Reg. No. : | | | | | | | | | | |

Question Paper Code: 31315

B.E. / B.Tech. DEGREE EXAMINATION, NOVEMBER 2015

Third Semester

Civil Engineering

01UCE305 – FLUID MECHANICS

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Define viscosity and write the units.
2. Define bulk modulus of elasticity.
3. Illustrate hydrostatic law.
4. State the laws of floatation.
5. Explain velocity potential and stream function.
6. On what principle continuity equation is derived?
7. Write the assumptions made in Bernoulli's equation.
8. Describe free liquid jet.
9. What is dimensional homogeneous?
10. Write the dimensions for force and viscosity.

PART - B (5 x 16 = 80 Marks)

11. (a) (i) The dynamic viscosity of an oil is used for lubrication between a shaft and a sleeve is 6 poise. The shaft is of diameter 0.4m and rotates at 190*rpm*. Calculate the horse power lost in the bearing for a sleeve length of 90*mm*. The thickness of the oil film is 1.5*mm*. (12)

(ii) Explain specific gravity and surface tension. (4)

Or

(b) Two large plane surfaces are 2.4 *cm* apart. The space between the surfaces is filled with glycerin. What force required to drag a very thin plate of surface area 0.5 square meter between the two large plane surfaces at a speed of 0.6*m/s* if (i) When the plate is in the middle of two surfaces and (ii) When the plate is at a distance of 0.8*cm* from one of the surfaces. If glycerin is having a viscosity of 0.810 Ns/m^2. (16)

12. (a) (i) Define Mata centre and Meta centric height. (6)

(ii) A rectangular pontoon is 5*m* long, 3*m* wide and 1.20*m* height. The depth of immersion of the pontoon is 0.80*m* in sea water. If the centre of gravity is 0.6*m* above the bottom of the pontoon, determine the meta-centric height. The density of sea water is 1025kg/m^3. (10)

Or

(b) Derive the equations for total pressure and centre of pressure acting on inclined plane submerged in liquid. (16)

13. (a) (i) Write the uses of flow nets. (4)

(ii) The velocity potential function Φ is given by the expression

$$\Phi = -xy^3/3 - x^2 + x^3y/3 + y^2$$

(a) Find the velocity components in *x* and *y* directions

(b) Show that Φ represents a possible case of flow (12)

Or

(b) Derive the continuity equation for three dimensional flow. (16)

14. (a) An oil of specific gravity 0.9 is flowing through a pipe of 20 *cm* diameter. An orifice meter with 10 *cm* diameter is inserted in the pipe to measure discharge. A differential U-tube mercury manometer connected to the orifice meter gives a pressure difference of 30 cm of mercury. Take C_d = 0.65 for orifice meter. Find the discharge. (16)

Or

(b) Derive Bernoulli's equation from the first principle and state the assumptions made. (16)

15. (a) Assuming that rate of discharge Q of a centrifugal pump is dependent upon mass density of a fluid, pump speed n, diameter D, pressure p, viscosity, using Buckingham pie theorem find the expression for Q. (16)

Or

(b) (i) What is similitude. Explain different types of similarities. (6)

(ii) Water is flowing through a pipe of 30*cm* diameter at a velocity of 4*m/sec*. Find the velocity of oil flowing in another pipe of diameter 10*cm*, if the condition of dynamic similarity is satisfied between two pipes. The viscosity of water and oil are 0.01 poise and 0.025 poise resp. The specific gravity of oil is 0.8. (10)