

4E1233

Roll No.

Total No of Pages: 7

4E1233
B. Tech. IV-Sem. (Back) Exam., Oct.-Nov. - 2020
Automobile Engineering
4AE4 - 05 Fluid Mechanics and Fluid Machines
AE, ME

Time: 2 Hours

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Maximum Marks: 110
Min. Passing Marks: 39

Instructions to Candidates:

Attempt all ten questions from Part A, four questions out of seven questions from Part B and two questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL

2. NIL

PART - A

(Answer should be given up to 25 words only)

[10×3=30]

All questions are compulsory

Q.1 Define ideal fluid, what will be Viscosity, Shear stress, Surface tension, Bulk modulus of elasticity for ideal fluid and real fluid. [3]

Q.2 Explain Newton's Law of viscosity and compare it with Hooke's law. [3]

Q.3 What will be the effect of temperature on the viscosity of the liquid and gas, explain and draw graph between viscosity and temperature. [3]

- Q.4 Explain capillary action, what are the different forces involved in capillary action? [3]
- Q.5 What was Reynolds Experiment, and what was its findings? [3]
- Q.6 State physical significance of Reynolds number. [3]
- Q.7 Gulliver's dimensions were 12x the Lilliputians, how much should they feed him? Will 12x their food ratio be enough? (Consider food requirement proportional to volume)[3]
- Q.8 What is similitude, and what types of similitude must exist between model and prototype. ersahilkagyan.com [3]
- Q.9 What are the advantages and disadvantages of Francis turbine over a Pelton wheel? [3]
- Q.10 Explain different flow regions in a pipe, show via a diagram. [3]

PART – B

(Analytical/Problem solving questions)

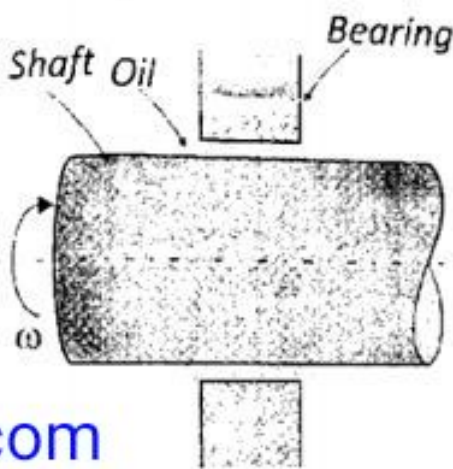
[4×10=40]

Attempt any four questions

- Q.1 (a) What will be weight of body completely immersed in a fluid and weight of body floating in a fluid, Explain? [5]
- (b) A stone weighs 392.4N in air and 196.2 N in water. Find volume of stone and its specific gravity. [5]

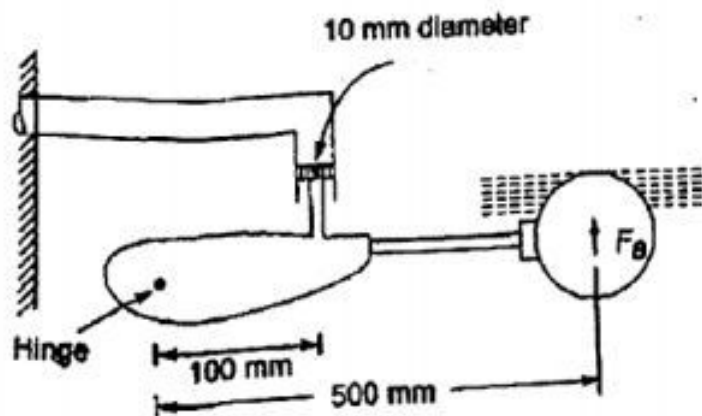
Q.2 Derive the formula to find center of pressure of inclined rectangular plate, if depth of submerged surface increases, will it mean closer is center of pressure and centroid of area? Explain analytically. [10]

Q.3 A shaft of 0.3m radius is required to rotate at 128 r.p.m. Shaft is supported by 0.3m long bearing of 0.31m diameter. The motor can deliver 1N-m torque. Find the correct viscosity of lubricant which can be filled between shaft and bearing. [10]



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Q.4 A float valve of the 'ball-clock' type is required to close an opening of a supply pipe feeding a cistern as shown in the given figure. The buoyant force F_B required to be exerted by the float to keep the valve closed against a pressure of 0.28 N/mm^2 is? [10]



Q.5 What is significance of Dimensionless Number, explain dimensionless numbers- [10]

- (a) Reynold's Number
- (b) Froude's Number
- (c) Euler's Number
- (d) Weber's Number
- (e) Mach's Number

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Q.6 (a) Explain the working of reciprocating pump with a diagram. [5]

- (b) A centrifugal pump has to overcome net head of 15 meter, its speed is 1000rpm, vane angle at outlet is 30° , impeller diameter at outlet is 300mm and its width is 50mm, pump efficiency is 98%, find discharge of water by the pump. [5]

Q.7 What is meant by priming of a centrifugal pump, when we require it? [10]

When we connect pump in series and when in parallel, explain?

What do you mean by degree of reaction in turbine?

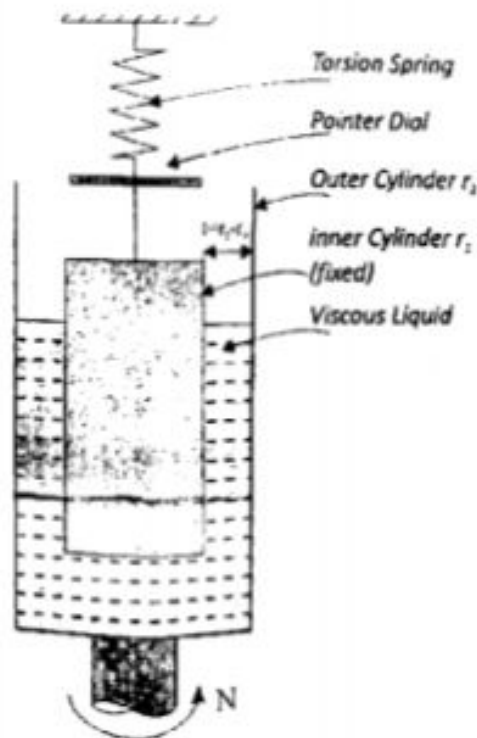
What is the function of draft tube, why does a Pelton wheel not possess any draft tube?

PART - C

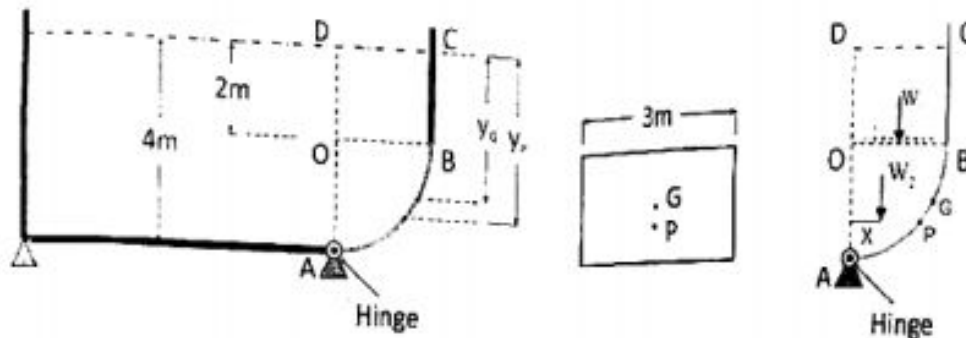
(Descriptive/Analytical/Problem Solving/Design Questions) [2×20=40]

Attempt any two questions

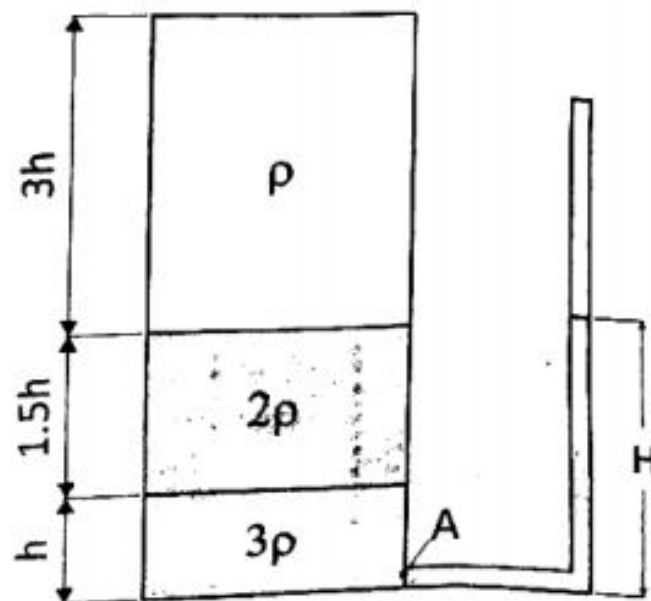
- Q.1 (a) Explain method to find viscosity of given oil. [10]
- (b) In a rotating cylinder viscometer, the radii of cylinders are 3.2 and 3 cm, outer cylinder rotates at 180 rpm. A liquid is filled between two cylinders upto a depth of 7.5cm, the torque produced on inner cylinder measured on dial pointer is 10^{-4} Nm. Calculate the viscosity of liquid. [10]



- Q.2 Curved surface AB is the quadrant of a circular cylinder of radius $R=2\text{m}$. The length of cylinder is $L=3\text{m}$ and water is 2m above B as shown. What will be the magnitude, direction and point of application of minimum force to prevent the gate from opening? [20]



- Q.3 (a) Applying the law of conservation of momentum to a control volume, we get Euler's Equation of Motion, explain and also derive Bernoulli's equation from it. [6]
- (b) "Pressure is Scalar", explain this statement also explain the difference between pressure and stress. [6]
- (c) Three immiscible liquids of specific densities ρ , 2ρ and 3ρ are kept in a jar. The height of the liquids in the jar and at the piezometer fitted to the bottom of the jar is as shown in the given figure. The ratio H/h is? [8]



Q.4 For viscous laminar flow through circular pipe, design the relations for : [20]

- (a) Shear stress and pressure gradient, maximum shear
- (b) Velocity profile equation
 - (i) Velocity distribution
 - (ii) Mean velocity
 - (iii) Maximum velocity
- (c) Total discharge
- (d) Shear stress
- (e) Frictional head loss and power required to overcome head loss

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Q.5 (a) What are model laws? [8]

- (b) State Reynold's model law in detail. A pipe of diameter 1.5m is required to transport an oil of specific gravity 0.90 and viscosity 3×10^{-2} poise at the rate of 3000 litre/sec. Tests were conducted on a 15cm diameter pipe using water at 20°C . Find the velocity and rate of flow in the model. [12]