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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: ME200
Course Name: FLUID MECHANICS AND MACHINERY(IE, PE, MP, AN, AU)

Max. Marks: 100 Duration: 3 Hours

PART A
Answer any three questions, each carries 10 marks.

1 a) Explain gauge, absolute, and vacuum pressure. Show the relationship between them. (2)

b) With neat sketch explain the types of fluids. (3)

c) A vertical gap 2.2 cm wide of infinite extent contains a fluid of viscosity 2Ns/m² and specific gravity 0.9. A metallic plate 1.2m x 1.2m x 0.2cm is to be lifted up with a constant velocity of 0.15m/sec, through the gap. If the plate is in the middle of the gap, find the force required. The weight of the plate is 40N. (5)

2 a) Definethe following terms : (4)
i) compressibility and bulk modulus ii) vapour pressure
iii) kinematic viscosity iv) specific gravity

b) The dynamic viscosity of an oil, used for lubrication between a shaft and sleeve is 6poise. The shaft is of diameter 0.4m and rotates at 190 r.p.m. Calculate the power lost in the bearing for a sleeve length of 90mm. the thickness of the oil film is 1.5mm. (6)

3 a) With neat sketch explain types of equilibrium of floating and submerged bodies. (4)

b) A solid cylinder of diameter 4 m has a height of 3 m. Find the meta-centric height of the cylinder when it is floating in water with its axis vertical. The specific gravity of the cylinder = 0.6. State whether it is stable or unstable equilibrium. (6)

4 a) Derive an expression for the force exerted on a sub-merged vertical plane surface by the static liquid and locate the position of centre of pressure. (4)

b) A rectangular plane surface 2m wide and 3m deep lies in water in such a way that its plane makes an angle 30˚ with the free surface of water. Determine the total pressure and position of center of pressure when the upper edge is 1.5m below the free water surface. (6)

PART B
Answer any three questions, each carries 10 marks.

5 a) The velocity potential function (Ø) is given by an expression (5)

$$(Ø) = -\frac{xy^3}{3} - x^2 + \frac{x^3y}{3} + y^2$$

(a) Find the velocity component in *x* and *y* direction.
(b) Show that (Ø) represents a possible case of flow.

b) Derive the expression for continuity equation in three dimensional flow. (5)

6 a) 1) A pipe of diameter 300mm and length 3500m is used for the transmission of power by water. The total head at the inlet of the pipe is 500m. Find the maximum power available at the out let of the pipe, if the value of $f = 0.006$ (5)

b) Derive the expression for power transmission through pipes and prove that

η_{max}=66.7% (5)

7 a) Find the displacement thickness, momentum thickness, and energy thickness for the velocity distribution in the boundary layer given by $\frac{u}{U}=\frac{y}{\delta}$ where u is the velocity at a distance y from the plate and u = U, at y = δ, where δ equals boundary layer thickness. Also calculate the value of δ^*/θ (6)

b) What are the methods of controlling the boundary layer? (4)

8 a) What is Venturimeter? Derive an expression for the discharge through the Venturimeter. (6)

b) An oil of sp. gr. 0.8 is flowing through a venturimeter having inlet diameter 20cm and throat diameter 10cm. The oil – mercury differential manometer shows a reading of 25cm. calculate the discharge of oil through the horizontal Venturimeter. Take Cd = 0.98. (4)

PART C

Answer any four questions, each carries 10 marks.

9 a) Find an expression for the efficiency of a series of moving curved vanes when a jet of water strikes the vanes at one of its tips and show that the maximum efficiency is 50%. (5)

b) Water is flowing through a pipe at the end of which a nozzle is fitted. The diameter of the nozzle is 100mm and the head of water at the centre nozzle is 100m. Find the force exerted by the jet of water on a fixed vertical plate. The co-efficient of velocity is given as 0.95. (5)

10 a) What is governing of turbines? With neat sketch explain the governing of impulse turbine. (5)

b) Two jet strikes the buckets of a Pelton wheel, which is having shaft power as 15450kw. The diameter of each jet is given as 200mm.if the net head on the turbine is 400m, find the overall efficiency of the turbine. Take C_v = 1.0 (5)

11 a) Define specific speed of a turbine. Derive an expression for the same. (6)

b) Efficiencies of turbine (4)

i) hydraulic efficiency ii) mechanical efficiency

iii) volumetric efficiency iv) overall efficiency

12 a) The diameter of an impeller of a centrifugal pump at inlet and outlet are 30cm and 60cm respectively. Determine the minimum starting speed of the pump if it works against a head of 30cm. (4)

b) A single acting reciprocating pump, running at 50 r.p.m delivers 0.01m³/s of water. The diameter of the piston is 200mm and stock length 400mm. determine : (6)

i) The theoretical discharge of the pump. ii) Co-efficient of discharge

iii) Slip and percentage slip of the pump.

13 a) Define ideal indicator diagram. Show that area of indicator diagram is proportional to the work done by the reciprocating pump. (6)

b) Define slip, percentage slip and negative slip of a reciprocating pump. (4)

14 a) With neat sketch explain the constructional features of a single-stage centrifugal pump. (6)

b) Draw and explain the characteristic curves of a centrifugal pump. (4)

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