CBCS SCHEME

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BCV402

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Fluid Mechanics and Hydraulics

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 the following terms along with symbols and units: (i) Compressibility (ii) Mass density (iii) Specific weight (iv) Relative density (v) Surface tension	10	L1	CO1
	b.	A differential manometer is connected at the two points A and B of two pipes. The centre of pipe A is 3 m above centre of pipe B. Pipe 'A' contains liquid of specific gravity 1.5, while pipe B contains a liquid of specific gravity 0.9. The manometric liquid mercury is 5m below the centre of pipe A. The pressure at A and B are 1 kgf/cm^2 and 1.8 kgf/cm^2 respectively. Find the difference in mercury level in the differential manometer.	10	L4	CO1
		OR			
Q.2	a.	Derive an expression for total pressure and centre of pressure for a vertical plane surface submerged in liquid.	08	L2	CO2
	b.	What is the bulk modulus of elasticity of a liquid which is compressed in a cylinder from a volume of 0.0125 m^3 at 80 N/cm^2 pressure to a volume of 0.0124 m^3 at 150 N/cm^2 pressure?	06	L3	CO2
	c.	An equilateral triangular plate of 5m side length is immersed in water with its base and apex at 2 m and 6 m below the free surface of water respectively. Calculate the total force and position of centre of pressure.	06	L4	CO2
		Module – 2			
Q.3	a.	Distinguish between : (i) Steady and unsteady flow (ii) Uniform and non-uniform flow (iii) Laminar and turbulent flow	06	L1	CO2
	b.	Derive an expression for continuity equation for a three dimensional flow in Cartesian coordinate.	08	L2	CO2
	c.	In a 2D incompressible flow, the fluid velocity components are given by $u = x - 4y$ and $v = -y - 4x$. Show that velocity potential exists.	06	L3	CO2
		OR			
Q.4	a.	State the assumptions and derive Bernoulli's equation of energy along a streamline.	10	L2	CO2
	b.	The following are the data given for laying water supply pipeline. The change in diameter is gradual from 20 cm at 'A' to 50 cm at B. Pressure at A and B is 80 kN/m^2 and 60 kN/m^2 respectively. The end B is 3m higher than A. If the flow in the pipe is 200 LPS, find: (i) Direction of flow (ii) Head loss between A and B.	10	L4	CO2
		Module – 3			
Q.5	a.	Derive an expression for the discharge over a triangular notch.	08	L2	CO3
	b.	Distinguish between pipes in series and pipes in parallel.	04	L1	CO3
	c.	A 0.5 m diameter and 100 m long pipeline carrying 0.5 m^3/sec of water is fitted with valve at the downstream end. Calculate the rise of pressure caused within the pipe due to valve closure. If: (i) Instantaneously (ii) In one second. Assume sonic velocity as 1430 m/s.	08	L4	CO3

		OR			
Q.6	**a.**	Derive Darcy-Weisback equation for head loss due to friction with assumptions.	**08**	**L2**	**CO3**
	b.	Water flows over a rectangular weir 1 m wide at a depth of 150 mm and afterwards passes through a triangular right angled weir. Take C_d for rectangular weir as 0.62 and for triangular weir as 0.59. Find the depth over triangular weir.	**08**	**L3**	**CO3**
	c.	Explain Water Hammer phenomenon.	**04**	**L1**	**CO3**
		Module – 4			
Q.7	**a.**	With neat sketches, differentiate between flow through pipes and flow through open channels with examples.	**06**	**L2**	**CO4**
	b.	What is meant by economical section of a channel? Derive the condition for the most economical rectangular section.	**08**	**L1**	**CO4**
	c.	A discharge of 18 m^3/sec flows through a rectangular channel 6m wide at a depth of 1.6 m. Find: (i) Specific energy (ii) Critical depth (iii) State weather the flow is subcritical or supercritical	**06**	**L4**	**CO4**
		OR			
Q.8	**a.**	Explain the term hydraulic jump. Derive an expression for the depth of hydraulic jump.	**10**	**L2**	**CO4**
	b.	A sluice gate discharges water into a horizontal rectangular channel with a velocity of 6 m/sec and depth of flow is 0.4 m. The width of the channel is 8m. Determine whether a hydraulic jump will occur or not, if occur find its height and loss of energy per kg of water. Also determine the power lost in the hydraulic jump.	**10**	**L4**	**CO4**
		Module – 5			
Q.9	**a.**	Explain impulse momentum principle.	**02**	**L2**	**CO5**
	b.	Explain concept of velocity triangles. Also obtain an expression for work done per second by jet striking unsymmetrical moving vane tangentially at one end of the tips.	**08**	**L3**	**CO5**
	c.	Design a pelton wheel turbine required to develop shaft power of 95.6475 KW working under a head of 60 m at a speed of 200 rpm. The overall efficiency may be taken as 85%. Take C_v = 0.98 and velocity of the buckets = 0.45 times the velocity of the jet.	**10**	**L4**	**CO5**
		OR			
Q.10	**a.**	Draw a neat sketch of the hydro electric power plant. Mention the functions of each component.	**08**	**L2**	**CO5**
	b.	A centrifugal pump is to discharge 0.118 m^3/sec at a speed of 1450 rpm against a head of 25 m. The impeller diameter is 250 mm, its width at outlet is 50 mm and manometric efficiency is 75%. Determine the vane angle at the outer periphery of the impeller.	**08**	**L4**	**CO5**
	c.	Distinguish between turbine and pump.	**04**	**L1**	**CO5**

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