3rd Semester Regular/Back Examination: 2022-23
SUBJECT: Fluid Mechanics and Hydraulic Machines
BRANCH(S): AERO,AME,C&EE,CIVIL,ENV,MECH,MMEAM
Time : 3 Hour
Max Marks : 100
Q.Code : L505

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 Answer the following questions : (2 x 10)

a) Write down the assumptions is Bernoulli's theorem

b) What do you mean by manometric efficiency and mechanical efficiency of centrifugal pump?

c) What is NPSH?

d) Explain Euler's equation and its significance.

e) Explain circulation and its significance.

f) Differentiate between TEL and HGL

g) Differentiate between uniform and non uniform flow.

h) What is flownet?

i) What is the draft tube? In which kind of turbines, draft tubes are attached.

j) What are bad implications of cavitation on blades?

Part-II

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

a) State the Newton's law of viscosity. Sketch the Newton's law relationship for Newtonian and Non-Newtonian fluids. Give examples for each fluid.

b) Derive the metacentric height of a floating body.

c) Derive the differential form of continuity equation for in-compressible fluid in Cartesian coordinates.

d) A cylinder of 150mm radius rotates concentrically inside a fixed cylinder of 155mm radius. Both cylinders are 300mm long. Determine the viscosity of the liquid which fills the space between the cylinders if a torque 1 N-m is required to maintain an angular velocity of 100r.p.m.

e) Explain any two pressure measuring instruments used in fluid flow.

f) Derive and explain, change of pressure in soap bubble and liquid jet cases.

g) A rectangular surface 5m (width) ×5m (height) lies in a vertical plane. Determine force and centre of pressure on the plate when its upper edge is 10m below the water surface.

h) Write short notes on Francis turbine

i) With sketch, explain pump characteristics.

j) Derive the velocity

k) A main pipe divides into two parallel pipes, which again forms one pipe. The length and diameter for the first parallel pipe are 2000m and 1m respectively, while the length and diameter of the second parallel pipe are 2000m and 0.8m respectively. Find the rate of flow in each parallel pipe, if total flow in the main is 3m³/s. the coefficient of friction for each parallel pipe is same and equal to 0.005

l) Define the following i) Stream lines ii) Path lines iii) Streak lines

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

Q3   Differentiate between potential function and stream function.   (16)

The two dimensional flow $u=8x^2y-(8/3)y^3+(8/3)x^3$. Determine the stream function for the flow and find the velocity potential function. State, if the flow is rotational or irrotational.

Q4   Obtain an expression for the work done per second by water on the runner of a Pelton wheel.   (16)

A Pelton wheel has a mean bucket speed of 12m/s and supplied with water at the rate of 0.7m³/s under head of 300m. If the buckets deflect the jet through an angle of 160°, find the power developed and hydraulic efficiency of the turbine.

Q5   Derive the Bernoulli's energy equation from Euler's motion equation.   (16)

A horizontal pipe of 250 mm diameter is enlarged suddenly to 500 mm diameter. The flow rate is 0.4m³/s, the pressure in smaller pipe before enlargement is 14.715N/cm². Determine i) loss of head due to sudden enlargement ii) pressure in the larger diameter section. and iii) power loss due to enlargement

Q6   A centrifugal water pump has an impeller of outer diameter of 60 cm and inner diameters 20 cm. It is 2 cm wide at outlet and 5 cm wide at inlet. The blade angles at inlet and outlet are 20° and 10° respectively. The impeller rotates at 1800 rpm. Neglecting losses and vane thickness, determine   (16)

     (I)   the discharge foe shockless radial entry
     (II)   the theoretical head
     (III)   the power required
     (Iv)   the pressure rise through impeller