Hall Ticket No

IARE

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous) Dundigal, Hyderabad - 500 043

B.Tech III SEMESTER END EXAMINATIONS (REGULAR / SUPPLEMENTARY) - FEBRUARY 2023 Regulation: UG20

PROBABILITY AND STATISTICS

Time: 2 Hours

(Common to AE | ME)

Max Marks: 20

Answer any FOUR questions All parts of the question must be answered in one place only

$\mathbf{MODULE}-\mathbf{I}$

1. (a) A random variable X has the following probability distribution given in Table 1

Table 1

| X | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|------|---|----|----|----|----|-----|-----|-----|-----|
| P(X) | a | 3a | 5a | 7a | 9a | 11a | 13a | 15a | 17a |

Determine the i) Value of 'a' ii) P(X < 3) iii) P(2 < X < 5)

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

(b) Consider the density function
$$f(x) = \begin{cases} k\sqrt{x}, & 0 < x < 1\\ 0 & elsewere \end{cases}$$

i) Evaluate k.

ii) Evaluate P(0.3 < x < 0.6) and P(0.5 < x < 0.9) using the density function

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

$\mathbf{MODULE}-\mathbf{II}$

- 2. (a) An electrical firm manufactures light bulbs that have a life, before burn out, i.e normally distributed with mean of 800 hours and standard deviation of 40 hours. Find the probability that a bulb
 - i) Burns between 778 and 834 hours
 - ii) Burns out after 900 hours
 - iii) Burns out before 200 hours
 - (b) A car-hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as a Poisson distribution with mean 1.5. Calculate the proportion of days
 - i) On which there is no demand
 - ii) On which demand is refused. [BL: Apply| CO: 2|Marks: 7]



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

$\mathbf{MODULE}-\mathbf{III}$

3. (a) Marks of 9 students in two subjects A and B are given in Table 2. Obtain rank correlation coefficient. [BL: Apply] CO: 3|Marks: 7]

Table 2

| Student No | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|------------|----|----|----|----|----|----|----|----|----|
| Marks in A | 10 | 15 | 12 | 17 | 13 | 16 | 24 | 14 | 22 |
| Marks in B | 30 | 42 | 45 | 46 | 33 | 34 | 40 | 35 | 39 |

(b) A study was made on the amount of converted sugar in a certain process at various temperatures. The data were coded and recorded as shown in Table 3 [BL: Apply] CO: 4[Marks: 7]

| Table | 3 |
|-------|----------|
|-------|----------|

| Coded Temperature | 1.0 | 1.1 | 1.3 | 1.4 | 1.5 | 1.6 |
|-------------------|-----|-----|-----|-----|-----|-----|
| Converted sugary | 8.1 | 7.8 | 9.8 | 8.9 | 8.6 | 8.7 |

i) Estimate the linear regression line

- ii) Estimate the mean amount of converted sugar produced when the coded temperature is 1.87.
- 4. (a) The data given in Table 4 pertain to the number of computer jobs per day and the central processing unit (CPU) time required [BL: Apply] CO: 4|Marks: 7]

Table 4

| Number of jobs (x) | 1 | 2 | 3 | 4 | 5 | 6 |
|--------------------|---|---|---|---|----|----|
| CPU time(y) | 2 | 5 | 4 | 9 | 10 | 11 |

i) Fit a straight line y on x.

- ii) Obtain an estimate the mean CPU time at number of jobs is 3.5.
- (b) Marks of 7 students in statistics and physics are given in Table 5. Find rank correlation coefficient between them. [BL: Apply] CO: 3|Marks: 7]

Table 5

| Statistics: | 58 | 64 | 65 | 55 | 44 | 80 | 65 |
|-------------|----|----|----|----|----|----|----|
| Physics: | 52 | 48 | 52 | 62 | 45 | 68 | 62 |

$\mathbf{MODULE}-\mathbf{IV}$

5. (a) A random sample of size 100 is taken from an infinite population having the mean 76 and the variance 256. Estimate the probability that will be between 75 and 78

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

(b) A population consists of the five numbers 2, 3, 6, 8, 11. Consider all possible samples of size two which can be drawn without replacement from this population. Find

i) The mean of the sampling distribution

ii) The standard deviation of the sampling distribution of means [BL: Apply] CO: 5|Marks: 7]

6. (a) The average grades in mathematics of a sample of 100 students was 51 with a standard deviation of 6. Could this have been a random sample from a population with average grades of 50?

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

(b) Random samples drawn from two countries has the data given in Table 6 relating to the heights of adult males.

| Heights | Country A | Country B |
|------------------------|-----------|-----------|
| Mean height(in Inches) | 67.42 | 67.25 |
| Standard Deviation | 2.58 | 2.50 |
| Number of samples | 1000 | 1200 |

Table 6

Is the significant difference between the means?

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

$\mathbf{MODULE}-\mathbf{V}$

7. (a) A sample of 20 items has mean 42 units and standard deviation is 5 units. Test the hypothesis that it is a random sample from a normal population with mean 45 units.

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

(b) The data given in Table 7 is collected on two characteristics

| Characteristics | Smokers | Non smokers |
|-----------------|---------|-------------|
| Literate | 83 | 57 |
| Illiterate | 45 | 68 |

Table 7

Based on this information can you say that there is no relation between habit of smoking and literacy? [BL: Apply| CO: 6|Marks: 7]

8. (a) In one sample of 8 observations the sum of squares of deviations of the sample values from the sample mean was 84.4 and another sample of 10 observations it was 102.6. Examine whether there is any significant difference between two sample variances at at 5% level of significance.

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

(b) The two random samples reveal the following data given in Table 8:

| Table | 8 |
|-------|---|
| Table | 0 |

| Sample no. | Size | Mean | Variance |
|------------|------|------|----------|
| Ι | 16 | 440 | 40 |
| II | 25 | 460 | 42 |

Test whether the samples come from the same normal population

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