**F 3131** (Pages : 3) Reg. No.....

Name.....

# B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

**Third Semester**

Branch : Civil Engineering

CE 010 303—FLUID MECHANICS (CE)

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

## Part A

*Answer* **all** *questions.*
*Each question carries* 3 *marks.*

1. Differentiate between specific volume and specific weight.
2. Define pathline and streakline.
3. What are "hydraulic coefficients" ?
4. Differentiate between Laminar flow and Turbulent flow.
5. Define Mach number.

(5 × 3 = 15 marks)

## Part B

*Answer* **all** *questions.*
*Each question carries* 5 *marks.*

6. Define and briefly explain Newton's law of viscosity.
7. Discuss the significance of a "flow net".
8. The head of water over an orifice of diameter 50 mm is 12m. Find the actual discharge and actual velocity of jet at vena-cantracta. Take $C_d = 0.6$ and $C_v = 0.98$.
9. Explain the principle of working of a syphon.
10. Show that ratio of inertia force to viscous force gives the Reynold's number.

(5 × 5 = 25 marks)

**Turn over**

## Part C

*Answer* **all** *questions.*
*Each full question carries* 12 *marks.*

11. (a) A square plate of size 1m × 1m and weighing 350 N slides down an inclined plane with a uniform velocity of 1.5 m/s. The inclined plane is laid on a slope of 5 vertical to 12 horizontal and has an oil film of 1 mm thickness. Calculate the dynamic viscosity of oil.

*Or*

(b) Explain why the resultant pressure on a curved submerged surface is determined by first finding horizontal and vertical forces on the curved surface ? Why is the same method not adopted for a plane inclined surface submerged in a liquid ?

12. (a) A fluid flow field is given by $v = x^2yi + y^2zj - (2xyz + yz^2)k$. Prove that it is a case of possible steady in compressible fluid flow. Calculate the velocity and acceleration at the point (2, 1, 3).

*Or*

(b) Discuss the analytical and experimental methods of determination of metacentric height for a floating body.

13. (a) Water is flowing through a pipe having diameters 30 cm and 15 cm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 29. 43 N/cm$^2$ and the pressure at the upper end is 14. 175 N/cm$^2$. Determine the difference in datum head if the rate of flow through pipe is 50 lit/s.

*Or*

(b) Derive an expression for discharge through a fully submerged orifice. State all the assumptions made.

14. (a) A pipe line of 0.6 m diameter is 1.5 km long. To increase the discharge, another line of the same diameter is introduced parallel to the first in the second half of the length. Neglecting minor losses, find the increasing in discharge if $4f = 0.04$ The head at inlet is 300 mm.

*Or*

(b) Determine the maximum power transmitted by a jet of water discharging freely out of nozzle fitted to a pipe = 300 m long and 100 mm diameter with coefficient of friction as 0.01. The available head at the nozzle is 90 m.

15. (a) The pressure difference $\Delta p$ in a pipe of a diameter D and length $l$ due to turbulent flow depends on the velocity V, viscosity $\mu$, density $\rho$ and roughness $k$. Using Buckingham's $\pi$-theorem, obtain an expression for $\Delta p$.

*Or*

(b) In a geometrically similar model of spillway the discharge per metre length is $\frac{1}{6}$ $m^3/s$. If the scale of the model is $\frac{1}{36}$, find the discharge per metre run of the prototype.

(5 × 12 = 60 marks)