CBCS SCHEME

USN | | | | | | | | | |

17MA44

Fourth Semester B.E. Degree Examination, June/July 2019
Fluid Mechanics and Machines

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define the following fluid properties :
(i) Density (ii) weight density (iii) Specific volume (iv) Specific gravity
(v) Viscosity **(10 Marks)**

b. A 15cm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 15.10cm. Both cylinders are 25cm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12 N-m is required to rotate the inner cylinder at 100 rpm. Determine the viscosity of the fluid. **(10 Marks)**

OR

2 a. State and prove Pascal's law. **(12 Marks)**

b. The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The center of the pipe is 12cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20 cm. **(08 Marks)**

Module-2

3 a. Define the following :
(i) Steady flow (ii) Non-uniform flow (iii) Laminar flow
(iv) Two dimensional flow (v) Turbulent flow. **(10 Marks)**

b. The stream function for a two dimensional flow is given by $\psi = 2xy$. Calculate the velocity at the point P(2, 3). Find the velocity potential function ϕ. **(10 Marks)**

OR

4 a. Derive Bernoulli's equation starting from fundamental and state all assumptions made. **(10 Marks)**

b. A pipeline carrying oil of specific gravity 0.87, changes in diameter from 200mm at a position A to 500mm diameter at a position B which is 4 meters at a higher level. If the pressures at A and B are 9.81 N/cm^2 and 5.886 N/cm^2 respectively and the discharge is 200litres/sec. Determine the loss of head and direction of flow. **(10 Marks)**

Module-3

5 a. Derive an expression for the discharge through a venturimeter. **(10 Marks)**

b. Prove that the discharge through a V-notch is given by

$$Q = \frac{8}{15} Cd \times \tan\frac{\theta}{2} \times \sqrt{2g} \times H^{5/2}$$

where H is the head of water over a notch, and θ is the angle of notch. **(10 Marks)**

OR

6 a. Explain the different types of hydraulic similarities that exist between the model and prototype. **(10 Marks)**

b. The pressure difference ΔP in a pipe of diameter D and length l due to viscous flow depends on the velocity V, viscosity μ and densityρ, using Buckinghams's π-theorem. Obtain an expression for ΔP. **(10 Marks)**

Module-4

7 a. Derive an expression for the loss of head due to friction by (ii) Darcy formula and (ii) Chezy's formula. **(10 Marks)**

b. An oil of specific gravity 0.9 and viscosity 0.06 poise is flowing through a pipe of diameter. 200mm at the rate of 60 litres/s. Find the head lost due to friction for a 500m length of pipe. Find the power required to maintain this flow. **(10 Marks)**

OR

8 a. Prove that the velocity distribution for viscous flow between two parallel plates when both plates are fixed across a section is parabolic in nature. Also prove that maximum velocity is equal to 3/2 of average velocity. **(10 Marks)**

b. Determine (i) the pressure gradient (ii) the shear stress at the two horizontal parallel plates (iii) the discharge per metre width for the laminar flow of oil with a maximum velocity of 2 m/s between two hiorizontal parallel fixed plates which are 100mm apart. Given $\mu = 2.4525$ N-s/m^2. **(10 Marks)**

Module-5

9 a. Derive an expression of minimum speed for starting centrifugal pump. **(10 Marks)**

b. A centrifugal pump is to discharge 0.118 m^3/s at a speed of 1450 rpm against a head of 25m the impeller diameter is 250 mm. Its width at outlet is 50 mm and manometric efficiency is 75%. Determine the vane angle at the outer periphery of the impeller. **(10 Marks)**

OR

10 Write a short notes on the following :

(i) Multistaging speed

(ii) Specific speed.

(iii) Surging in centrifugal compressors

(iv) Stalling **(20 Marks)**

* * * * *