

NUMERICAL TECHNIQUES AND STATISTICAL METHODS
(Civil Engineering)

Time: 3 hours

Max. Marks: 70

Question paper consists of Part A & Part B
 Answer **All** the questions in Part A & Part B

Part A(10 X 2 = 20M)

1.a	Find the second approximation of $x^3 - x - 1 = 0$ by using Bisection method.	[2M]	CO1	L3										
b	Prove that $\mu^2 = 1 + \frac{\delta^2}{4}$.	[2M]	CO1	L4										
c	Find $\int_0^2 f(x)dx$ from the following data and using Trapezoidal rule.	[2M]	CO2	L3										
	<table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;">x</td> <td style="padding: 5px;">0</td> <td style="padding: 5px;">0.5</td> <td style="padding: 5px;">1</td> <td style="padding: 5px;">1.5</td> <td style="padding: 5px;">2</td> </tr> <tr> <td style="padding: 5px;">$f(x)$</td> <td style="padding: 5px;">0</td> <td style="padding: 5px;">0.25</td> <td style="padding: 5px;">1</td> <td style="padding: 5px;">2.25</td> <td style="padding: 5px;">4</td> </tr> </table>				x	0	0.5	1	1.5	2	$f(x)$	0	0.25	1
x	0	0.5	1	1.5	2									
$f(x)$	0	0.25	1	2.25	4									
d	Use Eulers method to find $y(0.1)$ given $\frac{dy}{dx} = x^2 - y, y(0) = 1..$	[2M]	CO2	L3										
e	The mean and variance of Binomial distribution are 4 and $4/3$ respectively. Find $p(x \geq 1)$.	[2M]	CO3	L2										
f	Let x be a discrete random variable having the following probability distribution then	[2M]	CO3	L2										
	<table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;">X</td> <td style="padding: 5px;">-2</td> <td style="padding: 5px;">-1</td> <td style="padding: 5px;">0</td> <td style="padding: 5px;">1</td> <td style="padding: 5px;">2</td> <td style="padding: 5px;">3</td> </tr> <tr> <td style="padding: 5px;">$P(x)$</td> <td style="padding: 5px;">0.1</td> <td style="padding: 5px;">K</td> <td style="padding: 5px;">0.2</td> <td style="padding: 5px;">2k</td> <td style="padding: 5px;">0.3</td> <td style="padding: 5px;">3k</td> </tr> </table>				X	-2	-1	0	1	2	3	$P(x)$	0.1	K
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$P(x)$	0.1	K	0.2	2k	0.3	3k								
g	If we can assert with 95% that the maximum error is 0.05 and $P=0.2$, find the size of the sample.	[2M]	CO4	L2										
h	In a sample of 500 people Maharashtra 300 are wheat eaters. What can you about at the maximum error with 99% confidence interval.	[2M]	CO4	L2										
i	Define the terms i) Type-I error ii) Type-II error.	[2M]	CO5	L1										
j	Write the applications of chi-square distribution.	[2M]	CO5	L2										

Part B (5 X 10 = 50)

2.a.	Find a real root of the equation $3x = \cos x + 1$ using iteration method.	5(M)	CO1	L3						
b.	Using Lagrange's interpolation formula, find the value of $y(10)$ from the following table:	5(M)	CO1	L3						
	<table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;">x</td> <td style="padding: 5px;">5</td> <td style="padding: 5px;">6</td> <td style="padding: 5px;">9</td> <td style="padding: 5px;">11</td> </tr> <tr> <td style="padding: 5px;">y</td> <td style="padding: 5px;">12</td> <td style="padding: 5px;">13</td> <td style="padding: 5px;">14</td> <td style="padding: 5px;">16</td> </tr> </table>				x	5	6	9	11	y
x	5	6	9	11						
y	12	13	14	16						

OR

3	a	Find the root of the equation $x\sin x + \cos x = 0$ using Newton Raphson method.	5(M)	CO1	L3												
	b	Find the Newton's Forward difference interpolating polynomial for the following data and hence find $f(1.6)$ from the polynomial. <table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td>x</td> <td>1</td> <td>1.4</td> <td>1.8</td> <td>2.2</td> </tr> <tr> <td>$y = f(x)$</td> <td>3.49</td> <td>4.82</td> <td>5.96</td> <td>6.5</td> </tr> </tbody> </table>	x	1	1.4	1.8	2.2	$y = f(x)$	3.49	4.82	5.96	6.5	5(M)	CO1	L2		
x	1	1.4	1.8	2.2													
$y = f(x)$	3.49	4.82	5.96	6.5													
4	a	Evaluate $\int_0^6 \frac{1}{1+x} dx$ by using Simpson's 3/8th rule.	5(M)	CO2	L3												
	b	Given that $\frac{dy}{dx} = 1 + xy$ and $y(0) = 1$, compute $y(0.1)$ and $y(0.2)$ using Picard's method	5(M)	CO2	L3												
OR																	
5	a	Find $y(0.1)$ from the differential equation $y' = x - y^2$, $y(0) = 1$ by using Taylor's series method	5(M)	CO2	L3												
	b	Use Runge-Kutta method of fourth order to evaluate $y(0.1)$ and given that $y' = x + y$, $y(0) = 1$.	5(M)	CO2	L3												
6	a	A business man goes to hotels X,Y,Z, 20% 50% and 30% of the time respectively. It is known that 5%,4%,8% of the rooms in X,Y,Z hotels have faulty plumbing. What is the probability that businessman's room having faulty plumbing is assigned to hotel Z.	5(M)	CO3	L3												
	b	In a test on 2000 electric bulbs, it was found that the life of a particular make, was normally distributed with an average life of 2040 hours and standard deviation of 60 hours. Find the number of bulbs likely to burn for (i) more than 2150 hours (ii) between 1920 and 2160 hours.	5(M)	CO3	L2												
OR																	
7	a	Fit a Poisson distribution for the following data and calculate the expected frequencies. <table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td>X</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>F(X)</td> <td>109</td> <td>65</td> <td>22</td> <td>3</td> <td>1</td> </tr> </tbody> </table>	X	0	1	2	3	4	F(X)	109	65	22	3	1	10(M)	CO3	L3
X	0	1	2	3	4												
F(X)	109	65	22	3	1												
8	a	A population consists of 6 numbers 4,8,12,16,20,24. Consider all samples of size two which can be drawn without replacement from city population. Find i) the population mean ii) the population standard deviation. iii) the mean of the sampling distribution of means. iv) The standard deviation of the sampling distribution of means. v) verify (iii) and (iv) from (i) and (ii) with the help of suitable formulae.	10(M)	CO4	L3												
OR																	
9	a	Among 900 people in a state 90 are found to be chapatti eaters. Construct 99% confidence interval for the true proportion.	5(M)	CO4	L3												
	b	A random sample of size 64 is taken from an infinite population having the mean 45 and the standard deviation 8. What is the probability that sample mean will be between 46 and 47.5.	5(M)	CO4	L3												

10	a	In a sample of 600 students of a certain college 400 are found to use ball pens. in other college from a sample of 900 students 450 were found to be use ball pens. Test whether two colleges are significantly different with respect to the habit of using ball pens.	5(M)	CO5	L4
	b	A random sample of 8 envelopes is taken from letter box of a post office and their weights in grams are found to be 12.1,11.9,12.4,12.3,11.9,12.1, 12.4,12.1. Does this sample indicate that 1% level that the average weight of envelopes received at their post office is 12.35 grams.	5(M)	CO5	L3

OR

11	a	From the following data find whether is any significant liking in the habit of taking soft drinks among the categories of employees.	10(M)	CO5	L4																									
		<table border="1"> <thead> <tr> <th>Soft Drinks</th> <th>Clerks</th> <th>Teachers</th> <th>Officers</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Pepsi</td> <td>10</td> <td>25</td> <td>65</td> <td>100</td> </tr> <tr> <td>Thumps up</td> <td>15</td> <td>30</td> <td>65</td> <td>110</td> </tr> <tr> <td>Bovanto</td> <td>50</td> <td>60</td> <td>30</td> <td>140</td> </tr> <tr> <td>Total</td> <td>75</td> <td>115</td> <td>160</td> <td>350</td> </tr> </tbody> </table>	Soft Drinks	Clerks	Teachers	Officers	Total	Pepsi	10	25	65	100	Thumps up	15	30	65	110	Bovanto	50	60	30	140	Total	75	115	160	350			
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