CBCS SCHEME

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17CV43

Fourth Semester B.E. Degree Examination, June/July 2019
Applied Hydraulics

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Missing data may suitably be assumed.***

Module-1

1 a. Explain Dimensionally Homogeneous equation. Give any two examples. **(10 Marks)**

b. Using Buckingham's π – theorem, show that the velocity through a circular orifice is given by $V = \sqrt{2gH}\ \phi\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$, where H is head causing flow, μ is coefficient viscosity, ρ = mass density and g = gravitational acceleration. **(10 Marks)**

OR

2 a. Derive an expression for kinematic and dynamic similarities. **(04 Marks)**

b. In the model test of a spillway the discharge and velocity of flow over the model were $2m^3/s$ and 1.53 m/s respectively. Calculate the velocity and discharge over the prototype which is 36 times the model size. **(08 Marks)**

c. A solid cylinder 2m in diameter and 2m high is floating in water with its axis vertical. If the specific gravity of the material of cylinder is 0.65, find its metacentric height. State also whether the equilibrium is stable or unstable. **(08 Marks)**

Module-2

3 a. Explain various types of flows in channel. **(10 Marks)**

b. A canal of trapezoidal section has bed width of 8m and bed slope of 1 in 4000. If the depth of flow is 2.4m and side slopes of the channel are 1H to 3V, then determine the average velocity and the discharge carried by the channel. Also compute the average shear stress at the channel boundary. Take C = 56. **(10 Marks)**

OR

4 a. Obtain the conditions of most economical trapezoidal section in which side slope is constant. **(10 Marks)**

b. A 8m wide channel conveys $15m^3/s$ of water at a depth of 1.2m. Obtain the following :
i) Specific energy of the flowing water.
ii) Critical depth, Critical velocity and minimum specific energy.
iii) Froude number and state whether flow is subcritical or supercritical. **(10 Marks)**

Module-3

5 a. Derive an expression for loss of energy head for hydraulic jump. **(10 Marks)**

b. In a rectangular channel of 0.5m width, a hydraulic jump occurs at a point where depth of water flow is 0.15m and Froude number is 2.5 obtain the following :
i) Sp. Energy ii) Critical and subsequent depths iii) Loss of head and iv) Energy dissipated. **(10 Marks)**

OR

6 a. Derive an expression for length of Back water curve. **(10 Marks)**

b. In a rectangular channel of width 24m and depth of flow 6m, the rate of flow of water is 86.4 m^3/S. If the bed slope of the channel is 1 in 4000 then find the slope of the free surface of water. Take C = 60. **(10 Marks)**

Module-4

7 a. Derive an expression for impulse momentum equation. **(05 Marks)**

b. Derive an expression for thrust exerted by the jet strikes a stationary curved vane at one end tangentially when the vane is symmetrical. **(07 Marks)**

c. A jet of water from a nozzle is deflected through 60^0 from its original direction by curved vane which enters tangentially without shock with a velocity of 30m/s and leaves with a mean velocity of 25m/s. If the mass issued from nozzle per second is 0.8 kg/s, calculate the magnitude and direction of the resultant force on the vane, if the vane is stationary. **(08 Marks)**

OR

8 a. Explain classification and efficiencies of turbines. **(10 Marks)**

b. A pelton wheel is to be designed for the following specifications :
Shaft power = 11,772 kW ; Head = 380m ; Speed = 750 r.p.m ; Overall efficiency = 86%
Jet diameter is not to exceed one – sixth of the wheel diameter. Determine
i) Wheel diameter ii) No. of jets required iii) Diameter of the jet.
Take $K_{V_1} = 0.985$ and $K_{u_1} = 0.45$. **(10 Marks)**

Module-5

9 a. With the help of neat sketches, explain Franci's inward flow reaction turbine. **(10 Marks)**

b. Calculate the diameter and speed of the runner of a Kaplan turbine developing 6000 kW under an effective head of 5m. Overall efficiency of the turbine is 90%. The diameter of boss is 0.4 times the external diameter of the runner. The turbine speed ratio is 2.0 and flow ratio 0.6. What is the specific speed of the turbine? **(10 Marks)**

OR

10 a. Explain with neat sketches, components and working of a centrifugal pump. **(10 Marks)**

b. A centrifugal pump impeller runs at 80 r.p.m and has outlet vane angle of 60°. The velocity of flow is 2.5m/s throughout and diameter of impeller at exit is twice that at inlet. If the manometric head is 20m and the manometric efficiency is 75%, determine
i) The diameter of impeller at the exit ii) Inlet vane angle. **(10 Marks)**

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