B.E (Full Time) DEGREE END SEMESTER EXAMINATIONS, APR/MAY 2014

AGRICULTURAL AND IRRIGATION ENGINEERING BRANCH

FOURTH SEMESTER – (REGULATION 2012)

AI 8402 HYDRAULIC ENGINEERING FOR AGRICULTURAL ENGINEERS

Time : 3 hr Max Mark : 100

Part-A (10 x 2 = 20 Mark)

Answer All Questions

1. Classify the following open channel flow situations: a) Flow from a sluice gate. b) A river during flood.
2. A channel of bed slope 0.0009 carries a discharge of 30 m^3/s when the depth of the flow is 1 m. What discharge does an exactly similar channel at the same depth of flow carry if the slope is decreased to 0.0001?
3. Draw the resulting profiles due to change in slope from mild to steep.
4. Write the relationship between normal, critical and given depth for C_1 and H_3 profiles.
5. Describe the characteristics of the hydraulic jump having initial Froude number 5.
6. State the assumptions made in deriving dynamic equation for SVF with decreasing discharge.
7. Define cavitation and state the effects of cavitation in centrifugal pump.
8. State the advantages of a multistage centrifugal pump.
9. "The reciprocating pumps are used produce high head and low discharge"- Justify
10. What is an air vessel and state its use in reciprocating pump.

Part-B (5 x 16 = 80 Mark)

(Question number 11 is compulsory)

11. A rectangular channel is 2.5 m wide and conveys a discharge of 2.75 m^3/s at a depth of 0.9 m. A contraction of width is proposed at a section in this canal. Calculate the water surface elevations in the contracted section as well as in an upstream 2.5 m wide section when the width of the proposed contraction is 2 m. Neglect energy losses in the transition. (16)

12. (a) Draw and prove from the equation of GVF that S_2 and S_3 profiles asymptotically approach normal depth and S_1 profile asymptotically approach horizontal at very large depth in the downstream direction. Also, explain the characteristics of these profiles in upstream direction. (16)

(OR)

(P.T.O)

12. (b) A rectangular channel lined with concrete (Manning's n= 0.015) is 2 m wide and has a bottom slope of 1 in 1600. It ends in a free outfall. Identify the type of GVF profile and calculate the length of the profile from the outfall to a depth of 0.8 m when the flow rate is 2 m^3/s? (16)

13. (a) State the assumptions made for the formation of a hydraulic jump in a open channel flow and establish a relationship between the sequent depths of a hydraulic jump with its upstream Froude number with neat sketch. (16)

(OR)

13. (b) A hydraulic jump occurring in a horizontal channel with initial Froude number of 10. If the energy loss due to the jump is 3.2 m, estimate (i) sequent depths (ii) the discharge intensity (iii) the Froude number after the jump and (iv) power dissipated in the jump. (16)

14. (a) Explain with neat sketches the working of a single stage centrifugal pump with different types of casing. (16)

(OR)

14. (a) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 r.p.m. works against a head of 40 m. The velocity of flow through impeller is constant and equal to 2.5 m/s. The vanes are set back at an angle of 40° at outlet. If the outer diameter of the impeller is 500 mm and width at outlet is 50 mm, determine (i) vane angle at inlet (ii) work done by the impeller on water per second and (iii) manometric efficiency. (16)

15. (a) (i) Describe the working principle of a single acting reciprocating pump with a neat sketch. (12)
15. (a) (ii) Why is a reciprocating pump not coupled directly to the electric motor? (4)

(OR)

15. (b) The cylinder bore diameter of a single acting reciprocating pump is 150 mm and its stroke is 300 mm. The pump runs at 50 r.p.m. and lifts water through a height of 25 m. the delivery pipe is 22 m long and 100 mm in diameter. Find the theoretical discharge and the theoretical power required to run the pump. If the actual discharge is 4.2 litres/s, find the percentage slip. Also, determine the acceleration head at the beginning and middle of the delivery stroke. (16)

****