KUMARAGURU
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B.E. DEGREE EXAMINATIONS: APRIL / MAY 2023

(Regulation 2018)

Fourth Semester

AUTOMOBILE ENGINEERING

U18AUI4202: Fluid Mechanics and Machinery

COURSE OUTCOMES

CO1: Understand the properties of fluid, flow concepts and measuring devices.

CO2: Apply fluid flow concepts and solve the problems.

CO3: Analyze the practical flow problems using mathematical techniques.

CO4: Apply the laws of conservation in flow through pipes.

CO5: Illustrate the working principles of hydraulic machines.

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1.	Define Pascal's law.	CO1	[K_1]
2.	Two horizontal plates are placed 1.25 cm apart, the space between them being filled with oil of viscosity 14 Poises. Calculate the shear stress in oil if upper plate is moved with a velocity of 2.5 m/s.	CO1	[K_2]
3.	Distinguish between laminar and turbulent flow.	CO2	[K_1]
4.	What are the assumptions made in deriving Bernoulli's equations?	CO2	[K_2]
5.	Brief the advantages of using distorted models.	CO3	[K_1]
6.	State Buckingham's π-Theorem.	CO3	[K_1]
7.	Write the expression for Hagen Poiseuille formula.	CO4	[K_2]
8.	What is hydraulic gradient line and brief how it is useful in the study of fluid flow through pipes.	CO4	[K_2]
9.	Classify turbines according to the (i) type of energy at inlet (ii) direction of flow through runner.	CO5	[K_1]
10.	Why air vessels are necessary in reciprocating pumps?	CO5	[K_2]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11. a)   A differential manometer is connected at two points A and B of two pipes as   8   CO1   [K₃]
shown in Figure 1. The pipe A contains a liquid of specific gravity 1.5 while
pipe B contains a liquid of specific gravity 0.9. The pressures at A and B are
9.81×10^4 N/m² and 17.7×10^4 N/m² respectively. Find the difference in mercury
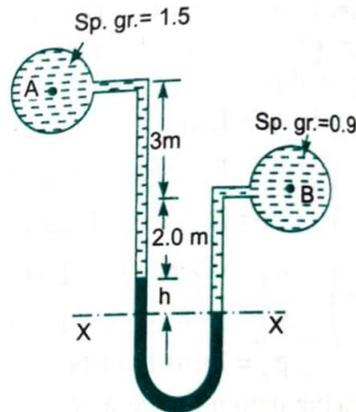level in the manometer.

Figure 1

b)   A pipe line which is 4 m in diameter contains a gate valve as shown in Figure 2.   8   CO1   [K₃]
The pressure at the centre of the pipe is 19.6 N/cm². If the pipe is filled with oil
of specific gravity 0.87, determine the force exerted by the oil upon the gate and
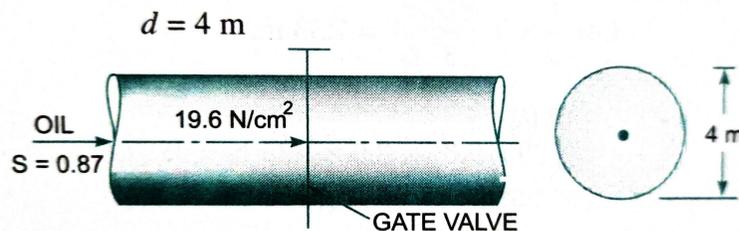position of centre of pressure.

Figure 2

12. a)   Derive Euler's equation of motion along a streamline for an ideal fluid.   10   CO2   [K₂]

b)   Obtain the Bernoulli's equation from Euler's equation along a streamline.   6   CO2   [K₂]

13.   Using Buckingham's π-Theorem, show that the velocity through a circular   16   CO3   [K4]
orifice is given by $V = \sqrt{2gH}\ \phi\ \left[\dfrac{D}{H}, \dfrac{\mu}{\rho g H}\right]$ where H is the head causing flow, D is
the diameter of the orifice, μ is co-efficient of viscosity, ρ is the mass density and
g is the acceleration due to gravity.

14.   A horizontal pipe of diameter 500 mm is suddenly contracted to a diameter of   16   CO4   [K3]
250 mm. The pressure intensities in the large and smaller pipe are given as
13.7 N/cm^2 and 11.7 N/cm^2 respectively. Find the loss of head due to contraction
if C_c=0.62. Also determine the rate of flow of water.

15. a)   Explain with a neat sketch, the working principle of a centrifugal pump.   8   CO5   [K2]
   b)   Explain with a simple sketch, the working of a Pelton turbine.   8   CO5   [K2]

16.   Water flows through a pipe AB of 1.2 m diameter at 3 m/s and then passes   16   CO2   [K4]
through a pipe BC of 1.5 m diameter. At C, the pipe branches. Branch CD is
0.8 m diameter and carries one third of the flow in AB. The flow velocity in
branch CE is 2.5 m/s. Find the volume rate of flow in AB, the velocity in BC and
CD and the diameter of CE.

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