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

Question Paper Code: 31374

B.E. / B.Tech. DEGREE EXAMINATION, NOVEMBER 2015

Third Semester

Mechanical Engineering

01UME304 – FLUID MECHANICS AND MACHINERY

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Define specific gravity.
2. In two dimensional, incompressible steady flow around an airfoil the stream lines are drawn so that they are 10 *mm* apart at a great distance from the airfoil, where the velocity is 40 *m/s*. What is the velocity near the airfoil, where the streamlines are 7.5 *mm* apart?
3. Write Dupuit's equation for equivalent pipe.
4. Suggest the name of an instrument that measures (i) pressure difference between the entrance and throat in a convergent divergent pipe and (ii) pressure in a pipe, which is having same diameter.
5. Define dimensional homogeneity.
6. Differentiate distorted and undistorted models.
7. Define jet ratio in a Pelton wheel.
8. What is draft tube?
9. Define cavitation.
10. Write the expression of mean velocity for a single acting reciprocating pump.

PART - B (5 x 16 = 80 Marks)

11. (a) The velocity profile of a viscous fluid over a plate is parabolic with vertex 20 *cm* from the plate, where the velocity is 120 *cm/s*. Calculate the velocity gradient and shear stress at a distance of 0, 5 and 15 *cm* from the plate, given the viscosity of the fluid is 6 *poise*. (16)

Or

(b) A pipe 1, 450 *mm* in diameter branches into two pipes 2 and 3 of diameters 300 *mm* and 200 *mm* respectively. If the average velocity in 450 *mm* diameter pipe is 3 *m/s*, find (i) discharge through 450 *mm* pipe (ii) velocity in 200 *mm* diameter pipe if average velocity in 300 *mm* pipe is 2.5 *m/s*. (16)

12. (a) Derive Bernoulli's equation by considering the motion of fluid elements along the streamline and state the assumptions made in the derivation. (16)

Or

(b) The following are the data given of a change in diameter effected in laying an apartment water supply pipe. The change in diameter is gradually increases from 200 *mm* at *A* to 500 *mm* at *B*. Pressures at *A* and *B* are 78.5 *kPa* and 58.9 *kPa* respectively with the end *B* is being 3 *m* higher than *A*. If the flow in the pipe line is 200 *litre/s*, find (i) direction of flow (ii) the head lost in friction between *A* and *B*. (16)

13. (a) What is similitude? Explain about the types of similarities exist between the model and prototype. (16)

Or

(b) The discharge through an orifice meter is depends on the diameter '*D*' of the orifice, head '*H*' over the orifice, density 'ρ' of the liquid, viscosity 'μ' of the liquid, and acceleration due to gravity '*g*'. Using dimensional analysis, find an expression for the discharge and hence find the dimensionless parameter on which the discharge coefficient of an orifice meter depend. (16)

14. (a) (i) Show that the hydraulic efficiency for a Francis turbine having velocity of flow through runner as constant is given by the relation $\eta_{hy} = \dfrac{1}{1+\left(\dfrac{\frac{1}{2}\tan^2\alpha}{1-\frac{\tan\alpha}{\tan\theta}}\right)}$. (10)

(ii) If the vanes are radial at inlet, then show $\eta_{hy} = \frac{2}{2 + \tan^2 \alpha}$. (6)

Or

(b) (i) What is axial flow turbine? Name the types of axial flow turbine. (4)

(ii) Explain about the axial flow reaction turbine with neat sketch. (8)

(iii) Give the importance points to be remembered for an axial flow turbine. (4)

15. (a) (i) Classify reciprocating pump. (4)

(ii) Define slip of reciprocating pump. What is negative slip? When it occurs? (6)

(iii) Using the following data, of an axial flow pump find (i) tip diameter of the impeller and (ii) power required to run the pump.
Discharge is 2.5 m^3/s, speed is 360 *rpm*, hub diameter is 30 *cm*, axial flow velocity is 5 *m/s*, head available is 6.118 *m* and overall efficiency is 83%. (6)

Or

(b) A single acting reciprocating pump has a plunger of 0.06 *m* diameter and a stroke length of 0.12 *m*. It takes its supply of water from a sump 3 *m* below the pump through a pipe 4 *m* long and 0.04 *m* in diameter. It delivers water to a tank to a tank 10 *m* above the pump through a pipe 0.025 *m* in diameter and 15 *m* long. If separation occurs at 0.75 bar below the P_{atm}, find the maximum speed at which the pump may to be operated without separation. Assume the plunger has a simple harmonic motion and take specific weight of water 9.81 kN/m^3. (16)