B.E. CIVIL ENGINEERING SECOND YEAR FIRST SEMESTER EXAM 2018

FLUID MECHANICS II

Time: Three hours   (*Answer any FIVE questions*)   Marks: 100

Different parts of the same question should be <u>answered together</u>. All symbols carry their usual meanings unless otherwise mentioned. Assume any relevant data if necessary.

1. a) Derive an expression for the discharge through an orifice meter.   8

   b) A horizontal venturimeter with inlet and throat diameters 20 cm and 10 cm respectively is used to measure the flow of water. The pressure at inlet is 18 N/cm^2 and the vacuum pressure at the throat is 30 cm of mercury. Determine the rate of flow. Take Cd = 0.98.   8

   c) What is pitot tube?   4

2. a) Show that for laminar flow the friction factor can be expressed as f= (64/R$_e$).   12

   b) An oil of sp. Gr. 0.9 and viscosity 0.06 poise is flowing through a pipe of diameter 200 mm at the rate of 60 litres/s. Find the head lost due to friction for a 500 m length of pipe. Find the power required to maintain this flow.   8

3. a) What are the different losses in pipe flow?   4

   b) Derive the expression for head loss due to sudden enlargement in a pipeline.   8

   c) At a sudden enlargement of a water main from 240 mm t0 480mm diameter the hydraulic gradient rises by 10 mm. Estimate the rate of flow.   8

4. a) What do you mean by open channel flow? Obtain Chezy's equation for open channel flow stating the assumptions.   10

   b) Find the bed slope of trapezoidal channel of bed width 4m, depth of water 3m and side slope of 2 horizontal to 3 vertical, when the discharge through the channel is 20 m^3/s. Take Manning's N = 0.03 in Manning's formula C = (m$^{1/6}$/N).   10

5. a) How water turbines are classified? Draw a schematic of different components of a Francis Turbine.   10

   b) A Francis turbine rotates at 300 rpm under a head of 50m. Its diameter at inlet is 1.2m and the flow area is 0.6m^2. The angles made by the absolute and relative velocities at inlet are 20^0 and 30^0 respectively with the tangential velocities. Calculate the discharge, the power developed and hydraulic efficiency. (Assume radial flow at outlet).   10

6. a) Discuss the main components of a centrifugal pump with suitable diagram. 6

b) A centrifugal pump delivers water against a net head of 14.5 metres and a design speed of 1000 r.p.m. The vanes are curved back to an angle of 30^0 with the periphery. The impeller diameter is 300 mm and outlet width 50 mm. Determine the discharge of 8 the pump if manometric efficiency is 95 %.

c) Derive the expression for the specific speed of a turbine. 6

7. a) What is hydraulic jump? Establish the relation between pre and post hydraulic jump 10 (DEPTHS).

b) A sluice gate discharges water into a horizontal rectangular channel with a velocity of 10 6 m/s and depth of flow is 0.4 m. The width of the channel is 8 m. Determine whether a hydraulic jump will occur, and if so, find its height and loss of energy per kg of water. Also determine the power lost in the hydraulic jump.

8. Write short notes on: (any **FOUR**) 4 X 5 20

a) V-Notch

b) Moody's Diagram

c) Equivalent pipe

d) Optimum cross-section of an open channel.

e) Draft tube

f) Pelton Wheel