

CBGS (3 Hours)

QP Code : 31076

Max Marks :80

N.B (1) Question No.1 is compulsory

(2) Solve any three questions of the remaining questions .

(3) Assume suitable data if required.

(4) Draw neat figures.

Q 1) Answer any Four out of the following.

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- What are the methods of dimensional analysis and state Reyleighs method.
- Define and explain Reynolds number and Mach number
- Define and explain the term jet propulsion
- Draw and label the sketch of Francis Turbine
- Explain working of hydraulic lift
- What is priming and why it is necessary

Q 2) a) Lawn sprinkler has two nozzles of diameters 3 mm each is connected across a tap of water. The nozzles are at distance of 40 cm and 30 cm from the centre of tap. The rate of water through the tap is $100 \text{ cm}^3/\text{s}$. The nozzle discharge water in the downward directions. Determine the angular speed at which the sprinkler will rotate free

b) A 30 cm diameter pipe carries water under a head of 15 m with velocity of 4 m/s. If the axis of the pipe turns through 45° , find the magnitude and direction of resultant force at the bend

Q 3) a) The performance of spillway of a power project is to be studied by means of a model constructed of scale 1:9. Neglecting the viscous and surface tension effect, determine:

- Rate of flow in the model for a prototype discharge of $1000 \text{ m}^3/\text{s}$
- The dissipation of energy in the prototype hydraulic jump, if the jump in the model studies dissipates 294.2 watts (0.4 metric horse power)

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- b) The pressure drop ' Δp ' in a pipe of diameter D and length L depends on mass density ρ and viscosity μ of the flowing fluid, mean velocity of flow V and average height k of roughness projections on the pipe surface 10
- Q 4) a) A jet of water having velocity of 30 m/s impinges on a series of vanes moving with a velocity of 20m/s. The jet makes an angle of 30° to the direction of motion of vane when entering and leaves at an angle of 120° . Draw the triangles of velocities at inlet and out and find, i) the angle of vanes tips so that water enters and leaves without shock ii) The work done per N of water entering the vanes iii) The efficiency. 10
- b) A turbine is to operate under a head of 200m at 200r.p.m the discharge is 9 cumec. If the efficiency is 90%. Determine the performance of the turbine under a head of 20m. 10
- Q 5) a) Write a short note on
i) Hydraulics intensifier
ii) Hydraulic press 10
- b) Describe the performance characteristics of centrifugal pump. 10
- Q 6) a) Two geometrically similar pumps are running at same speed of 1000 rpm. One pump has an impeller diameter of 0.30m and lifts water at the rate of 20 litres/s against a head of 15m. Determine the head and impeller diameter of the other pump to deliver half the discharge 10
- b) A propeller reaction turbine of runner diameter 4.5m is running at 40 rpm. The guide blade angle at inlet is 145° and runner blade angle at outlet is 25° to the direction of vane. The axial flow area of water through runner is 25 m². If the runner blade angle at inlet is radial determine (i) Hydraulic efficiency of turbine (ii) Discharge through turbine (iii) power developed by turbine and (iv) Specific speed of the turbine 10

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