College of Engineering, Pune
End Semester Exam – April 2013
S.Y. B. Tech (Civil Engineering)
(CE-209)- (Fluid Mechanics-II)

Day & Date- Saturday, 27 April 2013 Time: - 10 to 1 Maximum Marks 50

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 (any 5) **5**

1) Dynamic pressure 2) Stagnation pressure 3) Friction drag 4) Form drag
5) lift coefficient 6) Wake

Or

Discuss in detail about Karman's Vortex Street, along with the required diagram

B What is polar diagram? What do you mean by Magnus effect? **5**

Or

What are the different types of aerofoil? Draw a symmetric aerofoil and lable the Different parts of it.

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. For the same power expended in overcoming resistance, what percentage change speed of the car is possible if drag coefficient is reduced to 0.32 by streamlining the car body? Take density of air $\rho = 1.2$ kg/m^2. **5**

Q. 2 **A** Explain the function of surge tank and draw the neat diagram of a surge tank and show all the component. **5**

Or

What is 'Water Hammer Action'? Describe in detail the condition of water hamr flexible pipe considering the closure as sudden

B What do you mean by surge in open channel? Explain in detail about surge due to Sudden increase of flow. **5**

Or

Write a short note on any one

1) Negative surges 2) Celerity

C In a rectangular channel 3.5 m wide and 2 m water depth conveys water at 18 m^2/s. If the flow rate is reduced to 2/3 of its origin value, compute the magnitude and speedof the upstream surge. Assume that the front of the surge is rectangular and friction in the channel is neglected. 5

Q. 3 A Draw a neat sketch of hydroelectric power plant, where Reaction Turbine is installed and explain in detail the function of each component parts. 5

Or

Write a short note on any one

1) Selection of turbine 2) Specific Speed of turbine

B In a hydroelectric power plant, Pelton wheel is installed, water available under a head of 300m is delivered to the power house through three pipes each 2500 m long. Thorough these pipes, friction loss are estimated to be 25 m. The project is required to produce a total shaft output of 13.25 MW by installing a number of single jet Pelton wheel whose specific speed is not exceed 38.5. The other pertinent data is Wheel speed=650 rpm; Cv=0.97; Ku= 0.46; and overall efficiency of the wheel 85%. Pipe friction coefficient f=0.005. Determine 1) Number of Pelton wheel to be used 2) Jet diameter and 3) Diameter of supply pipe 5

C Following data pertaining to a Francis Turbine 5

Neat head =80 m, Speed=750 rpm, Shaft power= 330 Kw, Overall efficiency=85 %
Hydraulic efficiency=92 %, Flow ratio=0.22, Breadth ratio=0.1
Outer diameter of runner= 2 x inner diameter of runner, Velocity of flow= constant
Outlet discharge= radial, The thickness of vanes occupy 6 percentage of circumferential area of the runner.
Determine

1) Diameter of runner at inlet and outlet,
2) Width of the wheel at inlet,
3) Guide blade angle, and
4) Runner vane angles at inlet and outlet

Q. 4 A A hydraulic turbine is to develop 845 Kw when running at 100 rpm under a net head of 10. Workout the maximum flow rate and specific sped for the turbine if the overall efficiency at the best operating point is 92%. In order to predict its performance, a 1:10 scale model is tested under a head of 6 m. What would be the speed, power output, and water consumption of the model if it run under the condition similar to the prototype. 5

B Draw a neat sketch of centrifugal pump and explain in detail the function of each component parts, also state the difference between a closed, semi-closed and open impeller. 5

Or

Write a short note on any one

1) NPSH 2) Multistage pump

C Centrifugal pump impeller, having outlet diameter 0.35 m is running at 960 rpm. The Velocity of flow (assumed constant throughout the system) is equal to 2.4 m/s. The van angle at outlet is 28^0. The static suction lift is 4.03 m. The energy loss in suction pipe, impeller and volute casing are 0.88m, 0.70 m and 1.26m of water respectively. Determine the reading of vacuum or pressure gauges placed at **5**

1) Inlet to pump
2) Impeller outlet (in clearance between impeller and outlet)
3) Pump outlet or delivery flange, 0.24 m above the centerline of the pump.

Q.5 **A** Write a short note on any one **5**

1) Measurement of discharge in river
2) Standing wave flume

B Venturiflume is 1.40 m wide at entrance and 0.7 m in the throat. Neglecting hydraulic losses in the flume, calculate the flow if the depths at the entrance and throat are 0.70 m and 0.65 m respectively. A hump is now installed at the throat, of height 200mm, so that a standing wave (hydraulic jump) is formed beyond the throat. What Is the increase in the upstream depth when the same flow as before passes through the flume? **5**

C A wide rectangular channel conveys a discharge if 5 m^3/s per m width with a bed Slope of 1 in 3600 and N=0.02. If the depth at the section is 3.50 m determine how for upstream or downstream of the section the depth would vary within 5% of the normal depth. **5**

Q.6 **A** Solve any three **5**

1) Explain kinetic energy correction factor and momentum correction factor
2) Derive the condition for critical flow using the Specific Force equation
3) Difference between Standing Wave flume and
4) Difference between Francis turbine and Kaplan turbine

B A hydraulically efficient trapezoidal channel has side slopes of 1:1. It is required to Discharge 14 m^3/s with a gradient of 1 in 1000. If unlined , the value of Chezy's C is 45. If lined with concrete the value is 70. If the least cost per m^3 of excavation is three times the cost m^2 of lining, will the lined or the unlined channel be cheaper **5**

C Find the critical depth for a specific energy head on 1.5 m in the following channel **5**

1) Rectangular channel, B=2.0 m
2) Triangular channel, m=1.5
3) Trapezoidal channel, B=2.0 m and m=1.0