Course Code: 20HS0833 **R20**

SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR

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MODEL QUESTION BANK (DESCRIPTIVE)

Subject with Code : NUMERICAL METHODS, PROBABILITY & STATISTICS (20HS0833)

Course & Branch: B.Tech-ME **Year & Sem:** II-I **Regulation:** R20

UNIT –I

NUMERICAL SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS & INTERPOLATION

<table>
<tr><td rowspan="2">1</td><td>a) Define Algebraic equation and Transcendental equation.</td><td>[L1][CO2]</td><td>[2M]</td></tr>
<tr><td>b) Find a positive root of the equation $x^3 – x – 1 = 0$ by Bisection method.</td><td>[L3][CO2]</td><td>[10M]</td></tr>
<tr><td rowspan="2">2</td><td>a) What is the algorithm for the bisection method.</td><td>[L1][CO2]</td><td>[4M]</td></tr>
<tr><td>b) Find real root of the equation 3x= e^x by Bisection method.</td><td>[L3][CO1]</td><td>[8M]</td></tr>
<tr><td>3</td><td>a) Describe the formula for square root of a number by Newton – Raphson formula.</td><td>[L2][CO2]</td><td>[2M]</td></tr>
<tr><td></td><td>b) Find out the square root of 25 given $\boldsymbol{x_0 = 2.0,\ x_1 = 7.0}$ using Bisection method.</td><td>[L3][CO2]</td><td>[10M]</td></tr>
<tr><td rowspan="2">4</td><td>a) State Newton – Raphson formula for solution of polynomial and transcendental equations.</td><td>[L1][CO2]</td><td>[2M]</td></tr>
<tr><td>b) Estimate a real root of the equation $xe^x – \cos x = 0$ by using Newton – Raphson method.</td><td>[L4][CO1]</td><td>[10M]</td></tr>
<tr><td>5</td><td>Using Newton-Raphson method
(i) Find square root of 28
(ii) Find cube root of 15.</td><td>[L3][CO2]</td><td>[12M]</td></tr>
<tr><td rowspan="2">6</td><td>a) Using Newton-Raphson method , find reciprocal of 12.</td><td>[L3][CO2]</td><td>[6M]</td></tr>
<tr><td>b) Find a real root of the equation $x\tan x+1=0$ using Newton – Raphson method.</td><td>[L3][CO1]</td><td>[6M]</td></tr>
<tr><td rowspan="2">7</td><td>a) Write formula for Regula-falsi method.</td><td>[L2][CO1]</td><td>[2M]</td></tr>
<tr><td>b) Predict a real root of the equation $x\,e^x= 2$ by using Regula-falsi method.</td><td>[L2][CO1]</td><td>[10M]</td></tr>
<tr><td>8</td><td>Find the root of the equation $x \log_{10}(x)=1.2$ using False position method.</td><td>[L3][CO1]</td><td>[12M]</td></tr>
<tr><td rowspan="2">9</td><td>a) Write the formula for Newton’s forward interpolation.</td><td>[L1][CO1]</td><td>[2M]</td></tr>
<tr><td>b) From the following table values of x and $y=\tan x$. Interpolate the values of y when $x=0.12$ and $x=0.28$.
<table>
<tr><td>x</td><td>0.10</td><td>0.15</td><td>0.20</td><td>0.25</td><td>0.30</td></tr>
<tr><td>y</td><td>0.1003</td><td>0.1511</td><td>0.2027</td><td>0.2553</td><td>0.3093</td></tr>
</table></td><td>[L5][CO1]</td><td>[10M]</td></tr>
<tr><td rowspan="2">10</td><td>a) Apply Newton’s forward interpolation formula and the given table of values
<table>
<tr><td>x</td><td>1.1</td><td>1.3</td><td>1.5</td><td>1.7</td><td>1.9</td></tr>
<tr><td>f(x)</td><td>0.21</td><td>0.69</td><td>1.25</td><td>1.89</td><td>2.61</td></tr>
</table>
Obtain the value of $f(x)$ when $x=1.4$.</td><td>[L3][CO1]</td><td>[6M]</td></tr>
<tr><td>b) Use Newton’s backward interpolation formula to find f(32) given
f(25)=0.2707, f(30)=0.3027, f(35)=0.3386, f(40)=0.3794.</td><td>[L3][CO1]</td><td>[6M]</td></tr>
</table>

UNIT –II

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS & NUMERICAL INTEGRATION

1	a) State Taylor's series formula for first order differential equation.	[L1][CO3]	**[2M]**
	b) Tabulate y(0.1) and y(0.2) using Taylor's series method given that $y^1 = y^2 + x$ and y(0) = 1	[L1][CO3]	**[10M]**
2	Evaluate by Taylor's series method, find an approximate value of y at x=0.1and 0.2 for the D.E $y^{11} + xy = 0$; $y(0) = 1$, $y^1(0) = 1/2$.	[L5][CO3]	**[12M]**
3	a) Solve $y^1 = x + y$, given y (1)=0 find y(1.1) and y(1.2) by Taylor's series method.	[L3][CO3]	**[6M]**
	b) Solve by Euler's method $\frac{dy}{dx} = \frac{2y}{x}$ given y(1)=2 and find y(2)	[L3][CO3]	**[6M]**
4	a) State Euler's formula for differential equation.	[L1][CO3]	**[2M]**
	b)Using Euler's method, find an approximate value of y corresponding to $x = 0.2$ given that $\frac{dy}{dx} = x + y$ and $y = 1$ when $x = 0$ taking step size $h = 0.1$	[L3][CO3]	**[10M]**
5	Using modified Euler's method find $y(0.2) and\ y(0.4),\ given\ y^1 = y + e^x\ , y(0) = 0$	[L3][CO3]	**[12M]**
6	a) Solve by Euler's method $y^{'} = y^2 + x$, y(0)=1.and find y(0.1) and y(0.2)	[L3][CO3]	**[6M]**
	b) Using Runge – Kutta method of fourth order, compute y(0.2) from $y^1 = xy$ y(0)=1,taking h=0.2	[L3][CO3]	**[6M]**
7	Using R-K method of 4th order, solve $\frac{dy}{dx} = x^2 - y$, y(0)=1. Find y(0.1) and y(0.2) .	[L3][CO3]	**[12M]**
8	Using R-K method of 4th order find y(0.1) and y(0.2) given that $\frac{dy}{dx} = x + y, y(0) = 1.$	[L3][CO3]	**[12M]**
9	Evaluate $\int_0^1 \frac{1}{1+x}dx$ by (i) by Trapezoidal rule and Simpson's $\frac{1}{3}$ rule. (ii) Using Simpson's $\frac{3}{8}$ rule and compare the result with actual value.	[L5][CO3]	**[12M]**
10	a) Evaluate $\int_0^4 e^x dx$ by Simpson's $\frac{3}{8}$ rule with 12 sub divisions.	[L5][CO3]	**[6M]**
	b) Evaluate $\int_0^{\pi/2} sinx\, dx$ using Trapezoidal rule, Simpson's $\frac{1}{3}$ rule and compare with exact value.	[L5][CO3]	**[6M]**

UNIT –III
BASIC STATISTICS & BASIC PROBABILITY

1

a) Define Measures of Central tendency. [L1][CO4] **[2M]**

b) i) The weights of 6 competitors in a game are given below 58,62,56,63,55,61 kgs. Find arithmetic mean of weight of competitors. [L3][CO4] **[3M]**
ii) Find the median of the following values 26, 8, 6, 12, 15, 32. [L1][CO4] **[3M]**

c) Find arithmetic mean to the following data. [L1][CO4] **[4M]**

Marks	10-20	20-30	30-40	40-50	50-60
frequency	5	8	25	22	10

2

a) Describe arithmetic mean, mode and median. [L2][CO4] **[3M]**

b) Find the median to the following data [L1][CO4] **[5M]**

Class intervals	40-50	50-60	60-70	70-80	80-90
frequency	5	12	23	8	2

c) Find arithmetic mean to the following data [L1][CO4] **[4M]**

x	1	2	3	4	5
f	5	8	10	12	6

3

a) Find mode to the following data [L1][CO4] **[6M]**

X	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
F	5	7	10	18	20	12	8	2

b) Find the median to the following data. [L1][CO4] **[6M]**

x	5	8	11	14	17	20	23
f	2	8	12	20	10	6	3

4

a) Obtain mode of the values 10,12,15,20,12,16,18,15,12,10,16,20,12,24. [L3][CO4] **[6M]**

b) The first four moments of a distribution about the value 5 of the variables are 2, 20, 40 and 50. Calculate mean, variance, β_1 and β_2 of the distribution. [L5][CO4] **[6M]**

5

Compute Karl Pearson and Bowley's coefficient of Skewness to the following data [L6][CO4] **[12M]**

X	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
F	2	6	11	20	40	75	45	25	18	8

6

Compute the first four central moments to the following data and also find Sheppard's correction, β_1 and β_2 [L6][CO4] **[12M]**

Class intervals	0-10	10-20	20-30	30-40	40-50	50-60	60-70
frequency	2	8	12	40	20	15	3

7

a) What is the probability of an event? [L1][CO4] **[2M]**

b) Two dice are thrown. Let A be the event that the sum of the point on the faces is 9. Let B be the event that at least one number is 6.
Find (i) $P(A\cap B)$ (ii) $P(A\cup B)$ (iii) $P(A^c\cup B^c)$ (iv) $P(A^c\cap B^c)$ (v) $P(A\cap B^c)$ [L3][CO4] **[10M]**

8

a) State and prove Addition theorem of probability. [L1][CO4] **[6M]**

b) The probability that students A, B, C, solve the problem are $\frac{1}{3}$, $\frac{2}{5}$, $\frac{1}{5}$ and $\frac{1}{4}$ respectively If all of them try to solve the problem, what is the probability that the problem is solved. [L6][CO4] **[6M]**

9

a) State Baye's theorem. [L1][CO4] **[2M]**

	b) In a certain college 25% of boys and 10% of girls are studying mathematics. The girls Constitute 60% of the student body. (a) What is the probability that mathematics is being studied? (b) If a student is selected at random and is found to be studying mathematics, find the probability that the student is a girl? (c) a boy?	[L3][CO4]	**[10M]**
10	a) In a certain town 40% have brown hair, 25% have brown eyes and 15% have both brown hair and brown eyes. A person is selected at random from the town. i) If he has brown hair, what is the probability that he has brown eyes also? ii) If he has brown eyes, determine the probability, that he does not have brown hair?	[L1][CO4]	**[6M]**
	b) Determine (i) $P\left(B/A\right)$ (ii) $P\left(A/B^{C}\right)$ if A and B are events with $P(A)=\frac{1}{3}\ P(B)=\frac{1}{4},\ \ P(AUB)=\frac{1}{2}.$	[L5][CO4]	**[6M]**

UNIT –IV

RANDOM VARIABLES

<table>
<tr><td>1</td><td>a) Define Random variable.</td><td>[L1][CO5]</td><td>[2M]</td></tr>
<tr><td></td><td>b) Two dice are thrown. Let X assign to each point (a, b) in S the maximum of its numbers i.e, X (a, b) = max (a, b).
Find the probability distribution. X is a random variable with X(s)={1,2,3,4,5,6}. Also find the mean and variance of the distribution.</td><td>[L3][CO5]</td><td>[10M]</td></tr>
<tr><td>2</td><td>a) Describe Discrete random variable.</td><td>[L2][CO5]</td><td>[2M]</td></tr>
<tr><td></td><td>b) A random variable x has the following probability distribution function
<table>
<tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>P(x)</td><td>k</td><td>2k</td><td>3k</td><td>4k</td><td>5k</td><td>6k</td><td>7k</td><td>8k</td></tr>
</table>
Find i) k ii) P(X≤2) iii) P(2≤x≤5).</td><td>[L3][CO5]</td><td>[10M]</td></tr>
<tr><td>3</td><td>A random variable X has the following probability function.
<table>
<tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>P(x)</td><td>0</td><td>K</td><td>2K</td><td>2K</td><td>3K</td><td>K^2</td><td>$2K^2$</td><td>$7K^2+K$</td></tr>
</table>
Determine (i) K (ii) Mean iii) variance. (iv) if P(X ≤ K)>1/2, find the Minimum value of K</td><td>[L5][CO5]</td><td>[12M]</td></tr>
<tr><td>4</td><td>a) Write the Properties for Discrete and Continuous random variables.</td><td>[L2][CO5]</td><td>[4M]</td></tr>
<tr><td></td><td>b) A random variable x has the following probability distribution function
<table>
<tr><td>x</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>P(x)</td><td>k</td><td>0.1</td><td>k</td><td>0.2</td><td>2k</td><td>0.4</td><td>2k</td></tr>
</table>
Find i) k ii) Mean iii) Variance.</td><td>[L3][CO5]</td><td>[8M]</td></tr>
<tr><td>5</td><td>a) Define continuous random variable.</td><td>[L1][CO5]</td><td>[2M]</td></tr>
<tr><td></td><td>b) A random variable x has the following probability distribution
<table>
<tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>P(x)</td><td>k</td><td>3k</td><td>5k</td><td>7k</td><td>9k</td><td>11k</td></tr>
</table>
Find i) k ii) Mean iii) Variance.</td><td>[L3][CO5]</td><td>[10M]</td></tr>
<tr><td>6</td><td>a) Find the mean and variance of the uniform probability distribution given by $f(x)=\frac{1}{n}$ for $x=1,2,...,n.$</td><td>[L1][CO5]</td><td>[6M]</td></tr>
<tr><td></td><td>b) If a random variable has a Probability density f(x) as $f(x)=\begin{cases}2e^{-2x}, \ for\ x>0\\ 0,\ forx\le 0\end{cases}$
Find the Probabilities that it will take on a value (i) Between 1 & 3 (ii) Greater than 0.5</td><td>[L6][CO5]</td><td>[6M]</td></tr>
<tr><td>7</td><td>Probability density function of a random variable X is $f(x)=\begin{cases}\frac{1}{2}\sin x,\ for\ 0\le x\le \pi\\ 0, elsewhere\end{cases}$
Find the mean, mode and median of the distribution and also find the probability between 0 and $\pi/2$.</td><td>[L6][CO5]</td><td>[12M]</td></tr>
<tr><td>8</td><td>a) Probability density function $f(x)=\begin{cases}k(3x^2-1), in -1\le x\le 2\\ 0, elsewhere\end{cases}$.
(i)Find the value of k. (ii)Find the probability (-1≤x≤0)</td><td>[L1][CO5]</td><td>[6M]</td></tr>
</table>

	b) The probability density function of a random variable x is $f(x) = \begin{cases} kx(x-1); 1 \leq x \leq 4 \\ 0 ; elsewhere \end{cases}$ And $P(1 \leq x \leq 3) = \frac{28}{3}$ Find the value of k.	[L6][CO5]	**[6M]**
9	For the continuous probability function $f(x) = \begin{cases} kx^2e^{-x} \ when \ x \geq 0 \\ 0 ; elsewhere \end{cases}$ Find i) k ii) Mean iii) Variance.	[L1][CO5]	**[12M]**
10	a) Define Probability density function.	[L1][CO5]	**[2M]**
	b) A continuous random variable x has the distribution function $F(x) = \begin{cases} 0 \ \ if \ \ x \leq 1 \\ k(x-1)^4 \ \ ; 1 < x \leq 3 \\ 0 \ \ ; \ \ x > 3 \end{cases}$ Find the value of k and the probability density function of x.	[L6][CO5]	**[10M]**

UNIT –V
PROBABILITY DISTRIBUTIONS AND CORRELATION

1 a) Define Probability distribution function. [L1][CO5] **[2M]**

b) Derive the mean of Binomial distribution. [L2][CO5] **[4M]**

c) 20% of items produced from a factory are defective. Find the probability that in a sample of 5 chosen at random (i) one is defective (ii) $p(1<x<4)$ [L3][CO5] **[6M]**

2 a) Derive the Variance of Binomial distribution. [L2][CO5] **[4M]**

b) Fit a Binomial distribution to the following frequency distribution: [L5][CO5] **[8M]**

x	0	1	2	3	4	5
f	2	14	20	34	22	8

3 Out of 800 families with 5 children each, how many would you expect to have (i) 3 boys (ii) 5 girls (iii) either 2 or 3boys iv) At least one boy [L2][CO5] **[12M]**

4 a) If 2% of light bulbs are defective. Find the probability that (i) At least one is defective (ii) $p(1<x<8)$ in a sample of 100. [L3][CO5] **[6M]**

b) If for a Poisson variate 2P(X=0)=P(X=2) Find the probability that i) $P(X\leq3)$ ii) $P(2<X\leq5)$ iii) $P(X\geq3)$. [L3][CO5] **[6M]**

5 Fit a Poisson distribution to the following data [L5][CO5] **[12M]**

x	0	1	2	3	4	5	Total
f	142	156	69	27	5	1	400

6 In a sample of 1000 cases, the mean of certain test is 14 and standard deviation is 2.5. Assuming the distribution to be normal find
(i) how many students score between 12 and 15.
(ii) How many students score above 18? (iii) How many students score below 18? [L3][CO5] **[12M]**

7 a) The probability of poisson variate taking the values 1&2 are equal. Find i) μ ii) $P(X\geq1)$ iii) $P(1<X<4)$. [L3][CO5] **[6M]**

b) If X is a normal variate with mean 30 and standard deviation 5. Find the probability that i) $26\leq X\leq40$ ii) $X\geq45$. [L3][CO5] **[6M]**

8 Calculate Correlation coefficient to the following data [L3][CO6] **[12M]**

X	10	15	12	17	13	16	24	14	22	20
Y	30	42	45	46	33	34	40	35	39	38

9 Ten competitors in a musical test were ranked by the three judges A,B and C in the following order: [L3][CO6] **[12M]**

Ranks by A	1	6	5	10	3	2	4	9	7	8
Ranks by B	3	5	8	4	7	10	2	1	6	9
Ranks by C	6	4	9	8	1	2	3	10	5	7

Using rank Correlation coefficient method, discuss which pair of judges has the nearest approach to common likings in music.

10 Find two regression equations from the following data: [L3][CO6] **[12M]**

X	10	25	34	42	37	35	36	45
Y	56	64	63	58	73	75	82	77