Code No: R22014                      **R10**                      SET - 1

**II B. Tech II Semester Regular Examinations, August– 2014**
**HYDRAULICS AND HYDRAULIC MACHINERY**
(Civil Engineering)

Time: 3 hours                                                      Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1.  a) Explain the terms: i) specific energy     ii) critical depth and        iii) Critical velocity.
    b) In a rectangular open channel of 5 m width the flow rate is 12 m$^3$/s and depth of flow is 1.0 m. Determine the critical depth and the alternate depth.                      (6M+9M)

2.  a) Explain the term hydraulic jump. Derive an expression for the downstream depth of hydraulic jump.
    b) Define specific energy and draw the specific energy diagram. Explain how it is useful for the open channel flow.                      (8M+7M)

3.  Assuming that the viscous force F exerted by a fluid on a sphere of diameter D depends on the viscosity μ, mass density of the fluid "ρ", and the velocity of the sphere ν, obtain and expression for the viscous force.                      (15M)

4.   a) Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet.
    b) A jet of water of diameter 100 mm moving with a velocity of 35 m/s strikes a curved fixed symmetrical plate at the center. Find the force exerted by the jet of water in the direction of the jet, if the jet is deflected through an angle of 120° at the outlet of the curved plate.

                                                                      (7M+8M)
5.  a) Explain how hydraulic turbines are classified.
    b) Explain briefly the principles on which a Kaplan turbine works.                      (7M+8M)

6.  a) What is cavitation? How can it be avoided in reaction turbine?
    b) What is the basis of selection of a turbine at a particular place?                      (8M+7M)

7.  Define a centrifugal pump. Explain the working of a single stage centrifugal pump with neat sketches.                      (15M)

8.  Write short notes on the following:
    a) Firm Power
    b) Secondary power
    c) Diversity factor
    d) Load duration curve.                      (15M)

Code No: R22014 | **R10** | SET - 2

**II B. Tech II Semester Regular Examinations, August– 2014**
**HYDRAULICS AND HYDRAULIC MACHINERY**
(Civil Engineering)

Time: 3 hours                                                                                    Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. a) Derive the condition for depth of flow of a most economical circular channel section subject to the condition for maximum velocity.
   b) Determine the economical cross-section for an open channel of trapezoidal section with side slopes of 1 vertical to 2 horizontal, to carry 12 $m^3$/s, the bed slope being 1/2100. Assume Manning coefficient as 0.022.                                                        (7M+8M)

2. Define specific energy? Sketch the specific energy curve and explain regimes of flow? Indicate the features of critical flow? Deduce the condition for minimum specific energy and the related expressions in rectangular channels?                                            (15M)

3. a) Explain different types of hydraulic similarities that must exist between a prototype and its model.
   b) Explain the terms: distorted models and undistorted models. What is the use of distorted models?                                                                                (7M+8M)

4. a) Derive the expression for the force exerted by a water jet on a plate moving in the same direction of the jet with a velocity less than that of the jet.
   b) A blade turns the jet of diameter 2.5cm at a velocity of 25 m/s by 60°. Determine the force exerted by the blade on the fluid.                                            (8M+7M)

5. a) What are the main differences between impulse and reaction turbines?
   b) List the various efficiencies used to express the performance of hydraulic turbines.
                                                                                        (7M+8M)

6. a) What are unit quantities? Define the unit quantities for turbine.
   b) By means of a neat sketch explain the governing mechanism of Francis turbine.    (7M+8M)

7. What do you mean by manometric efficiency, mechanical efficiency and overall efficiency of centrifugal pump?                                                                        (15M)

8. a) What is meant by flow duration curve and power duration curve? How do you differentiate these? How would you construct such curves?
   b) Explain how hydropower plants are classified.                                  (8M+7M)

Code No: R22014          **R10**          SET - 3

## II B. Tech II Semester Regular Examinations, August– 2014
## HYDRAULICS AND HYDRAULIC MACHINERY
(Civil Engineering)

Time: 3 hours                                             Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1.  a) Explain the terms specific energy of a flowing liquid, minimum specific energy, critical depth, critical velocity and alternate depths as applied to non-uniform flow.
    b) A trapezoidal channel has a bed width of 5 m, side slopes of 1 upon 1.5 and Manning's n = 0.016. Compute the critical slope and the corresponding discharge for a critical depth of 2 m                                             (7M+8M)

2.  a) Define a back water curve and derive an expression for finding the length of the back water curve.
    b) A rectangular channel of 5 m width discharges water at the rate of 1.6 m³/s into a 5 m wide apron with 1/2800 slope at a velocity of 5 m/s. Determine the height of the hydraulic jump and energy loss.                                             (7M+8M)

3.  What do you mean by dimensional numbers? Name any four dimensional numbers. Define and explain Reynold's number, Froude's number and Mach number. Derive expressions for any above two numbers.                                             (15M)

4.  a) Show that the force exerted by a jet of water on an inclined fixed plate in the direction of the jet is given by $F_x = \rho\ aV^2\ \sin^2\theta$, where a= Area of the jet, V=velocity of the jet and θ=inclination of the plate with the jet.
    b) A blade turns the jet of diameter 3 cm at a velocity of 20 m/s by 60°. Determine the force exerted by the blade on the fluid.                                             (7M+8M)

5.  a) What is draft tube? What are its functions?
    b) Describe functions of various main components of Pelton turbine with neat sketch (7M+8M)

6.  a) What do you mean by surge tank? What are different types of surge tanks?
    b) Explain various characteristics curves of a hydraulic turbine.                                             (8M+7M)

7.  Define a centrifugal pump. Explain the working of a single stage centrifugal pump with neat sketches.                                             (15M)

8.  a) How do you estimate hydropower potential
    b) List out twelve important hydropower plants in India.                                             (7M+8M)

Code No: R22014          **R10**          SET - 4

## II B. Tech II Semester Regular Examinations, August– 2014
## HYDRAULICS AND HYDRAULIC MACHINERY
(Civil Engineering)

Time: 3 hours                                                        Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. a) Derive the condition for the best side slope of the most economical trapezoidal channel.
   b) Using Bazins formula, determine the discharge through a rectangular ordinary earthen channel 2 m wide and 0.6 m deep with a slope of l in 2600. Assume Bazins constant k = 1.303. If Manning constant for this type is 0.025, determine and compare the flow.
   (7M+8M)

2. a) Define hydraulic jump and explain under what circumstances it occurs
   b) Obtain an expression for the depth after the hydraulic jump and the loss of head due to the jump. Write the assumptions made.          (7M+8M)

3. State Buckingham's Π-theorem. Why this theorem is considered superior over the Rayleigh's method for dimensional analysis.          (15M)

4. a) Define the terms: i) Impact of jets, and          ii) Jet propulsion.
   b) A jet of water of diameter 55 mm moving with a velocity of 20 m/s strikes a fixed plate in such a way that the angle between the jet and the plate is 60°. Find the force exerted by the jet on the plate   i) in the direction normal to the plate, and     ii) in the direction of the jet.
   (6M+9M)

5. a) How will you classify the turbines?
   b) Differentiate between turbines and pumps.          (7M+8M)

6. What do you understand by the characteristics curves of turbine? Name the important characteristics of a turbine.          (15M)

7. Draw and discuss the operating characteristics of a centrifugal pump          (15M)

8. a) What are the main components of hydropower plants and explain each in detail
   b)  Define the terms: i) load factor,       ii) utilization factor and       iii) capacity factor
   (8M+7M)