

B.CIVIL ENGG. 3rd YEAR 2nd SEMESTER EXAMINATION 2017

WASTE WATER ENGINEERING

Time: Three hours

Full Marks 100
(60 marks for this part)

Use a separate Answer-Script for each part

Part-I

Question no. 1 is compulsory

Answer any **three** from the rest*(Assume any data, if required, reasonably)*

[CPHEEO Wastewater manual graphs (figure) are allowed]

[Provide sketches wherever possible]

Q.1. Write short notes on the following (any three): (3×5) = 15

- I. Show the time versus concentration graphs of continuous feed nonreactive dye tracer for (i) plug flow reactor, (ii) continuous flow stirred tank reactor, and (iii) arbitrary flow reactor.
- II. Show the flow sheets of (i) primary sludge management and (ii) management of secondary sludge along with primary sludge.
- III. Discuss the design consideration of septic tank as per CPHEEO manual.
- IV. Write short note on oxidation ditch.
- V. Describe with neat sketch the symbiotic relationship and function of a facultative stabilization pond.

Q.2.

- a) Discuss with a sketch about the different components of a sand sludge drying bed.

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- b) Design a grit chamber system (2W+1S) to treat a peak design wastewater flow of 65MLD to remove grit particles up to size 0.15mm having average specific gravity 2.64. The kinematic viscosity of wastewater is
- 1.15×10^{-6}
- m
- ²
- /s at design temperature. The grit chamber should be equipped with proportional flow weir as control device and very good settling basin performance should also be considered. Compute the settling velocity, surface overflow rate, the dimensions of grit chamber and proportional flow weir.

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2. a) (i) Name all the eight sub-groups of total solids, when it is classified based on size and volatility. 4
- (ii) Mention the sub-groups which are removed and/or transformed to other form in the following units of WW treatment plants (WWTP):
- (x) grit chamber (y) secondary clarifier (z) biological unit
- b) (i) What is the main importance of odour as a WW characteristic?
- (ii) 'Turbidity is only a qualitative assessment of suspended solid'-explain with an example.
- (iii) Which physical WWC is most responsible for septicity of a tropical water body and why?
- (iv) What is the importance of RSH or thioalcohol as a municipal WW characteristic? 6+4 =10
3. a) If $K =$ BOD rate constant (base e), $K_{20} = 0.13/\text{day}$ and $K_{30} = 0.2/\text{day}$, find the temperature coefficient.
- b) Calculate the population equivalent of a city, given (i) the average WW from the city is 95×10^6 L/day, (ii) the average 5 day BOD is 300 mg/L and (iii) per capita BOD₅ may be taken as 0.08kg/day.
- c) The following observations were made on a 2% dilution of WW: (i) DO of aerated water used for dilution = 5.0 mg/L (ii) DO of diluted sample after 5 days incubation = 1.8 mg/L (iii) DO of undiluted sample = 0.6 mg/L (iv) K (base e) may be assumed as 0.35/day. Calculate BOD_u.
- d) Why is dilution done in BOD test? What are seed mixture and sample mixtures in seeded BOD test? 2+2+3+3=10

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4. a) What does the top most point of the growth pattern of microorganism based on mass indicate?
- b) How the size of a completely unknown WW sample may be assumed for BOD test?
- c) If the formula of an organic substance is $C_aH_bO_c$, calculate ThOD.
- d) Write the relevant aerobic reaction to produce the compound directly responsible for crown corrosion.
- e) Define TKN as a WW characteristic?
- f) Why is sometimes nitrogen required to be added for WW management?
- g) Which value of peak factor should be assumed to calculate peak domestic WW flow and why?
- h) For a starting manhole, what is the difference between values of time of concentration and inlet time?
- i) What was the original equation for 'Rational Method'?
- j) What should be the minimum value of d/D and why?

1x10=10