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

Question Paper Code: 31015

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 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 surface tension.
2. Define compressibility
3. Define metacentric height.
4. Write the continuity equation
5. Define stream tube.
6. Define path line
7. Define Bernoulli's equation.
8. Write the instruments used for measurement of discharge.
9. Write the advantages of model analysis.
10. Write the uses of dimension analysis.

PART - B (5 x 16 = 80 Marks)

11. (a) (i) Explain the different types of fluids . (6)

(ii) Calculate the capillary rise in a glass tube of 2.5*mm* in diameter when immersed vertically in a water and mercury. The surface tension of water and mercury are 0.0725*N/m* and 0.52*N/m* respectively. The specific gravity of mercury is 13.6 and contact angle is 130^0 and give reason why there is a fall in mercury capillary. (10)

Or

(b) Calculate the dynamic viscosity of oil, which is used for lubrication between a square plate of size 0.8*m*x0.8*m* and an inclined plane with an angle of inclination 30^0. The weight of the square plate is 300*N* and it slides down on an inclined plane at a velocity of 0.3*m/s*. The thickness of the oil film is 1.5*mm*. (16)

12. (a) A circular plate 1.5*m* diameter is submerged in water with its greatest and least depths below the surface being 2*m* and 0.75*m* respectively. Determine the total pressure and centre of pressure on the plate. (16)

Or

(b) A uniform body of size 3*m* long 2*m* wide 1*m* deep floats in water. What is the weight of the body if the depth of the immersion is 0.8*m*? Determine the meta-centric height also. (16)

13. (a) In a two dimensional incompressible flow the fluid velocity components are given by $u = x - 4y$ and $v = -y - 4x$; Where *u* and v are *x* and *y* components of velocity of flow. Show that the flow satisfies the continuity equation and obtain the expression for stream function. If the flow is potential, obtain also the expression for the velocity potential. (16)

Or

(b) (i) Explain stream function and velocity potential function. (8)

(ii) A 30*cm* diameter pipe, conveying water, branches into two pipes of diameters 20*cm* and 15*cm* respectively. If the average velocity in the 30*cm* diameter pipe is 2.5*m/s*, find the discharge in this pipe. Also determine the velocity in 15*cm* pipe, if the average velocity in 20*cm* diameter pipe is 2*m/s*. (8)

14. (a) Derive the discharge equation for venturimeter. (16)

Or

(b) A 20*cm* x10*cm* venturimeter is inserted in a vertical pipe carrying an oil of specific gravity 0.8, the flow of an oil is upward direction. The difference of levels between the throat and the inlet section is 50*cm*. The oil mercury differential manometer gives a reading of 30*cm* of mercury. Find the discharge of oil. (16)

15. (a) The wave resistance of a ship when travelling at 12.5*m/s* is estimated by test on 1/40 scale model. The resistance measured in fresh water was 16*N*. Determine the speed of the model and the wave resistance of the prototype in sea water. The density of sea water = 1025 kg/m^3. (16)

Or

(b) The thrust force, F generated by a propeller is found to depend on the following parameters: diameter D, forward velocity u, density ρ, viscosity μ and rotational speed N. Determine the dimensionless parameters to correlate the phenomenon. (16)