NATIONAL INSTITUTE OF TECHNOLOGY, WARANGAL
(An Institution of National Importance)
DEPARTMENT OF CIVIL ENGINEERING, END EXAM, December, 2016
I B. Tech (Common to A,B,C,D,E & F Sections) I Semester
CE 102 – ENVIRONMENTAL SCIENCE AND ENGINEERING

Date: 08-12-2016 Time: 9.30 AM -12.30 Noon Max. Marks. 50

NOTE: Answer all the sub sections of a question together.

1. A BOD test is run using 100 mL of treated wastewater mixed with 200 ml of pure water. The initial D.O of the mix is 9.0 mg/L. After 5 days, the D.O is 4.0 mg/L. After a long period of time, the D.O is 2.0 mg/L, and it no longer seems to be dropping. Assume nitrification has been inhibited so the only BOD being measured is carbonaceous. [10]
   (a). Explain why BOD test duration is taken as 5 days?
   (b). What is the five – day BOD of the wastewater?
   (c). Assuming no nitrification effects, estimate the ultimate carbonaceous BOD.
   (d). What would be the remaining BOD after five days have elapsed?
   (e). Estimate the reaction rate constant k (day^{-1})

2. a). What is meant by solid waste management and explain with the help of a flow chart? How hazardous wastes are different from municipal solid waste? With the help of neat sketches, describe composting and incineration of municipal solid waste? [6+4]
   b). Briefly describe the following
   (i). Kaya identity.
   (ii). Airborne fraction.
   (iii). Atmospheric radiative window.
   (iv). Albedo.

3. a) The estimation of CO_2 concentration in the atmosphere conducted before the Industrial Revolution showed about 275 ppmv. The accumulation of CO_2 in the atmosphere has been continuing since then, and by the middle of this century it is expected to reach around 600 ppmv. Calculate the pH of the rainwater (neglecting the effect of any other gas) at 25 °C both before the Industrial Revolution and by the middle of this century. [6+4]
   Use the following data.
   $[H^+] = [HCO_3^-] + 2[CO_3^{2-}] + [OH^-]$;
   $[CO_3^{2-}] << [HCO_3^-]$; $K_w = 10^{-14}$
   $[H^+]\,[HCO_3^-] / [\,CO_2(aq)] = K_1 = 4.47 \times 10^{-7}$ mol/L ;
   Henry's coefficient for CO_2 at 25 °C = K_H = 0.033363 mol/L.atm

   b) What is EIA? Why it is important for any major projects? Tabulate the most important advantages and disadvantages of conducting EIA for any project.

4. a) With the help of a neat sketch, explain the working principle of gravitational settling chambers and fabric/bag filters for removing the particulate matter from air.

   b) What is ecosystem? Explain any four important salient features of a grass land ecosystem with the help of food Chain.
   c) Describe different types of ecological pyramids with examples. [4+3+3]

5. A lagoon with volume 1,200 m^3 has been receiving a steady flow of a non-conservative waste at a rate of 100 m^3/day for a long enough time to assume that steady-state conditions apply. The waste entering the lagoon has a concentration of 10 mg/L. Assuming completely mixed conditions, What would be the concentration of pollutant in the effluent leaving the lagoon if the decay rate constant is 0.2 $L^{-1}\,mg^{-1}\,day^{-1}$.

   If another waste is replaced with the earlier one to enter the lagoon with a concentration of 100 mg/L, what would the concentration in the effluent be after 6 days, if the rate of decay reaction for the waste is 0.2/day . [5+5]