M. Tech Odd Semester Examination, February, 2023

Agricultural Engineering
(Water Rescources Development Management)
(1st Semester)

Course No.: 1AE-115
[Programme Elective-II (Aquacultural Engineering)]

Full Marks: 70
Pass Marks: 28

Time: 3 hours

Note: 1. Attempt 05 (Five) questions by taking one form each unit.
2. Begin each answer in a new page.
3. Answer parts of a question at a place.
4. Assume reasonable data wherever required.
5. The figures in the right margin indicate full marks for the question.

UNIT-I

1. (a) Describe the significance and present status of aquacultural engineering in Indian.   7

   (b) Show that the theoretical discharge, Q of open channel flow can be expressed as:

$$Q = A_2 \sqrt{\frac{2g\,(\Delta y - h_f)}{1 - \left(\frac{A_2}{A_1}\right)^2}}$$

   A_1 and A_2 are cross-sectional area at upper head and lower head of channel respectively, Δy = difference between hydraulic heads, h_f = head loss due to friction, g = acceleration due to gravity.   7

Turn Over

2. (a) What is the open channel flow? Classify the open channel flow based on variation of flow parameters with time and space. 6

(b) Write the short notes on: 8

I. Hydraulic Jump　　　II. Critical flow

III. Prismatic Channel　　IV. Specific Energy

UNIT-II

3. (a) How does pH effect the fish growth? If pH value of five different section of aquacultural farm was recorded as 8.5, 8.1, 9.0, 8.5, 9.1 and 10.1; find out the average pH of aquacultural farm. 7

(b) Describe the factors which can affect the solubility of oxygen in aquacultural pond. 7

4. (a) With flow diagram describe the Nitrogen cycle of aquaculture pond. 7

(b) What is C and N ratio? Describe the importance of C and N ratio in aquacultural pond. 7

UNIT-III

5. (a) Show that cost of construction of square pond is cheaper than the rectangular pond for constant area of pond. 5

(b) What do you mean by dike, and explain the design consideration of main dike? 9

6. (a) Calculate the total quantity of water require for a semi-intensive shrimp farm as per the details given below:

Area of each stocking pond: 2 hectare; No of stocking ponds: 5; depth of stocking pond: 1 meter; pond to be re-filled: once in 3 days; mean annual evaporation: $1m^3/m^2$; seepage coefficient: 0.001m/day; culture period: 90 days; mean annual rainfall: $0.5m^3/m^2$; surface area of feeder canal: 500 m^2 7

(b) Explain the suitability criteria for Embankment type and Excavated type aquaculture pond. 7

UNIT-IV

7. (a) What is aeration? Explain the necessity of aerator in intensive aquaculture pond. 7

(b) Calculate the SOTR and SAE values of 2 kW Cascade aerator, the results of standard test as given below.

The test tank contained 200 m^3 of clean tap water. The test was run to determine that, the $(Cs)_{25}$ of the basin was 6.8 mg/L. 20% and 80% saturation were considered.

DO at 20% saturation = 1.36 mg/L in 11.2 min.

DO at 80% saturation = 5.44 mg/L in 53 min.

$(Cs)_{20}$ = 9.07 mg/L. 7

8. (a) What is RAS? and describe its all components. 7

(b) What is the importance of nitrogen removal unit and UV disinfection unit in recirculatory aquaculture system? 7

UNIT-V

9. Explain the design consideration of all components of commercial carp hatchery. 14

10 What do you mean by hatchery? Explain the different component of fresh water prawn hatchery. 14

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