Total No. of Pages- 2

Roll No. .....

V^th SEMESTER

B.Tech. (Mech.)

Feb.-2019

SUPPLEMENTARY EXAMINATION

ME301 Fluid Systems

Time: 3:00 Hours

Max. Marks : 40

Note: Answer all question by Selecting any two parts from each questions. All questions carry equal marks. Assume suitable missing data, if any.

Q.1[a] Derive and discus linear and angular momentum for control volume.

[b] A wind generator with a 9 m-diameter blade span has a cut-in wind speed (minimum speed for power generation) of 11 km/ at which velocity the turbine generates 0.4 kW of electric power (Fig. 1). Determine (i) the efficiency of the wind turbin generator unit and (ii) the horizontal force exerted by the wind on the supporting mast of the wind turbine. What is the effect doubling the wind velocity to 22 km/h on power generation and the force exerted? Assume the efficiency remains the same, and tal the density of air to be 1.22 kg/m^3.

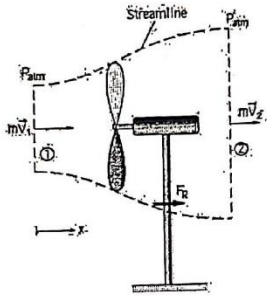

Fig.1

[c] Derive an expression for condition of maximum fluid power transmission through pipe.

Q.2[a] Derive the specific speed of the turbine and how does it help in selecting turbine.

[b] A Pelton wheels operate with a jet of 150 mm diameter under the head of 500 m. Its mean runner diameter is 2.25m and rotates with a speed of 375 rpm. The angle of bucket tip at outlet as 15° , coefficient of velocity is 0.98, mechanical lo equal to 3% of power supplied and the reduction in relative velocity of water passing through bucket is 15%. Find (i) force of jet on the bucket,(ii) the power developed, (iii) bucket efficiency and (iv) the overall efficiency.

[c]A Francis turbine has a wheel diameter of 1.2 m at the entrance and 0.6 m at the exit. The blade angle at the entrance 90^0 a the guide vane angle is 15^0. The water at the exit leaves the blades without any tangential velocity. The available head is m and the radial component of flow velocity is constant. What would be the speed of the wheel in rpm and blade angle at exit? Ignore friction

Q.3[a] A Kaplan turbine operating under a net head of 20 m develops 16 MW with an overall efficiency of 80%. The diameter of runner is 4.2 m, while the hub diameter is 2 m the dimensionless specific speed is 3 rad. If the hydraulic efficiency is 9(calculate the inlet and exit angles of the runner blades at the mean blade radius if the flow leaving the runner is purely axia

P.T.C

[b] A Pelton wheel produces 300kW of power when working under a head of 180 m with a discharge of 0.2 m^3/s. Compute the (a) hydraulic efficiency, (b) mean bucket speed, and (c) velocity of whirl at inlet and outlet. Take C_v =0.985,angle of deflection of jet = 165° and assume the relative velocity at exit remains unchanged till the exit at the bucket. Assume mechanical efficiency =1.0.

[c] Draw and explain main and operating characteristics of Kaplan turbine.

Q.4[a] The impeller of a centrifugal pump is 0.3 m in diameter and runs at 1450 rpm.The pressure gauges on suction and delivery sides show the difference of 25 m. The blades are curved back to an angle of 30°. The velocity of flow through impeller, being constant, equals to 2.5 m/s, find the manometric efficiency of the pump. If the frictional losses in impeller amount to 2 m, find the fraction of total energy which is converted into pressure energy by impeller. Also find the pressure rise in pump casing.

[b] A single acting reciprocating pump having a cylinder diameter of 150 mm and stroke of 300 mm is used to raise the water through a height of 20 m. Its crank rotates at 60 rpm. Find the theoretical power required to run the pump and the theoretical discharge. If actual discharge is 5 litres/s, find the percentage slip. If delivery pipe is 100 mm in diameter and is 15 m long, find the acceleration head at the beginning of the stroke.

[c] A hydraulic ram pump receives 80 liter/s of water from a source under a head of 5.0 m and delivers 8.0 litre/s to a reservoir 15 m above the ram. The delivery pipe is 75 m long and has a diameter of 100 mm. The supply pipe is 12 long and is 200 mm in diameter. (a) Assuming a friction factor F = 0.025 for both the pipes, estimate the efficiency of the ram. (b) What would be the efficiency if the friction in the pipes are neglected?

Q.5[a] Explain Advantages of air vessels in reciprocating pump.

[b]Explain the need for CFD and its strategy.

[c] How does CFD deals with nonlinearity in Navier-Strokes equations.