation for loss of head due to friction in pipes.	**10**	**L2**	**CO3**
	b.	Find the head lost due to friction in a pipe of diameter 300mm and length 50m, through which water is flowing at a velocity of 3m/s using i) Darcy formula ii) Chezy's formula for which C = 60 take γ for water = 0.01 stoke.	**10**	**L3**	**CO3**
Module – 5					
Q.9	**a.**	i) A state Buckingham π-theorem ii) The efficiency η of a fan depends on density ρ, dynamic viscosity μ of fluid, angular velocity ω, diameter D of the motor and discharge Q, Express η in terms of dimensional parameter.	**10**	**L4**	**CO5**
	b.	The frictional torque of a disc of diameter D, rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by $T = D^5N^2\rho\phi\left(\frac{\mu}{D^5N\rho}\right)$. Proving this by the method of dimension.	**10**	**L4**	**CO5**
OR					
Q.10	**a.**	Derive the expression for velocity of sound wave (pressure wave) in a fluid.	**10**	**L2**	**CO5**
	b.	Defin CFD, explain Necessity and limitation of CFD and mention applications of it.	**10**	**L2**	**CO5**

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