Total No. of Questions : 8]

SEAT No. :

PF-5022

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T.E. (Mechanical) & (Mechanical Sandwich Engineering)
NUMERICAL & STATISTICAL METHODS
(2019 Pattern) (Semester - V) (302041)

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) ***Assume suitable data, if necessary.***

Q1) a) Use Trapezoidal Rule to estimate integration $I = \int_0^6 \frac{dx}{1+x^2} dx$. Take 6 strips. **[6]**

b) Draw flowchart for Simpson 1/3 method to solve integration of any function. **[6]**

c) Using Guass-Legendre three point formula find $I = \int_0^1 (e^x \cos x - 2x)\, dx$. **[6]**

OR

Q2) a) Draw flowchart for Gauss Legendre two point method. **[6]**

b) Evaluate $\int_1^{1.3} \sqrt{x}\, dx$ using Simpson's 3/8th rule. **[6]**

c) A river is 60 ft wide. The depth '*d*' in feet at a distance *x* feet from one bank is given by the following table : **[6]**

x:	0	10	20	30	40	50	60
d:	0	5	9	15	10	6	2

Find approximately the area of the cross-section by Simpson' 1/3 rule.

P.T.O.

Q3) a) Following data refers to the load lifted and corresponding force applied in a pulley system. If the load lifted is and effort required are related by equation **[8]**

Effort = A x (Load Lifted) + B,

where A and B are constants. Find A and B values.

Load lifted in kN	10	15	20	25	30
Effort applied in kN	0.75	0.935	1.100	1.200	1.300

b) Draw the flow chart for Lagranges interpolation formula. **[10]**

OR

Q4) a) Fit a Parabola $y = ax^2 + bx + c$ in least square sense to following data **[10]**

x	10	12	15	23	20
y	14	17	23	25	21

b) The velocity distribution of a fluid near a flat surface is given below **[8]**

x	0.1	0.3	0.6	0.8
V	0.72	1.81	2.73	3.47

Where x is the distance from the surface (mm) and V is the velocity (mm/sec). Use Lagranges interpolation formula to obtain the velocity at x = 0.4.

Q5) a) From the group of 10 students marks obtained by each in the papers of Mathematics and Applied Science are given as: **[9]**

Marks in Maths (x)	23	28	42	17	26	35	29	37	16	47
Marks in Applied Science (y)	25	22	38	21	27	39	24	32	18	44

Calculate the Karl Pearson's coefficient of correlation

b) Discuss the following terms **[8]**

i) Coefficient of Variation

ii) Central Moments

iii) Skewness

iv) Kurtosis

OR

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Q6) a) The first four moments of distribution about the value 5 of the variable are 2, 20, 40 and 50. Find the moments about the mean, β_1 and β_2. **[8]**

b) Calculate the rank correlation coefficient from the following data showing ranks of 10 students in two subjects : **[9]**

Student	1	2	3	4	5	6	7	8	9	10
Maths	3	8	9	2	7	10	4	6	1	5
Physics	5	9	10	1	8	7	3	4	2	6

What inference can we draw from the value of rank correlation coefficient?

Q7) a) What is probability distribution? Explain following terms with illustrations. **[8]**

i) Marginal Probability Distribution

ii) Joint Probability Distribution

b) Among 64 off springs of a certain cross between guinea pigs 34 were red, 10 were black and 20 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 $\chi^2_{0.05} = 5.99$. **[9]**

OR

Q8) 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) Let F : $R^4 \rightarrow R^3$ be the linear mapping defined by

$T(x_1, x_2, x_3, x_4) = (2x_1 + 4x_2 + 6x_3 + 8x_4,\ x_1 + 3x_2 + 5x_4,\ x_1 + 2x_2 + 6x_3 + 3x_4)$

Find a basis and the dimension of (a) the image of T, (b) the kernel of T. **[8]**

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