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GSTO 8/6/12

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Printed Pages—4

EME011

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2528 Roll No.

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B. Tech.

(SEM. VI) THEORY EXAMINATION 2011-12

FLUID MACHINERY

Time : 3 Hours

Total Marks : 100

- Note** :—(1) Attempt *all* questions.
(2) All questions carry equal marks.
(3) Assume suitably any relevant data, if required.

1. Attempt any *two* out of the following :— (10×2=20)

- (a) Classify fluid machinery based on
- (i) Energy added to fluid,
 - (ii) Energy subtracted from fluid, and
 - (iii) Fluid used as means of energy transfer.

Give appropriate examples.

- (b) A jet of water from a fixed nozzle has a diameter of 25 mm and strikes a flat plate at an angle of 30° to the normal to the plate. The velocity of jet is 5 m/s and surface of plate is frictionless. Calculate the force exerted normal to the plate :
- (i) if the plate is stationary and
 - (ii) if the plate is moving with a velocity u of 2 m/s in the same direction as the jet.

(c) The mean bucket speed of a Pelton turbine is 14 m/s. The rate of flow of water supplied by the jet under a head of 45 m is 800 litres per second. If the jet is deflected by the buckets at an angle of 165° . Find the horse power and efficiency of turbine. Draw the velocity triangles. Take coefficient of velocity as 0.985.

2. Attempt any *two* out of the following :— (10×2=20)

(a) What are the uses of a draft tube ? Sketch and name the different types of draft tubes and state which one of them gives maximum efficiency.

(b) What is the Thoma's factor of cavitation ? What is its significance for turbines ? On what factors does the cavitation in water turbine depend ? Describe some methods to avoid cavitation in water turbines.

(c) Water is supplied to an axial flow turbine under a total head of 35 m. The mean diameter of runner is 2 m and it rotates at 145 rpm. Water leaves the guide vanes at 30° to the direction of runner rotation and at mean radius the angle of runner blade at outlet is 28° . If 7 per cent of total head is lost in the casing and guide vanes and the relative velocity is reduced by 8 per cent due to friction in the runner, determine the blade angle at inlet (at mean radius) and the hydraulic efficiency of turbine.

3. Attempt any *two* out of the following :— (10×2=20)

(a) Show that pressure rise in the impeller of a centrifugal pump is given by :

$$\frac{1}{2g} [v_1^2 + u_2^2 - v_2^2 \operatorname{cosec}^2 \beta_2].$$

Neglect all frictional losses and assume that the blades of the impeller are curved back through angle β_2 at outlet. Notations used have usual meaning.

(b) Sketch and briefly describe the volute and diffusion type pumps. What function is served by the volute chamber in a centrifugal pump ?

(c) A centrifugal pump impeller has diameter of 60 cm and width 6 cm at outlet. The pump delivers $0.8 \text{ m}^3/\text{s}$ against a head of 80 m while running at 1450 rpm. The leakage loss after the impeller is 4 per cent of discharge, the external mechanical loss is 10 kW and the hydraulic efficiency is 80 per cent. Determine the blade angle at outlet, the power required and the overall efficiency of the pump.

4. Attempt any *two* out of the following :— (10×2=20)

(a) Explain the term negative slip as used in connection with the working of a reciprocating pump. Why and when does negative slip occur ?

The diameter and stroke of a single acting reciprocating pump are 10 cm and 20 cm respectively. The suction lift is 3 m. The pump is fed by a suction pipe 5 cm in diameter and 6 m long. What is the maximum speed at which pump can be run without separation in the suction pipe ?

(b) Show that work saved in overcoming friction in the pipeline by fitting air vessel is 84.8% for a single acting pump and 39.2% for a double acting pump.

(c) With the help of a neat sketch explain the working of a gear pump. Draw the typical performance curves of a gear pump.

5. Attempt any *two* out of the following :— (10×2=20)

(a) Explain, with a neat sketch, the construction and operation of a hydraulic ram.

(b) In a hydraulic crane, the ram has a diameter of 20 cm and ratio between the movement of load and the ram is 10 : 1. The liquid is supplied to the jigger at a pressure of 5 MPa and the mechanism has a mechanical efficiency of 55%. Determine :

(i) the load lifted by the crane and

(ii) the quantity of liquid used when the load is raised through 8 m height.

(c) Draw neat sketches of :

(i) Hydraulic intensifier and

(ii) Torque convertor.

Label the diagram. Where are these devices used ?