

Total No. of Questions : 8]

SEAT No. :

P-339

[Total No. of Pages : 3

[6003]-420

T.E. (Mechanical/Mechanical Sandwich)

NUMERICAL AND STATISTICAL METHODS

(2019 Pattern) (Semester - I) (302041) (End Sem.)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Solve Q.1 OR Q.2, Q.3 OR Q.4, Q.5 OR Q.6 and Q.7 OR Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Scientific Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

Q1) a) Find double integral of $f(x, y) = x^2 + y^2 + 5$ for $x = 0$ to 2 and $y = 0$ to 2 taking increment in both x and y as 0.5. Applying Simpson's $1/3^{\text{rd}}$ rule. **[12]**

b) Draw a flow chart for Simpson's $1/3^{\text{rd}}$ rule to evaluate integration of any function. **[6]**

OR

Q2) a) Find integration of $e^x \cos(x) - 2x$ in limits 0 to 1 by using 3-point Gauss Legendre formula with 6 strips. **[5]**

b) Draw a flow chart for Trapezoidal rule to evaluate integration of any function. **[5]**

c) The velocity 'v' (km/hr) of a vehicle which starts from rest, is given at fixed intervals of time 't' (min) as follows : **[8]**

t(min)	2	4	6	8	10	12	14	16	18	20
V(km/hr)	10	18	25	29	32	20	11	05	02	00

Estimate approximately the distance covered in 20 minutes. Select appropriate method.

P.T.O.

- Q3) a)** Following data refers to the load lifted and corresponding force applied in a pulley system. If the load lifted and effort required are related by equation, $\text{Effort} = A \times (\text{Load lifted}) + B$, where 'A' and 'B' are constants. Find The Values of A and B. [9]

Load lifted in kN	10.0	15.0	20.0	25.0	30.0
Effort applied in kN	0.750	0.935	1.100	1.200	1.300

- b) The following data gives the values of y corresponding to certain values of x. Find the value of x when $y = 167.59789$ by applying Lagrange's method [9]

x	1	2	5	7
y	1	12	117	317

OR

- Q4) a)** Growth of bacteria (N) in a culture after t hours is given in following table: [9]

t	0	1	2	3	4
N	32	47	65	92	132

Fit a curve of the form $N = ab^t$ and estimate N when $t = 4.5$ and $t = 7$.

- b) From the following table of yearly premium for policies maturing at coming ages, estimate the premiums for policies maturing at the age of 46 years. Use suitable method [9]

Age	x :	45	50	55	60	65
Premium	y :	2.871	2.404	2.083	1.862	1.712

- Q5) a)** Fluctuations in the Aggregate of marks obtained by two groups of students are given below. Find out which of the two shows greater variability and which is more consistent. [8]

Group A	518	519	530	530	544	542	518	550	527	527	531	550	550	529	528
Group B	825	830	830	819	814	814	844	842	842	826	832	835	835	840	840

- b) Illustrate the following statistical diagrams with real life example. [9]
- Scattered diagram
 - Histogram
 - Pie chart

OR

- Q6) a)** Calculate the first four moments about the mean of the given distribution, Arithmetic mean, standard deviation. Also find β_1 and β_2 . [10]

X	2.0	2.5	3.0	3.5	4.0	4.5	5.0
f	4	36	60	90	70	40	10

- b)** Compute Karl Pearson's coefficient of correlation between X and Y for the following data : [7]

X	100	98	78	85	110	93	80
Y	85	90	70	72	95	81	74

- Q7) a)** Supposing that out of 12 test matches played between India and Pakistan during last 3 years, 6 are won by India, 4 are won by Pakistan and 2 have ended in a draw. If they agree to play a test series consisting of three matches, find the probability that India wins the test series on the basis of past performance. [9]

- b)** In a distribution of 'NSM' marks exactly normal, 7% of students are under 35 and 89% are under 63. Find the mean and standard deviation of the distribution. [$A_1 = 0.43$, $Z_1 = 1.48$, $A_2 = 0.39$, $Z_2 = 1.23$]. [8]

OR

- Q8) a)** Among 64 offsprings of a certain cross between guinea pigs 34 were red, 10 were black and 20 were white. According to a genetic model, these numbers should be in the ratio 9:3:4. Are the data consistent with the model at 5% level? Given ($\chi_{2,0.05}^2 = 5.99$). [9]

- b)** Let $F: \mathbb{R}^4 \rightarrow \mathbb{R}^3$ be the linear mapping defined by $F(x, y, z, t) = (x - y + z + t, x + 2z - t, x + y + 3z - 3t)$. Find a basis and the dimension of (a) the image of F, (b) the kernel of F. [8]

