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

II B. Tech II Semester Supplementary Examinations Jan/Feb - 2015
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) Define an open channel and compare open channel with pipe flow.
   b) Determine the expressions for the most economical depths of flow of water in terms of the diameter of a channel of circular cross-section for maximum velocity. (7M+8M)

2. a) Derive the equation for gradually varied flow.
   b) In a rectangular channel 0.6 m wide, a hydraulic jump occurs where the Froude number is 3. The depth after the jump is 0.6 m. Estimate the total loss of head and the power dissipated due to jump. (7M+8M)

3. a) What are the limitations of hydraulic similitude?
   b) Explain what is meant by dynamic similarity between a flow system and its model. If the dynamic behavior of the flow system for an overflow spillway is governed by the Froude law of similarity, what would be the discharge Q_r, when the (model) scale ratio is L_r? Show that the same result would be obtained if the weir formula is used instead and it is assumed that the prototype and the model spillways have the same coefficient of discharge. (7M+8M)

4. a) Derive the expression for force of jet impinging on a moving curved vane.
   b) A jet of water having a velocity of 45 m/s impinges without shock on a series of vanes moving at 15 m/s. The direction of motion of the vanes is inclined at 20^0 to that of jet, the relative velocity at outlet is 0.9 of that at inlet and absolute velocity of water at exit is to be normal to the motion of vanes. Find i) vane angles at inlet and outlet and ii) Work done on vanes per N (newton) of water supplied by jet. (7M+8M)

5. a) Classify hydraulic turbines based on head, flow type and specific speed.
   b) Determine the maximum height of straight conical draft tube of 13240 KW Francis turbine running at 150 r.p.m., under a net head of 27 m. The turbine is installed at station where the effective atmospheric pressure is 10.6 m of water. The draft tube must sink at least 0.77 m below the tail race. (7M+8M)
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Code No: R22014 **R10** SET - 1

6. a) Explain the performance characteristics of Kaplan turbine.
   b) In a hydroelectric station, the water is available under a head of 15 m at the rate of 100 m^3/s. Calculate the number of turbines with a speed of 65 r.p.m and 82% efficiency. The specific speed of the turbine is not to exceed 125 r.p.m. Also calculate the power produced by each turbine. (5M+10M)

7. a) Classify centrifugal pumps and give advantages of centrifugal pumps over reciprocating pumps.
   b) A three stage centrifugal pump has impellers 400 mm in diameter and 20 mm wide at outlet. The vanes are curved back at the outlet at 45^0 and reduce the circumferential area by 10 %. The manometric efficiency is 90 % and overall efficiency is 80 %. The pump is running at 1000 r.p.m and delivering 0.05 m^3/s. Determine:
   i) Head generated by the pump and ii) Shaft power required to run the pump. (7M+8M)

8. a) Compare hydropower stations with thermal power stations.
   b) A hydro-electric power plant produces 20 MW under a head of 15m. If the overall efficiency of the plant is 72%, determine: i) Type of turbine ii) Synchronous speed of the generator. (7M+8M)

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

II B. Tech II Semester Supplementary Examinations Jan/Feb - 2015
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) List out and explain the types of flow in channels.
   b) A rectangular channel 3 m wide takes a discharge of 5 m^3/s at a water depth of 1m. If it is converted to a trapezoidal channel of side slopes 1:2, would there be an appreciable saving in the power lost? Take C, the Chezy's constant as 50 in SI units for each case. (7M+8M)

2. a) Define critical depth, critical velocity and critical flow.
   b) A rectangular channel 6 m wide discharges 1440 liters/s of water into a 6 m wide apron with no slope with a mean velocity of 6 m/s. What is the height of the jump? How much energy is absorbed in the jump? (7M+8M)

3. a) Define and explain geometric, kinematic and dynamic similarities.
   b) An air duct is to be modeled to a scale of 1:20 and tested with water which is 50 times viscous and 800 times denser than air. When tested under dynamically similar conditions, the pressure drop between two sections in the model is 235 kPa. What is the corresponding pressure drop in the prototype? (7M+8M)

4. a) Derive the expression for work done and efficiency of jet striking centrally on a moving curved vane. Also find the condition for maximum efficiency.
   b) A 75 mm diameter jet having a velocity of 30 m/s strikes a flat plate, the normal of which is inclined at 45^0 to the axis of the jet. Find the normal pressure on the plate,
   i) When the plate is stationary
   ii) When the plate is moving with a velocity of 15 m/s in the direction of the jet, away from the jet. Also determine the power and efficiency of the jet when the plate is moving.
   (7M+8M)

5. a) Compare impulse turbine with reaction turbine.
   b) An inward flow reaction turbine is working under a head of 25 m and running at 300 r.p.m. The velocity of periphery of the wheel is 30 m/s and velocity of flow is 4 m/s. If the hydraulic losses are 20 % of the available head and the discharge is radial, find:
   i) Guide blade at inlet, ii) Wheel angle at inlet and iii) Diameter of the wheel.
   (5M+10M)
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Code No: R22014 **R10** SET - 2

6. a) Explain the governing of impulse turbines.
   b) Find the type of turbine you would employ to develop 1700 kW under a head of 150 m at 350 r.p.m, while discharging 1.75 cubic meters of water per second. (7M+8M)

7. a) Derive the expression for work done by centrifugal pump on liquid.
   b) It is required to deliver 0.048 m^3/s of water to a height of 24 m through a 150 mm diameter pipe and 120 m long by a centrifugal pump. If the overall efficiency of the pump is 75 % and co-efficient of friction, f = 0.01 for the pipe line, find the power required to drive the pump. (7M+8M)

8. a) A hydro-electric power plant produces 20 MW under a head of 15 m. If the overall efficiency of the plant is 72%, determine:
   i) Type of turbine ii) Synchronous speed of the generator.
   b) Define and explain the following terms in detail:
   i) Load factor ii) Utilization factor iii) Capacity factor (7M+8M)

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

II B. Tech II Semester Supplementary Examinations Jan/Feb - 2015
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) Give a brief note on energy and momentum correction factors.
   b) Design a concrete lined channel to carry a discharge of 500 m^3/s at a slope of 1 in 4000. The side slopes of channel may be taken as 1:1. The manning's roughness co-efficient for the lining is 0.014. Assume the permissible velocity in the section as 2.5 m/s. (7M+8M)

2. a) Derive the equation for Non-uniform flow.
   b) Determine the depth flow after the jump in a horizontal rectangular channel and consequent loss in total head when the sluice gate discharges water into the channel with a velocity of 20 m/s and depth of 2 m. (6M+9M)

3. a) Explain Rayleigh's method of dimensional analysis.
   b) An overflow structure 30m long discharges water at the rate of 750 m^3/s under a head of 8m. A model test of this structure is to be carried out in a laboratory with a maximum supply available at 50 lit/sec. Recommend a suitable scale ratio for the model. (7M+8M)

4. a) Derive the expression for work done and efficiency of jet striking at the tip of a moving curved vane.
   b) A jet of water moving with a velocity of 20 m/s strikes curved vanes moving with a velocity of 10 m/s. The jet makes an angle of 20^0 with the direction of motion of vanes at inlet and leaves at an angle of 130^0 with the direction of motion of the vanes. Calculate the vane angles at inlet and outlet, so that the water has shock less entry and exit. (7M+8M)

5. a) What is a draft tube. Derive the expression for efficiency of draft tube and explain the types of draft tubes.
   b) A Pelton wheel has a mean bucket speed of 12 m/s and is supplied with water at the rate of 0.7 m^3/s under a head of 30 m. If the buckets deflect the jet through an angle of 160^0, find the power and the efficiency of the turbine. (7M+8M)
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Code No: R22014 **R10** SET - 3

6. a) What is cavitation? How we can prevent cavitation in turbines.
   b) A hydraulic turbine is to develop 1015 KW when running at 120 r.p.m under a net head of 12 m. Work out the maximum flow rate and specific speed for the turbine if the overall efficiency at the best operating point is 92%. In order to predict its performance, a 1:10 scale model is tested under a head of 7.2 m. What would be the speed, power output and water consumption of the model if it runs under the conditions similar to the prototype? (7M+8M)

7. a) Explain various head, losses and efficiencies of a pump.
   b) A centrifugal pump is required to discharge 0.2 m^3 of water per second against a head of 22 m when the impeller rotates at a speed of 1500 r.p.m. The manometric efficiency is 75%. The head loss in pump in meters due to fluid resistance is $0.03V_2^2$ where V_2 m/s is the velocity of water leaving the impeller. The area of the impeller outlet surface is 1.2 D_2^2 m^2, where D is the impeller diameter in m. Determine: i) The impeller diameter and
   ii) The outlet vane angle. (7M+8M)

8. a) Define and explain the following terms in detail:
   i) Load factor ii) Utilization factor iii) Capacity factor
   b) Classify hydro power plants and list out the advantages and applications of hydro power plants. (7M+8M)

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

II B. Tech II Semester Supplementary Examinations Jan/Feb - 2015
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) Calculate the specific energy, critical depth and velocity for the flow of 10 m^3/s in a cement lined rectangular channel 2.5 m wide with 2 m depth of water. Is the given flow subcritical or supercritical?
   b) Determine the most economical section of rectangular channel carrying water at the rate of 0.5 m^3/s, the bed slope of the channels being 1 in 2000. Take Chezy's constant C = 50. (7M+8M)

2. a) What is hydraulic jump, explain in detail.
   b) Water flows at a velocity of 1 m/s and a depth of 2 m in an open channel of rectangular cross section, 3 m wide. At a certain section the width is reduced to 1.8 m and the bed is raised by 0.65 m. Will the upstream depth be affected? If so, to what extent? (7M+8M)

3. a) Explain the relation between model and prototype.
   b) The efficiency of a fan depends upon density, dynamic viscosity of the fluid, angular velocity of rotor, diameter of rotor and discharge of fluid. Explain in terms of dimensionless parameters. (7M+8M)

4. a) Derive the expression for work done and efficiency of jet impinging on a series of vanes.
   b) A jet of water moving at 12 m/s impinges on a concave vane shaped to deflect the jet through 120^0 when stationary. If the vane is moving at 5 m/s, find the angle of jet so that there is no shock at outlet. What is the absolute velocity of jet at exit and the work done per KN of water? Assume that the vane is smooth. (7M+8M)

5. a) Derive the expression for work done and efficiency of Francis turbine.
   b) Calculate the efficiency of a Kaplan turbine developing 2900 KW under a net head of 5 m. It is provided with a draft tube with its inlet (diameter 3 m) set 1.6 m above the tail race level. A vacuum gauge connected to the draft tube indicates a reading of 5 m of water. Assume draft tube efficiency as 78%. (7M+8M)
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Code No: R22014 **R10** SET - 4

6. a) What is surge tank? Give a brief note on different types of surge tanks.
   b) A Pelton wheel generates 8000 KW under a net head of 130 m at a speed of 200 r.p.m. Assuming the co-efficient of velocity for the nozzle 0.98, hydraulic efficiency 87%, mechanical efficiency 75%, speed ratio 0.46 and jet diameter to wheel diameter ratio is 1/9, determine: i) Discharge required ii) Diameter of the wheel iii) Diameter and number of jets required and iv) Specific speed (6M+9M)

7. a) Explain the characteristics of centrifugal pump.
   b) Two geometrically similar pumps are running at the same speed of 1000 r.p.m. One pump has an impeller diameter of 300 mm and lifts water at the rate of 0.02 m^3/s against a head of 15 m. Determine the head and impeller diameter of the other pump to deliver half the discharge. (6M+9M)

8. a) Classify hydro power plants and list out the advantages and applications of hydro power plants.
   b) Compare hydropower stations with thermal power stations. (7M+8M)

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)
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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)
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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 m^3/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)
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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 1 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)
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Code No: RT22012 **R13** SET - 1

II B. Tech II Semester Regular Examinations, May/June – 2015
HYDRAULICS AND HYDRAULIC MACHINERY
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART-A

1. a) Differentiate between uniform and non uniform flow
   b) What are the methods of dimensional analysis?
   c) Differentiate between inward and outward radial flow turbine
   d) How cavitations be avoided in reaction turbine
   e) Define slip, percentage slip and negative slip of a reciprocating pump.
   f) Define the term utilization factor

(3M+4M+4M+4M+4M+3M)

PART-B

2. a)Obtain an expression for the depth after the hydraulic jump and the loss of head Due to the jump. Write the assumptions made.
   b) Determine the economical cross-section for an open channel of trapezoidal section with side slopes of 1 vertical to 2 horizontal, to carry 10 m^3/s, the bed slope being 1/2000. Assume Manning coefficient as 0.022. (8M+8M)

3. a) What do you mean by dimensional numbers? Name any four dimensional numbers. Define and explain Reynolds's number, Froude's number and Mach number. Derive expressions for any above two numbers.
   b) What is meant by geometric, kinematic and dynamic similarities? (10M+6M)
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4. a) A water jet 20 mm in diameter and having a velocity of 90 m/s strikes series of moving blades in a wheel. The direction of the jet makes 20° with the direction of movement of the blade. The blade angle at inlet is 35°. If the jet should enter the blade without striking, what should be the blade velocity? If the outlet angle of the blade is 30°, determine the force on the blade. Assume that there is no friction involved in the flow over the blade.
   b) Differentiate between the force exerted by a jet on a single curved moving plate and a series of curved moving plate (10M+6M)

5. a) A Francis turbine working under a head of 5 m at a speed of 210 rpm develops 75 KW when the rate of flow of water is 1.8 m3/ sec. If the head is increased to 16 m, determine the speed, discharge and power.
   b) Explain briefly the principles on which a Kaplan turbine works. (9M+7M)

6. a) A centrifugal pump works against a head of 30 m and discharges 0.25 m3/s while running at 1000 rpm. The velocity of flow at the outlet is 3 m/s and the vane angle at outlet is 300. Determine the diameter and width of impeller at outlet if the hydraulic efficiency is 80 per cent.
   b) Draw and discuss the operating characteristics of a centrifugal pump (9M+7M)

7. Write short notes on the following:
   i) Firm Power ii) Secondary power iii) Utilization factor iv) Load duration curve.
   (4M+4M+4M+4M)

Code No: RT22012 **R13** SET - 2

II B. Tech II Semester Regular Examinations, May/June – 2015
HYDRAULICS AND HYDRAULIC MACHINERY
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART-A

1. a) Differentiate between Steady and unsteady flow
   b) What do you mean by repeating variable?
   c) Differentiate between the radial and axial flow turbines
   d) Define and explain hydraulic efficiency and mechanical efficiency
   e) What is an air vessel?
   f) What do you mean by mass curve?

(3M+4M+4M+3M+4M+4M)

PART-B

2. a) Derive the condition for depth of flow of a most economical circular channel Section subject to the condition for maximum velocity.
   b) A Wide channel of uniform rectangular section with a slope of 1/95 has a flow rate of 3.75 $m^3/s/m$. The Manning constant is 0.013. Suddenly the slope changes to 1/1420. Determine the normal depths for each case. Show that a hydraulic jump has to occur and calculate the downstream flow height. (8M+8M)

3. a) What are the methods of dimensional analysis? Describe the Rayleigh's method for Dimensional analysis.
   b) Explain the terms: distorted models and undistorted models. What the use is of distorted Models? (8M+8M)
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4. a) Prove that the force exerted by a jet of water on a fixed semi-circular plate in the direction of the jet when the jet strikes at the center of the semi-circular plate is two times the force exerted by the jet on an fixed vertical plate.
   b) Find the force exerted by a jet of water of diameter 100 mm on a stationary flat plate, when the jet strikes the plate normally with a velocity of 30 m/s. (8M+8M)

5. a) Define the specific speed of the turbine? Derive an expression for the specific speed. What is the significance of specific speed of the turbine.
   b) Two jets strike at bucket of a Pelton wheel, which is having shaft power as 14,715 kW. The diameter of each jet is given as 150 mm. If the net head on the turbine is 500 m, find the overall efficiency of the turbine. Take $C_v = 1.0$

   (8M+8M)

6. a) The diameter and width of a centrifugal pump impeller are 50 cm and 2.5 cm. The pump runs at 1200 rpm. The suction head is 6 m and the delivery head is 40m. The frictional drop in suction is 2 m and in the delivery 8 m. The blade angle at out let is 30°. The manometric efficiency is 80% and the overall efficiency is 75%. Determine the power required to drive the pump. Also calculate the pressures at the suction and delivery side of the pump
   b) Define a centrifugal pump. Explain the working of a single stage centrifugal pump with neat sketches.

   (9M+7M)

7. a) How do you estimate hydropower potential
   b) Discuss various classifications of different types of hydropower plants

   (9M+7M)

Code No: RT22012 **R13** SET - 3

II B. Tech II Semester Regular Examinations, May/June – 2015
HYDRAULICS AND HYDRAULIC MACHINERY
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART-A

1. a)What is specific energy curve
   b) State Buckingham's π- theorem
   c) Differentiate between the impulse and reaction turbine
   d) Define the terms 'unit power', 'unit speed' and 'unit discharge'
   e) Differentiate between a single acting and double acting reciprocating pump
   f) What is a draft tube? What are its functions? (3M+4M+3M+4M+4M+4M)

PART-B

2. 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 rectangular channel of 5 m width discharges water at the rate of 1.5 m^3/s into a 5 m wide apron with 1/3000 slope at a velocity of 5 m/s. Determine the height of the hydraulic jump and energy loss. (8M+8M)

3. a) Explain different types of hydraulic similarities that must exist between a prototype and its model.
   b) Define the term dimensional analysis and model analysis (10M+6M)

4. a) A jet of water of diameter 50 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.
   b) Differentiate between the force exerted by a jet of water on a fixed vertical plate and moving vertical plate. (10M+6M)

5. a) A Kaplan turbine is to develop 2400 KW when running at 240 rpm under a net head of 49m. In order to predict its performance a model of scale 1:5 istested under a net head of 25m. At what speed should the model run and what power would it develop. Determine the discharge in the model and in full scale turbine if the overall efficiency of the model is 85%
   b) Explain the different types of the efficiency of a turbine (9M+7M)

6. a)What do you mean by manometric efficiency, mechanical efficiency and overall efficiency of centrifugal pump.
   b) What is negative slip in a reciprocating pump? Explain with neat sketches the functions of air vessels in a reciprocating pump (8M+8M)

7. 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 (9M+7M)
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Code No: RT22012 **R13** SET - 4

II B. Tech II Semester Regular Examinations, May/June – 2015
HYDRAULICS AND HYDRAULIC MACHINERY
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART-A

1. a) Differentiate between Critical, sub-critical and super –critical flow in a open channel
b) What do you mean by fundamental units and derived units? Give examples
c) Differentiate between the turbines and pumps
d) What is specific speed
e) Differentiate between a single cylinder and double cylinder reciprocating pump
f) Define the term load factor

(4M+4M+4M+3M+4M+3M)

PART-B

2. a) Derive the condition for the best side slope of the most economical trapezoidalchannel.
b)Water is discharged at a velocity of 8 m/s with a depth of 0.7 m in a horizontal rectangular open channel of constant width when the sluice gate is opened upwards. Determine the height of the hydraulic jump and the loss of energy (8M+8M)

3. a) State Buckingham's Π-theorem. Why this theorem is considered superior over the Rayleigh's method for dimensional analysis.
b) What is meant by geometric, kinematic and dynamic similarities? (10M+6M)

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 3 cm at a velocity of 20 m/s by 60°. Determine the force exerted by the blade on the fluid. (8M+8M)

5. a) A Pelton wheel is having a mean bucket diameter of 0.8 m and is running at 1000 r.p.m. The net head on the Pelton wheel is 400 m. If the side clearance angle is 15° and discharge through nozzle is 150 liters/s, find (i) Power available at the nozzle, and (ii) Hydraulic efficiency of the turbine
b)What do you understand by the characteristics curves of turbine? Name the important characteristics of a turbine.

(9M+7M)

6. a) What is meant by priming of a centrifugal pump? What are the different priming arrangements employed for small and big pumping units?
b) Find an expression for the head lost due to friction in suction and delivery pipe (8M+8M)

7. a) Compare and contrast between hydropower station and thermal power station.
b) List out twelve important hydropower plants in India. (9M+7M)
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