Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **B.Tech**

PME3I102

3rd Semester Back Examination 2019-20

FLUID MECHANICS & HYDRAULICS MACHINES

BRANCH : MECH

Max Marks : 100

Time : 3 Hours

Q.CODE : HB898

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.

The figures in the right hand margin indicate marks.

Part- I

Q1 **Only Short Answer Type Questions (Answer All-10)** **(2 x 10)**

a) What is, the property by which its own molecules are attracted, called?

b) Determine the pressure in bar at a depth of 10 m oil of relative density 0.750.

c) Differentiate hydrostatic and aerostatics.

d) State the types flow line.

e) How do you relate stream function and velocity potential function?

f) Write two use of fownet.

g) List out the minor losses those happen in pipe.

h) Why do you need a draft tube?

i) What is cavitation in pump?

j) State the working principle of positive displacement pump.

Part- II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) A liquid having specific gravity of 0.82 is filled in a vessel, calculate Density, Specific volume and specific weight.

b) A simple manometer (U tube) containing mercury is connected to a pipe in which an oil of specific gravity 0.8 is flowing. The pressure in the pipe is vacuum. The other end of the manometer is open to atmosphere. Find the vacuum pressure in the pipe, if the difference of mercury levels in the two limbs is 20 cm and the height of the oil in the left limb from the centre of the pipe is 15 cm below.

c) Derive equation for pressure exerted on a vertical plane surface.

d) A block of wood of specific gravity 0.7 floats in water. Determine the metacentric height of the block if its size is 2m×1m×0.8m.

e) The velocity field in a fluid medium is given by *V =axi + ayj +_(-2az)* . Find the equation of streamline at point P (2,2,4).

f) A two-dimensional velocity field is given by $u = 2xy, v = -x^2y$. Compute (a) velocity, (b) local acceleration, (c) convective acceleration at (1,1).

g) A venturimeter has its axis vertical, the inlet and throat diameters being 150 mm and 75 mm respectively. The throat is 300 mm above inlet, oil of specific gravity 0.85 flows up through the meter at a rate of Q = 0.029 m^3/s. If the pressure difference between the inlet and the throat is 20 kPa. Assume the losses in the pipe to be expressed as $h = k\frac{v^2}{2g}$. Find the value of k.

h) Discuss the difference between venturimeter and orificemter

i) What is meant by equivalent pipe? Determine the equivalent pipe corresponding to 3 pipes in series with lengths and diameters L_1, L_2, L_3, D_1, D_2, D_3 respectively.

j) Find the power developed by the runner (in hp) of a Pelton wheel having gross head of 150 m and has a loss of head due to friction of thrice the discharge cube and is of speed 100 rpm. If the flow rate of jet is 2.5 m^3/s having diameter of 1.5 m, been deflected by 130° by the vane. Assume that the surface is smooth, speed ratio 0.45 and overall efficiency of 80%.

k) Draw the constant head characteristic curves of turbine.

l) Design a Kaplan turbine having width to diameter ratio 0.7, head of 70 m , speed 500 rpm, flow ratio 0.2 and diameter of hub is 10m.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 The velocity profile distribution of flow over a plate is parabolic ($u = Ay^2 + By + C$) with vertex 30 cm from the plate, where the velocity is 0.18 m/s. If the viscosity of the fluid is 0.9 Ns/m^2, find the velocity gradient and shear stress at a distance of 0 cm, 15 cm and 30 cm from the plate. **(16)**

Q4 In a two dimensional incompressible flow, the fluid velocity components are given by $u = x - 4y, v = -y - 4x$. Show that the velocity potential exists and determine its form for stream function as well. **(16)**

Q5 Define hydraulic gradient line and energy gradient line in a pipe with sketch. **(4+12)**

Two tanks containing water are connected by a horizontal pipe of length 25 m and diameter 20 cm. If the difference of water surface in the reservoir is 4 m, find the rate of flow. Also draw the energy gradient line and hydraulic gradient line. Take Darcy's friction factor $f = 0.01$.

Q6 Describe the characteristic curves of centrifugal pump. **(16)**