Code No. : **6081/S**

FACULTY OF ENGINEERING
B.E. 3/4 (Civil) I Semester (Suppl.) Examination, July 2014
FLUID MECHANICS – II

Time: 3 Hours] [Max. Marks: 75

***Note** : Answer **all** questions from Part – **A** and **any five** questions from Part – **B**.*

PART – A **(25 Marks)**

1. Define the terms : Energy and momentum correction factors. **3**
2. A sewer pipe line laid at a slope of 0.0001 flowing full conveys a discharge of 900 litres per second. Find the size of the pipe taking n = 0.015. **3**
3. State under what conditions a hydraulic jump can occur. **2**
4. List out the types of mild slopes and steep slope surface profiles along with neat sketch. **3**
5. A rigid pipe conveying water is 4.2 km long. The velocity of flow is 1.75 m/s. Calculate the vise of pressure behind a valve at the lower end if it is closed in 15 seconds. Take bulk modulus of water equal to 2150 N/mm^2. **3**
6. What are the ranges of Reynolds number for the flow in the boundary layer to be laminar and turbulent ? **3**
7. What do you mean by scale effect ? **2**
8. Differentiate between radial flow and Parallel flow turbines with examples. **3**
9. State the significance of characteristic curves of centrifugal pumps. **3**

PART – B **(5×10=50 Marks)**

10. a) Explain in detail the significance of velocity and pressure distribution in open channel flow.
    b) Design a erapezoidal channel of best section of area 25 m^2 with side slopes 1.75 H : 1.0 V. Taking C = 42.5, find the maximum discharge, if the bed slope is 1 in 2500.
11. a) Derive the momentum equation for a jump in horizontal rectangular channel. Also explain what do you understand by energy dissipation in hydraulic jumps.
    b) A rectangular channel 6.5 m wide has a uniform depth of flow of 2.5 m and has a bed slope of 1 in 3000. If due to weir constructed at the downstream end of the channel, water surface at a section is raised by 0.85 m, determine the water surface slope with respect to horizontal. Assume mannings n = 0.023.

12. a) What is meant by water hammer phenomenon ? Water flowing in a pipe line is brought to rest by instantaneous closure of valve at its lower end. Show that the pressure rise due to valve closure is given by

$$p = \sqrt{\frac{\frac{rv^2}{g}}{\frac{1}{k} + \frac{d}{Et}}}.$$

b) A smooth flat plate 2.4 m long and 0.9 m wide moves lengthwise at 6 m/s through still atmospheric air of density 1.226 kg/m^3 and kinematic viscosity 1.49 10^{-5} m^2/s. Assuming the boundary layer to be entirely laminar, calculate the boundary layer thickness at the trailing edge of the plate, the shear stress half-way along the plate and the power required to more the plate.

13. a) Explain Rayleigh method of obtaining relation between a given set of variables influencing a phenomenon.

b) A spillway model is to be built to a geometrically similar scale of 1/60 across a flume of 500 mm width. The prototype is 20 m high and the maximum head on it is expected to be 1.74 metres.

i) What height of model and what head on the model should be used ?

ii) If the flow the model at a certain head is 14 c/s; what flow per metre length of the prototype is expected ?

14. a) Enumerate in detail various efficiencies that need to be determined for a Radia flow turbine along with the equations.

b) The external diameter of the runner of an inward flow reaction is 700 mm with a corresponding breadth of 150 mm. Similar dimensions at the inside of the runner are 500 mm and 225 mm respectively. The effective head is 21 m. If the velocity of flow at inlet is 3 m/sec, the guide vane angle is 12°, and the runner vanes are radial at inlet, find the speed of the turbine, the outlet vane angle and the power developed. Assume that the turbine discharges radially at outlet.

15. a) What is specific speed of a centrifugal pump and obtain the expression for the same ?

b) A centrifugal pump has an impeller 45 cms in diameter running at 450 mm. The discharge at inlet is entirely radial. The velocity of flow at outlet is 1.2 m/sec. The vanes are curved backwards at outlet at 30° to the wheel tangent. If the discharge of the pump is 0.15 cumec. Calculate the impeller power and the torque on the shaft.

16. a) Write short notes on the elementary surge analysis.

b) Obtain an expression for the depth after the hydraulic jump and the loss of head due to the jump.