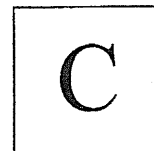


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B.Tech. Degree V Semester Special Supplementary Examination September 2022

CE/CS/EC/EE/IT/ME/SE 19-200-0501 NUMERICAL AND STATISTICAL METHODS
(2019 Scheme)

Time: 3 Hours

Maximum Marks: 60

Course Outcomes

On successful completion of the course, the students will be able to:

CO1: Solve algebraic and transcendental equations by numerical methods.

CO2: Solve numerical differentiation and integration problems.

CO3: Compute the mean and variance of a probability distribution including the binomial distribution.

CO4: Test hypotheses on data.

Bloom's Taxonomy Levels (BL): L1 – Remember, L2 – Understand, L3 – Apply, L4 – Analyze,

L5 – Evaluate, L6 – Create

PO – Programme Outcome

PART A(Answer *ALL* questions)

(8 × 3 = 24)

		Marks	BL	CO	PO
I. (a)	Prove that (i) $\mu^2 = 1 + \frac{\delta^2}{4}$ (ii) $\mu\delta = \frac{1}{2}(\Delta + \nabla)$.	3	L1,L3	1	1
(b)	Find the third divided difference of $f(x)$ with arguments 2, 4, 9, 10 where $f(x) = x^3 - 2x$.	3	L3	1	1
(c)	Evaluate $\int_0^1 \frac{dx}{(1+x^2)}$ using Simpson's $\frac{1}{3}$ rule taking $h = \frac{1}{4}$.	3	L1,L3	1	3
(d)	Use Euler's method to find $y(0.4)$ given $y' = xy$, $y(0) = 1$ (Take $h = 0.2$)	3	L3	2	2
(e)	A random variable x has the following probability function.	3	L1,L3	3	1
	$ \begin{array}{cccccc} x: & -2 & -1 & 0 & 1 & 2 & 3 \\ p(x): & 0.1 & k & 0.2 & 2k & 0.3 & k \end{array} $				
	Find the value of k and calculate mean and variance.				
	Find the probability that no defective fuse will be found in a box of 200 fuses if experience shows that 2% such fuses are defective.	3	L3,L4	3	3
(g)	Define (i) parameter and statistic (ii) critical region (iii) test statistic.	3	L1	4	1
(h)	The average score in mathematics of a sample of 100 students was 51 with a standard deviation of 6 points. Could this have been a random sample from a population with average score 50?	3	L4	4	4

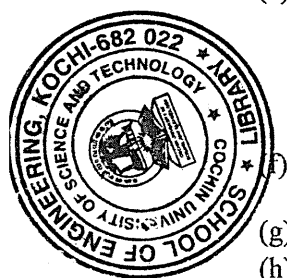
PART B

(4 × 12 = 48)

- II. (a) Find a real root of $x^3 + x - 1 = 0$ near $x = 1$ correct to 3 decimal places by Regula-Falsi method. 6 L3 1 2
- (b) Solve the system of equation by Gauss Seidel method. 6 L3 1 2
- $$27x + 6y - z = 85$$
- $$6x + 15y + 2z = 72$$
- $$x + y + 54z = 110$$

OR

(P.T.O.)



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		Marks	BL	CO	PO
III.	(a) Using Lagrange's formula find $f(6)$ from the following table.	6	L3	1	2
	$x:$ 2 5 7 10 12 $f(x):$ 18 180 448 1210 2028				
	(b) From the following table of half-yearly premium for policies maturing at different ages, find the premium for policies maturing at age 46 and 63.	6	L3	1	3
	Age $x:$ 45 50 55 60 65 Premium $y:$ 1150 960 830 740 680				
IV.	(a) Using modified Euler method, find $y(0.2)$, $y(0.4)$, given $y' = y - x^2$ $y(0) = 1$.	6	L3	2	2
	(b) The table below gives the results of an observation: θ is the observed temperature in degree centigrade of a vessel of cooling water; t is the time in minutes from the beginning of observation.	6	L2,L3	2	3
	$t:$ 1 3 5 7 9 $\theta:$ 85.3 74.5 67.0 60.5 54.3				
	Find the approximate rate of cooling at $t = 3$.				
	OR				
V.	(a) Apply Runge-Kutta method to obtain $y(0.2)$, given $y' = \frac{y-x}{y+x}$ when $y(0) = 1$.	6	L2,L3	2	2
	(b) A rocket is launched from the ground. Its acceleration is registered during the first 80 seconds and is given in the table below. Using Simpson's $\frac{1}{3}$ rule, find the velocity of the rocket at $t = 80$ seconds.	6	L3	2	4
	$t(\text{sec}):$ 0 10 20 30 40 50 60 70 80 $A(\text{cm/sec}^2):$ 30.0 31.63 33.34 35.47 37.75 40.33 43.25 46.69 50.67				
VI.	(a) Derive the mean and variance of Binomial Distribution.	6	L1	3	1
	(b) A screw manufacturing company is known to produce 5% defectives in a random sample of 15 screws. What is the probability that there are (i) exactly 3 defectives (ii) not more than 3 defectives	6	L4	3	3
	OR				
VII.	(a) Fit a parabola, by the method of least squares, to the following data.	6	L3	3	2
	$x:$ 1 2 3 4 5 $y:$ 5 12 26 60 97				
	(b) A sample of 100 dry battery cells tested to find the length of life produces the following results: $\bar{x} = 12$ hrs, $\sigma = 3$ hrs. Assuming the data to be normally distributed, what percentage of battery cells are expected to have life (i) more than 15 hrs (ii) less than 6 hrs (iii) between 10 and 14 hrs	6	L3,L4	3	3
VIII.	(a) A manufacturer of tyres guarantees that the average lifetime of its tyres is more than 28000 miles. If 40 tyres of this company tested, yields a mean lifetime of 27463 miles with standard deviation of 1348 miles, can the guarantee be accepted at 0.01 level of significance?	6	L4,L5	4	4
	(b) A sample of 900 numbers is found to have a mean 3.4 and standard deviation 2.61. Is this sample taken from a large population of mean 3.25?	6	L4	4	4

OR

(Continued)

BTS-V(SS)-09-22-1059

		Marks	BL	CO	PO
IX.	(a)	6	L4	4	3
	(b)	6	L4	4	4

(a) The standard deviation of a sample of 20 observations from a normal population was found to be 5. Examine whether the sample was taken from a population with standard deviation 5.3.

(b) In a random sample of 100 tube lights produced by a company *A*, the mean lifetime of tube light is 1190 hrs with standard deviation of 90 hrs. Also in a random sample of 75 tube lights from company *B* the mean lifetime is 1230 hrs with standard deviation 120 hrs. Is there a difference between the mean lifetime of the two brands of the tube lights?
