A **Reg. No. :** | | | | | | | | | | | | |

Question Paper Code: R3A05

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2025

Third Semester

Agricultural Engineering

R21UAG305 – FLUID MECHANICS AND OPEN CHANNEL

(Regulations R2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. A manometer is used to measure CO1- U

   (a) low pressure (b) moderate pressure (c) high pressure (d) atmospheric pressure

2. The resultant hydrostatic force acts through a point known as CO1- U

   (a) center of gravity (b) center of buoyancy

   (c) center of pressure (d) none of the above

3. Stream line and equipotential lines in a flow field CO1- U

   (a) are parallel to each other (b) are identical to each other

   (c) are perpendicular to each other (d) intersect at acute angles

4. The continuity equation is the result of application of the following law to the flow field CO1- U

   (a) first law of thermodynamics (b) conservation of energy

   (c)Newton's second law of motion (d) conservation of mass

5. The pressure of the liquid flowing through the divergent portion of a venturimeter CO1- U

   (a) Remains constant (b) increase (c) Decrease (d) depends upon mass of liquid

6. Which property of the fluid accounts for the major losses in pipes CO1- U

   (a) density (b) specific gravity

   (c) viscosity (d) compressibility

7. The discharge over a rectangular notch is CO1- U

(a) inversely proportional toH3/2 (b) directly proportional toH3/2

(c) inversely proportional toH5/2 (d) directly proportional toH5/2

8. The discharge in an open channel corresponding to critical depth is CO1- U

(a) zero (b) minimum (c) maximum (d) none of these

9. Pump is a device which convert CO1- U

(a) hydraulic energy into electrical energy (b) hydraulic energy into mechanical energy

(c) mechanical energy into hydraulic energy (d) mechanical energy into electrical energy

10. A Single acting reciprocating pump has the plunger diameter of 20cm and stroke of 30cm.the pump discharge $0.53m^3$ of water per minutes at 60rpm.find the theoretical discharge CO2-AP

(a) 0.00742 m^3/sec (a) 0.00642 m^3/sec

(c) 0.00842 m^3/sec (d) 0.00942 m^3/sec

PART – B (5 x 2= 10 Marks)

11. Classify the types of fluids and give examples CO1 U

12. Distinguish between stream line and streak line. CO1 U

13. Compare hydraulic gradient line with total energy line CO1 U

14. Compute the hydraulic mean depth of a small channel of 1m wide and 0.5m deep with water flowing at 2m/s. CO2-App

15. Mention the main components of reciprocating pump. CO1U

PART – C (5 x 16= 80 Marks)

16. (a) An oil film of thickness 17.5 mm is trapped between two large square plates, each measuring 60 cm × 60 cm. The upper plate moves steadily at 5.5 m/s and requires a force of 98.1 N to keep this speed constant. Specific gravity of the oil is 0.95. Calculate dynamic viscosity of the oil and kinematic viscosity. CO2- App (16)

Or

(b) If the velocity profile of a fluid over a plate is parabolic with the vertex 20cm from the plate, where the velocity is 120cm/sec. Calculate the velocity gradients and shear stress at a distance of 0,10 and 20cm from the plate, if the viscosity of the fluid is 8.5 poise. CO2- App (16)

17.	(a)	Water flow through a pipe AB 1.2 m diameter at 3 m/s and the passes through a pipe BC 1.5 cm diameter. At C, the pipe branches. Branch CD is0.8 m in diameter and carries one third of flow in AB. The velocity in branch CE is 2.5 m/s. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD and the diameter of CE.	CO2- App	(16)
		Or		
	(b)	A pipe line carrying oil of specific gravity 0.87changes in diameter from 200 mm dia at a position Ato 500 mm dia at a position B which is 4m at a higher level. If the pressure at A and B are 9.81N/cm^2 and 5.886 N/cm^2 respectively and the discharge is 200 lit/s. Determine the loss of head and direction of flow.	CO2- App	(16)
18.	(a)	Starting from the basic principles of fluid mechanics, derive the Darcy-Weisbach equation that expresses the head loss due to friction in a pipe.	CO2- App	(16)
		Or		
	(b)	A horizontal Venturimeter with inlet diameter 30cmand throat dia 15cm is used to measure the flow of oil of sp.gr 0.8.The discharge of oil through Venturimeter is 50 lit/sec. Find the reading of the oil-mercury differential manometer.cd=0.98	CO3- App	(16)
19.	(a)	A civil engineer is designing a storm water drainage channel in a region with a bed slope of 1 in 4000. The channel is trapezoidal, 8 meters wide at the bottom, with side slopes of 1H:3V. If the flow depth is expected to be 2.4 meters and Chezy's constant is 50. Calculate the Discharge.	CO4- Ana	(16)
		Or		
	(b)	A rectangular channel 4m wide has depth of water 1.5m.the slope of the bed of the channel is 1 in 1000 and value of chezy's constant c=55.it is desired to increase the discharge to a maximum by changing the dimensions of the section for constant area of cross section slope of the bed and roughness of the channel. Find the new dimensions of the channel and increase in discharge.	CO4- Ana	(16)

20.	(a)	Using Buckingham's π theorem, show that the velocity through a circular orifice is given by $v=\sqrt{2gH}\emptyset\left[\frac{D}{H},\frac{\mu}{\rho VH}\right]$ where H is the head causing flow,D is the diameter of the orifice is co-efficient of viscosity is the mass density and g is the acceleration due to gravity.	CO5- Ana	(16)
		Or		
	(b)	The efficiency η 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 η in terms of dimensionless parameters. Using Rayleigh's method	CO5- Ana	(16)