

**M.Sc. ENVIRONMENTAL SCIENCE**  
**Third Semester**  
**STATISTICAL TECHNIQUES**  
**(MEV – 12)**

**Duration: 3Hrs.**

**Full Marks: 70**

Part-A (Objective) =20  
Part-B (Descriptive)=50

**(PART-B: Descriptive)**

**Duration: 2 hrs. 40 mins.**

**Marks: 50**

**Answer any *five* of the following questions:**

1. Define quartile deviation and measure of skewness. Labour absenteeism is a factor of concern for the productivity engineer of an automobile company. He has collected data pertaining to the labour absenteeism during the last year and summarized its distribution as shown in the following table:

Absenteeism( in days)	No. of employees
0-4	10
4-8	76
8-12	100
12-16	150
16-20	24
20-24	36
24-28	14
28-32	2

Determine the Karl Pearson's coefficient of skewness for the labour absenteeism for the above distribution and offer your comment. (2+2+6=10)

2. Define probability. Explain three important terminologies of probability. What do you understand by conditional probability? In an organization, out of 200 employees, 40 are having their monthly salary more than Rs. 15000 and 120 of



them are regular takers of Alpha brand tea. Out of those 40, who are having monthly salary more than Rs. 15000, 20 are regular takers of Alpha brand tea. Parag is an employee there, what is the probability that he is having monthly salary more than Rs. 15000, if he is a regular taker of Alpha brand tea?  $(2+3+2+3=10)$

3. Classify statistical measures and put forward proper definition for each. Give support of examples. (10)
4. Define null hypotheses and alternate hypotheses. Explain types of error with proper example. If in a normal distribution, variance of the weight of cement bags of a particular company is specified as 0.64 kg, and a sample of 8 cement bags taken and found the variance of the sample is 0.36 kg. Then check the quality at a significance level of 0.01. [The table chi-square value is 1.239] (3+3+4=10)
5. ERD Foundation has deputed four different batches of its employees to four different training programmes (A,B,C and D) to improve their decision making skills. Each batch contained five employees with similar qualification and work experience. After the training programme the office conducted a common examination to test their improvement. The percentage scores are summarized in the following table:

A	B	C	D
80	70	65	90
90	60	50	89
96	55	58	85
85	85	55	95
70	90	40	80

Perform ANOVA to check whether there is a significant difference in terms of improving decision making skills of the employees by assuming a significance level of 0.05. [The table value of F ratio is 3.24] (10)



6. What do you understand by linear regression? The annual sales (in crores of rupees) of washing machines for the past 7 years as a function of R &D expenditure (in lakhs of rupees) are summarised in the following table-

Year	R&D expenditure (X)	Sales(Y)
1	10	25
2	15	35
3	20	45
4	25	55
5	30	70
6	35	65
7	40	85

- a. Fit a regression model to estimate Y on X.
- b. Find the mean square error if this model is used. (2+4+4=10)
7. The demand values of a product over the past 10 years are summarized in the following table. Find the auto-correlation coefficients with one year lag( $r_1$ ), two year lag( $r_2$ ) and three year lag( $r_3$ ). (10)

Year (t)	Demand(in '000)
1	20
2	30
3	50
4	60
5	80
6	90
7	100
8	120
9	140
10	160



8. Draw Histogram, Frequency polygon and Frequency curve from the following set of distribution. Put forward proper definition of each. (10)

Experience(in months)	No. of social workers
5 – 10	5
10 -15	6
15 -20	15
20 -25	10
25-30	5
30 -35	4
35 -40	2
40 -45	2

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**Duration: 20 minutes**

**Marks – 20**

**(PART A- Objective Type)**

**I. Choose the correct answer:**

**1×20=20**

1. In an unbalanced, or skewed distribution, which measure of central tendency is least biased?  
a) Mean            b) Median            c) Mode            d) Range
2. How hypothesis is verified?  
a) By observation            b) By solution  
c) By experiments            d) By analysis rules
3. What does hypothesis become after verification?  
a) Research problem            b) Theory or principles  
c) Formulation            d) Solution of the problem
4. A sample is generally used when the group being studied is:  
a) Located in same area.  
b) Very large.  
c) Widely variant in the opinion they express.  
d) Predominantly male or female.
5. The formula  $3 \text{ Median} - 2 \text{ Mean}$  is used to calculate:  
a) Arithmetic mean            b) Weighed mean  
c) Median            d) Mode
6. Full form of SPSS is:  
a) Statistical package for social sciences  
b) Scientific package for Statistics and Science  
c) Both (a) and (b)  
d) None of above
7. The number of elements in the obtained sample is called:  
a) Sampling frame            b) Sampling unit  
c) Sample design            d) Sample size
8. If ' $>$ ' means ' $-$ ', ' $-$ ' means ' $\div$ ', ' $+$ ' means ' $\times$ ' and ' $\times$ ' means ' $+$ ', then  $17 > 15 - 5 \times 2 + 7 > 9 \times 3 = ?$   
a) 16            b) 18            c) 20            d) 22



