Hall Ticket Number:

Code No. : 14525

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (Mech. Engg. : CBCS) IV-Semester Main Examinations, January-2021

Mechanics of Fluids and Hydraulic Mechanics

Time: **2** hours Max. Marks: **60**

*Note: Answer any **NINE** questions from **Part-A** and any **THREE** from **Part-B***

Part-A (9× 2 = 18 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Define compressibility. How is it related to bulk modulus of elasticity?	2	2	1	1
2.	What is meant by intensity of pressure? How it varies with the depth of fluid?	2	1	1	1,2
3.	Classify the following as laminar or turbulent flow: (i) Flow through hypodermic needle (ii) Atmospheric winds (iii) Flow in a river (iv) Flow of lubricating oil from oil can.	2	3	2	1,2
4.	Define stream line and write the equation of stream line for 2-D flow.	2	2	2	1
5.	Give four examples in everyday life where formation of boundary layer is important.	2	5	3	1
6.	What is the difference between a laminar flow and a turbulent flow?	2	3	3	1
7.	Draw the layout of a hydraulic power plant and name the important components.	2	1	4	1
8.	What are the functions of a draft tube?	2	2	4	1
9.	How does a volute casing differ from a vortex casing for the centrifugal pump?	2	2	5	1
10.	How are reciprocating pumps classified?	2	2	5	1
11.	What is the difference between an ideal and a real fluid?	2	1	5	1
12.	List the assumptions which are made while deriving Bernoulli's equation.	2	1	1	1
	Part-B (3 × 14 = 42 Marks)				
13. a)	Explain how the surface tension accounts for (i) formation of a droplet and (ii) rise of liquid in a capillary	8	1	1	1
b)	A U tube manometer is used to measure the pressure of oil of specific gravity 0.85 flowing in a pipe line. Its left end is connected to the pipe and the right limb is open to the atmosphere. The centre of the pipe is 100 mm below the level of mercury (specific gravity =13.6) in the right limb. If the difference of mercury level in the two limbs is 160 mm, determine the absolute pressure of the oil in the pipe.	6	4	1	2
14. a)	The velocity potential for a two – dimensional flow is $\phi = x(2y-1)$. Determine the velocity at the point P (4, 5). Also obtain the value of stream function at this point P.	6	4	2	2
b)	250 liters per second of water is flowing in a pipe having a diameter of 30cm. If the pipe is Bent by 135^0 (the fluid turns an angle of 135° from initial to final direction), find the magnitude and direction of the resultant force on the bend. The pressure of water flowing in the pipe is 400 kPa.	8	4	2	2

Contd... 2

15. a)	Explain what is meant by separation of boundary layer. Describe with sketches the methods to control separation.	8	2	3	1
b)	In a pipe of 300 mm diameter and 800 m length an oil of specific gravity 0.8 is flowing at the rate of 0.45 m^3/s. Find : (i) Head lost due to friction, and (ii) Power required to maintain the flow Take kinematic viscosity of oil as 0.3 stoke.	6	4	3	2
16. a)	A 75 mm diameter water jet having a velocity of 12 m/s impinges on a plane, smooth plate at an angle of 60^0 to the normal to the plate. What will be the impact when (i) the plate is stationary and (ii) the plate is moving in the direction of the jet at 6m/s? Estimate the work done per unit time by the jet on the plate in each case. Take density of water as 998 kg/m^3.	6	4	4	2
b)	Explain the working of a Kaplan turbine with the help of a neat sketch and differentiate between Kaplan and Propeller turbine.	8	2	4	1
17. a)	The impeller of a centrifugal pump has an external diameter of 450 mm and internal diameter of 200 mm and it runs at 1440 r.p.m. Assuming a constant radial flow through the impeller at 2.5 m/s and that the vanes at exit are set back at an angle 25^0, determine: (i) Inlet vane angle, (ii) The work done per N of water.	8	4	5	2
b)	A single acting reciprocating pump, running at 50 r.p.m. delivers 0.00736 m^3/s of water. The diameter of the piston is 200 mm and stroke length 300 mm .The suction and delivery heads are 3.5 m and 11.5 m respectively, Determine: (i) Theoretical discharge (ii) Co efficient of discharge (iii) Percentage slip of the pump and (iv) Power required to run the pump.	6	4	5	2
18. a)	Two horizontal flat plates are placed 0.15 mm apart and the space between them is filled with an oil of viscosity 1 poise. The upper plate of area 1.5 m^2 is required to move with a speed of 0.5 m/s relative to lower plate. Determine the necessary force and power required to maintain this speed.	6	4	1	2
b)	With help of a neat sketch explain the working of Venturi meter and derive the expression for calculating the discharge.	8	2	2	1,2
19.	Answer any ***two*** of the following:				
a)	Derive an expression for the loss of head due to friction in pipes.	7	2,3	3	2
b)	Give comparison between impulse and reaction turbines.	7	2	4	1
c)	Define specific speed of a centrifugal pump. Derive an expression for the same.	7	2,3	5	1

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

S. No.	Criteria for questions	Percentage
1	Fundamental knowledge (Level-1 & 2)	48
2	Knowledge on application and analysis (Level-3 & 4)	50
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable)	02

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