Total No. of Questions : 8]

SEAT No. : ____

PA-1528

[Total No. of Pages : 3

[5926]-148

T.E. (Mechanical/Mechanical-Sandwich)

NUMERICAL AND STATISTICAL METHODS

(2019 Pattern) (Semester - I) (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) ***Use of Scientific Calculator is allowed.***
5) ***Assume Suitable data if necessary.***

Q1) a) Evaluate $\int_0^1\int_0^1 \left(x^2y^2\right)dxdy$ by using suitable method.Take Step size in x & y as 0.25. **[9]**

b) Use Simpson's $\left(\frac{3}{8}\right)$ th rule to estimate integration $\int_0^{\pi} \frac{\sin^2 x}{e^x+\cos x}dx$. And compare result with Trapezoidal Method. **[9]**

OR

Q2) a) Gas is expanded according to law $pV^{1.3} = C$ from the pressure of $10N/m^2$. Assuming the initial volume of gas $1m^3$ and final volume $7\ m^3$. Calculate work done using Simpson's $\frac{1}{3}$ rule. Divide volume in 6 equal strips. **[8]**

b) Using Gauss-Legendre three point formula, find $\int_0^2 \left(e^x+4x-3\right)dx$. **[5]**

c) Draw Flowchart of Trapezoidal Method to evaluate integration of a function. **[5]**

Q3) a) Use Newton's Forward Difference Method to find y_g at x_g = 1.105 and 1.56. **[8]**

x	1.0	1.1	1.2	1.3	1.4	1.5	1.6
y	0	0.331	0.728	1.207	1.744	2.375	3.096

P.T.O.

b) The values of Nusselt numbers (Nu) and Reynolds numbers (Re) found experimentally are given below. If the relation between Nu and Re is of type $Nu = a.Re^b$, find the values of a and b for the given values of Nu and Re. **[10]**

Re	3000	4000	5000	6000	7000
Nu	14.3575	16.6517	16.7353	17.6762	18.5128

OR

Q4) a) The variations of deformation of a metal rod can be modeled as $d = aT^2 + bT+c$, where T is the Operating Temperature. Calculate the values of a, b and c from the following table : **[10]**

Temperature (K)	300	350	400	450	500
Deformation (mm)	0.913	0.929	0.922	0.918	0.909

b) The following data are taken from the steam table. Find pressure and temperature, t=142°C. Use suitable method of interpolation. **[8]**

Temperature °C	140	150	160	170	180
Pressure kg/cm^2	3.685	4.854	6.302	8.076	10.225

Q5) a) If $\Sigma f = 27, \Sigma fx = 91, \Sigma fx^2 = 359, \Sigma fx^3 = 1567, \Sigma fx^4 = 7343$. Find first four moments about origin. Find A.M., S.D, μ_1, μ_2, μ_3, μ_4. Find coefficients of skewness and kurtosis. Comment on skewness and kurtosis. **[8]**

b) Compute the first four central moments, arithmetic mean, standard deviation and variance for the following frequencies : **[9]**

F	0-10	10-20	20-30	30-40	40-50
x	13	20	30	25	12

OR

Q6) a) Following is the score of seven students in management accounting(X) and business statistics(Y). Calculate Karl Pearson correlation coefficient between the score in two subjects. **[10]**

Student No.	1	2	3	4	5	6	7
Score X	40	70	84	74	26	78	48
Score Y	64	74	100	60	50	48	80

b) Runs scored in 10 matches of current IPL season by two batsmen A and B are tabulated as under **[7]**

Batsman A	46	34	52	78	65	81	26	46	19	47
Batsman B	59	25	81	47	73	78	42	35	42	10

Decide who better batsman is and who is more consistent.

Q7) a) A can hit the target 1 out of 4 times, B can hit the target 2 out of 3 times and C can hit the target 3 out of 4 times. Find the probability of **[9]**

i) at least two hit the target

ii) At most two hit the target

iii) No one hitting the target

b) A microchip company has two machines that produce the chips. Machine I produce 65% of the chips, but 5% of its chips are defective. Machine II produces 35% of the chips and 15% of its chip are defective. A chip is selected at random and found to be defective. A chip selected at random and found to be defective. What is the probability that it came from machine I? **[8]**

OR

Q8) a) The demand for a particular spare part in a factory was found to vary from day to day. In a sample study the following information was obtained. **[9]**

Days	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
No. of parts demanded	1124	1125	1110	1120	1126	1115

Test the hypothesis that the number of parts demanded does not depend on the day of the week.

b) Let $F : R^4 \rightarrow R^3$ 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 **[8]**

i) the image of F,

ii) the kernel of F

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