MA3251 STATISTICS AND NUMARICAL METHODS

IMPORTANT QUESTIONS AND QUESTION BANK

UNIT-I TESTING OF HYPOTHESIS

2-Marks

1. Define type-I error and type-II error?
2. Mention the various steps involved in testing of hypothesis?
3. What are null and alternate hypothesis?
4. What is the essential difference between confidence limits and tolerance limits?
5. What are the parameters and statistics in sampling?
6. State level of significance?
7. Write down the formula of statistics 't' to test the significance of difference between the means?
8. What are the application of t-test?
9. Write a formula for the chi-square test of goodness of fit of a random sample to a hypothetical distribution?
10. Give the main use of φ^2 test?

13-Marks

1. The main life time of sample of 100 light tubes produced by a company in found to be 1580 hours with standard deviation of 90 hours. Examine the hypothesis that the mean life time of the tubes produced by the company is 1600 hours.
2. A sample of 100 students is taken from a large population. The mean height of the students in this sample is 160cms. Can it be reasonably regarded that sample is form the populations of mean 165cm and standard deviation 10cm? also estimate the 95%fidicial limits for the mean.
3. A simple sample of heights of 6400 Englishmen has a mean of 170cms and a standard deviation of 6.4cms, while a simple sample of heights of 1600 Americans has a mean of 172cms and a standard deviation of 6.3cms. Do the data indicate that Americans are on the average, taller than Englishmen?
4. A certain medicine administered to each of 10 patients resulted in the following increases in the B.P.8,8,7,5,4,1,0,0, -1, -1. Can be concluded that the medicine was responsible for the increase in B.P.5% l.o.s
5. The theory predicts that the population of beans in the four groups A, B, C and D should be 9:3:3:1. In an experiment among 1600 beans, the number in the four groups was 882,313,297 and 118. Do the experimental results support the survey?

6. Test of fidelity and selectivity of 190 radio receivers produced the results shown in the following table

Selectivity	Low	Average	High
Low	6	12	32
Average	33	61	18
High	13	15	0

Use 0.01 level of significance to test weather there is a relationship between fidelity and selectivity.

7. In a certain factory there are two independent processes manufacturing the same item. The average weight in a sample of 250 items produced from one process is found to be 120 Ozs, with a standard deviation of 12 Ozs, while the corresponding figures in a sample of 400 items from the other process are 124 and 14. In this difference between the two sample means significant?
8. Records taken the number of male and female births in 800 families having four children are fellows:

Number of male births	: 0	1	2	3	4
Number of female births	: 4	3	2	1	0
Number of families	: 32	178	290	236	64

Infer whether the data are consistent with the hypothesis that the binomial law holds the change of a male birth is equal to female birth, namely P = $\frac{1}{2}$ = q.

9. The mean produce of wheat from a sample of 100 fields comes to 200kg per acre and another sample of 150 fields gives a mean 220kg per acre. Assuming the standard deviation of the yield at 11kg for the universe, test if there ia s significant difference between the means of the samples?
10. Two independent samples of sizes 9 and 7 from the normal population had the following values of the variables

Sample1	18	13	12	15	12	14	16	14	15
Sample2	16	19	13	16	18	13	15		

Justify whether the difference between the means of samples of samples significant?

11. In a year there are 956 births in a town a of which 52.5% were male while in towns A and B combined this proportion of male births was 0.496. If there any significant difference in the proportion in a total of 1406 births was 0.496. Is there any significant difference in the proportion of male births in the two towns?

12. In a random sample of 1000 people from city. A,400 are found to be consumers of rice. In a sample of 800 from city B, 400 are found to be consumers of rice. Does this data give a significant difference between the two cities as far as the proportion of rice consumers is concerned?
13. In a referendum submitted by the students to the body at a university, 850men and 650 women voted. 500 men and 320 women voted. Does this indicate a significant difference of opinion between men and women on this matter at 1% level of significance?
14. Random samples drawn from two places gave the following data relating to the heights of male adults:

	Place A	Place B
Mean heigh (in inches)	68.50	65.50
S.D (in inches)	2.5	3.0
No. of adult males in sample	1200	1500

The test at 5% level that the mean height is the same for adults in the two places.

15. A sample of 200 persons with a particular disease was selected out of these, 100 were given a drug and the others were not given any drug. The results are as follows: the test whether the drug is effective or not?

Number of persons	Drug	Non- Drug	Total
cured	65	55	120
Not cured	35	45	80
Total	100	100	200

UNIT-II DESIGN OF EXPERIMENTS

2-Marks

1. What is the aim of design of experiments?
2. Write the basic assumption in analysis of variance?
3. When do you apply analysis of variance technique?

4. Define Randomization?
5. Define Replications?
6. Define local control?
7. What is meant by tolerance limits?
8. What is ANOVA?
9. What are the uses of ANOVA?
10. Define experimental error?

13-Marks

1. The accompanying data resulted from an experiment comparing the degree of soiling for fabric copolymerized with the 3 different mixtures of met acrylic acid. Analyse the classification.
   Mixture 1 : 0.56 1.12 0.90 1.07 0.94
   Mixture 2 : 0.72 0.69 0.87 0.78 0.91
   Mixture 3 : 0.62 1.08 1.07 0.99 0.93
2. A set of data involving 4 tropical food stuffs A, B. C, D tried on 20 chicks is given below. All the 20 chicks are treated a like in all respects expect the feeding treatments and each feeding treatments is given to 5 chicks Analysis the data:

A	55	49	42	21	52
B	61	112	30	89	63
C	42	97	81	95	92
D	169	137	169	85	154

3. The following tables shows the lives in hours of four brands of electric lamps brand

   A : 1610, 1610, 1650, 1680, 1700, 1720, 1800

   B ; 1580, 1640, 1640, 1700, 1750

   C : 1460, 1550, 1600, 1620, 1640, 1660, 1740, 1820

   D : 1510, 1520, 1530, 1570, 1600, 1680

   Identify an analysis of variance and test the homogeneity of the mean lives of the four brands of lamps.
4. A company appoints 4 salesmen A, B, C, D and observes their sales in 3 seasons, summer winter and monsoon. The figures are given in the following table:

Season	1	2	3	4
Summer	45	40	28	37
Winter	43	41	45	38
Monsoon	39	39	43	41

Carry out an analysis of variances?

5. In order determine whether there is significant difference in the durability of 3 makes of computer samples of size 5 are selected from each make and the frequency of repair during the first year of purchase is observed. The results are as fellows in view of the above data what conclusion can you draw?

Makes

A	B	C
5	8	7
6	10	3
8	11	5
9	12	4
7	4	1

6. Five doctors each test five treatments for a certain disease and observe the number of days each patient take store over. The results are as follows (recovery time in days)

Doctor	1	2	3	4	5
A	10	14	23	18	20
B	11	15	24	17	21
C	9	12	20	16	19
D	8	13	17	17	20
E	12	15	19	15	22

Estimate the difference between (a) doctors and (b) treatments for the above data at 5% level

7. Perform a 2-way ANOVA on the data given below

Treatment 1

1 2 3

Treatment 2	1	30	26	38
	2	24	29	28
	3	33	24	35
	4	36	31	30
	5	27	35	33

Using the methods subtracting 30 from the given no

8. The following data represent a certain person to work from Monday to Friday by 4 different routes test at 5% level of significance whether the difference among the means obtained for the different routes are significant and also whether the difference among the means obtained for the different days of week are significant

	Mon	Tue	wed	Thu	Fri
1	22	26	25	25	31
2	25	27	28	26	29
3	26	29	33	30	33
4	26	28	27	30	30

9. Analysis the variance in the following Latin square of yields of paddy where A, B, C, D denote the different methods of cultivation Examine whether the different methods of cultivation have given significantly different yields

D122	A121	C123	B122
B124	C123	A122	D125
A120	B119	D120	C121
C122	D123	B121	A122

10. The following data resulted from an experiment to compare three burners A, B. C. A Latin square design was used as the test were made on 3 engines and were spread over 3 days. Test the hypothesis and infer that there is no different between the burners

A 16	B 17	C 20
B 16	C 21	A 15
C 15	A 12	B 13

11. A variable trial was conducted on wheat with 4 varieties in a Latin square design the plan of the experiment and the per plot yield are given below

C25	B232	A20	C20
A19	D19	C21	B18
B19	A14	D17	C20
D17	C20	B21	A15

12. A farmer wishes to test the effects of four different fertilizers A, B, C, D on the yield of wheat in order to estimate sources of error due to variability in soil fertility, Heuse the fertilizers in a Latin square arrangement as indicated in the following table where the numbers indicate yields per unit area. Design an analysis of variance to determine if there is a significant difference between the fertilizers at a=0.05 and a=0.01 levels of significance

A18	C21	D25	B11
D22	B12	A15	C19
B15	C23	C23	D24
C22	D21	B10	A17

13. Set up the analysis of variance for the following results of a Latin square experiment, the data collected is given in the matrix below yield per plot is given in quintals for the five different cultivation treatments A, B, C, D and E. perform the analysis of variance.

A48	E66	D56	C52	B61
D64	B62	A50	E64	C63
B69	A53	C60	D61	E67
C57	D58	E67	B65	A55
E67	C57	B66	A60	D57

14. In a Latin square experiment given below are the yields in quintals per acre on the paddy crop carried out for testing the effect of five fertilizers A, B, C, D, E. Analysis the data for variation.

B25	A18	E27	D30	C27
A19	D31	C29	E26	B23

C28	B22	D33	A18	E27
E28	C26	A20	B25	D33
D32	E25	B23	C28	A20

15. Find out the main effects and interaction effects in the following 2^2 factorial experiment and write down the analysis of variance table.

Blocks	(1) 00	a 10	b 01	c 11
I	64	25	30	60
II	75	14	50	33
III	76	12	41	17
IV	75	33	25	10

UNIT-III SOLUTION OF EQUATION AND EIGENVALUE PROBLEMS

2-Marks

1. State the principle used in Gauss-Jordan method?
2. State the error term of Newton Raphson method?
3. Name of two direct method to solve system of linear equations?
4. What or the merits of Newton's methods of iterations?
5. Give an example of transcendental and algebraic equations?
6. Find the smallest positive root of $x^3 - 2x + 0.5 = 0$
7. Find the real positive root of $3x - cosx - 1 = 0$ by Newton's method correct to 6 decimal places?
8. Solve the following system of equations using Gauss-Jordan elimination method $2x + y = 3, x - 2y = -1$
9. Find the dominant eigenvalue of the matrix $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ by power method?
10. Compare Gauss elimination and Gauss Jordan methods?

13-Marks

1. Solve the equation $xlog_{10}x = 1.2$ using Newton Raphson method

2. Find the numerically largest eigenvalue of $\begin{bmatrix}1 & -3 & 0\\ 4 & 2 & 0\\ 6 & -1 & 0\end{bmatrix}$ by power method
3. Using the power method find all the eigen values of $A=\begin{bmatrix}5 & 0 & 1\\ 0 & -2 & 0\\ 1 & 0 & 5\end{bmatrix}$
4. Using Newton Raphson method solve $xlog_{10}x = 12.34$ taking the initial value $x_{10}\ as\ 10$
5. Find the largest eigenvalue of the matrix $\begin{bmatrix}2 & -1 & 0\\ -1 & 2 & 0\\ 0 & -1 & 0\end{bmatrix}$ using Gauss Jordan method?
6. Predict the inverse of the matrix $\begin{bmatrix}3 & 1 & 2\\ 2 & -3 & -1\\ 1 & 2 & 1\end{bmatrix}$ using gauss Jordan method
7. Solve the following set of equations using Gauss- Seidal iterative procedure $-10x+2y+2z=4; x-10y+2z; x+y-10z=45$
8. Infer the inverse of the matrix $\begin{bmatrix}2 & 1 & 1\\ 1 & 2 & 1\\ 1 & 1 & 2\end{bmatrix}$ using Gauss Jordan method
9. Find the dominant eigenvalue and of $\begin{bmatrix}1 & 3 & -1\\ 3 & 2 & 4\\ -1 & 4 & 10\end{bmatrix}$ by power method
10. Give the iterative formula to find $\sqrt{N}$ and where N is positive integer using newtons method and hence find $\sqrt{11}$.
11. If $A=\begin{bmatrix}2 & 1 & 1\\ 3 & 2 & 3\\ 1 & 4 & 9\end{bmatrix}$ find A^{-1} by Gauss- Jordan Methods
12. By the Gauss- Jordan elimination method and find the inverse of the matrix $\begin{bmatrix}2 & 1 & 1\\ 1 & 0 & -1\\ 2 & -1 & 2\end{bmatrix}$
13. Solve by Gauss Seidal methods the following systems: $28x+4y-z=32; x+3y+10z=24; 2x+17y+4z=35$
14. Solve the following equation by gauss elimination method; $x+y+z=9; 2x-3y+4z=13;\ \ 3x+4y+5z=40$
15. Find the positive real root of $2x^3-3x-6=0\ by\ newton's\ method$

UNIT-IV INTERPOLATION NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION

2-marks

1. State any two properties of divided differences?
2. State the formula to find the second order derivative using the forward differences?
3. Write down the Lagrange's interpolating formula?
4. State the Simpson's 1\3 rule in numerical integration?
5. State the use of Lagrange's interpolation formulae?
6. State the formula to find the second order derivative using forward difference formula?
7. Predict divided difference table for the following data (0,0), (1,2), (2,2.5), (3,2.3), (4,2), (5,1.7), and (6,1.5)
8. Interpret inverse Lagrange's interpolation formula?
9. Show that the divided difference of second order can be expressed as the quotient of two determinants of third order?
10. Describe in numerical integration what should be the number of intervals to apply Simpson's one-third rule and Simpson's three – eighths rule?

13-Marks

1. The population of certain town is given below. find the rate of growth of the population in 1931, 1941,1961 and 1971

Year	1931	1941	1951	1961	1971
Population (in1000)	40.62	60.80	79.95	103.56	132.66

2. Given $log_{10}\ 654 = 2.8156, log_{10}658 = 2.8182, log_{10}659 = 2.8189\ and\ log_{10}661 = 2.8202.\ find\ the\ value\ of\ log_{10}656$ using newtons divided difference formula
3. Find Y (22) given that

X	20	25	30	35	40	45
Y	354	332	291	260	231	204

4. Find $y'(1)$, if

X	0	2	3	4	7	9
F(X)	4	26	58	112	466	922

5. From the given table compute the value of $sin38^{\circ}$

X	0°	10°	20°	30°	40°
Sin X	0	0.17365	0.34202	0.50000	0.64279

6. Evaluate $\int_0^1 \int_0^1 \frac{dxdy}{1+x+y}$ using Trapezoidal rule
7. Using newtons forward interpolation formula find that the polynomial f(x) satisfying the following data hence evaluate f(x) at x=5

X	4	6	8	10
F(x)	1	3	8	16

8. Find the sixth term of the sequence 8,12, 9, 29, 42
9. Evaluate $\int_0^1 \frac{dx}{1+x}$ by using Simpson one third rule and hence deduce the value of $log_e 2$
10. A rod is rotating a plane. the following table gives the angel θ with respect to time t seconds

t	0	0.2	0.4	0.6	0.8	1
θ	0	0.12	0.49	1.12	2.02	3.2

11. From the data given below findθ $at\ x = 43\ and\ at\ x = 84$

X	40	50	60	70	90
θ	184	204	226	250	304

12. Using Lagrange's interpolation formula find the polynomial f(x) from the following data;

x	0	1	4	5
F(x)	4	3	24	39

13. Evaluate $\int_2^{2.4} \int_4^{4.4} xy\ dxdy\ using\ simpson\ 1\backslash 3^{rd}$ rule divide the range into 4 equal part
14. By dividing the range into 10 equal parts, evaluate $\int_0^{\pi} sinx\ dx$ by the trapezoidal and Simpson rule. Verify your answer with integration.
15. Evaluate $\int_1^{1.2} \int_1^{1.4} \frac{1}{1+x}\ dxdy$ by trapezoidal rule with h=k=0.1.

UNIT-V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

2-Marks

1. State the advantages of Runge- kutta method over Taylor series method?
2. State the merits of RK- method over Taylor series method?
3. Write Milne's predictor-corrector formula?
4. Define initial value problems?
5. Explain the terms initial value problems
6. What the main difference between single step and multi-step methods in solving first order differential equation?
7. What are the distinguished properties of R.K methods?
8. Identify the multi-step methods available for solving ordinary differential equation?
9. Bring out the merits and demerits of Taylor series method?
10. Obtain the finite difference scheme for differential equation $2\frac{d^2y}{dx^2} + y = 5$

13-Marks

1. Determine the value of y (0.4) using Milne's method given $\frac{dy}{dx} = xy + y^2, y(0) = 1$ use Taylors series to get the value of y at x=0.1. Euler's method for y at x=0.2 and R-K fourth order method for y at x=0.3
2. Solve the following by finite difference method $y'' - y = 1\ orgin\ by\ y(0) = 0, y(1) = 1\ with\ h = 0.25$
3. Using finite difference solve the boundary value problem $y'' + 3y' - 2y = 2x + 3,\ y(0) = 2, y(1) = 1 with\ h = 0.2$
4. Using Taylor method compute y (0.2) and y (0.4) correct to 4 decimal places given $\frac{dy}{dx} = 1 - 2xy\ and\ y\ (0) = 0\ by\ taking\ h = 0.2$
5. Using modified Euler method find y (0.2) y (0.1) given $\frac{dy}{dx} = x^2 + y^2, y(0) = 1$
6. Given $\frac{dy}{dx} = 1 + y^2$ whare y=0 when x=0 find y (0.2), y (0.4) and y (0.6), using Taylor's series method
7. Apply Taylors series method to find and approximate value of y when x=0.1, 0.2 given that $\frac{dy}{dx} = x + y, y(0) = 1$
8. By Taylor series method find y (0.1), y (0.2) and y (0.3) if $\frac{dy}{dx} = x - y^2, y(0) = 1$
9. Using R-K method of 4^{th} order find y (0.8) correct to 4 decimal places if $\frac{dy}{dx} = y - x^2, given\ y\ (0.6) = 1.7379$
10. Solve the BVP $y'' + y' = 0, y\ (0) = 1\ y\ (1) = 0$ using finite difference method, taking h=0.25

11. By modified Euler method find y (0.1), y (0.2), and y (0.3) if $\frac{dy}{dx} = x + y, y(0) = 1$
12. Given $\frac{dy}{dx} = x^3 = y, y(0) = 2\ , y(0.2) = 2.073\ , y(0.4) = 2.452, y(0.6) = 3.023\ compute\ y(0.8)$ by Milne method
13. Using Euler's method find the solution of the IVP $\frac{dy}{dx} = \log(x + y)\ , y(0) = 2$ at x=0.2 and taking h=0.2
14. Using Euler's method to solve $y' = y(e^x - 1), y(0) = 1$ at x=0.1, 0.2 and 0.3
15. Using Euler's method find the solution of the IVP $\frac{dy}{dx} = x\ logx - y\ logy\ , y(1) = 1 at\ x = 1.6\ taking\ h = 0.1$