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| **20CE404**  **Hall Ticket Number:**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  |      |  |  |  | | --- | --- | --- | | **II/IV B.Tech (Regular) DEGREE EXAMINATION** | | | | **August, 2022** | **Civil Engineering** | | | **Fourth Semester** | **Hydraulics & Hydraulic Machines** | | | **Time: Three Hours** | | **Maximum:70 Marks** | | | | | | | | |  |
| |  |  | | --- | --- | | ***Answer question 1 compulsory.*** | **(14X1 = 14 Marks)** | | ***Answer one question from each unit.*** | **(4X14=56 Marks)** | | | | | | | | |  |
| 1. | a) | Define energy correction factor. |  | BL1 | CO1 |
|  | b) | What is critical depth in open channel flow? |  | BL2 | CO1 |
|  | c) | In a rectangular channel, flow is taking place with a hydraulic radius of 1 m. Determine Manning’s coefficient, if the Chezy’s coefficient C is 50. |  | BL2 | CO1 |
|  | d) | Write the conditions for most economical rectangular channel section. |  | BL1 | CO1 |
|  | e) | The depth of flow in a rectangular channel of width 2 m is 1 m while the discharge is 5 m3/s. Find the Froude Number. |  | BL2 | CO2 |
|  | f) | Name the water surface profile at a section when the depth of flow is 2.6 m while its normal depth and critical depths are 1.5 m and 2.5 m respectively. |  | BL2 | CO2 |
|  | g) | The sequent depths of a hydraulic jump are 0.5 m and 4 m, find the discharge intensity. |  | BL3 | CO2 |
|  | h) | Classify the hydraulic jump based on Froude Number if Froude Number is 3.5. |  | BL2 | CO2 |
|  | i) | Define impulse momentum principle. |  | BL1 | CO3 |
|  | j) | Write the expression for specific speed of a turbine. |  | BL1 | CO3 |
|  | k) | Define a draft tube. |  | BL1 | CO3 |
|  | l) | When cavitation takes place in centrifugal pump? |  | BL1 | CO4 |
|  | m) | What do you understand by dimensional homogeneity? |  | BL1 | CO4 |
|  | n) | Write the expression of Reynold’s number. |  | BL1 | CO4 |
| **Unit –I** | | | | | |
| 2. | a) | Derive Chezy’s equation of uniform flow in an open channel. | BL2 | CO1 | 7M |
|  | b) | A flow of 200 litre/s flows down in a rectangular laboratory flume of width 50cm and having adjustable bottom slope if Chezy’s constant is 50, determine the bottom slope necessary for uniform flows with a depth of flow 20cm. | BL3 | CO1 | 7M |
| **(OR)** | | | | | |
| 3. | a) | Define critical flow and derive the conditions for critical flow in a rectangular open channel. | BL2 | CO1 | 7M |
|  | b) | In a rectangular channel of bed width 5 m with a bed slope of 0.0001, uniform flow is taking place with a normal depth of 2 m. Calculate the specific energy of flow assuming Chezy’s constant as 50. Also find the minimum specific energy required for the flow and corresponding critical depth. | BL3 | CO1 | 7M |
| **Unit –II** | | | | | |
| 4. | a) | Derive the differential equation for gradually varied flow in prismatic channels, stating clearly the assumptions made in its derivation. | BL2 | CO2 | 7M |
|  | b) | GVF is taking place in a rectangular channel of bed with 5 m at a rate of 15m3/s. At a particular section, the depth of flow is 1.5 m. Determine the slope of water surface elevation if the channel is laid at a slope of 0.0001. Take Manning’s coefficient as 0.012. | BL3 | CO2 | 7M |
| **(OR)** | | | | | |
| 5. | a) | Find the % head loss that takes place in a rectangular channel of bed width 2m when the pre-jump depth is 0.5m for a discharge of 15 m3/s. | BL4 | CO2 | 7M |
|  | b) | Derive the equation of energy loss while hydraulic jump takes place in a rectangular channel. | BL3 | CO2 | 7M |
| **P.T.O**  **20CE404**  **Unit –III** | | | | | |
| 6. | a) | Show that the efficiency of a free jet striking normally as series of flat plates mounted on the periphery of a wheel never exceeds 50%. | BL3 | CO3 | 7M |
|  | b) | Derive the expression for work done/sec by the jet on a curved plate which is moving in the direction of jet | BL3 | CO3 | 7M |
|  |  |  |  |  |  |
| **(OR)** | | | | | |
| 7. | a) | Derive an expression for specific speed of a turbine. | BL3 | CO3 | 4M |
|  | b) | The following data is given for a Francis turbine.  Net head = 40 m, speed = 500 rpm, shaft power = 400 kW, overall efficiency = 85%, hydraulic efficiency = 90%, flow ratio = 0.2, breadth ratio = 0.1, outer diameter of the runner = 2 x inner diameter of the runner. The thickness of the vanes occupy 5% of circumferential area of the runner, velocity of flow is constant at inlet and outlet. Discharge is radial at outlet. Determine, i) guide blade angle at inlet ii) vane angles at inlet and outlet iii) diameters of the runner at inlet and outlet iv) width of wheel at inlet. | BL5 | CO3 | 10M |
| **Unit –IV** | | | | | |
| 8. | a) | Discuss about the following:  i) Pumps in series ii) Pumps in parallel iii) Various efficiencies of pump. | BL2 | CO4 | 7M |
|  | b) | The internal and external diameters of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1000 r.p.m. The vane angles of the impeller at inlet and outlet are 200 and 300 respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water. | BL5 | CO4 | 7M |
| **(OR)** | | | | | |
| 9. | a) | The resistance force *F* of a ship is a function of its length *L*, velocity *V*, acceleration due to gravity *g* and fluid properties like density  and viscosity. Write the relationship in a dimensionless form. | BL4 | CO4 | 7M |
|  | b) | Explain different types of similarities that must exist between model and prototype. | BL2 | CO4 | 7M |

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