APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Scheme for Valuation/Answer Key

Scheme of evaluation (marks in brackets) and answers of problems/key

EIGHTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019

Course Code: CE402

Course Name: ENVIRONMENTAL ENGINEERING – II

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) 1 mark each for each definition (4)

b) Definition- 1 mark, inlet time and channel flow with equation -2 marks (3)

c) Using equations, calculate value of α, p and r – 2 marks each. Using manning's equation get value of diameter- 2 marks (8)

Using Manning's Equation find D.

d/D = 0.5 =(1/2(1-(1/2)cosα/2)), cosα/2=0,α/2=90,α=180

$a=D^2/4((\pi\alpha/360) - (\sin\alpha)/2) = D^2/4((\pi 180/360) - (\sin 180)/2) = D^2\pi/8$

wetted perimeter $p=\pi D\alpha/360 = \pi D*180/360=\pi D/2$

Hydraulic radius r= a/p =D/4

$Q=(1/n)*(a)*(r)^{2/3}*(i)^{1/2}$

$0.7=(1/0.015)*(D^2 \pi /8)*(D/4)^{2/3}*(0.0001)^{1/2}$

D=2.045m

(Since its sewer running half full direct substitution for a, p ,r can be made with following formulae a=$\left(\frac{\pi}{8}\right) D^2$-2 marks , p =$\left(\frac{\pi}{2}\right) D$,-2 marks ,r = (D/4)- 2marks Using Manning's Equation find D.-2 marks)

2 a) Combined system Merits – 2points with small description -2 Marks , Demerits – 2 points with small description , 2marks (8)

Separate system Merits – 2 points with small description -2 Marks , Demerits – 2 points with small description , 2marks

b) Explanation-3 fig. -2 (5)

c) Explanation-2 (2)

3 a) BOD – 2 marks, COD -2 marks (4)

b) Any 4 physical characteristics with small description - 1.5 mark each (6)

c) Equation - 1 mark (5)

Ultimate B.O.D (L) = 219.4 mg/l - 2 mark

Using B.O.D equation ,3 day B.O.D which is = 109.43 mg/l - 2 mark

PART B

Answer any two full questions, each carries 15 marks.

4 a) Flow diagram with (3)

Preliminary and primary treatment(1)

Secondary treatment(1)

Sludge digestion and disposal(1)

b) DO of mixture of sewage and stream - 1.5 (12)

BOD_5 of mixture of sewage and stream - 1.5

Ultimate BOD -1

Critical deficit -3

Time at which critical deficit occurs in the stream -3

Distance at which critical deficit occurs in the stream -2

5 a) Sludge volume index definition -2 (5)

Estimation of sludge volume index -2

Equation for sludge volume index -1

b) Any five limitations (one mark each) (5)

c) Rotating biological contactors principle -2 (5)

Working and operation of rotating biological contactors -3

6 a) 1mark for each comparison (7)

b) Area of the grit chamber -2 marks (8)

Breadth of the grit chamber-1 marks

Depth of the grit chamber -1 marks

Detention time -1 marks

Length of the grit chamber -1 marks

Fig of Grit Chamber -2 marks

PART C

Answer any two full questions, each carries 20 marks.

7 a) Design of sedimentation chamber -4 marks (14)

Design of gas vent and neutral zone -3 marks

Design of digestion chamber - 4 marks

Sketch of Imhoff tank -3

b) Advantages-3 marks (6)

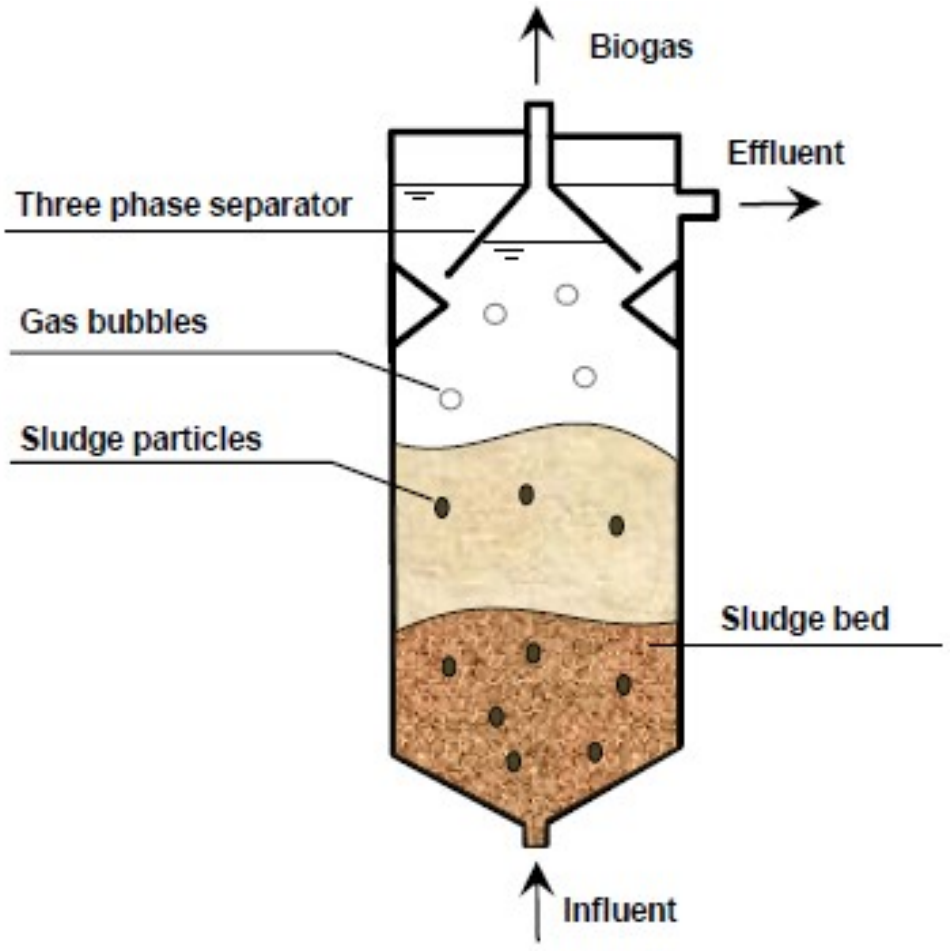
Disadvantages -3 marks

8 a) Sludge digestion (10)

Features of acid regression stage (5)

Features of alkaline fermentation stage(5)

b) (10)



It is somewhat modified version of the contact process, based on an upward movement of the liquid waste through a dense blanket of anaerobic sludge. No inert medium is provided in these systems. The upflow anaerobic sludge blanket reactor (UASB) is a single tank process. Wastewater enters the reactor from the bottom, and flows upward. A suspended sludge blanket filters and treats the wastewater as the wastewater flows through it.

The sludge blanket is comprised of microbial granules (1 to 3 mm in diameter), i.e., small agglomerations of microorganisms that, because of their weight, resist being washed out

in the upflow. The microorganisms in the sludge layer degrade organic compounds. As a result, gases (methane and carbon dioxide) are released. The rising bubbles mix the sludge without the assistance of any mechanical parts. Sloped walls deflect material that reaches the top of the tank downwards. The clarified effluent is extracted from the top of the tank in an area above the sloped walls.

After several weeks of use, larger granules of sludge form which, in turn, act as filters for smaller particles as the effluent rises through the cushion of sludge. Because of the upflow regime, granule-forming organisms are preferentially accumulated as the others are washed out.

Critical elements for the design of UASB reactors are the influent distribution system, the gas-solids separator, and the effluent withdrawal design. The gas that rises to the top is collected in a gas collection dome and can be used as energy An upflow velocity of 0.7 to 1 m/h must be maintained to keep the sludge blanket in suspension. Primary settling is usually not required before the UASB

(Above is a typical explanation, and valuer may not completely adher to this, and give credits to whatever points written outside the above explanation which is found correct.)

Advantages

1. High reduction of BOD
2. Can withstand high organic and hydraulic loading rates
3. Low sludge production hence frequent desludging not required)
4. Biogas can be used for energy

Disadvantages

1. Treatment may be unstable with variable hydraulic and organic loads
2. Requires operation and maintenance by skilled personnel.
3. A constant source of electricity is required
4. Requires expert design and construction
5. Effluent and sludge require further treatment and/or appropriate discharge

Figure – 2 marks
Explanation-4 marks
Four Disadvantages – 4 marks

9 a) Method of sludge disposal :3 methods(2marks each) (6)

b) Sludge drying bed fig and constructional details- 4 marks, Operation -4 marks (8)

c) Two factors with description :3 marks each (6)

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