Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV /DEC 2024

Third Semester

Mechanical Engineering

CE3391 – Fluid Mechanics and Machinery

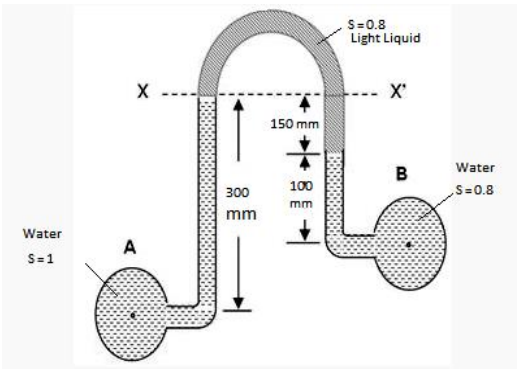
Regulations - 2021

Duration : 3 Hrs *Maximum : 100 Marks*

*PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)*

Q.No	*Questions*	*BLT*	*CO*	*Marks*
1.	"Lighter oil is used in winter season than summer season for automobiles", Justify your answer.	UN	1	2
2.	Define the term buoyancy.	RE	1	2
3.	Summarize the characteristics of laminar flow.	UN	2	2
4.	Compare laminar and turbulent flow.	UN	2	2
5.	Distinguish between model and prototype.	UN	3	2
6.	Outline of the dimensional homogeneity with suitable example.	UN	3	2
7.	Mention the effect of cavitations in a centrifugal pump.	RE	4	2
8.	Relate the specific speed and unit speed of turbine.	RE	4	2
9.	What is the function of a draft tube?	RE	5	2
10.	List the objectives that would fulfilled by the use of air vessel in reciprocating pump.	RE	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*13 = 65)*

Q.No		*Questions*	*BLT*	*CO*	*Marks*
11.	a i	Determine the minimum size of the glass tubing that can be used to measure water level, if the capillary rise in the tube is not to be exceed 0.25 cm. Take surface tension of water in contact with air as 0.0075 kg(f)/m.	AP	1	5
	ii	Fig shows an inverted differential manometer having an oil of specific gravity 0.82 connected to two different pipes carrying water under the pressure. Determine the pressure difference in the pipe B. The pressure in a pipe A is 21.2 N/m^2. 	AP	1	8
		Or			
	b	Extrapolate the Euler's equation of motion and deduce the expression to Bernoulli's equation with basic assumptions.	UN	1	13

12.	a	Using Hagen-Poiseuille equation derive an expression for the head loss in a pipe of diameter D and length L in terms of Reynolds number and velocity head.	AP	2	13
		Or			
	b	Water at 15 °C is to be discharged from a reservoir at a rate of 20 L/s using two horizontal cast iron pipes connected in series and a pump between them. The first pipe is 22 m long and has a 6 cm diameter, while the second pipe is 33 m long and has a 4 cm diameter. The water level in the reservoir is 30 m above the centerline of the pipe. The pipe entrance is sharp-edged, and losses associated with the connection of the pump are negligible. Determine the required pumping head and the minimum pumping power to maintain the indicated flow rate.	AP	2	13
13.	a	The discharge of a centrifugal pump Q is dependent on N speed of the pump, D diameter of a impeller, g acceleration due to gravity, H manometric head developed by a pump, ρ density and μ dynamic viscosity of the fluid . Using the dimensional analysis and Buckingham's π theorem, prove that it is given by $$Q = ND^5\phi\left[\frac{gH}{N^2D^2}\ ,\ \frac{\mu}{ND^2\rho}\right]$$	AN	3	13
		Or			
	b	The resisting force R of a supersonic plane during flight can be considered as dependent upon the length of the aircraft L, velocity V, air viscosity μ, air density ρ and bulk modulus of air k. Express the functional relationship between the variables and the resisting force.	AN	3	13
14.	a	Draw a neat sketch and explain the construction and working of Pelton wheel turbine.	UN	4	13
		Or			
	b	Design a Kaplan turbine to develop 9100 kW. Net available head H = 5.6 m. Speed ratio = 2.09. Flow ratio = 0.68; η_0 = 86% and diameter of boss is 1/3 diameter of runner. Find diameter of runner and its speed.	AP	4	13
15.	a	A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1200rpm works against a total head of 75m. The velocity of flow through the impeller is constant and equal to 3m/s. The vanes are set back at an angle of 30° at outlet. If the outer diameter of the impeller is 600mm and width at outlet is 50mm, Determine vane angle at inlet, Work done per second by impeller and manometric efficiency.	AP	5	13
		Or			
	b	Analyze the amount of work saved by air vessel in single acting reciprocating pump .	AN	5	13

*PART – C (Marks 1*15 = 15)*

Q.No		*Questions*	*BLT*	*CO*	*Marks*
16.	a	The characteristics of spillway are to be studied by means of a geometrically similar model constituted to the ratio of 1:10 i) If the maximum rate of flow in the prototype is 28.3 m3/s. What will be the corresponding flow in the model? ii) If the measured velocity in the model at a point on the spillway is 2.4 m/s. What will be the corresponding velocity in the prototype? iii) If the energy dissipated per second in the model is 3.5J, what will be the energy that will be dissipated in the prototype? iv) If the hydraulic jump at the model is 50mm high, what will be the height of the jumping prototype?	AP	3	15
		Or			
	b	The following data are given for a Francis turbine. Net head H = 60 m, speed N = 700 rpm, Shaft power P = 294.3 KW, overall efficiency = 84%, hydraulic efficiency = 93%, flow ratio = 0.20, breadth ratio = 0.1, outer diameter of the runner is two times of inner diameter of the runner, velocity of flow is constant at inlet and outlet and discharge is radial at outlet. Determine Guide Blade angle, Runner vane angle at inner and outer, Diameter of runner at inlet and outlet and Width of the wheel at inlet.	AP	5	15