Question Paper

Exam Date & Time: 22-Nov-2019 (02:00 PM - 05:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
END SEMESTER THEORY EXAMINATIONS-NOVEMBER 2019
III SEMESTER B.Sc.(APPLIED SCIENCES) IN ENGINEERING
FLUID MECHANICS [IME 234 - S2]

Marks: 100 **Duration: 180 mins.**

Answer 5 out of 8 questions.

1) A) Answer the following and write relevant equations if any: (10)
i) State Newton's Law of viscosity
ii) Define specific volume of a fluid
iii) Define Kinematic viscosity
iv) Define Dynamic viscosity
v) Define weight density of a fluid

B) Derive the equation for total pressure and centre of pressure for an inclined plane surface submerged in water. (10)

2) A) A differential manometer is connected at the two points A and B as shown in figure.Q.2A. At B air pressure is 9.81 N/cm^2 (abs), find the absolute pressure at A. (10)

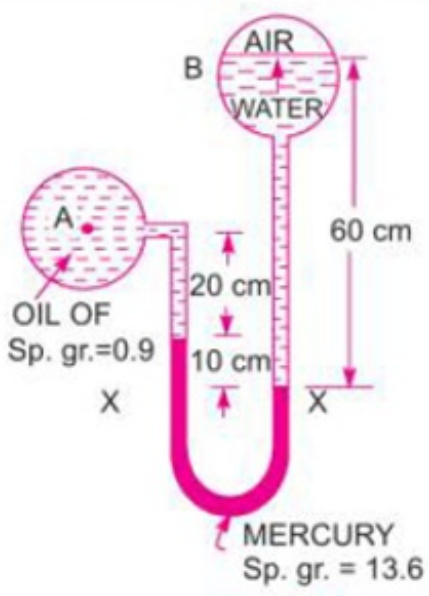

Figure.Q.2A

B) With neat sketches explain the stability of submerged and floating bodies. (10)

3) Define: (10)

A) i) Path line
ii) Streak line
iii) Stream line
iv) Stream tube
v) Velocity potential function

B) Derive the Euler's equation of motion for a fluid flow. (10)

4) An oil of specific gravity 0.8 is flowing through a Venturimeter having inlet diameter 20 cm and throat diameter 10 cm. The oil-mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal Venturimeter. Take C_d=0.98. (10)

A)

B) Define the following and write relevant equations if any- (10)
i) Reynold's number
ii) Kinematic similarity between model and prototype
iii) Dimensionally homogeneous equation
iv) Derived quantities
v) Mach's number

5) Derive the equation for shear stress across a section for flow of viscous fluid through the circular pipe. (10)

A)

B) Derive the Dracy-Weisbach formula for the flow of fluid through a pipe. (10)

6) The dynamic viscosity of an oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4 m and rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 90 mm. The thickness of the oil film is 1.5 mm. (10)

A)

B) State and prove the Pascal's Law. (10)

7) Determine the total pressure and centre of pressure on an isosceles triangular plate of base 4 m and altitude 4 m when it is immersed vertically in an oil of specific gravity 0.9. The base of the plate coincides with the free surface of oil. (10)

A)

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 is 0.6. (10)

8) Derive the continuity equation in three dimensions by considering the Cartesian coordinates. (10)

A)

B) An orifice meter with orifice diameter 15 cm is inserted in a pipe of 30 cm diameter. The pressure difference measured by a mercury oil differential manometer on the two sides of the orifice meter gives a reading of 50 cm of mercury. Find the rate of flow of oil of specific gravity 0.9 when the coefficient of discharge of the orifice meter=0.64 (10)

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