ENV
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Environmental
ENGINEERING

M.E/ SEM-1

STATISTICS FOR ENVIRONMENTAL ENGINEERS

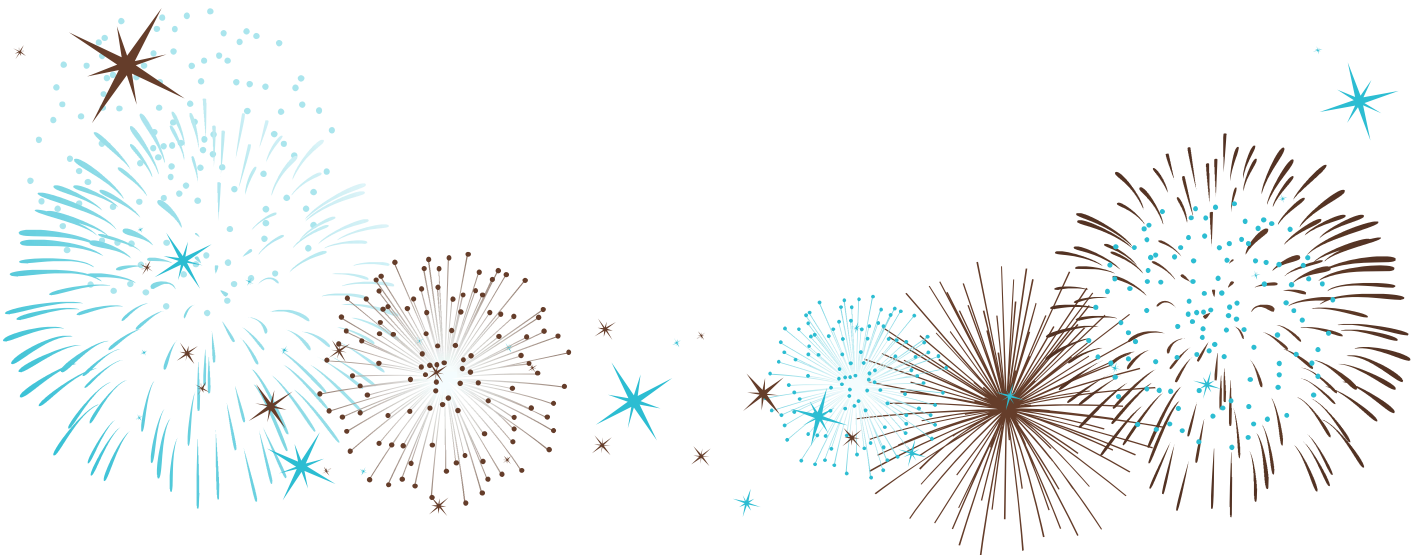June2012, Jan 2012, Jan2013

ENVIRONMENTAL CHEMISTRY

Jan 2012, Jan 2013

PRINCIPLES & DESIGN OF PHY-CHE TREATMENT SYM

June 2012, Jan 2012, Jan 2013

SOLID AND HAZARDOUS WASTE MANAGMENT

June 2012, Jan 2012, Nov 2012

Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 81581

M.E./M.Tech. DEGREE EXAMINATION, JUNE 2012.

First Semester

Environmental Science and Engineering

MA 9323 – STATISTICS FOR ENVIRONMENTAL ENGINEERS

(Regulation 2009)

Time : Three hours   Maximum : 100 marks

Statistical Tables May be Permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Name different measures of central tendency that are in common use.

2. State the empirical relation between mean, median and mode.

3. If T is an unbiased estimator for θ, show that T^2 is a biased estimator for θ^2.

4. Write down the invariance property of maximum likelihood estimator.

5. Define type I and type II errors.

6. What are the condition for the validity of χ^2-test?

7. What are the basic principle of experimental design?

8. What is the main advantage of LSD.

9. When are use np-chart and p-chart?

10. Define control chart and what is the use of it?

PART B — (5 × 16 = 80 marks)

11. (a) (i) The geometric mean of 10 observations on a certain variable was calculated as 16.2. It was later discovered that one of the observations was wrongly recorded as 12.9; infact it was 21.9. Apply appropriate correction and calculate the correct geometric means. (8)

    (ii) Calculate the mean and S.D for the following table giving the age distribution of 542 members. (8)

Age (in years)	20-30	30-40	40-50	50-60	60-70	70-80	80-90
No. of members	3	61	132	153	140	51	2

Or

(b) (i) Show that for discrete distribution $\beta_2 > 1$ (8)

(ii) For a group of 200 candidates, the mean and S.D. of scores were found to be 40 and 15 respectively. Later on it was discovered that the scores 43 and 35 were misread as 34 and 53 respectively. Find the corrected mean and S.D corresponding to the corrected figures. (8)

12. (a) (i) Fit a second degree parallel to the following data, taking y as dependent variable. (8)

x: 1 2 3 4 5 6 7 8 9

y: 2 6 7 8 10 11 11 10 9

(ii) In random sampling from normal population $N(\mu, \sigma^2)$ find the maximum likelihood estimators for

(1) μ when σ^2 is known (2) σ^2 when μ is known. (8)

Or

(b) (i) Obtain the equations of two lines of regression for the following data. (8)

x: 65 66 67 67 68 69 70 72

y: 67 68 65 68 72 72 69 71

(ii) A random variable X taken the values 0,1,2 with respective probabilities $\dfrac{\theta}{4N} + \dfrac{1}{2}\left(1 - \dfrac{\theta}{N}\right), \dfrac{0}{2N} + \dfrac{\alpha}{2}\left(1 - \dfrac{\theta}{N}\right)$ and $\dfrac{\theta}{4N} + \dfrac{1-\alpha}{2}\left(1 - \dfrac{\theta}{N}\right)$, where N is a known number and α, θ are unknown parameters. If 75 independent observation on X yielded the values 0,1,2 with frequencies 27, 38, 10 respectively, estimate θ, and α by the method of moments. (8)

13. (a) (i) In a large city A, 20% of a random sample of 900 school boys had a slight physical defect. In another large city B, 18.5% of a random sample of 1600 school boys had the same defect. Is the difference between the proportions significant? (8)

(ii) Fit a Poisson distribution for the following distribution and also test the goodness of fit. (8)

x:	0	1	2	3	4	5	Total
f:	142	156	69	27	5	1	400

Or

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(b) (i) A certain infection administered to each of the 12 patients resulted in the following increases of blood presure 5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4. can it be concluded that the injection will be in general accompanied by an increase in BP. (8)

(ii) Two samples of sizes 9 and 8 gave the sums of squares of decimations from their respective means equal to 160 and 91 respectively. Can they be regarded as drawn from the same normal population. (8)

14. (a) The following table shows the lives in hours of four brands of electric lamps.

Brand A: 1610 1610 1650 1680 1700 1720 1800

B: 1580 1640 1640 1700 1750

C: 1460 1550 1600 1620 1640 1660 1740 1820

D: 1510 1520 1530 1570 1600

Perform an analysis of variance and test the homogeneity of the mean lives of the four brands of lamps. (16)

Or

(b) Analyse the variance in the following Latin square of yields (in kgs) of paddy where A,B,C,D denote the different methods of cultivation.

D122 A121 C123 B122

B124 C123 A122 D125

A120 D119 D120 C121

C122 D123 B121 A122

Examine whether different methods of cultivation have given significantly different yields. (16)

15. (a) In a factory producing spark plugs, the number of defectives found in the inspection of 15 lots of 100 each is given below. Draw the control chart for the number of defectives and comment on the state of control. (16)

Sample No. (i)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No of defectives (np)	5	10	12	8	6	4	6	3	4	5	4	7	9	3	4

Or

360 (b) The specifications for a certain quantity characteristic are 15.0 ± 6.0 (in coded values). 15 samples of 4 readings each gave the following values for $\bar{X}$ and R.

Sample No (i)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
$\bar{X}$	16.1	15.2	14.2	13.9	15.4	15.7	15.2	15	16.5	14.9	15.3	17.8	15.9	14.6	15.2
R:	3.0	2.1	5.6	2.4	4.1	2.7	2.3	3.8	5	2.9	13.8	14.2	4.8	5	2.2

Compute the control limits for $\bar{X}$ and R-charts using the above data for all the samples. Hence deduce if the process is in control. If not, remove the doubt ful samples and recompute the values of $\bar{\bar{X}}$ and $\bar{R}$. After testing the state of control, estimate the tolerance limits and find if the process will meet the required specifications.

(16)

Question Paper Code : 91708

M.Tech. DEGREE EXAMINATION, JANUARY 2012.

First Semester

Environmental Science and Engineering

MA 9323 — STATISTICS FOR ENVIRONMENTAL ENGINEERS

(Regulation 2009)

Time : Three hours   Maximum : 100 marks

Statistical tables may be permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   Define population and sample.

2.   Define coefficient of variation.

3.   Define an unbiased estimator and give an example.

4.   Why do need two regression lines if we have two variables?

5.   Define Type I error and Type II error.

6.   Define χ^2 test for independence of attributes.

7.   Define the analysis of variance technique.

8.   Define degrees of freedom and what is the error degrees of freedom in RBD when we have 't' treatments and 'b' blocks.

9.   Define "statistical quality control".

10. Define UCL and LCL.

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11. (a) (i) What is the best measure of central values - why? (6)

      (ii) Calculate Mean, Median and Mode for the following frequency distribution. (10)

Marks :	0–10	10–20	20–30	30–40	40–50	50–60
Frequency :	8	15	22	20	10	5

Or

(b) (i) Define standard deviation and its relative measure. (4)

      (ii) From the prices of shares of company A and company B below find out which is more stable. (12)

Co. A	35	54	52	53	56	58	52	50	51	49
Co. B	108	107	105	105	106	107	104	103	104	101

12. (a) (i) Explain the following with an example.

        (1) Estimator and Estimate. (4)

        (2) Unbiased estimator. (4)

      (ii) Explain the Maximum Likelihood estimation method. (8)

Or

(b) The following table shows the ages (X) and blood pressure (Y) of 8 persons. (16)

X:	52	63	45	36	72	65	47	25
Y:	62	53	51	25	79	43	60	33

Obtain the regression equation of Y on X and find the expected blood pressure of a person who is 49 years old.

13. (a) (i) Define Sampling distribution and standard error. (8)

      (ii) A machine produced 20 defective articles in a batch of 400. After overhauling it produced 10 defectives in a batch of 300. Has the machine improved? (8)

Or

(b) (i) What are the steps involved in any testing of significance problem? (6)

      (ii) For a random sample of 10 persons, fed on diet A, the increased weight in pounds for a period of 3 months were

10, 6, 16, 17, 13, 12, 8, 14, 15, 9

For another random sample of 12 persons, fed on diet B, the increase in the same period were

7, 13, 22, 15, 12, 14, 18, 8, 21, 23, 10, 17

Test whether the diets A and B differ significantly as regards their effect on increase in weight. (10)

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14. (a) (i) Explain the concept of ANOVA technique and state the assumptions involved in the same. (8)

(ii) A tea company appoints four salesmen A, B, C and D and observes their sales in three seasons - summer, winter and monsoon. The figures (in lakhs) are given in the following table. (8)

Salesmen

Seasons	A	B	C	D
Summer	36	36	21	35
Winter	28	29	31	32
Monsoon	26	28	29	29

(1) Do the salesmen significantly differ in performance?

(2) Is there significant difference between the seasons?

Or

(b) (i) What is meant by a Randomized block design and state its advantages over CRD? (6)

(ii) Set up the analysis of variance for the following results of Latin Square Design. (10)

	I	II	III	IV
R_1	D 29.1	B 18.9	C 29.4	A 5.7
R_2	C 16.4	A 10.2	D 21.2	B 19.1
R_3	A 5.4	D 38.8	B 24.0	C 37.0
R_4	B 24.3	C 41.7	A 9.5	D 28.9

15. (a) Construct a control chart for mean and the range for the following data on the basis of fuses, samples of 5 being taken every hour. Comment on the data.

42	42	19	36	42	51	60	18	15	69	64	61
65	45	24	54	51	74	60	20	30	109	90	78
75	68	80	69	57	75	72	27	39	113	93	94
78	72	81	77	59	78	95	42	62	118	109	109
87	90	81	84	78	132	138	60	84	153	112	136

Or

(b) The following are the figures of defectives in 22 lots each containing 2000 rubber belts.

425, 430, 216, 341, 225, 322, 280, 306,

337, 305, 356, 402, 216, 264, 126, 409,

193, 326, 280, 389, 451, 420

Draw control chart for fraction defective and comment on the state of control of the process.

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Question Paper Code : 91639

M.Tech. DEGREE EXAMINATION, JANUARY 2012.

First Semester

Environmental Science and Engineering

ES 9311 — ENVIRONMENTAL CHEMISTRY

(Regulation 2009)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are colloids?

2. What is solubility product?

3. What is B.O.D?

4. Define sorption.

5. Mention any two disadvantages of photochemical smog.

6. What is acid rain?

7. What is meant by reclamation?

8. What are the different types of soils?

9. Write a note on atom economy.

10. What is meant by mass index?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Discuss any two heavy metal precipitation techniques. (8)

    (ii) Write a detailed note on electrical double layer theory. (8)

Or

(b) (i) What are first order reactions? Discuss in detail. (8)

(ii) Explain the environmental significance of colloids and coagulation. (8)

12. (a) (i) Discuss the various steps involved in the waste water treatment. (8)

(ii) Give a brief account of Eh-pH diagrams and explain. (8)

Or

(b) (i) What are the various processes involved during the degradation of synthetic chemicals? (8)

(ii) Discuss the chemical speciation of trace metals in aquatic environment. (8)

13. (a) (i) Discuss the causes, effects and determination of any two air pollutants. (8)

(ii) Describe the origin and composition of any two particulates. (8)

Or

(b) (i) Discuss global warming effect and its consequences in detail. (8)

(ii) Write notes on any two photo chemical reactions and explain. (8)

14. (a) (i) Explain any two types of ion exchange reactions in soil. (8)

(ii) Discuss the various processes involved during reclamation of soil in detail. (8)

Or

(b) (i) Write notes on acid-base reactions in soil. (8)

(ii) Discuss cation exchange capacity of clay in detail. (8)

15. (a) (i) Discuss the principles of green chemistry. (8)

(ii) What are carbon nano tubes? Discuss their properties and applications. (8)

Or

(b) (i) How are titania nano tubes synthesised? Mention their properties. (8)

(ii) Discuss the nano technology composite materials for environmental applications. (8)

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Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 81419

M.Tech. DEGREE EXAMINATION, JUNE 2012.

First Semester

Environmental Science and Engineering

ES 9314/UEE 9115/UEN 9107 — PRINCIPLES AND DESIGN OF PHYSICO–CHEMICAL TREATMENT SYSTEMS

(Regulation 2009)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Brief about Non Point Source of water pollution.

2. What is retention time in a bioreactor? How retention time of a wastewater is fixed?

3. Write the importance of Equalization and Neutralization of wastewater.

4. Brief about Incineration.

5. Brief about Ozonised water with merits and demerits.

6. Write briefly about Alum treatment. What are the limitations in Alum treatment?

7. What are the primary treatments used for treating Municipal waste.

8. Brief about the different types of aeration systems.

9. Write briefly about Grit Chambers.

10. Brief about the Activated Sludge process.

PART B — (5 × 16 = 80 marks)

11. (a) (i) What are the pollutants in Drinking water and Industrial wastewater? (7)

    (ii) Brief about the characteristics of wastewater. Give the Water quality Standards. (9)

Or

    (b) (i) Brief about the different types of Reactor used for wastewater treatment. (10)

    (ii) List out the criteria used while selecting a reactor. (6)

12. (a) (i) Write in detail about the physical method treating wastewater. (8)

    (ii) What is Continuous type reactor? (4)

    (iii) What are the basic criteria to be used while selecting anaerobic process? (4)

Or

    (b) Write a detailed account on Reverse Osmosis Process with Merits and Demerits. (16)

13. (a) (i) Brief about the chemicals used for wastewater treatment with mode of action. (12)

    (ii) Write in detail about the advantages and disadvantages in using chemical method of treatment. (4)

Or

    (b) Write in detail about the different types of water disinfectants with their mode of Action. (16)

14. (a) (i) What are sand Filters? what are the different types of Sand filters? (4)

    (ii) Brief about water softeners with merits and Demerits. (12)

Or

    (b) Write in detail about sludge management in Municipal water treatment plants. (16)

15. (a) (i) Write in detail about the sewage water treatment plant at Chennai. (10)

    (ii) Brief about the various sludge management options adopted in chennai sewage treatment plant. (6)

Or

    (b) Write in detail about the Zero Discharge concepts in industries. What are the recent advances in wastewater treatment system to achieve Zero Discharge? (16)

Reg. No. :

Question Paper Code : 91642

M.Tech. DEGREE EXAMINATION, JANUARY 2012.

First Semester

Environmental Science and Engineering

ES 9314 — PRINCIPLES AND DESIGN OF PHYSICO CHEMICAL TREATMENT SYSTEMS

(Regulation 2009)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Name and characterize the most significant components of municipal wastewater.

2. Sketch the output tracer response curves from the reactors subject to pulse and step inputs of a tracer in (a) Complete mix reactor (b) Plug flow reactor.

3. What are the factors influencing the rate of sedimentation?

4. Show schematically any two types of filter based on the direction of flow.

5. What is the purpose of coagulation? List the four major mechanisms by which coagulation occurs.

6. Explain the role resin plays in the ion exchange process.

7. What is the significance of "time of contact "and pH in disinfection?

8. What are the mechanisms causing destabilizations of colloidal dispersions?

9. Describe operating problems that may be experienced with reverse osmosis installations.

10. Define :

   (a) Neutralization

   (b) Equalization

PART B — (5 × 16 = 80 marks)

11. (a) (i) Characterize the different forms of solids that can occur in a water sample. (8)

    (ii) Name the most common non toxic metals found in water supplies, identify their sources and discuss their impacts. (8)

Or

(b) (i) Define biodegradable organics. Give examples, discuss sources, and assess the impact of biodegradable organics in water. (8)

    (ii) What are the principal types of reactors used in wastewater treatment? Briefly explain with examples for each reactor. (8)

12. (a) (i) Explain concepts of sedimentation, including types of classifiers, sedimentation system components and steps for normal operation. (8)

    (ii) What is meant by gas transfer in water treatment? Briefly explain the two-film theory of Gas transfer and give examples for Gas transfer. (8)

Or

(b) (i) What are the transport mechanisms involved in the adsorption process and explain them in brief. When will the film diffusion limits the rate of adsorption and how can you eliminate it. (8)

    (ii) Explain Pressure driven membrane process in detail. (8)

13. (a) (i) Explain ortho kinetic flocculation and peri kinetic flocculation in water treatment. (8)

    (ii) What is the principle involved in dissolved air floatation? Sketch the schematic diagram of dissolved air floatation with or without recycles. (8)

Or

(b) (i) The disinfection kinetics can be described by the following model, $\ln \dfrac{N}{N_0} = -10.48(C)^{1.2} t$ at 20°C. Estimate the time required to kill 99.9% of E. coli at 25°C for a chlorine dose of 0.05 mg/l. The activation energy is 26,800 J/mole and gas constant 8.3144 J/mole.°K for the reaction. (8)

    (ii) Write short notes on (1) Ion Exchange (2) Advanced Oxidation. (8)

14. (a) (i) Design an Air striping column to treat a ground water supply contaminated with trichloroethylene (TCE). The maximum level of TCE in the ground water is 2 mg/l, and this must be decreased to 20 μg/l. The following data are provided.

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$K_L a = 0.018/\text{sec}$, $Q_W = 12 \ l/s$

$T = 20^\circ$

$H = 550 \ \text{atm}$

Select a column diameter of 0.8 m and the air to Void ratio $\dfrac{Q_A}{A_{w}} = 25$.

Determine Striping factor (R), HTU, NTU, and Height of packing in column. (8)

(ii) A water treatment plant is to process 50,000 m³/d. The rapid mixing tank will blend 35 mg/l of alum with the flow and is to have a detention time of 2 min. The tank is to have a square cross-section with vertical baffles and a flat blade. The water temperature is 20°C ($\mu = 1.002 \times 10^{-3}$ N.s/m² $\rho = 998.2$ kg/m³). Determine the following

(1) Quantity (kg/day) of alum added

(2) Dimensions of the tank

(3) Power input (kilowatts) necessary for a G value of 1000 s^{-1} (8)

Or

(b) (i) An experimental filter consists of a 2.5 m depth of uniform sand with diameter of 0.9 mm and a shape factor of 0.8. The porosity of bed is 0.4 and the specific gravity of the sand is 2.65. Determine the head (meters of water) to maintain a flow of water through the bed at a flow rate of 10 m/hr. The water temperature is 20°C ($\mu = 1.002 \times 10^{-3}$ N.s/m² p= 998.2 kg/m³). (8)

(ii) An adsorption study was conducted by adding varying amounts of Activated carbon to a series of six flasks containing 500 ml of an industrial waste having an initial TOC (Total Organic Carbon) of 150 mg/l. The flasks were agitated for 4 hours, and the residual steady state TOC concentrations were determined. Plot the Freundlich isotherms for the data presented below and determine the values of the appropriate constants.

Flask No.	Carbon dosage (mg)	Final TOC (mg/l)
1	0	150
2	75	105
3	175	70
4	250	54.5
5	500	28.3
6	1000	12.5

(8)

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Question Paper Code : 81399

M.E./M.Tech. DEGREE EXAMINATION, JUNE 2012.

Second Semester

Environmental Engineering/Environmental Science and Engineering

EN 9321 – SOLID AND HAZARDOUS WASTE MANAGEMENT

(Common to M.Tech. Environmental Science and Engineering)

(Regulation 2009)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Name any four hazardous wastes.

2. List the key responsibilities of a biomedical waste generator.

3. A 300 kg sample solid waste has a dry mass of 180 kg. Determine its moisture content.

4. Enumerate the biological properties of solid wastes.

5. When will you recommend a hauled container system?

6. What is the role of transfer station in MSW management?

7. What is the role of earth worms in vermicomposting?

8. Distinguish between incineration and pyrolysis.

9. List out the benefits associated with leachate recirculation in landfill bioreactors.

10. What is the use of daily cover in a landfill?

PART B — (5 × 16 = 80 marks)

11. (a) Explain the environmental and public health significance of municipal solid wastes, biomedical wastes and hazardous waste management.

Or

(b) (i) What are the sources of municipal solid wastes? (5)

(ii) List the authorities in India having responsibilities for hazardous waste management? State their role and responsibilities. (10)

12. (a) (i) Briefly discuss the factors affecting solid waste generation in a city.

(6)

(ii) Determine the density of a mixed waste with the following characteristics.

(10)

Sl. No	Components	Mass (%)	Density (kg/m³)	Moisture (%)
1	Newspaper	8	85	6.5
2	Card board	6	50	5.5
3	Glass	4	195	0.5
4	Food waste	45	290	60
5	Metals	6	320	0.8
6	Plastics	6	65	2.5
7	Inerts	25	600	6.0

Or

(b) (i) Explain the TCLP test procedure. (12)

(ii) What is meant by proximate analysis of solid waste? (4)

13. (a) (i) Explain the considerations in the finalization of solid waste collection routes. (10)

(ii) What is meant by 'at site', 'off route' and 'pick up' in the analysis of solid waste collection? (6)

Or

(b) Briefly outline the important factors that must be considered in the storage, labeling and handling of hazardous waste.

14. (a) (i) Describe the factors to be considered in the selection of waste processing equipments. (10)

(ii) Explain the principles of unit operation used for separation of municipal solid wastes. (6)

Or

(b) (i) Briefly outline the different waste to energy options for management of solid and hazardous waste. (8)

(ii) What are the important factors affecting composting? How are they controlled during composting? (8)

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15. (a) (i) Enlist the key characteristics of an engineered landfill that distinguishes it from an open dump.

(ii) With the help of a neat sketch describe the operational components of a landfill and state their functions.

(10)

Or

(b) (i) Elaborate the post closure care required for a secure landfill. (6)

(ii) List out the factors that must be considered in identification of potential site for a secure landfill. Describe the site selection procedure.

(10)

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Question Paper Code : 34026

M.E./M.Tech. DEGREE EXAMINATION, JUNE 2012.

Second Semester

Environmental Engineering

UEE 9123 — SOLID AND HAZARDOUS WASTE MANAGEMENT

(Common to UEN 9104 – M.Tech. Environmental Science and Engineering)

(Regulation 2009)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Municipal solid waste.

2. What is e-waste?

3. What is meant by proximate analysis of solid waste?

4. Differentiate Reuse and Recycle.

5. What is a Transfer station?

6. Define Hazardous waste.

7. What are the objectives of waste processing?

8. What is C/N ratio?

9. What is meant by leachate?

10. What is the purpose of daily cover at a sanitary landfill?

PART B — (5 × 16 = 80 marks)

11. (a) Explain briefly elements of integrated waste management and role of stakeholders.   (8 + 8)

Or

(b) Briefly discuss the mandatory requirements of municipal solid waste (M and H) Rules in India.   (16)

12. 6(a) List the factors that will affect the characteristics of solid waste from a community and explain it. (16)

Or

(b) Briefly explain the TCLP Test procedure. What is its importance? (16)

13. (a) What is meant by hauled container system and stationary container system? When you will recommend each? (16)

Or

(b) (i) Describe the Hazardous waste manifest and its purpose. (8)

(ii) What are the responsibilities of "state pollution control boards" and "state government" under hazardous waste (management and handling) Rules in India. (8)

14. (a) Describe briefly about process of aerobic composting and discuss the factors affecting composting. (16)

Or

(b) Write a note on biomedical waste treatment. (16)

15. (a) List the guidelines to be followed while selecting a site for landfill. (16)

Or

(b) (i) Write a note on landfill stabilisation. (8)

(ii) Write a note on liner system in landfill. (8)

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Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 68143

M.Tech. DEGREE EXAMINATION, JANUARY 2013.

First Semester

Environmental Science and Engineering

ES 9311/UEE 9112/UEN 9102 — ENVIRONMENTAL CHEMISTRY

(Regulation 2009)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by chemical equilibrium? Why is it called a dynamic equilibrium?

2. Which is the better chemical for removing Magnesium ions from solution, NaOH or Na_2CO_3? Why?

3. What are amphoteric Hydroxides? Give examples.

4. Give the significance of Photochemical transformation in aqueous system.

5. Differentiate between Mist and fog.

6. What is acid rain? How is it caused?

7. What do you mean by soil horizons? Give the composition of soil.

8. What is the significance of soil colour?

9. Explain 'Reaction mass efficiency'.

10. What is CNT? Give its significance.

PART B — (5 × 16 = 80 marks)

11. (a) (i) State the principle of solubility product. The solubility product for the dissociation of $Mg(OH)_2$ is 9×10^{-12}. Determine the concentration of Mg^{2+} and OH^- at equilibrium, expressed as milligrams per liter of $CaCO_3$.   (8)

(ii) What are colloids? Discuss the origin of charge on colloidal particles. What is meant by electrical double layer? What is meant by Zeta potential? (8)

Or

(b) (i) Give an account on, "CO_2 Solubility in water" and "environmental significance of colloids". (8)

(ii) How does half-life period of a first order reaction vary with temperature? 50% of a first order reaction is complete in 23 minutes. Calculate the time required to complete 90% of the reaction. (8)

12. (a) (i) What is meant by chemical speciation? Explain with suitable examples. (8)

(ii) List the water quality parameters. Indicate the permissible limits for the more relevant parameters. (8)

Or

(b) (i) Draw and explain Eh-pH diagram with a suitable example. Give its significance. (8)

(ii) Explain the degradation of synthetic chemicals and metals in aquatic system with suitable examples. (8)

13. (a) (i) What is greenhouse effect? How is it caused? What are the major gases causing it? What are the adverse effect of greenhouse effect? (8)

(ii) Explain the chemical and photo chemical reactions in the atmosphere with suitable Examples. (8)

Or

(b) (i) What is Ozone depletion? Explain its causes and consequences. (8)

(ii) Discuss in detail "Air quality parameters-effects and determination". (8)

14. (a) (i) Explain the acid-base and ion-exchange reactions in soil with suitable examples. (8)

(ii) Explain the degradation of soil by acidification, contamination, erosion, and salination with suitable examples. (8)

Or

(b) (i) Give an account on "Reclamation of contaminated land". (8)

(ii) Explain the Cation exchange capacity of Clays and mention the important chemical properties of soil with suitable examples. (8)

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15. (a) (i) What is green chemistry? Explain the principle, objectives and applications of green chemistry. (8)

    (ii) How are Titania composites prepared? Give its properties and uses. (8)

Or

(b) (i) Discuss in detail about the atom economy and mass index. (8)

    (ii) Explain how the green chemistry preventing pollution to achieve a sustainable civilization on earth. (8)

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Question Paper Code : 68146

M.Tech. DEGREE EXAMINATION, JANUARY 2013.

First Semester

Environmental Science and Engineering

ES 9314/ UEE 9115/UEN 9107 — PRINCIPLES AND DESIGN OF PHYSICO CHEMICAL TREATMENT SYSTEMS

(Regulation 2009)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is a plug flow and complete mix reactor?

2. What is equalization of waste?

3. What are the adsorption isotherms?

4. What is the principle of solidification?

5. What is "Ca.t" value of disinfection?

6. Define peris and ortho kinetic flocculation.

7. What is Reverse osmosis process?

8. What is a tube settler?

9. What is a velocity control section in a girl chamber?

10. What is the principle of flotation?

PART B — (5 × 16 = 80 marks)

11. (a) (i)   What is Toxicity of a waste? How could toxicity be measured?   (8)

        (ii) Explain the process kinetics for batch and complete mix rector.   (8)

                                    Or

    (b) (i)   What are the removal mechanisms postulated in filtration process? Explain.   (8)

        (ii) What are break through curves in adsorption process? Explain their uses.   (8)

12. (a) (i) What is membrane filtration process? How are they classified? What are the issues in the process? (8)

(ii) Explain two-film theory in gas transfer. (8)

Or

(b) (i) What is coagulation? What are the factors influencing coagulation? (8)

(ii) Explain the chemistry of Ion exchange. What are the applications of ion exchange process? (8)

13. (a) Using the data given below, determine the recovery and rejection rates for the reverse osmosis unit

Item	Value
Flow rate m^3/d	20,000
Concentrate Flow rate m^3/d	2200
Effluent TDS g/m^3	125
Concentrate g/m^3	1850

Or

(b) A rectangular setting tank has an over flow rate of $30 m^3/m^2$ day and dimensions of 2.75 m deep by 6 m wide by 15 m long. Determine whether or not particles with a diameter of 0.1 mm and a specific gravity of 2.5 will be second from the bottom. Take $f = 0.03$ and $k = 0.04$.

14. (a) Design a rapid sand filter system for a town with a population of 2.0 Lakh people. Rate of water supply 200 lpcd. Filtration rate : 200 L/m^2 min. Make assumptions suitably for needy data.

Or

(b) (i) How do R.O. plant rejects be managed? Explain with practical examples. (8)

(ii) What is sludge thickening? Why moisture removal is so important in sludge management? (8)

15. (a) Design an equalization basis for the waste water generated from an industry.

Time hrs :	0-4	4-8	8-12	12-16	16-20	20-24
Flow rate m^3/d:	7000	12,400	13,000	12,000	9500	8400

Or

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(b) (i) What is neutralization of waste? Why it is necessary? How could it be done? (8)

(ii) Make a detailed discussion an operation and maintenance issues in waste water treatment plants. (8)

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Question Paper Code : 68202

M.Tech. DEGREE EXAMINATION, JANUARY 2013.

First Semester

Environmental Science and Engineering

MA 9323/UEE 9111/UEN 9101 – STATISTICS FOR ENVIRONMENTAL ENGINEERING

(Regulation 2009)

Time : Three hours   Maximum : 100 marks

Use of statistical tables and control charts is permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Prove that algebraic sum of the deviation of set of values from their arithmatic mean is zero.

2. Name different types of measures of dispersion.

3. Define unbaised estimator.

4. What is the principle of least square?

5. Define level of significance.

6. What are the uses of t-distribution?

7. What is the total number of all possible Latin squares of order 3? and 4?

8. Is a 2×2 Latin square design possible? Why?

9. What are the two types of control charts?

10. When are the np - chart and p - chart used?

PART B — (5 × 16 = 80 marks)

11. (a) (i) The average salary of male employees in a firm was Rs. 5200 and that of females was Rs. 4200. The mean salary of all the employees was Rs. 5000. Find the percentage of male and female employees.

(8)

(ii) If n_1 and n_2 are the sizes, G_1 and G_2 are the geometric means of two series respectively prove that the geometric mean G, of the combined series is given by $\log G = \dfrac{n_1 \log G_1 = n_2 \log G_2}{n_1 + n_2}$.

(8)

Or

(b) (i) Calculate : Q.D, mean deviation from mean, for the following data : (8)

Marks:	0-10	10-20	20-30	30-40	40-50	50-60	60-70
No of Students :	6	5	8	15	7	6	3

(ii) Prove that for any discrete distribution, S.D is not less than that of mean deviation from mean. (8)

12. (a) (i) Find the maximum likelihood estimate for the parameter λ of a Poisson distribution on the basis of a sample of size n. Also find its variance. (8)

(ii) Estimate α and β in the case of Pearson's Type III distribution by method of moments

$$f(x,\alpha,\beta) = \frac{\beta^{\alpha}}{|\alpha|} x^{\alpha-1} e^{-\beta x}, \ 0 \le x < \infty$$ (8)

Or

(b) (i) Fit a straight line to the following data. Also estimate the value of y at $x = 70$ (8)

x:	71	68	73	69	67	65	66	67
f:	69	72	70	70	68	67	68	64

(ii) In a partially destroyed laboratory, record of an analysis of correlation data, the following results only are legible. Variance of $X = 9$, Regression equation $8X - 10Y + 66 = 0$, $40X - 18Y = 214$. Find mean values of $X \& Y$ and the correlation coefficient between X and Y. (8)

13. (a) (i) The fatality rate of typhoid patients is believed to be 17.26%. In a certain year 640 patients suffering from typhoid were treated in a metropolitan hospital and only 63 patients died. Can you consider the hospital efficient? (8)

(ii) A certain injection administed to each of the 12 patients resulted in following increases of blood pressure. 5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4. Can it be concluded that the injection will be in general accompanied by an increase in BP? (8)

Or

(b) (i) The following data show defective articles produced by 4 machines:

Machine :	A	B	C	D
Production Time :	1	1	2	3
No of Defective :	12	30	63	98

Do the figures indicate a significant difference in the performance of the machine? (8)

(ii) A sample of size 13 have an estimated population variance of 3.0 while another sample of size 15 gave an estimate of 2.5. Could both samples be from populations with the same variance? (8)

14. (a) The following data resulted from an experiment to compare three burners B_1, B_2 and B_3. A Latin square design was used as the tests were made on 3 engineers and were spread over 3 days

	Engine 1	Engine 2	Engine 3
Day 1	B_1 – 16	B_2 – 17	B_3 – 20
Day 2	B_2 – 16	B_3 – 21	B_1 – 15
Day 3	B_3 – 15	B_1 – 12	B_2 – 13

Test the hypothesis that there is no difference between the burners. (16)

Or

(b) In order to determine whether there is significant difference in the durability of 3 makes of computers, sample of size 5 are selected from each make and the frequency of repair during the 1st year of purchase is observed and the results are as follows

Makes

A	B	C
5	8	7
6	10	3
8	11	5
9	12	4
7	4	1

In view of the above data, what conclusion can you draw? (16)

15. (a) Given below are the values of sample mean $\overline{X}$ and sample range R for 10 samples, each of size 5. Draw the appropriate mean and range charts and comment on the state of control of the process. (16)

Sample No :	1	2	3	4	5	6	7	8	9	10
Mean :	43	49	37	44	45	37	51	46	43	47
Range :	5	6	5	7	7	4	8	6	4	6

Or

(b) 10 samples each of size 50 were inspected and the number of defectives in the inspection were 2, 1, 1, 2, 3, 5, 5, 1, 2, 3. Draw the appropriate control chart for defectures. (16)

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Question Paper Code : 61370

M.E./M.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2012.

Second Semester

Environmental Engineering

EN 9321 — SOLID AND HAZARDOUS WASTE MANAGEMENT

(Common to M.Tech Environmental Science and Engineering)

(Regulation 2009)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is hazardous waste? State examples and their sources.

2. State any four different sources of wastes contribute the municipal solid waste and their nature.

3. What is the solid waste generation rate is our country.

4. What are the different 'R's to be followed in making an effective solid waste management.

5. What are the advantages of segregation of waste at source?

6. What do you mean by hazardous waste?

7. State the objectives of solid waste processing.

8. Brief the method of solidification for waste disposal.

9. Compare the stabilisation taking place in an open land filling of solid waste and a sanitary land fill.

10. What is meant by environmental monitoring in a sanitary land fill.

PART B — (5 × 16 = 80 marks)

11. (a) Explain the components/activities involved in an integrated solid waste management.

Or

(b) Discuss the Indian Legislation measures for the handling of :
    (i) municipal solid waste. (8)
    (ii) hazardous waste. (8)

12. (a) (i) Explain the factors influencing the solid waste generation. (10)
        (ii) Write a detailed note on waste reduction by waste exchange. (6)

Or

(b) Discuss the composition of solid waste and its characterisation.

13. (a) Discuss the storage and collection methods of solid waste.

Or

(b) What is transfer station? State and discuss the factors influencing the transfer station location selection.

14. (a) Explain the biological conversion technologies for solid waste treatment.

Or

(b) Discuss the following :
    (i) incineration of solid waste
    (ii) material separation technologies.

15. (a) Explain the methods of sanitary landfilling and site selection.

Or

(b) (i) Discuss the environmental protective/preventive measures in a sanitary landfill. (10)
    (ii) Write notes on landfill closure and environment monitoring. (6)