FIFTH/SEVENTH SEMESTER   **B.Tech**

END TERM EXAMINATION   **NOV/DEC-2024**

EN301 Wastewater Engineering: Design and Applications

Time: 3:00 Hours   *Max. Marks: 40*

Note : Attempt all the questions.
Assume suitable missing data, if any.

Q.1 (a) The sewage is flowing @5.5 million litres per day from a primary clarifier to a standard rate trickling filter. The 5-Day BOD of the influent is 160 mg/l. The value of the adopted organic loading is to be 160 gm/m^3/day and surface loading 2000 l/m^2/day. Determine the volume of the filter and its depth. Also calculate the efficiency of this filter unit.   [5][CO5][L3]

 (b) Classify the different stages of the sludge digestion process in a digester tank.

<center>OR</center>

 (b) Describe the factors affecting sludge digestion and their control. [3][CO4][L1]

Q.2 (a) Summarize the design and construction principles of a grit chamber, using a sketch for illustration.   [4][CO2][L4]

 (b) Design a circular settling tank units for a primary treatment of sewage 20 Million Litres/day. Assume a suitable value of detention period (presuming that trickling filters are to follow sedimentation tank) and surface loading. [4][CO1,2][L6]

Q.3 (a) Build a comparison of septic tanks and Imhoff tanks, analysing their scope, function, and overall performance in the context of wastewater treatment. [4][CO4][L5]

 (b)   Design the septic tank for a small colony having the following data :
      No. of People = 250
      Sewage/head/day = 110 litres
      Length : width = 3 : 1
      Depth of tank = 1.5 m
      De sludge period = 1 year
      Detention period = 24 hrs   [4][CO4][L3]

Q.4 (a) Explain Upflow anaerobic sludge blanket.　　　　　　　　[3][CO5][L2]

(b) An Average operating Data for conventional Activated Sludge treatment plant is as follows:

1) Wastewater flow=30000 Cubic Metre/day
2) Volume of aeration tank =10000 Cubic metre
3) Influent BOD=250 mg/l
4) Effluent BOD=30 mg/l
5) Mixed Liquor Suspended Solids(MLSS)=2500 mg/l
6) Effluent suspended solids=30 mg/l
7) Waste sludge suspended solids=9800 mg/l
8) Quantity of waste sludge= 220 m³/day
   Based on data above, determine.
   (a)Aeration Period(hrs)
   (b)Food to micro-organisms (F/M) (kg BOD per day/kg MLSS)
   (c)Percentage efficiency of BOD removal
   (d)Sludge age (days).

OR

(b)　　Design a digestion tank for the primary sludge with the help of following data:
(i)　　Average flow=300 Mld ;
(ii)　Total Suspended Solids in raw sewage =310 mg/l;
(iii)　Moisture Content of digested sludge=85%
(iv)　Solid removed in primary tank = 60%
(v)　Moisture content of fresh sludge = 95%　　　　　　　[5][CO5][L6]

Q.5 (a) Summarize the construction and maintenance of sewers, highlighting the key features such as materials, shapes, and gradients typically adopted.
　　　　　　　　　　　　　　　　　　　　　　　　　[3][CO6][L2]

(b) A 200 mm diameter sewer is to flow at 0.6 depth on a grade ensuring a degree of self-cleansing equivalent to that obtained at full depth at a velocity of 0.90 m/sec. Find the required grade and associated velocity and rate of discharge at this depth. Assume Manning's rugosity coefficient n as 0.015. The variations of n with depth may be neglected. At d/D = 0.6, a/A = 0.626, r/R = 1.11, q/Q = 0.671　　　　　　　　　　　　　[5][CO6][L4]

FIFTH SEMESTER

END TERM EXAMINATION

DEC-2022

EN301   WASTEWATER ENGINEERING: DESIGN AND
           APPLICATIONS

Time: 3:00 Hours   Max. Marks: 40

> **Note :** All the questions carry equal marks.
>   Attempt any five questions.
>   Assume suitable missing data, if any.

Q.1 (a) Differentiate between aerobic treatment and anaerobic treatment of sewage, giving an account of major end products.

(b) Draw the flow diagram for sewage treatment plant which uses activated sludge process.
[08][CO1]

Q.2 (a) With the help of sketch, describe the principle involved in the design and construction of grit chamber.

(b) Design a circular settling tank unit for a primary treatment of sewage at 15 million litres per day. Assume suitable values of detention period (presuming that trickling filters are to follow the sedimentation tank), and surface loading.   [08][CO2]

Q.3 (a) What is coagulation? Write the merits and demerits of Coagulation process in sewage treatment.

(b) Define sludge volume index. What is its importance in sewage treatment?   [08][CO3,4]

Q.4 (a) Explain the working of conventional activated sludge process (ASP) with flow diagram.

(b) The sewage is flowing @ 6.5 Million litres per day from a primary clarifier to a standard rate trickling filter. The 5-day BOD of the influent is 200mg/l. The value of adopted organic loading is to be 200gm/m³/day, and surface loading 2500 l/m²/day. Determine the

volume of the filter and its depth. Also calculate the efficiency of the filter unit. [08][CO4]

Q.5 (a) Explain briefly the different stages of sludge digestion process in a "Digestor". With a neat sketch, explain the constructional details of sludge digestion tank.

(b) Design a septic tank for 200 users. Water allowance is 120 litres per head per day. Detention period may be taken as 8 hours. Draw a neat dimension sketch of the septic tank you design. [08][CO5]

Q.6 (a) Discuss the mechanism of working of a UASB reactor.

(b) Write a short note on sewer materials, bringing out the criteria for selection of sewer material. [08][CO6]

FIFTH SEMESTER   B.Tech

MID TERM EXAMINATION   *Sept-2022*

EN301   WASTEWATER ENGINEERING: DESIGN AND
           APPLICATIONS

Time: 1:30 Hours   Max. Marks: 20

Note : All questions are compulsory.
       All questions carry equal marks.
       Assume suitable missing data, if any.

Q.1(a) Enumerate the major objectives of primary, secondary and tertiary treatment of wastewater.

(b) Define coagulants. Why are coagulants used in the sewage treatment? Name a few coagulants commonly used in wastewater treatment.   [4][CO1]

Q.2 (a) What is the significance of roll velocity in aerated grit chambers?

(b) A rectangular grit chamber is designed to remove particles with diameter 0.2mm, specific gravity 2.65. A flow through velocity of 0.3m/sec will be maintained by proportional weir. Determine the channel dimensions for a maximum wastewater flow of 12 MLD.
                                                   [4][CO2]

Q.3 (a) Write a short note on different types of screens.

(b) Estimate the screen requirement for a plant treating a peak flow of 50,000m³/day .   [4][CO2]

Q.4 (a) Differentiate between conventional trickling filters and high-rate filters.

(b) Discuss in brief stabilisation ponds   [4][CO4]

Q.5 Design a suitable rectangular sedimentation tank (provided with mechanical cleaning equipment) for treating the sewage from a city, provided with an assured public water supply system, with maximum daily demand of 8 million litres per day.   [4][CO2]

B.Tech.

V SEMESTER

Sept-2019

MID SEMESTER EXAMINATION

PAPER CODE: EN-301   Wastewater Engineering: Design and Applications

Max. Marks: 20

Time: 1:30 Hours

Note : Answer all questions
       All questions carry equal marks.
       Assume suitable data required, if any.

Q1.   Discuss the need and financing of the sewerage projects. Also discuss design and planning of a sewerage system.

Q2.   (a) What is the design period Explain the design periods for different components of a sewage scheme.

       (b) Differentiate between combined and separate sewerage systems of sewage with their relative merits and demerits.

Q3.   (a) Explain self purification of streams and indicate how sunlight helps in such purification.

       (b) The 5 day 30°C BOD of sewage is 110mg/l. Calculate its 5 days 20°C BOD. Assume the deoxygenation constant at 20°C, K_{20} as 0.1.

Q4.   Design a sewer to serve a population of 36000. The daily water supply to the city is 135 lpcd and channel bottom slope is 1:625. Sewer is designed to carry 4 times the average discharge. What will be the velocity generated if N is constant and is equal to 0.01.
       Assume depth of flow 3/4th full

Q5   Write a short note on any two

       (a) Egg shaped sewers
       (b) Self-cleansing velocity
       (c) Functions of Manholes and drop holes
       (d) BOD and COD

Roll No. ......

B.Tech.

END SEMESTER EXAMINATION
PAPER CODE: EN-301

Nov/Dec-2019

Time: 3:00 Hours

Waste Water Engg: Design Application

Max. Marks: 40

Note : Answer any five questions
All questions carry equal marks.
Assume suitable data required, if any.

Q1.   Discuss the methods adopted for sewage disposal and also discuss their   favouring conditions for their adoption.

(b) A grit chamber is designed to remove particles with a diameter of 0.2mm, specific gravity 2.65. Settling velocity for these particles has been found to range from 0.016 to 0.022 m/sec, depending on their shape factor. A flow through velocity of 0.3 m/sec will be maintained by proportioning weir. Determine the channel dimensions for a maximum wastewater flow of 10,000 cu m/day.

Q.2 (a) Differentiate between BOD and COD. The BOD_5 of waste water is 150 mg/l at 20°C. The k value is known to be 0.23 per day. What would be BOD_5 be, if the test was run at 15°C?

(b) Determine the size of a circular sewer for a discharge of 600 lps running half full. (Assume s= 0.001 and n= 0.015)

Q.3 (a) Explain with a neat sketch the working of a trickling filter. Also discuss the factors affecting rate of removal of organic matter in it.

(b) Distinguish between activated sludge process and trickling filter. Also mention the operational problems of standard rate trickling filter.

Q.4 (a) Differentiate between aerobic and anaerobic treatment of sewage, giving major end products. Describe one treatment method in each category in brief.

(b) Design a circular settling tank unit for a primary treatment of sewage at million litres per day. Assume suitable values of detention period and surface loading rate.

Q.5 (a) What do you understand by digestion of sewage sludge? Give a neat sketch of separate digestion tank and explain its working.

(b) Based on the following information of activated sludge treatment plant determine (a) aeration period (b) Food to microorganism ratio (c) percentage efficiency of BOD removal (d) sludge age

Wastewater flow	: 35000 m³/d
Volume of aeration tank	: 10900 m³
Influent BOD	: 250 mg/l
Effluent BOD	: 20mg/l
Mixed liquor suspended solids (MLSS)	: 2500 mg/l
Effluent suspended solids	: 30 mg/l
Waste sludge suspended solids	: 9700 mg/l
Quantity of waste sludge	: 220 m³/d

Q.6.   Write Short notes on Any Four:

a)   Types of settling
b)   Sludge volume index
c)   Skimming tank
d)   UASBR
e)   Imhoff tank
f)   Productivity of lake

V^{th} & VIIth SEMESTER   B.Tech.(Env. Engg.)

MID-TERM EXAMINATION   September-2023

ENE-301 Waste Water Engineering: Design and Applications

Duration: 1:30 Hours   Maximum Marks: 20

Note: All questions are compulsory. Assume suitable missing data, if any.		Marks	CO
Q1	Design a suitable grit chamber for a sewage treatment plant getting a dry weather flow from a separate sewerage system @ 430l/s.	3	2
Q2	Explain the following terms: - (i) Screening. (ii) Coagulation in Sewage Treatment.	4	1
Q3	Design a suitable circular settling tank for a primary treatment of sewage @ 15 million litres per day from a city. The detention period for the tank is 2hr.	4	2
Q4	Compare the advantages & disadvantages of High Rate Trickling Filter over the Conventional Filter.	4	2
Q5	The design flow of sewage is 4.2 million litres per day & BOD of the raw sewage is 290mg/l. Design a single stage Bio filter to produce an effluent having a BOD of 40mg/l or less. 30% of BOD is remove in the primary sedimentation tank.	5	4

VIIth SEMESTER

B.Tech.(Env. Engg.)

MID-TERM EXAMINATION

September-2024

EN-301 Waste Water Engineering: Design and Applications

Duration: 1:30 Hours

Maximum Marks: 20

Note: All questions are compulsory. Assume suitable missing data, if any.	Marks	CO
Q1 **Q.1** Design the screen for a sewage treatment plant treating a peak flow of 75 million litres per day of sewage.	4	CO2, CO4
Q2 Describe the merits and demerits of coagulation process in sewage treatment.	4	CO1
Q3 Design a single stage trickling filter for a loading of 11000kg of BOD in a raw sewage per hectare metre & the recirculation ratio is 1. If it is to treat a raw flow of 4Ml/d of sewage having BOD of 250mg/l.	5	CO4, CO5
Q4 Explain the following terms:- (i)Oxidation Pond. (ii)Primary sedimentation tank	4	CO4
Q5 **Q.6** Design a suitable circular settling tank for a primary treatment of sewage @ 10 million litres per day from a city. The surface loading is 50,000l/m²/d.	3	CO2