

**INSTITUTE OF AERONAUTICAL ENGINEERING**

(Autonomous)

Dundigal-500043, Hyderabad

B.Tech III SEMESTER END EXAMINATIONS (REGULAR/ SUPPLEMENTARY) - FEBRUARY 2024

Regulation: UG20

PROBABILITY AND STATISTICS

Time: 3 Hours

(COMMON TO AE | ME)

Max Marks: 70

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) If X is a continuous random variable with probability density function given by

$$f(x) = \begin{cases} kx & 0 \leq x < 2, \\ 2k & 2 \leq x < 4, \\ -kx + 6k & 4 \leq x < 6 \end{cases}, \text{ then find } k \text{ and mean value of } X.$$

[BL: Apply| CO: 4|Marks: 7]

- (b) The probability mass function of a discrete random variable X is given in the Table 1

[BL: Apply| CO: 1|Marks: 7]

Table 1

X	0	1	2	3	4	5	6
p(X)	k	3k	5k	7k	9k	11k	13k

Find the value of i) k ii) $P(X < 4)$ iii) $P(X \geq 4)$ iv) $P(3 < X \leq 6)$ **MODULE – II**

2. (a) If the probability of a bad reaction from a certain injection is 0.001, determine the chance that out of 2000 individuals more than two will get a bad reaction. [BL: Apply| CO: 2|Marks: 7]
- (b) The probability that a pen manufactured by a company will be defective is 1/10. If 12 such pens are manufactured, find the probability that
- Exactly two will be defective
 - At least two will be defective
 - None will be defective.

[BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) Psychological tests of intelligence and of engineering ability were applied to 10 students. The record of ungrouped data showing intelligence ratio (I.R.) and engineering ratio (E.R.) is given in Table 2. Calculate the co-efficient of correlation.

Table 2

Student	A	B	C	D	E	F	G	H	I	J
I.R.	105	104	102	101	100	99	98	96	93	92
E.R.	101	103	100	98	95	96	104	92	97	94

[BL: Apply| CO: 3|Marks: 7]

- (b) Ten participants in a contest are ranked by two judges x and y given in Table 3:

Table 3

x:	1	6	5	10	3	2	4	9	7	8
y	6	4	9	8	1	2	3	10	5	7

Calculate the rank correlation coefficient ρ

[BL: Apply| CO: 3|Marks: 7]

4. (a) In a partially destroyed laboratory record, only the lines of regression of y on x and x on y are available as $4x - 5y + 33 = 0$ and $20x - 9y = 307$ respectively. Calculate \bar{x} , \bar{y} and the coefficient of correlation between x and y.

[BL: Apply| CO: 4|Marks: 7]

- (b) If θ is the angle between the two regression lines, show that $\tan \theta = \frac{1 - r^2}{r} \cdot \frac{\sigma_x \sigma_y}{\sigma_x^2 + \sigma_y^2}$

Explain its significance when $r=0$ and $r = \pm 1$.

[BL: Apply| CO: 4|Marks: 7]

MODULE – IV

5. (a) A die was thrown 9000 times and a throw of 5 or 6 was obtained 3240 times. On the assumption of random throwing, do the data indicate an unbiased die?

[BL: Apply| CO: 5|Marks: 7]

- (b) In a city A 20% of a random sample of 900 school boys had a certain slight physical defect. In another city B, 18.5% of a random sample of 1600 school boys had the same defect. Is the difference between the proportions significant?

[BL: Apply| CO: 5|Marks: 7].

6. (a) A sample of 900 members is found to have a mean of 3.4 cm. Can it be reasonably regarded as a truly random sample from a large population with mean 3.25 cm and standard deviation 1.61 cm.

[BL: Apply| CO: 5|Marks: 7]

- (b) The means of simple samples of sizes 1000 and 2000 are 67.5 and 68.0 cm respectively. Can the samples be regarded as drawn from the same population of standard deviation of 2.5 cm.

[BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) A certain stimulus administered to each of 12 patients resulted in the following increase of blood pressure: 5, 2, 8, -1, 3, 0, -2, 1, 5, 0, 4, 6. Can it be concluded that the stimulus will in general be accompanied by an increase in blood pressure?

[BL: Apply| CO: 6|Marks: 7]

- (b) Measurements on the length of a copper wire were taken in 2 experiments A and B as given in Table 4:

Table 4

A' s (mm):	12.29	12.25	11.86	12.13	12.44	12.78	12.77	11.90	12.47
B' s (mm):	12.39	12.46	12.34	12.22	11.98	12.46	12.23	12.06	

Test whether B's measurements are more accurate than A's. [BL: Apply| CO: 6|Marks: 7]

8. (a) Eleven students were given a test in statistics. They were given a month's further tuition and a second test of equal difficulty was held at the end of it. Do the marks given in Table 5 give evidence that the students have benefitted by extra coaching?

Table 5

Boys:	1	2	3	4	5	6	7	8	9	10	11
Marks I test:	23	20	19	21	18	20	18	17	23	16	19
Marks II test:	24	19	22	18	20	22	20	20	23	20	17

[BL: Apply| CO: 6|Marks: 7]

- (b) The data given in Table 6 shows the number of aircraft accidents that occurred during the various days of a week.

Table 6

Day	Mon	Tue	Wed	Thur	Fri	Sat
No. of accidents	15	19	13	12	16	15

Test whether the accidents are uniformly distributed over the week.

[BL: Apply| CO: 6|Marks: 7]

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