College of Engineering, Pune
End Semester Exam – May 2012
S.Y. B. Tech (Civil Engineering)
(209)- (Fluid Mechanics-II)

Day & Date- Saturday, 12 May 2012 | Time: - 9 to 12
Maximum Marks: 50 | Duration – 3 hrs.

Instructions:
1. Solve any five questions
2. From each question solve any two
2. Figures to the write indicate full marks.
3. Assume suitable data, if necessary
4. Solve questions sequentially

Q. 1 **A.** Define following terms **5**
1) Friction drag 2) Form drag 3) lift coefficient 4) Strouhal number
4) Wake 5) Airfoil

B. Write a short note on any one **5**
1) Karman Vortex Street
2) Magnus effect

C A passenger car with frontal projected area of 1.5 m^2 travels at 56 km/hr. Determine the power required to overcome wind resistance if the drag coefficient of the car is 0.4 **5**

For the same power expended in overcoming resistance, what percentage change in speed of the car is possible if drag coefficient is reduced to 0.32 by streamlining the car body? Take density of air is 1.2 kg/m^3

Q. 2 **A.** Explain in detail the functions, location and classification of a surge tank **5**

or

Set up expression for the pressure rise produced due to closure of a valve fitted at the discharge end of a pipeline running full i) when the valve is closed gradually ii) when the valve is closed instantaneously . Consider pipe to be rigid.

B. With a sketch for pressure variation for one complete cycle, explain the phenomenon of water hammer? **5**

C The depth and velocity of flow in a rectangular channel are 1 m and 1.5 m/s respectively. If the rate of inflow at the upstream end of the channel is increased to the extent that the depth is doubled in magnitude, determine the absolute velocity of the resulting surge. **5**

Q. 3 **A.** Draw a neat sketch of hydroelectric power plant installing impulse turbine in a scheme, indicate all the major component parts and state the functions of each of the components. **5**

B The following data obtained form a test on a Pelton wheel: **5**
Head at the base of nozzle =32 m
Discharge of the nozzle=0.18 m^3/s
Area of jet =7500 sq. mm.
Power available at the shaft =44 kW
Mechanical efficiency=94%
Calculate Power lost in nozzle, in the runner and in mechanical friction.

C What are the disadvantages of an outward –flow radial turbine as compared with a radial inward-flow turbine? **5**
Design a Francis turbine runner with the following data: Net head H=68m; Speed N=750 rpm; output power P=330 kW; Hydraulic efficiency 94%; overall efficiency 85%; flow ratio=0.15; breadth ratio n=0.1; inner diameter is (1/2) outer diameter. Also assume 6%of circumferential area of the runner to be occupied by the thickness of vanes. Velocity of flow remains constant throughout and flow is radial at exit.

Q. 4 **A.** 1) Define specific speed of a centrifugal pump. Derive an expression for the same. **2**
2) What is meant by 'Priming of a pump? What are the different arrangements employed for small and big pumping units? **2**
3) Why can the suction lift of a pump not exceed a certain limit? **1**

Or

1) Show that , in general, for centrifugal pump running at speed N and giving a discharge Q, the manometric head is expressible in the form **3**

$$Hmano = AN^2 + BNQ + CQ^2$$

2) State the difference between a closed, semi-closed and open impeller **2**

B. The impeller of a centrifugal pump having external and internal diameters 500m and 250 mm respectively, width at outlet 50 mm and running at 1200 r.p.m. works against a head of 48 m. The velocity of flow through the impeller is constant and equal to 3.0 m/s. The vanes are set an angle of 40^o at outlet. Determine **5**
a) Inlet vane angle, b) Work done by the impeller on water per second and
c) Manometeric efficiency

C. A hydraulic turbine is to develop 1015 kW when running at 120 r.p.m. under a net head of 12 m. Work out the maximum flow rate and specific speed for the turbine if the overall efficiency at the best operating point is 92 percent. In order to predict its performance, a 1:10 scale model is tested under a head of 7.2 m. What would be the speed, Power output and water consumption of the model if it runs under the conditions similar to the prototype? **5**

Q. 5 **A.** Derive the Chezy's equation for uniform flow in open channel and state the dimension of Chezy's constant. What is the relation between the Chezy's 'C' and Manning's 'n' **5**

B. What is hydraulic jump? Classify them. Derive the expression of losses for a hydraulic jump. **5**

Or

Write a short note on devices used for measurement of velocity and discharges for open channel.

C A rectangular flume 2 m wide carries discharge at the rate of 2 m^2/s. The bed slope of the flume is 0.0004. At a certain section the depth of flow is 1m. Calculate the distance of the section downstream where the depth of flow is 0.9 m. Solve by single step method. Assume rugosity coefficient as 0.014. **5**
Is the slope of the channel mild or steep? How is this type of surface profile classified?

Q6 **A.** 1) Does the slope of the channel bed affect the specific energy diagram and the depth discharge diagram? **1**
2) Obtain the relationship between the critical depth and critical velocity of flow in case of a rectangular channel. What is the significant of this relationship? **2**
3) Define terms efficiency of hydraulic jump and height of hydraulic jump **1**

B. What are the differences between a venture flume and a standing wave flume? **5**
Water flows at a velocity of 1 m/s and a depth of 2 m in an open channel of rectangular cross-section, 3 m wide. At a certain section the width is reduced to 1.8m and the bed is raised by 0.65m. Will the upstream depth be affected? If so to what extent.

C Write a short note on any one **5**

1) Governing of Turbine
2) Characteristic curves of Pump
3) Describe M1 and S3 curves in detail