

B.Tech Even Semester (CBCS) Exam., April—2017

AGRICULTURAL ENGINEERING

(6th Semester)

Course No. : AE-605 (C)

(Aquacultural Engineering)

Full Marks : 75*Pass Marks* : 30*Time* : 3 hours

- Note* :
1. Attempt **one** question from 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 margin indicate full marks for the questions.

UNIT—1

1. (a) Describe the present scenario of aquacultural engineering in India. 7
- (b) A rectangular channel model is used to simulate a prototype channel having the width of 30 m, carrying a discharge of $14 \text{ m}^3/\text{s}$ at a depth of 25 cm. The model is designed for gravity effect and

turbulent flow condition is assumed. Determine the minimum size of the model, discharge and scale ratio, assuming the upper limit of the transitional flow region to be 2000 (R). Take kinematic viscosity = $1 \times 10^{-6} \text{ m}^2/\text{s}$. 8

2. (a) Show that relation between the alternate depths in rectangular channel can be expressed as

$$y_c^3 = \frac{2y_1^2 y_2^2}{(y_1 + y_2)}$$

where, y_c = critical depth, and
 y_1 and y_2 = alternate depths 9

- (b) What do you mean by specific energy and critical flow in open channel? 6

UNIT—2

3. (a) With flow diagram, describe the nitrogen cycle for aquacultural pond. 8
- (b) What is liming? Describe the beneficial effect of liming. 7
4. (a) What do you mean by C and N ratio? Describe the importance of C and N ratio in aquacultural pond. 7
- (b) What do you mean by 'Bohr root' effect? 4
- (c) What do you understand by BOD and COD? 4

(3)

UNIT—3

5. (a) Calculate the total quantity of water require for a semi-intensive shrimp farm as per the details given below : 8
- Area of each stocking pond : 2 hectare
Number of stocking ponds : 5
Depth of stocking pond : 1 meter
Pond to be refilled : once in 3 days
Mean annual evaporation : $1\text{m}^3/\text{m}^2$
Seepage coefficient : 0.001 m/day
Culture period : 90 days
Mean annual rainfall : $0.5\text{ m}^3/\text{m}^2$
Surface area of feeder canal : 500 m^2
- (b) Explain the process of farm design on the basis of the nature of work. 7
6. (a) What is the importance of dike in aquaculture farm? Explain the design consideration of main dike. 8
- (b) Explain the procedure of estimating oxygen transfer coefficient. 7

UNIT—4

7. (a) How aeration removes or modifies constitutes of pond water? What methods are used for removal of constituents? Explain any two with neat sketch. 1+2+2=5

(4)

- (b) Write short notes on the following : 5
- (i) SOTR
(ii) SAE
(iii) $K_L a_{20}$
(iv) OTR_f
(v) AE_f
- (c) What is recirculating aquacultural system (RAS)? Describe with components of RAS. 2+3=5
8. (a) Calculate the standard oxygen transfer rate and standard aeration efficiency of an aerator of capacity 2 HP (1.5 kW). Following is the data obtained during a standard test conducted in a clean tap water basin of capacity 200 m^3 . The test was run sufficiency long to determine that $(C_s)_{25}$ of the basin water was 6.8 mg/l : 5
- DO at 20% saturation = 1.36 mg/l in 11.2 min
DO at 80% saturation = 5.44 mg/l in 53 min
- factor = 1.024
 (C_s) 9.08 mg/l
- (b) Write the advantages and disadvantages of recirculating aquacultural system. How the RAS will impact negatively on the water quality by affecting the performance efficiency of the water treatment units? 3+3=6

- (c) Write brief notes on the following : 2+2=4
- (i) Centrifugal aeration
 - (ii) Differentiation between diffused and mechanical aerations

UNIT—5

9. (a) Draw a layout plan and describe the design consideration of a commercial carp hatchery with neat sketch. 10
- (b) Draw a life cycle of fish with sketch. 2
- (c) The water surface of 1 ha pond is 10 cm below the overflow structure. The pond has a 20 ha watershed, in a 24 hr period, rainfall is 50 mm on the watershed and storm runoff is 5 mm. How much water will overflow from the pond? 3
10. (a) Give a construction design for a commercial freshwater prawn hatchery. Write all the supportive operations for better production. 10
- (b) Design broodstock requirements for the following : 5
- (i) Target production of carp spawn per annum = 100 million
 - (ii) Number of operations per annum = 25
 - (iii) Production per operation = 4 million
- (Assume missing data)

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