Ref No: **Ex/CE/PC/B/T/321/2025**

B.E. Civil Engineering Third Year Second Semester Examination 2025

Environmental Engineering II

Time: Three Hours | Full Marks: 100

Use separate answer script for each part

(**Part I 50** and Part II 50)

Part-I

Answer **briefly**. **Notations** used have their usual meanings. Any **relevant data** may be assumed, if necessary.

1. (CO1) Answer the following questions very briefly:

a) 'Land for irrigation' general effluent standard is related with minimisation of wastewater'-explain.

b) What is a 'partially separate sewerage system'?

c) Mention the role of 'importance of drainage area' in selection of design frequency to calculate design storm water run-off.

d) When is time of concentration equal to inlet time?

e) What should not be the d/D in designing a sanitary sewer (Notations have their usual meaning)? 2X5=**10**

2. (CO2) Answer the following questions very briefly:

a) Mention the significance of volatile suspended solid as a WW characteristic.

b) Compare the COD and BOD values of a completely biodegradable WW sample with reasons.

c) Write a very brief note on the role of photo-autotrophic microorganisms in WW treatment

d) Draw a sketch to show the progression of first stage BOD in a fresh wastewater sample.

e) Draw a growth pattern of 'mixed' culture of microorganisms based on cell mass.

2x5=**10**

[Turn over

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(**Part I 50** and Part II 50)

Part-I

3. (CO1) a) Write the steps to calculate design sanitary WW flow.

b) Write the steps to calculate design storm water runoff by Rational Method.

c) For a sanitary sewer, following data are given:

i) ultimate peak flow = 500 lps

ii) present peak flow = 400 lps

iii) Diameter of the sewer may be taken as 1050 mm.

iv) (d/D) may be taken as 0.75 at ultimate peak flow

v) n = n' = 0.013

Calculate S, V, Q and v at ultimate peak flow and v at present peak flow. (The notations have their usual meanings.) Comment on the results.

Following table may be used:

d/D	v/V	q/Q
0.8	1.14	0.99
0.7	1.12	0.84
0.6	1.07	0.67
0.5	1.00	0.50

3+4+8=**15**

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Part-I

4. (CO2) a) Classify microorganisms based on

(i) source of energy

(ii) source of carbon

(ii) temperature relationship

b) Answer followings very briefly

(i) 'BOD is a sum parameter' – explain the statement briefly

(ii) Why should COD test of a WW sample sometimes be performed before the BOD test?

(iii) A WW sample contains an organic compound with the general formula $C_aH_bO_cN_d$. Calculate the theoretical oxygen demand of the WW sample.

c) In a BOD test, using 5% dilution of a septic wastewater sample, dissolved oxygen value of dilution water is 9.0 mg/L. After 5 days incubation, the dissolved oxygen value of the incubated wastewater sample is 2.5 mg/L. Calculate 5-day 20°C BOD of the sample. **3+8+4=15**

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B.E. CIVIL ENGG. 3rd YEAR 2nd SEMESTER EXAMINATION 2025

ENVIRONMENTAL ENGINEERING II

Time: Three hours | Full Marks 100 (50 marks for this part)

Use a separate Answer-Script for each part

Part-II

Question no. **1** and **2** are compulsory

And answer any **two** from the rest

(Assume any data, if required, reasonably)

[CPHEEO Wastewater manual graphs (figure) [with my signature] are allowed]

[Provide sketches wherever possible]

Q.1. Answer the following (any three): (CO3) (3×4) = 12

I. Discuss the significant features of 'Aerated grit chamber'.

II. Denitrification for reducing the energy consumption in NBOD in biological treatment of wastewater.

III. Deduce the relationship $VX = [\theta_c\, Y\, Q\, (S_0 - S)]/\, (1 + k_d\, \theta_c)$ with usual notations for activated sludge process.

IV. Write short note on oxidation ditch.

V. Describe with neat sketch the symbiotic relationship and function of a facultative stabilization pond.

Q.2.

Draw a typical flow diagram of Municipal wastewater treatment plant including sludge management. Describe briefly the function of each unit.

(CO3) 10

Q.3.

a) Design a septic tank for a population of 160 persons having water supply of 200 lpcd. 80% of the water supply is wastewater flow and rate of deposition of sludge is 30 liter/capita/year. Consider period of cleaning as 2 years. (CO4) 8

b) Discuss the design features of the 'critical section' near the out fall of a screen chamber.

(CO4) 6

Q.4.

Find out the following design requirements of a conventional activated sludge process from the given data. Average inflow of raw wastewater is 70 MLD having BOD_5 of 250 mg/l and suspended solids of 420 mg/l. Minimum and maximum temperatures are 18° C and 32° C. Primary sedimentation tank efficiency for BOD_5 and suspended solids removal are 30% and 70% respectively. In primary and secondary excess sludge, solids concentrations are 4% and 1%. Assume the MLSS concentration within a range from 1900 to 2100 mg/l and oxygen transfer efficiency of aeration equipment under standard condition is 1.8 kg O_2 / kWh. Find the aeration tank volume, excess sludge amount, amount of sludge recirculation, oxygen requirement and amount of total sludge generated.

(CO4) 14

Q.5.

Design a Waste Stabilization Pond system in India with an anaerobic pond followed by a facultative pond. Wastewater inflow is 12500 m^3/d having BOD_5 of 375 mg/l. The design temperature is 25° C and the net evaporation rate is 5 mm/d. Comments on the effluent quality after facultative pond, if the treated effluent has to be discharge in the inland surface water. Also comments on the requirement of the maturation ponds to meet the BOD_5 discharge standard, if the BOD_5 removal efficiency of the maturation pond is 32%.

(CO4) 14