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B. E. (Fifth Semester) Examination
April-May/Nov.-Dec. 2020

(New Scheme)

(Mechanical Engineering Branch)

FLUID MACHINERY

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Part (a) of each question is compulsory. Answer any* ***two*** *parts from (b), (c) and (d) in each question.*

Unit-I

1. (a) Explain "Boundary Layer". 2

(b) Derive VonKarman momentum integral equation for boundary layer. 7

(c) Obtain an expression for coefficient of lift for a rotating cylinder placed in a uniform flow. 7

(d) A smooth plate 2 m wide & 2·5 m long is towed in oil (sp. gr. = ·8) at a velocity of 1·5 m/s along its length. Find the thickness of boundary layer & shear stress at the training edge of the plate. $V_{oil} = 10^{-4}$ m^2/s. 7

Unit-II

2. (a) Define specific speed of turbine. 2

(b) Describe with a neat sketch the governing mechanism of a pelton turbine. 7

(c) A nozzle of 60 mm diameter delivers of stream of water at 24 m/s perpendicular to a plate that moves away from the jet at 6 m/s 7

Find :

(i) The force on the plate

(ii) The workdone

(iii) The efficiency of the jet

(d) A single jet pelton wheel runs at 300 rpm under a

head of 510 m. The jet diameter is 200 mm its deflection inside the bucket is 165° and its relative velocity is reduced by 15% due to friction. Determine :

(i) Water power

(ii) Resultant force on the bucket

(iii) Overall efficiency.

take mechanical loss = 3%

Coefficient of velocity = ·98

speed ratio = ·46 7

Unit-III

3. (a) What is Draft tube 2

(b) Show that the hydraulic efficiency for a Francis turbine having velocity of flow through runner as constant is given by relation : 7

$$\eta_{th} = \frac{1}{\frac{1/2 \tan^2 \alpha}{\left(1 - \frac{\tan \alpha}{\tan \theta}\right)}}$$

(c) What is cavitation? How can its be avoided in Reaction turbine? Explain. 7

(d) A reaction turbine works at 450 rpm under a head of 120 m. Its diameter at inlet is 1·2 m and the flow area is ·4 m^2. The angles make by absolute & relative velocities at inlet are 20° & 60° respectively with tangential velocity. 7

Determine :

(i) The volume flow rate

(ii) The Power developed

(iii) The hydraulic efficiency

Unit-IV

4. (a) Write down the principle of working of a centrifugal pump. 2

(b) Explain the working of a single stare centrifugal pump with a neat sketch & list the components parts. 7

(c) Explain briefly with neat sketches the following types of casing : 7

(i) Volute casing

(ii) Vortex casing

(d) It is required to deliver ·048 m^3/s of water to a height of 24 m through a 150 mm diameter pipe & 120 m long by centrifugal pump. If the overall efficiency of the pump is 75% & co-efficient of friction f = ·01 for the pipe line. Find the power required to drive the pump. 7

Unit-V

5. (a) Explain Slip. 2

(b) How will you classify the reciprocating pumps? Explain main parts of Reciprocating pumps. 7

(c) Define an indicator diagram. How will you prove that area of indicator diagram is proportional to the work done by reciprocating pump. 7

(d) A single acting reciprocating pump has a stroke length of 150 mm, suction pipe is 7 m long & the ratio of suction pipe diameter to the piston diameter is 3/4. The water level in the sump is 2.5 m below the axis of the pump cylinder & the pipe connecting the sump & pump cylinder is 75 mm in diameter. If the crank is running at 75 rpm. Determine the pressure

head on the piston at the beginning, middle & end of the suction stroke. 7

Take friction co-efficient f = .01