Model Question Paper-1 with effect from 2019-20 (CBCS Scheme)

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Fourth Semester B.E. Degree Examination
Fluid Mechanics And Machines

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

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
02.
03.

		Module -1	*Bloom's Taxonomy Level	Marks
Q.01	a	Define the following terms with S.I units: i) Kinematic viscosity ii) Weight density iii) Surface tension	L1	6
	b	The dynamic viscosity of an oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft diameter is 0.4m and rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 90 mm. The thickness of oil film is 1.5mm.	L3	6
	c	Define Pascal's law and prove it.	L2	8
		OR		
Q.02	a	Derive the expression for Centre of pressure of vertical plane surface submerged in a liquid.	L3	8
	b	Explain the terms : Vapor pressure and Cavitation	L1	4
	c	A circular plate of 3.0 m diameter is immersed in water in such a way that its greatest and least depth below the free surface are 4 m and 1.5 m respectively. Determine the total pressure on one face of the plate and Position of centre of pressure.	L3	8
		Module-2		
Q. 03	a	Explain the different types of fluid flows.	L2	8
	b	Define Velocity potential function and stream function.	L1	4
	c	A fluid flow field is given by $V=x^2yi+y^2zj-(2xyz+yz^2)k$. Prove that it is a case of possible steady incompressible fluid flow .Calculate the velocity and acceleration at the point (2,1,3).	L3	8
		OR		
Q.04	a	Derive an expression for Euler's equation of motion along a stream line and deduce it to Bernoulli's equation.	L2,L3	8
	b	Mention the assumptions and applications of Bernoulli's equation	L1	4
	c	The water is flowing through a pipe having diameters 20cm and 10 cm at sections 1 and 2 respectively. The rate of flow through pipe is 35 litres/s. The section 1 is 6 m above datum and section 2 is 4 m above datum. If the pressure at section 1 is 39.24 N/cm^2.Find the intensity of pressure at section 2.	L3	8
		Module-3		
Q. 05	a	Describe the different types of Similarity between model and prototype?	L1	6
	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 these variables and the resisting force. Use Rayleigh's method	L3	6
	c	The pressure difference Δp in a pipe of diameter D and length l due to viscous flow depends on the velocity V, viscosity μ, density ρ. Using	L3	8

		Buckingham's π theorem, Obtain an expression for Δp.		
		OR		
Q. 06	a	Derive the expression for Rate of flow through a Venturimeter	L3	8
	b	An oil of specific gravity 0.8 is flowing through a venturimeter having inlet diameter 20 cm and throat diameter 10 cm. The oil-mercury differential manometers shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter. Take C_d =0.98	L3	8
	c	Find the discharge over a triangular Notch of 60° when the head over the V-notch is 0.3 m. Assume C_d =0.6	L4	4
		Module-4		
Q. 07	a	Define turbomachine? Compare Positive displacement machines with turbomachines	L2	8
	b	Define Degree of reaction ?Obtain the expression for General Relationship between degree of reaction and utilization factor	L1,L2	6
	c	In a certain turbomachine the inlet whirl velocity 15m/s. Inlet flow velocity is 10 m/s. Blade speed are 13m/s and 8 m/s at inlet and outlet respectively. Discharge is radial with an absolute velocity of 15 m/s.If water is the working fluid, flowing at a rate of 1500 litres/s. Calculate i) power in kW.ii) change in total pressure in bar iii) the degree of reaction iv) utilization factor. Is this power generating or power absorbing machine	L3	6
		OR		
Q. 08	a	Derive the expression for alternate form of Euler turbine equation and explain the importance of energy components.	L3	10
	b	The radial outward flow turbo machine has no inlet whirl velocity. The blade speed at the exit is twice that at the inlet. Radial velocity is constant throughout. Taking inlet blade angle as 45°. Show that degree of reaction R is given by $R=2+\cot\beta_2/4$, where β_2 is the blade angle at exit with respect to tangential direction .	L3	10
		Module-5		
Q. 09	a	Derive the condition for maximum efficiency of a Pelton wheel.	L3	8
	b	An inward flow reaction turbine works under a total head of 20m.inner diameter 0.6m and outer diameter is double that of inner diameter water enters at angle of 16° and vane tip is radial at entry. Water leaves the draft tube has a velocity of 3.65 m/s. Calculate the speed of wheel and vane exit angle. Assume water leaves radially. What will be the power developed if the width at inlet is 7.5m.	L3	8
	c	What is draft tube? What is the necessary of draft tube ,explain its types	L2	4
		OR		
Q. 10	a	Derive the expression for maximum blade efficiency of single stage impulse turbine	L3	8
	b	Define compounding, What is the necessity of compounding ?	L2	4
	c	A single stage impulse turbine has a diameter of 1.5 m and running at 3000 rpm. The nozzle angle is 20°.speed ratio is 0.45. Ratio of relative velocity at the outlet that at the inlet is 0.9. The outlet angle of blade is 3°less than inlet blade angle. Steam flow rate is 6kg/s. Draw the velocity diagram and find the following i)velocity of whirl ii) axial thrust iii) blade angles iv) power developed v) η_{blade}	L3	8

*Bloom's Taxonomy Level: Indicate as L1, L2, L3, L4, etc. It is also desirable to indicate the COs and POs to be attained by every bit of questions.