B. TECH.

(SEM. IV) EXAMINATION, 2006-07

FLUID MECHANICS & MACHINERY

Time : 3 Hours] [Total Marks : 100

Note : (1) Attempt all questions.
(2) All questions carry equal marks.
(3) In case of numerical problems, assume data wherever not provided.
(4) Be precise in your answer.

1. Attempt any two parts of the following : 10×2=20
   (a) Briefly explain compressibility of fluid, stating the value of property on which it depends. Prove that for isothermal compression of a perfect gas, the bulk modulus of elasticity is equal to the pressure.
   (b) Explain (i) Cohesion and adhesion (ii) Capillarity and (iii) Velocity field.
   (c) State the characteristic equation for gases and explain its significance.

2. Attempt any two parts of the following : 10×2=20
   (a) (i) Prove that the intensity of hydrostatic pressure at any point in a liquid is proportional to the head of the liquid over the point.

V-4083] 1 [Contd...
(ii) Define atmospheric pressure, gauge pressure, vacuum pressure and absolute pressure.

(b) Explain the following:
   (i) Buoyancy
   (ii) Stable equilibrium of floating bodies
   (iii) Unstable equilibrium of floating bodies.
   (iv) Neutral equilibrium of floating bodies.

(c) (i) Explain the concept of velocity potential. From its derivative, develop Laplace equation.
   (ii) What are the conditions for a flow to be irrotational.

3 Attempt any two parts of the following: 10×2=20
   (a) State Bernoulli's theorem. Outline the assumptions made in deriving Bernoulli’s equation. Derive Bernoulli’s equation.
   (b) What is function of a venturimeter. Prove the formula for discharge through a venturi meter.
   (c) Define and give significance of following dimensionless numbers. Develop mathematical expression for these.
      (i) Reynolds number
      (ii) Mach’s number
      (iii) Euler’s number.

4 Attempt any two parts of the following: 10×2=20
   (a) With the help of a neat sketch, explain the working of a radial flow turbine. Explain how energy is imparted to the runner as water flows over the vanes.
(b) Explain impulse momentum principle. Derive an expression for force exerted by a jet of water, on a single moving vertical flat plate, in the direction of plate motion.

(c) Explain the principle of working of a fluid coupling.

OR

4 A jet of water 10 cm in diameter enters a fixed curved vane with a velocity of 20 m/s at an angle of 30° to the horizontal.

Determine the normal (horizontal) and tangential (vertical) force at the centre of the curved vane if the jet leaves the vane at an angle of 20° to the horizontal. Assume there is no loss of energy due to impact and friction in the blade passage.

5 Attempt any two of the following: 10x2=20

(a) Draw a general layout of a hydroelectric power plant using an impulse turbine and define:
   (i) Gross head
   (ii) Net head
   (iii) Hydraulic efficiency and
   (iv) Overall efficiency.

(b) What is governing? How it is achieved in Francis turbine?

(c) Enumerate the losses which occur in a centrifugal pump, and hence explain various efficiencies of a centrifugal pump.

OR

5 Classify:
   (i) Hydraulic turbines
   (ii) Centrifugal pumps.