BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : VII**
BRANCH: EEE/BT/MECH/PROD **SESSION : MO/19**

SUBJECT: CE7021 ENVIRONMENTAL ENGINEERING

TIME: 3.00Hrs. **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Discuss secondary treatment processes used in wastewater treatment. [2]
Q.1(b) Describe bacterial growth curve in a batch process. [4]
Q.1(c) Describe activated sludge process emphasizing kinetic parameters. [6]

Q.2(a) Based on the data given below for 100 kg MSW sample (ash content 5.0%), estimate the moisture content (%), total energy, energy content (kJ/kg) on dry basis and ash-free dry basis. [6]

Component	% by Mass	Moisture (%)	Energy (kJ/kg)
Food Wastes	18	73	5,200
Paper	26	7	16,800
Cardboard	12	5	16,200
Plastics	15	3	32,900
Garden trimmings	14	61	6,900
Wood	8	19	18,700
Tin cans	7	2	700

Q.2(b) Determine the quantity of air required to oxidize (including the amount required to stabilize NH_3 formed) completely 1 tonne of waste through composting having the chemical formula ($C_{100}H_{240}O_{100}N_{20}$). Density of air = 1.2928 kg/m^3. [6]

$$C_aH_bO_cN_d + (4a + b - 2c - 3d/4)\ O_2 \longrightarrow a CO_2 + (b - 3d/2)\ H_2O + d NH_3$$

Q.3(a) Illustrate relationship between NO, NO_2 and O_3 in a full sunlight day. Discuss the health effect thus caused. [6]
Q.3(b) What PSI, and what air quality description, should be reported for the air pollution on the day given? [6]

Pollutant	Day
O3, 1 hr (ppm)	0.15
CO, 8 hr,(ppm)	12
PM10, 24 hr (microg/m3)	150
SO2, 24 hr (ppm)	0.12
NO2 , 1 hr (ppm)	0.4

Q.4(a) Illustrate idealized general air circulation patterns, drawn at the equinox. [6]
Q.4(b) Illustrate the difference between local stability and stability based on mixing layers. [6]

Q.5(a) A cyclone with diameter (D) 1.0 m handles 3.0 m^3/s of standard air carrying particles with a density (ρ_p) of 2000 kg/m^3. for N_e=6, determine the cut size (d_{pc}) and the efficiency at particle diameter 5 μm. (μ_g =1.81 x 10^{-5} kg/m.s). The ratio of entrance height (a) =0.5 & entrance width (b)= 0.25. [6]
Q.5(b) A cylindrical precipitator having a diameter of 1.0 m handles dust particles of 2.5 micron in standard air with an efficiency of 99%. The volumetric flow rate of air is 0.2 m^3/s. for an electric field strength of 150,000 v/m and q_p = 1.0 x 10^{-15} coulomb, determine the required length of the precipitator. [Cunningham correction factor $C = 1 + \frac{2\lambda}{d_p}(1.257 + 0.4e^{-0.55 d_{p/\lambda}}$ for standard air, λ = 0.066 μm. μ_g =1.84 x 10^{-5} kg/m-s]. [6]

Q.6(a) Define noise pollution. How it is different from other type of pollution? [2]
Q.6(b) Illustrate sonic boom created by a jet plane and bow wake generated by a duck in water. [4]
Q.6(c) Write expression for observed frequency when source and or observer are moving. [6]

PTO

Q.7(a) What was the purpose of UN conference on Man and Biosphere held on 1972? [2]

Q.7(b) Enlist and briefly write the pur pose of different international laws which prohibit movement of hazardous materials. [4]

Q.7(c) Environmental protection act is called gamut of all laws. Highlight the points which empower the govt. to deal with any environmental issues. [6]

:::::11/12/2019E:::::

Table 7.3. Pollutant Standards Index (PSI) Breakpoints

Index	Designation	1 hr O_3 (ppm)	8 hr CO (ppm)	24 hr PM 10 ($\mu g/m^3$)	24 hr SO_2 (ppm)	1 hr NO_2 (ppm)
0	-	0	0	0	0	—[a]
50	—	0.06	4.5	50	0.03	—[a]
100	NAAQS	0.12[b]	9	150	0.14	—[a]
200	Alert	0.20	15	350	0.30	0.6
300	Warning	0.40	30	420	0.60	1.2
400	Emergency	0.50	40	500	0.80	1.6
500	Significant harm	0.60	50	600	1.00	2.0

[a] No index values reported at concentrations below the Alert level.

[b] Does not yet reflect 1997 change in standard.

Source: EPA, 1994b.