

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY- GURAJADA VIZIANAGARAM
II B. Tech I Semester Supplementary Examinations, November – 2024
FLUID MECHANICS & HYDRAULIC MACHINES
(COMMON TO ME, AME)

Time: 3 hours**Max. Marks: 70**

***Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks

- 1 a) State and prove the Pascal law. [7]
b) Explain the principle and working of piezometer with a neat sketch. [7]
(OR)
 - 2 a) A wooden block of width 1.25 m, depth 0.75 m and length 3.0 m is floating in water. [7]
Specific weight of the wood is 6.4 kN/m^3 . Find
(i) Volume of water displaced, and
(ii) Position of Centre of buoyancy.
b) A single column vertical manometer is connected to a pipe containing oil of specific gravity 0.9. The area of the reservoir is 80 times the area of the manometer tube. The reservoir contains mercury of specific gravity 13.6. The level of mercury in the reservoir is at a height of 300 mm below the Centre of the pipe and difference of mercury levels in the reservoir and right limb is 500 mm. Find the pressure in the pipe. [7]
 - 3 a) Explain about different types of fluid flow. [7]
b) The velocity potential function (ϕ) is given by: [7]

$$\phi = -\frac{xy^3}{3} - x^2 + \frac{x^3y}{3} + y^2$$
Determine the velocity components in x and y directions and show that ϕ represents a possible case of flow.
(OR)
 - 4 a) Derive the Bernoulli's equation from the Euler's equation and state the assumptions made in the derivation of Bernoulli's equation. [7]
b) Two sharp ended pipes of diameters 50 mm and 100 mm respectively, each of length 100 m respectively, are connected in parallel between two reservoirs which have a difference of level of 10 m. If the friction factor for each pipe is 0.32, calculate [7]
(i) Rate of flow for each pipe, and
(ii) The diameter of a single pipe 100 m long which would give the same discharge, if it were substituted for the original two pipes.
 - 5 a) Explain how the boundary layer separation takes place when the fluid moves over a curved surface. [7]
b) What is bluff body? Explain its applications. [7]
(OR)
 - 6 Derive on the basis of dimensional analysis suitable parameters to present the thrust developed by a propeller. Assume that the thrust P depends upon the angular velocity ω , speed of advance V, diameter D, dynamic viscosity μ , mass density ρ , elasticity of the fluid medium which can be denoted by the speed of sound in the medium C. [14]
 - 7 a) Derive an expression for force exerted by the jet on the moving plate when plate is held inclined to the jet. [7]

- b) A jet of water of diameter 100 mm strikes a curved plate at its centre with a velocity of 15 m/sec. The curved plate is moving with a velocity of 7 m/sec in the direction of the jet. The jet is deflected through an angle of 150° . Assuming the plate is smooth, find [7]

- (i) force exerted on the plate in the direction of the jet
- (ii) power of the jet
- (iii) efficiency

(OR)

- 8 a) The water available for a Pelton wheel is $4 \text{ m}^3/\text{s}$ and the total head from the reservoir to the nozzle is 250 m. The turbine has two runners with two jets per runner. All the four jets have the same diameters. The pipe is 3 km long. The efficiency of transmission through the pipeline and the nozzle is 91 % and efficiency of each runner is 90 %. The velocity co-efficient of each nozzle is 0.975 and co-efficient of friction '4f' for the pipe is 0.0045. Determine [9]

- (i) The power developed by the turbine
- (ii) The diameter of the jet, and
- (iii) The diameter of the pipeline.

- b) Distinguish between impulse and reaction turbine. [5]

- 9 a) Explain the constructional features of the Reciprocating pump with neat sketch. [7]

- b) The impeller of a centrifugal pump has an external diameter of 450 mm and internal diameter of 200 mm and it runs at 1440 rpm. Assuming a constant radial flow through the impeller at 2.4 m/s and that the vanes at exit are set back at an angle 25° . Determine [7]

- (i) Inlet vane angle
- (ii) The angle, absolute velocity of water at exit makes with the tangent
- (iii) The work done per N of water.

(OR)

- 10 a) Explain with neat sketch principle and working of hydraulic ram [7]

- b) What is governing and how it is accomplished for different types of water turbines? [7]
