Total No. of printed pages = 3

19/3rd Sem/UCE302

2021

FLUID MECHANICS

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) The water is flowing through a taper pipe of length 100m having diameters 600mm at the upper end and 300mm at the lower end, at the rate of 50 litre/sec. The pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62 N/cm^2. 10

   (b) The efficiency 'n' of a fan depends on the density 'ρ', the dynamic viscosity 'μ' of the fluid, the angular velocity 'ω', diameter 'D' of the rotor and the discharge Q. Express 'n' in the terms of dimensionless parameters. 10

[Turn over

2. (a) Derive the Bernoulli's equation. List out the assumptions made. 10

(b) Derive the discharge equation for Venturimeter and Orificemeter. 10

3. What are the different types of pressures in fluid mechanics ? Explain with figures, the different types of pressure measuring instruments. 20

4. Write short notes on : 5×4=20

(a) Vortex Flow

(b) 5 dimensionless numbers

(c) Similitude

(d) Buckingham's π-Theorem.

5. (a) The stream function for a 2D flow is given by $\Phi = x(2y-1)$, calculate the velocity at the point P (2, 3). Find the stream function ψ at the pint P. 10

(b) Write the definitions of :

(i) Stream line

(ii) Path line

(iii) Streak line

(iv) Stream function and

(v) Velocity potential. 10

6. (a) Derive the 3D continuity equation in Cartesian co-ordinates. 10

(b) The velocity vector in a fluid flow is given by $V = 4x^3i - 10x^2y^2j + 2t^2k$

Find the velocity and acceleration at (2, 2, 3) at time = 2 units. 10