Model Question Paper-2 with effect from 2019-20 (CBCS Scheme)

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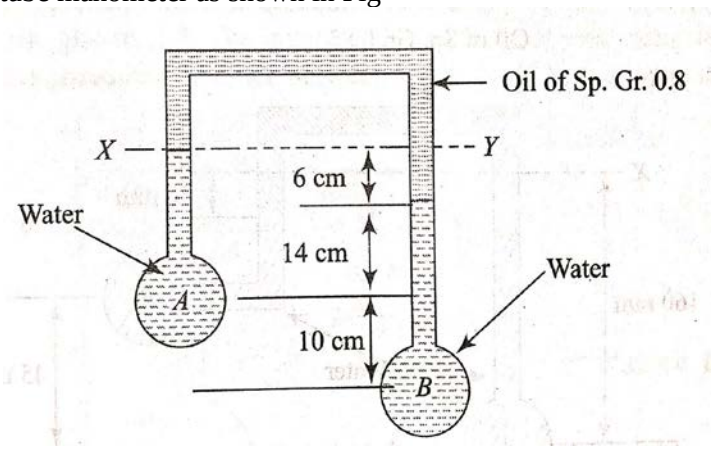
Fourth Semester B.E. Degree Examination

Thermodynamics and Fluid Mechanics

TIME: 03 Hours **Max. Marks: 100**

Note: Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

		Module -1	*Bloom's Taxonomy Level	Marks
Q.01	a	List the type of thermodynamic system and explain with examples C01, PO1	L1	8
	b	Explain the factors which causes irreversibility in the process	L2	4
	c	The Celsius thermometers A and B with same temperature readings T_A and T_B agree at ice point and steam point , but else where they are related by $T_A = p + qT_B + rT_B^2$, where p, q and r constants. When thermometers are immersed in oil bath A shows a temperature of 51°C while B shows 50° C . Determine the temperature T_A and T_B C01, PO1	L3	8
		OR		
Q.02	a	Define and explain the work in thermodynamics of point of view C01, PO2	L1	4
	b	Discuss with examples i) Flow work ii) Stirring work iii) Electric work C01, PO2	L2	10
	c	A balloon of flexible material is to be filled with air from a storage bottle until it has a volume of 0.8m^3 . The atmospheric pressure is 1.013 bar . Determine the work done by the system comprising the air initially in the bottle , given that balloon is light and requires no stretching C01, PO1	L3	6
		Module-2		
Q. 03	a	State first law of Thermodynamics and prove that internal energy is an property of the system CO1,PO1	L1,L2	6
	b	Discuss the limitations of first law of thermodynamics CO1, PO1	L2	4
	c	3 kg of air at pressure of 150kPa and temperature 360K is compressed polytropically to 750KPa according to $pV^{1.2}$=C . The gas is then cooed to initial temperature 360K at constant pressure. The air is then expanded at constant temperature till it reaches original pressure of 150kPa . Draw the cycle on p-V diagram and determine the net work and heat transfer CO1,PO1	L3	10
		OR		
Q.04	a	Enumerate advantages multistage compressor over single stage compressor CO3,PO3	L1	4
	b	Define volumetric efficiency. Obtain expression for the volumetric efficiency of a single stage air compressor in terms of the pressure ratio, clearance and 'n' the exponent and compression and explain the effect of clearance on the volumetric efficiency CO3,PO3	L2	6
	c	A single acting Air compressor has a bore and stroke of 12cms and 15cms. The speed is 1200rpm. It compresses CO_2 gas from a pressure of 120kPa, 20°C to a temperature of 215°C. Assume polytropic compression with n=1.3, no clearance and volumetric efficiency of 100%. Calculate i) pressure ratio ii) indicate power iii) Shaft power if the mechanical efficiency is 80%. iv) mass flow rate CO3,PO3	L3	10
		Module-3		
Q. 05	a	Discuss i) real and ideal fluid ii) Compressibility of fluid ii) vapor pressure and cavitation CO2, PO5	L2	10
	b	Derive an expression for capillary rise when a glass tube is immersed in fluid CO2, PO5	L2	6
	c	Calculate the capillary depression in a glass tube of 1mm radius when immersed vertically in mercury in contact with air as 0.44N/m and the area wetting contact angle as 130° CO2, PO5	L3	4

		OR		
Q. 06	a	Discuss various hydraulic losses in flow throw through pipes CO2,PO5	L1	8
	b	Derive an expression for discharge of fluid through the orifice CO2,PO5	L2	6
	c	A closed tank contains water to a depth of 2m. The top portion of the tank contains air under a pressure of 40kPa. The sharp –edged circular orifice of diameter 50mm and coefficient of discharge 0.6 is provided on the side of the tank with its centre 50cm above the base . Find the discharge through the orifice CO2,PO5	L3	6
		Module-4		
Q. 07	a	Explain atmospheric pressure , total pressure gauge pressure and vacuum pressure with the help of diagram CO2, PO5	L2	6
	b	Define total pressure and centre of pressure on submerged surfaces	L1	4
	c	Determine the pressure difference between the points A and B for the inverted U-tube manometer as shown in Fig  CO2, PO5	L3	10
		OR		
Q. 08	a	Define the following i)Centre of Buoyancy ii) Meta centre iii) Met centric Hieght CO2, PO5	L1	6
	b	Explain how the Metacentric height is determined experimentally in a floating body CO2, PO5	L2	6
	c	A wooden block of dimensions 50cmx25cmx20cm floats in water with its shortest axis vertical. The depth of immersion of the block is 15cm.Determine the metacentric height and state the condition of its equilibrium	L3	8
		Module-5		
Q. 09	a	Discuss i) Static pressure , ii) Dynamic pressure iii) Stagnation pressure in fluid flow CO2, PO5	L1	6
	b	A vertical pipeline 10cm diameter at the top tapers uniformly to 20cm at bottom. The length of the pipeline is 2m. If the discharge through the pipeline is 30litres/s. find the difference in pressure CO4,PO4	L3	8
	c	Water flows vertically upwards through a pipe of 1m diameter and 10m length . The pressure at the upper end of the pipe is 5m of water and the head loss due to friction is 1m of water column. When water flows at an average velocity of 5m/s, find the pressure head at the lower end of the pipe CO4,PO4	L3	6
		OR		
Q. 10	a	Discuss the limitation of Bernoullis equation CO2, PO5	L2	4
	b	Derive an Bernuollis equations from Eulers Eqation CO2, PO5	L2	6
	c	Water is flowing through a horizontal pipe of 30cm diameter and 40m length . While one end of the pipe is connected to a tank, the other end is open to the atmosphere. If the height of eater in the tank is 5m above the center of pipe , determine the rate of flow through the pipe , determine the rate of flow of through the pipe . Also draw the energy gradient line and hydraulic gradient line. The Darcy,s friction factor f = 0.02 CO4,PO4	L3	10