Total No. of Questions : 9]

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S.E. (Computer/I.T./AI&ML)

ENGINEERING MATHEMATICS - III

(2019 Pattern) (Semester - IV) (207003)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Q.1 is compulsory.*
2) *Attempt Q2 or Q3, Q4 or Q5, Q6 or Q7, Q8 or Q9.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Figures to the right indicate full marks.*
5) *Use of electronic pocket calculator is allowed.*
6) *Assume suitable data, if necessary.*

Q1) Write the correct option for the following multiple choice questions :

i) y : 1 2 3

x : 1 5 9

The least square fit of the form $x = ay + b$ to the above data is ________. **[2]**

a) $x = 2y - 5$

b) $x = 4y + 4$

c) $x = 4y + 1$

d) $x = 4y - 3$

ii) For two events A and B, $P(A)=\frac{2}{3}, P(B)=\frac{3}{8}$ and $P(A\cap B)=\frac{1}{4}$, then the events A and B are __________. **[2]**

a) mutually exclusive and independent

b) not mutually exclusive and not independent

c) independent, but not mutually exclusive

d) mutually exclusive, but not independent

P.T.O.

iii) Using Gauss elimination method, the solution of system of equations $x+4y-z=-5,\ y+\frac{5}{3}z=\frac{7}{3}$ and $-13y+2z=19$ is _________. **[2]**

a) $x=\frac{117}{71},\ y=-\frac{81}{71},\ z=\frac{148}{71}$

b) $x=\frac{71}{117},\ y=-\frac{71}{81},\ z=\frac{71}{148}$

c) $x=-\frac{117}{71},\ y=\frac{81}{71},\ z=-\frac{148}{71}$

d) $x=1,\ y=2,\ z=0$

iv) If Lagrange's polynomial passes through $\begin{matrix} x & 0 & 1 \\ y & 1 & 2 \end{matrix}$ then $\int_0^1 y\,dx=$ _________. **[2]**

a) $\frac{2}{3}$

b) $\frac{3}{2}$

c) $\frac{1}{2}$

d) 3

v) If $\sum xy=2638,\ \bar{x}=14,\ \bar{y}=17,\ n=10$, then $\operatorname{cov}(x,y)=$ _________. **[1]**

a) 25.8

b) 23.9

c) 20.5

d) 24.2

vi) If x_0, x_1 are two initial approximations to the root of $f(x) = 0$, by secant method the next approximation x_2 is given by ________. **[1]**

a) $x_2 = \dfrac{x_0 + x_1}{2}$

b) $x_2 = x_1 - \dfrac{f(x_1)}{f^1(x_1)}$

c) $x_2 = x_1 - \dfrac{(x_1 - x_0)}{(f_1 - f_0)} f_1$

d) $x_2 = x_1 + \dfrac{(x_1 + x_0)}{(f_1 + f_0)} f_1$

Q2) a) The first four moments of a distribution about 4 are –1.4, 17, –30 and 108. Obtain the first four central moments and coefficient of skewness & kurtosis. **[5]**

b) Fit a linear curve of the type $y = ax + b$, to following data, **[5]**

x	10	15	20	25	30
y	0.75	0.935	1.1	1.2	1.3

c) Find the correlation coefficient for the following data, **[5]**

Population density	200	500	400	700	800
Death rate	12	18	16	21	10

OR

Q3) a) Find coefficient of variability for following data, **[5]**

C.I.	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Freq. (f)	4	7	8	12	25	18	10

b) Fit a linear curve $y = ax + b$, by least square method to the data, **[5]**

x	100	120	140	160	180	200
y	0.9	1.1	1.2	1.4	1.6	1.7

c) The regression equations are $8x - 10y + 66 = 0$ and $40x - 18y = 214$. The value of variance of x is 9. Find **[5]**

i) the mean values of x and y

ii) the correlation x and y and

iii) the standard deviation of y

Q4) a) Three factories A, B and C produce light bulbs. 20%, 50% and 30% of the bulbs are available in the market by factories A, B and C respectively. Among these, 2%, 1% and 3% of the bulbs produced by factories A, B and C are defective. A bulb is selected at random in the market and found to be defective. Find the probability that this bulb was produced by factory B. **[5]**

b) On an average, 20% of the computers in a firm are virus infected. If 10 computers are chosen at random from this firm, find the probability that at least one computer is virus infected, using Binomial distribution. **[5]**

c) The height of a student in a school follows a normal distribution with mean 190 cm and variance 80 cm^2. Among the 1,000 students from the school, how many are expected to have height above 200 cm? **[5]**

(Given : z = 1.118, A = 0.3686)

OR

Q5) a) A die is tampered in such a way that the probability of observing an even number is twice as likely to observe an odd number. Find the expected value of the upper most face obtained after rolling the die. **[5]**

b) The number of industrial injuries per working week in a factory is known to follow a Poisson distribution with mean 0.5. Find the probability that during a particular week, at least two accidents will take place. **[5]**

c) A pea cultivating experiment was performed. 219 round yellow peas, 81 round green peas, 61 wrinkled yellow peas and 31 wrinkled green peas were noted. Theory predicts that these phenotypes should be obtained in the ratios 9:3:3:1. Test the compatibility of the data with theory, using 5% level of significance. (Given : $\chi^2_{tab} = 7.815$) **[5]**

Q6) a) Obtain the root of the equation $x^3 - 4x - 9 = 0$ that lies between 2 and 3 by Newton-Raphson method correct to four decimal places. **[5]**

b) Solve $2x - \cos x - 3 = 0$ by using the method of successive approximations correct of three decimal places. **[5]**

c) Solve by Gauss - Seidel method, the system of equations : **[5]**

$2x_1 + x_2 + 6x_3 = 9$

$8x_1 + 3x_2 + 2x_3 = 13$

$x_1 + 5x_2 + x_3 = 7$

OR

Q7) a) Solve by Gauss elimination method, the system of equations : **[5]**

$4x_1 + x_2 + x_3 = 4$

$x_1 + 4x_2 - 2x_3 = 4$

$3x_1 + 2x_2 - 4x_3 = 6$

b) Solve by Jacobi's iteration method, the system of equations : **[5]**

$20x_1 + x_2 - 2x_3 = 17$

$3x_1 + 20x_2 - x_3 = -18$

$2x_1 - 3x_2 + 20x_3 = 25$

c) Find a real root of the equation $x^3 - 2x - 5 = 0$ by the method of false position at the end of fifth iteration. **[5]**

Q8) a) Using Newton's backward difference formula, find y at x = 4.5 for the following data. **[5]**

x	1	2	3	4	5
y	3.47	6.92	11.25	16.75	22.94

b) Use Simpson's 3/8th rule, to estimate $\int_1^7 f(x)dx$ from the following data. **[5]**

x	1	2	3	4	5	6	7
$f(x)$	81	75	80	83	78	70	60

c) Use Euler's method to solve $\frac{dy}{dx} = x^2 + y, y(0) = 1$. Tabulate values of y for $x = 0$ to $x = 0.3$. (Take $h = 0.1$) **[5]**

OR

Q9) a) Use Runge-Kutta method of 4[th] order to solve $\frac{dy}{dx}=\frac{y-x}{y+x}$, $y(0)=1$ at $x = 0.2$ with $h = 0.2$. **[5]**

b) Using modified Euler's method, find $y(1.1)$. Given $\frac{dy}{dx}=2+\sqrt{xy}$, $y(1)=1$. Take $h = 0.1$. (Two iterations only) **[5]**

c) Determine the value of $y=\sqrt{151}$, using Newton's forward difference formula, from the following data. **[5]**

x	150	152	154	156
$y=\sqrt{x}$	12.247	12.329	12.410	12.490

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