(Please write your Exam Roll No.) Exam Roll No. ..0031.....

END TERM EXAMINATION

FOURTH SEMESTER [B.TECH.] MAY-JUNE 2015

Paper Code: ETCE 206 **Subject: Hydraulics & Hydraulic Machines**

Time : 3 Hours **Maximum Marks :75**

Note: Attempt five questions including Q.no.1 which is compulsory. Select one question from each unit.

Q1 (a) What are the factors that can change a laminar flow into a turbulent flow? **(5x5=25)**

(b) Explain the Magnus effect with neat diagram.

(c) What is the slip of a reciprocating pump? Why is it negative sometimes?

(d) What are the important aspects of total energy line and hydraulic gradient line?

(e) Define -

(i) Unit Speed

(ii) Jet Ratio

(iii) Manometric efficiency

(iv) Hydraulic efficiency

(iv) NPSH

UNIT-I

Q2 (a) Derive an expression for mean velocity for laminar flow through a pipe. **(6)**

(b) Two parallel plates are placed horizontally with 10mm gap between them. The oil in the gap has a dynamic viscosity 200 centi-poise and density 900Kg/m^3. If the pressure gradient is 1K Pa per meter length of the plate, when the top plate is pulled at 1m/s, find the velocity distribution, the discharge and the shears stress on the top and the bottom plates. **(6.5)**

OR

Q3 (a) Using Von Karman's Momentum integral equation for a laminar flat plate boundary layer $\frac{\tau}{\rho U^2} = \frac{d\theta}{dx}$, derive an expression for δ, τ_0, C'_D and C_D for $\frac{u}{U_\infty} = \frac{u}{U} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}$. **(7.5)**

(b) Define physically and mathematically the concept of displacement, momentum and energy thickness of boundary layer. Place them in order of their magnitudes. **(5)**

UNIT-II

Q4 (a) Explain major and minor losses in a pipe flow. **(4.5)**

(b) A 200mm diameter, 3km long straight pipe runs between two reservoirs of surface elevations 140m and 70m. A 1.5km long, 250mm diameter pipe is laid parallel to the 200mm diameter pipe from its mid point to the lower reservoir. Neglecting all minor losses and assuming a friction factor of 0.02 for both pipes, find the increase in discharge caused by addition of 250mm diameter pipe. **(8)**

OR

Q5 (a) Explain – **(4)**

(i) HGL (ii) TEL.

P.T.O.

ETCE-206

P1/2

(b) The difference in water surface levels in two tank connected by three pipes in series of lengths 300m, 170m and 210m and of diameters 300mm, 200mm and 400mm respectively is 12m. Calculate the rate of flow of water if coefficient of friction are 0.005, 0.0052 and 0.0048 respectively considering: **(8.5)**
(i) minor losses (ii) neglecting minor losses

UNIT-III

Q6 (a) Draw and explain the inlet and outlet velocity diagram of Pelton turbine. **(6.5)**

(b) Explain (i) Hydraulic efficiency (ii) Volumetric efficiency (iii) Mechanical efficiency (iv) Overall efficiency **(6)**

OR

Q7 (a) A double overhung 1.6m diameter Pelton turbine installation is to develop 3200kW at 410 rpm under a head of 300m. If the overall efficiency is 0.89. Find: (i) Diameter of the nozzle (ii) Speed ratio (iii) Specific speed. **(8)**

(b) What is a draft tube? Why is it used in a reaction turbine? **(4.5)**

UNIT-IV

Q8 (a) Explain the construction and working of a centrifugal pump with the help of a neat sketch. **(6)**

(b) A centrifugal pump is delivering $0.21 m^3/s$ of water against a head of 19m, the speed of rotation of impeller is 600rpm. The diameters at outer and inner periphery of the impeller are 600mm and 300mm respectively. The area of flow is constant at $0.085 m^2$ from inlet to outlet of impeller. If the vanes of the impeller are curved backwards at an angle of 35^0 to the tangent at exit. Find- **(6.5)**
(i) Manometric efficiency
(ii) Inlet vane angle
(iii) Loss of head at inlet to the impeller when discharge is reduced by 30%.

OR

Q9 (a) Differentiate between centrifugal pump and reciprocating pump. **(4)**

(b) In a single acting reciprocating pump, the suction and delivery heads are 4.8m and 1.2m. the pump runs at 90rpm and its piston diameter is 100mm and stroke 150mm. The actual quantity of water lifted is 102 lit/min. Determine: **(8.5)**
(i) The slip
(ii) The coefficient of discharge
(iii) Theoretical power required to drive the pump.
(iv) Force required to work the piston during the suction stroke.
(v) Force required to work the piston during the delivery stroke.

****