Printed Page:-05 Subject Code:- BAS0402

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech (ECE-Working Professional)

SEM: II - THEORY EXAMINATION (2024 - 2025)

Subject: Engineering Mathematics IV

Time: 3 Hours Max. Marks: 100

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A 20

1. Attempt all parts:-

1-a. The mode of series 0,1,6,7,2,3,7,6,6,2,6,0,5,6,0 (CO1,K1) 1

(a) 5

(b) 0

(c) 6

(d) None of these

1-b. In a correlation analysis, if r=0 then we may say that there is .....between variables.(CO1,K1) 1

(a) No correlation

(b) Linear correlation

(c) Perfect correlation

(d) None of these

1-c. Which of the following distributions is used to compare two variances? (CO2,K1) 1

(a) F – Test

(b) T – Test

(c) Normal Distribution

(d) Poisson Distribution

1-d. While testing the significance of difference of two sample means in case of small sample, then the degree of freedom is: (CO2,K3) 1

(a) $n_1 - 1$

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(b) $n_1 + n_2 - 2$

(c) $n_2 - 1$

(d) $n_1 n_2 - 2$

1-e. The diameter, say X of an electric cable, is assumed to be a continuous random variable with p.d.f : $f(x) = 6x(1-x),\ 0 < x < 1$. The value of k if $P(X < k) = P(X > k)$ is...(CO3, K3) 1

(a) $\frac{1+\sqrt{3}}{2}$

(b) $\frac{1-\sqrt{3}}{2}$

(c) $\frac{1\pm\sqrt{3}}{2}$

(d) 1/2

1-f. A random variable X has the following probability distribution: 1

Value of X, x: 0 1 2 3 4 5 6 7 8

P(x): a 3a 5a 7a 9a 11a 13a 15a 17a

Determine the value of a Is.... (CO3,K2)

(a) 1/81

(b) 2/81

(c) 5-81

(d) 1

1-g. For Binomial distribution sum of mean and variance is 6 and difference of mean and variance is 2 then the find the probability of success.(CO4,K3) 1

(a) 1

(b) 0.5

(c) 0.25

(d) 0.75

1-h. For a Poisson Distribution, if mean(m) = 1, then P(1) is? (CO4,K1) 1

(a) 1/e

(b) e

(c) e/2

(d) Indeterminate

1-i. X can do a piece of work in 10 days while Y can do it in 15 days. In how many days can X and Y working together do it?(CO5,K3) 1

(a) 6 Days

(b) 8 Days

(c) 25 Days

(d) 12.5 Days

1-j. 12 buckets of water fill a tank when the capacity of each bucket is 13.5 litres. How 1

many buckets will be needed to fill the same tank, if the capacity of each bucket is 9 litres? (CO5,K3)

(a) 8

(b) 15

(c) 16

(d) 18

2. Attempt all parts:-

2.a. Write down the normal equation of the curve $y = a + bx$ (CO1,K1) 2

2.b. Write the Control Limits (UCL & LCL) for C chart. (CO2,K1)) 2

2.c. A random variable X has the following distribution (CO3,K1) 2

X	1	2	3	4	5	6
P(X)	k	3k	5k	7k	9k	11k

Find k.

2.d. Write mean and variance of binomial distribution. (CO4,K1) 2

2.e. A train 75 metres long is running with a speed of 20 km/hr. Find the time that it will pass a standing man.(CO5,K3) 2

SECTION-B 30

3. Answer any five of the following:-

3-a. Obtain the Karl Pearson coefficient of Skewness for the following data- (CO1,K3) 6

x	10	11	12	13	14	15
y	2	4	10	8	5	1

3-b. By the method of least squares, fit the curve $y = ax + b x^2$ to the following data:(CO1,K3) 6

x	1	2	3	4	5
y	1.8	5.1	8.9	14.1	19.8

3-c. The average income of persons was Rs 210 with S.D. of Rs 10 in a sample of 100 people of a city. For another sample of 150 persons, the average income was Rs 220 with S.D. of Rs 12. The S.D. of income of the people of the city was Rs 11. Test whether there is any significant difference between the average incomes of the localities. If the tabulated value is 1.96 at 5% level of significance.(CO2,K3) 6

3-d. The following are the mean lengths and ranges of lengths of a finished product from 10 samples each of size 5. The central limit for length is 200 cm. Construct the mean $\bar{x}$ - Chart. Also examine whether the process is under control and state your recommendations. (CO2,K3) 6

Sample No.	1	2	3	4	5	6	7	8	9	10
Mean	201	198	202	200	203	204	199	196	199	201

$(\bar{X})$										
Range (R)	5	0	7	3	3	7	2	8	5	6

Given that : n=5, A_2=0.58 .

3.e. If X and Y are two random variables having the joint probability mass function 6

$$p(x,y) = \frac{1}{27}(2x+y); \quad x = 0,1,2 \;\; ; y = 0,1,2$$

Find the Marginal l distribution for X and Y. (CO3,K3)

3.f. Out of 800 families with 4 children each, how many families would be expected to have (i) 2 boys and 2 girls (ii) at least one boy (iii) no girl. (CO4,K3) 6

3.g. Two pipes X and Y fill a tank in 15 hrs. and 20 hrs. respectively, while a third pipe 'Z' can empty the full tank in 25 hrs. All the three pipes are opened in the beginning. After 10 hrs. Z is closed. In how much time, will the tank be full? (CO5,K3) 6

SECTION-C 50

4. Answer any one of the following:-

4-a. calculate first four central moments (CO1,K3) 10

Marks	5-15	15-25	25-35	35-45	45-55	55-65
No. of students	10	20	25	20	15	10

4-b. In a partially destroyed laboratory record of analysis of a correlation data, the following results only are legible:(CO1,K3) 10
Variance of x=9. Regression equations: 8x-10y+66=0 , 40x -18y=214
Calculate (a) the mean values of x and y (b) the standard deviation of y and the coefficient correlation between x and y.

5. Answer any one of the following:-

5-a. A manufacturing company purchased three new machines of different makes and wishes to determine whether one of them is faster than the others in producing a certain output. Five hourly production figures are observed at random from each machine and results are given below:(CO2,K3) 10

Observations	A	B	C
1	25	31	24
2	30	39	30
3	36	38	28
4	38	42	25
5	31	35	28

Use ANOVA and determine whether the machines are significantly different in their mean speed. Given that the tabular value of F for d.f. 2 and 12 is 3.89 at 5% LOS.

5-b. The theory predicts that proportions of beans in the four groups G_1, G_2, G_3, G_4 should be in the ratio 9:3:3:1. In an experiment with 1600 beans the numbers in the four groups were 882, 313, 287 and 118. Does the experimental results 10

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support the theory? (Tabular value at 5 % level of significance and d.f. 3 is 7.815)(CO2,K3)

6. Answer any <u>one</u> of the following:-

6-a. The joint probability density function of two-dimensional random variable (X,Y) is given by- (CO3,K3) 10

$$f(x.y) = \begin{cases} 2 & 0 \le x < 1,\ 0 < y < x \\ 0 & \text{elsewhere} \end{cases}$$

I. Find marginal density function of X and Y

II. Find the conditional density function of Y given X= x and conditional distribution of X given Y=y .

6-b. A random variable has the following probability mass function: (CO3,K3) 10

x	0	1	2
p(x)	$3c^3$	$4c-10c^2$	5c-1

i. Find c

ii. Evaluate $P(X<2)$ and $P(1<X\le 2)$.

iii. If $P(X \le a) < \frac{1}{2}$ find the maximum value of a

7. Answer any <u>one</u> of the following:-

7-a. The income of a group of 10,000 persons was found to be normally distributed with mean rs 750 p.m. and standard deviation of rs 50. show that of this group , about 95 % had income exceeding rs 668 and only 5 % had income exceeding rs 832. Given that value of z for 1.64 is 0.4495.(CO4,K3) 10

7-b. Fit a Poisson distribution to the set of observations: (CO4,K3) 10

x	0	1	2	3	4
f	122	60	15	2	1

8. Answer any <u>one</u> of the following:-

8-a. (i) A can do a work in 4 days, B in 5 days and C in 10 days. Find the time taken by A, B and C to do the work together? 10
(ii) If Roger can do a piece of work in 8 days and Antony can complete the same work in 5 days, in how many days will both of them together complete it? (CO5, K3)

8-b. (i) Bucket P has thrice the capacity as bucket Q. It takes 60 turns for bucket P to fill the empty drum. How many turns will it take for both the buckets P and Q, having each turn together to fill the empty drum? 10
(ii) Two pipes A and B can fill a tank in 15 hours and 20 hours respectively while a third pipe C can empty the full tank in 25 hours. All the three pipes are opened in the beginning. After 10 hours, C is closed. In how much time will the tank be full? (CO5,K3)