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Code No: ME1521

GEC-R14

III B. Tech I Semester Supplementary Examinations, July 2017

HYDRAULIC MACHINES AND SYSTEMS

(Mechanical Engineering)

Time: 3 Hours

Max. Marks: 60

Note: All Questions from **PART-A** are to be answered at one place.

Answer any **FOUR** questions from **PART-B**. All Questions carry equal Marks.

PART-A

6 × 2 = 12M

1. What is a mass curve and write its uses.
2. Write an expression for the force exerted by a jet of water on a moving inclined plate in the direction of the jet.
3. Define the specific speed of a turbine. What is the significance of the specific speed?
4. Define an indicator diagram. Draw an indicator diagram by considering the effect of acceleration and friction in suction and delivery pipes of a reciprocating pump.
5. Differentiate between the volute casing and vortex casing of centrifugal pump.
6. List out the functions of Hydraulic control system.

PART-B

4 × 12 = 48M

1. a) Distinguish between Hydro Electric power plant and Thermal Power plant. (6M)
b) A run-of-river Hydrel Power Plant with an installed capacity of 15000 kW operates at 20% load factor when it serves as a peak load station. What should be the minimum discharge in the stream so that it may serve as the base load station? The plant efficiency may be taken as 80% when working under a head of 15 m. Also calculate the maximum load factor of the plant when the discharge in the stream is 30 m³/s. (6M)
2. A jet of water having a velocity of 40 m/s strikes a curved vane, which is moving with a velocity of 20 m/s. The jet makes an angle of 30° with the direction of motion of vane at inlet and leaves an angle of 90° to the direction of motion of vane at outlet. Draw the velocity triangles at inlet and outlet and determine
 - i) the vane angles at inlet and outlet so that the water enters and leaves the vane without shock,
 - ii) the work done per second by the jet and
 - iii) Efficiency of the jet. (12M)

3. a) How will you classify the turbines? (8M)
- b) A turbine is to operate under head of 25 m at 200 rpm. The discharge is $9 \text{ m}^3/\text{s}$. if the efficiency is 90%, determine:
- i) specific speed of the machine,
 - ii) power generated, and
 - iii) type of turbine. (4M)
4. a) Explain the working principle of single stroke reciprocating pump with neat sketch. (6M)
- b) A double acting pump has a bore of 0.2 m and stroke of 0.4 m. The suction pipe has a diameter of 0.1 m and is fitted with an air vessel. Find the rate of flow into or from the air vessel when the crank makes angle of 30° , 90° and 120° with inner dead center. Determine also the crank angles at which there is no flow to or from the air vessel. Take the speed as 120 r.p.m., and assume that the plunger has simple harmonic motion. (6M)
5. a) Draw and discuss the characteristics curves of the pump. (6M)
- b) Derive an equation for work done by the impeller of centrifugal pump. (6M)
6. Explain with the help of neat sketch, the principle and the working of the Hydraulic devices:
- i) Hydraulic ram, and
 - ii) Hydraulic torque converter and Hydraulic coupling. (12M)
