**20ME305**

**Hall Ticket Number:**

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| **II/IV B.Tech (Regular\Supplementary) DEGREE EXAMINATION** | | | |
| **February, 2023** | **Mechanical Engineering** | | |
| **Third Semester** | **Fluid Mechanics & Hydraulic Machines** | | |
| **Time:** Three Hours | | **Maximum:**70 Marks | |
| *Answer Question No.1 compulsorily.* | | | (1X14 = 14 Marks) |
| *Answer ONE question from each unit.* | | | (4X14=56 Marks) |

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| 1. | | a) | Define Pascal’s Law. | | CO1 | | L1 |  | |
|  | | b) | Define centre of pressure. | | CO1 | | L1 |  | |
|  | | c) | What is vapour pressure? | | CO1 | | L1 |  | |
|  | | d) | What is a meta centric height? | | CO1 | | L1 |  | |
|  | | e) | Write the expression for Euler’s equation of motion. | | CO2 | | L1 |  | |
|  | | f) | What is a water hammer in pipe flow? | | CO2 | | L1 |  | |
|  | | g) | Define impact of jet. | | CO2 | | L1 |  | |
|  | | h) | Write the expression of force exerted by a fluid jet on a moving inclined plate. | | CO3 | | L2 |  | |
|  | | i) | Define overall efficiency for a turbine. | | CO3 | | L1 |  | |
|  | | j) | Define Specific speed of a turbine. | | CO3 | | L1 |  | |
|  | | k) | Define Slip and negative slip of a reciprocating pump | | CO4 | | L1 |  | |
|  | | l) | What is an air vessel? | | CO4 | | L1 |  | |
|  | | m) | Define hydraulic efficiency of a centrifugal pump. | | CO4 | | L1 |  | |
|  | | n) | What are the effects of cavitation in centrifugal pump? | | CO4 | | L1 |  | |
| **UNIT I** | | | | | | | | | |
| 2. | | a) | Definition of density, specific weight, specific gravity, viscosity, compressibility, surface tension and capillarity. | | CO1 | | L1 | | 7M |
|  | | b) | The left limb of a U-tube mercury manometer is connected to a pipe line conveying water, the level of mercury (specific gravity = 13.6) in the leg being 0.5 m below the centre of pipe line and the right limb is open to atmosphere. The level of mercury in the right limb is 0.4 m above that in the left limb and the space above mercury in the right limb contains benzene (specific gravity = 0.88) to a height of 0.2 m. Determine the pressure of water in the pipe. | | CO1 | | L2 | | 7M |
| **(OR)** | | | | | | |  | |  |
| 3. | | a) | Find the velocity and acceleration components at point A(1, 2, 3) m and at t = 2 s for the fluid flow described by the velocity vector V = 2x3i −5x2yj +3tk. | | CO1 | | L3 | | 7M |
|  | | b) | Derive the expression of continuity equation in Cartesian coordinates. | | CO1 | | L2 | | 7M |
| **UNIT II** | | | | | | |  | |  |
| 4 | a) | | Derive the expression of Bernoulli’s equation. | | CO2 | | L2 | | 7M |
|  | b) | | A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of oil of specific gravity 0.8. The discharge of oil through venturimeter is 60 litres/s. Find the reading of the oil mercury differential manometer. Take Cd = 0.98 | | CO2 | | L2 | | 7M |
| **(OR)** | | | | | | |  | |  |
| 5 | a) | | Derive the expression for Darcy-Wiesbach equation. | | CO2 | | L2 | | 7M |
|  | b) | | A horizontal pipe of diameter 0.2 m is suddenly enlarged to 0.3 m. If the rate of flow of water through the pipe is 0.2 m3/s and the intensity of pressure in the smaller pipe is 100 kPa, then find (i) the head loss due to sudden enlargement, (ii) power loss due to enlargement and (iii) intensity of pressure in the larger diameter pipe | | CO2 | | L3 | | 7M |
| **P.T.O**  **20ME305**  **UNIT III** | | | | | | | | | |
| 6 | a) | | Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet. | CO3 | | L2 | | | 7M |
|  | b) | | A jet of water 75 mm diameter having velocity 35 m/s strikes a curved fixed symmetrical vane at the centre. If the jet is deflected through an angle of 165° at the outlet of the curved vane, then find the force exerted by the jet of water in the direction of the jet when (i) vane is smooth and (ii) when coefficient of friction is 0.85. | CO3 | | L2 | | | 7M |
| **(OR)** | | | | | |  | | |  |
| 7 | a) | | Explain with neat sketch working of Francis turbines and its parts. | CO3 | | L1 | | | 7M |
|  | b) | | A turbine develops 9000 kW when running at 100 r.p.m. The head on the turbine is 30 m. If the head on the turbine is reduced to 18 m, determine the speed and power developed by the turbine. | CO3 | | L2 | | | 7M |
| **UNIT IV** | | | | | |  | | |  |
| 8. | | a) | Explain with neat sketch working of single acting Reciprocating pump. | CO4 | | L1 | | | 7M |
|  | | b) | A single acting reciprocating pump delivers 9 litres per second of water against a suction head of 4 m and a delivery head of 16 m while running at a speed of 60 rpm. The diameter and stroke of the piston are 200 mm and 300 mm, respectively. Determine (i) the theoretical discharge, (ii) coefficient of discharge, (iii) slip, (iv) percentage slip and (v) power required to drive the pump. | CO4 | | L3 | | | 7M |
| **(OR)** | | | | | |  | | |  |
| 9 | a) | | Explain with neat sketch working of Centrifugal pump. | CO4 | | L1 | | | 7M |
|  | b) | | The impeller of a centrifugal pump is of 0.3 m diameter, 0.05 m width at the periphery and has blades whose tip angle inclines backwards 60° from the radius. The pump delivers 15 m3/min and the impeller rotates at 1000 rpm. Assume that the pump is designed to admit radially and calculate (i) the speed and direction of water as it leaves the impeller, (ii) torque exerted by the impeller in water, (iii) shaft power required. Take mechanical efficiency as 95% and hydraulic efficiency as 75%. | CO4 | | L2 | | | 7M |

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