



9. Why Euler method is known as point – slope method?
10. Give an example for single step and multi-step method for solving ordinary differential equations.

PART B — (5 × 16 = 80 marks)

11. (a) (i) The dynamic modulus of concrete is obtained for two different concrete mixes. For the first mix,  $n_1 = 33$ ,  $\bar{x}_1 = 115.1$ , and  $s_1 = 0.47$  psi. For the second mix,  $n_2 = 31$ ,  $\bar{x}_2 = 114.6$  and  $s_2 = 0.38$ . Test, with  $\alpha = 0.05$ , the null hypothesis of equality of mean dynamic modulus versus the two-sided alternative. (8)
- (ii) In an air-pollution study performed at an experiment station, the following amount of suspended benzene soluble organic matter (in micrograms per cubic meter) was obtained for eight different samples of air: 2.2, 1.8, 3.1, 2.0, 2.4, 2.0, 2.1, 1.2. Assuming that the population sampled is normal. Test the null hypothesis  $\mu = 2$  against the alternative hypothesis  $\mu > 2$  at the 0.05 level of significance. (8)

Or,

- (b) (i) A manufacturer of machine bearings claims that 90% of the heavy machine bearings have a work life of more than 5 years. You doubt this claim and want to refute it on the basis of a sample of 200 bearings where 170 did work for more than 5 years. Conduct a test of hypotheses using  $\alpha = 0.10$ . (8)
- (ii) Mechanical engineers, testing a new arc-welding technique, classified welds both with respect to appearance and an X-ray inspection. (8)

	Appearance			
	Bad	Normal	Good	
X-ray	Bad	20	7	3
	Normal	13	51	16
	Good	7	12	21

Using Chi-square statistic, test for independence using  $\alpha = 0.05$ .

12. (a) Four different, though supposedly equivalent, forms of a standardized reading achievement test were given to each of 5 students, and the following are the scores which they obtained:

	Student 1	Student 2	Student 3	Student 4	Student 5
Form A	75	73	59	69	84
Form B	83	72	56	70	92
Form C	86	61	53	72	88
Form D	73	67	62	79	95

Treating students as blocks, perform an analysis of variance to test at the level of significance  $\alpha = 0.01$  whether it is reasonable to treat the 4 forms as equivalent. (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 :

D:122	A:121	C:123	B:122
B:124	C:123	A:122	D:125
A:120	B:119	D:120	C:121
C:122	D:123	B:121	A:122

Examine whether the different methods of cultivation have given significantly different yields at 5% L.O.S. (16)

13. (a) (i) Using Newton-Raphson method, find a root of the equation  $e^x - x^3 - \cos 25x = 0$  nearer to  $x = 4.5$  (correct to three decimal places). (8)
- (ii) Apply Gauss elimination method, to solve (8)
- $$2x - y + 3z = 9; x + y + z = 6; x - y + z = 2.$$

Or

- (b) (i) Apply Gauss-Seidel method to solve equations  $27x + 6y - z = 85$ ;  $x + y + 54z = 110$ ;  $6x + 15y + 2z = 72$ . (Perform 5 iterations) (8)
- (ii) Using power method, find the largest eigenvalue and the corresponding eigenvector of the Matrix  $\begin{pmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{pmatrix}$

Take  $[1, 0, 0]^T$  as the initial eigenvector. (8)