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Question Paper Code: AHSD11



INSTITUTE OF AERONAUTICAL ENGINEERING (Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-II

B.Tech III Semester End Examinations, SEPTEMBER – 2024

Regulation: BT23

PROBABILITY AND STATISTICS COMPUTER SCIENCE ENGINEERING

Time: 3 hour

Max Marks: 60

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) Out of $(2n + 1)$ tickets consecutively numbered, three tickets are drawn at random. find the probability that the numbers on them are in Arithmetical Progression (A.P).

[BL: Apply |CO: 1|Marks:6M]

- (b) A problem in statistics is given to the three students A, B and C whose chances of solving it or $\frac{1}{2}, \frac{3}{4}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved if all of them try independently.

[BL: Apply|CO: 1|Marks:6M]

MODULE-II

2. (a) Outline the concept of random variables. A random variable x has the following probability function: Calculate (i) k (ii) $P(x < 6)$ (iii) $P(X \geq 6)$

x	0	1	2	3	4	5	6	7
$P(X)$	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2 + k$

[BL: Apply|CO: 2|Marks:6M]

- (b) Is the function defined by a probability density function? Estimate the probability that a

$$\text{variate having } f(x) = \begin{cases} 0, & x < 2 \\ \frac{1}{18}(2x + 3), & 2 \leq x \leq 4 \\ 0, & x > 4 \end{cases}$$

a probability density function? Estimate the probability that a variate having $f(x)$ as density function will fall in the interval $2 \leq x \leq 3$

[BL:Apply|CO: 2|Marks:6M]

MODULE-III

3. (a) Show that the Poisson distribution is a limiting case of Binomial distribution.

[BL: Apply|CO: 3|Marks:6M]

- (b) The life of electronic tubes of a certain type may be assumed to be normal distributed with mean 155 hours and standard deviation 19 hours. Calculate the probability that the life of a randomly chosen tube is (i) between 136 hours and 174 hours. (ii) less than 117 hours (iii) will be more than 195 hours. [BL: Apply|CO: 4|Marks:6M]
4. (a) Explain the properties of Binomial distribution. Obtain the formula for mean of Binomial Distribution. [BL: Understand|CO: 3|Marks:6M]
- (b) If X is a normal variate with mean 30 and standard deviation 5. Calculate the probabilities that i) $P(26 \leq x \leq 40)$ ii) $P(X \geq 45)$. [BL: Apply|CO: 4|Marks:6M]

MODULE-IV

5. (a) Outline the properties of Spearman's rank correlation coefficient. A random sample of 5 college students is selected and their grades in mathematics and statistics are found to be calculate Spearman's rank correlation coefficient.

	1	2	3	4	5
Mathematics	85	60	73	40	90
Statistics	93	75	65	50	80

[BL: Apply|CO: 5|Marks:6M]

- (b) Ten competitors in a musical test were ranked by the three judges A, B and C in the following order. Using rank correlation method, estimate which pair of judges has the nearest approach to common likings in music.

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

[BL: Apply|CO: 5|Marks:6M]

6. (a) Outline the proof of the formula for angle between two regression lines. [BL: Understand|CO: 5|Marks:6M]
- (b) If $\sigma_x = \sigma_y = \sigma$ and the angle between the regression lines are $\theta = \tan^{-1}(3)$. Outline the formula of angle between two regression lines. Obtain r. [BL: Understand|CO: 5|Marks:6M]

MODULE-V

7. (a) It is claimed that a random sample of 49 tires has a mean life of 15200 kms This sample was taken from population whose mean is 15150 kms and S.D is 1200 km Examine the truth value of the claim at 0.05 level of significant. [BL: Apply|CO: 6|Marks:6M]
- (b) A cigarette manufacturing firm claims that brand A line of cigarettes outsells its brand B by 8%. if it is found that 42 out of a sample of 200 smokers prefer brand A and 18 out of another sample of 100 smokers prefer brand B. Examine whether 8% difference is a valid claim. [BL: Apply|CO: 6|Marks:6M]
8. (a) The measurements of the output of two units have given the following results. Assuming that both samples have been obtained from the normal populations at 10% significant level, examine whether the two populations have the same variance.

Unit A	14.1	10.1	14.7	13.7	14.0
Unit B	14.0	14.5	13.7	12.7	14.1

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

- (b) From the following data, calculate whether there is any significant liking in the habit of taking soft drinks among the categories of employees.

Soft drinks	Clerks	Teachers	officers
Pepsi	10	25	65
Thumbs up	15	30	65
Fanta	50	60	30

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

****END OF EXAMINATION****

COURSE OBJECTIVES:

The course should enable the students to:

I	The theory of random variables, basic random variate distributions and their applications.
II	The Methods and techniques for quantifying the degree of closeness among two or more variables and linear regression analysis.
III	The Estimation statistics and Hypothesis testing which play a vital role in the assessment of the quality of the materials, products and ensuring the standards of the engineering process.
IV	The statistical tools which are essential for translating an engineering problem into probability model.

COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Explain the role of random variables and types of random variables, expected values of the discrete and continuous random variables under randomized probabilistic conditions.	Understand
CO 2	Interpret the parameters of random variate Probability distributions such as Binomial, Poisson and Normal distribution by using their probability functions, expectation and variance.	Understand
CO 3	Apply Bivariate Regression as well as Correlation Analysis for statistical forecasting.	Apply
CO 4	Make Use of estimation statistics in computing confidence intervals, Regression analysis and hypothesis testing.	Apply
CO 5	Identify the role of statistical hypotheses, types of errors, confidence intervals, the tests of hypotheses for large sample in making decisions over statistical claims in hypothesis testing	Apply
CO 6	Identify the tests of hypothesis for small sample in making decisions over statistical claims in hypothesis testing	Apply

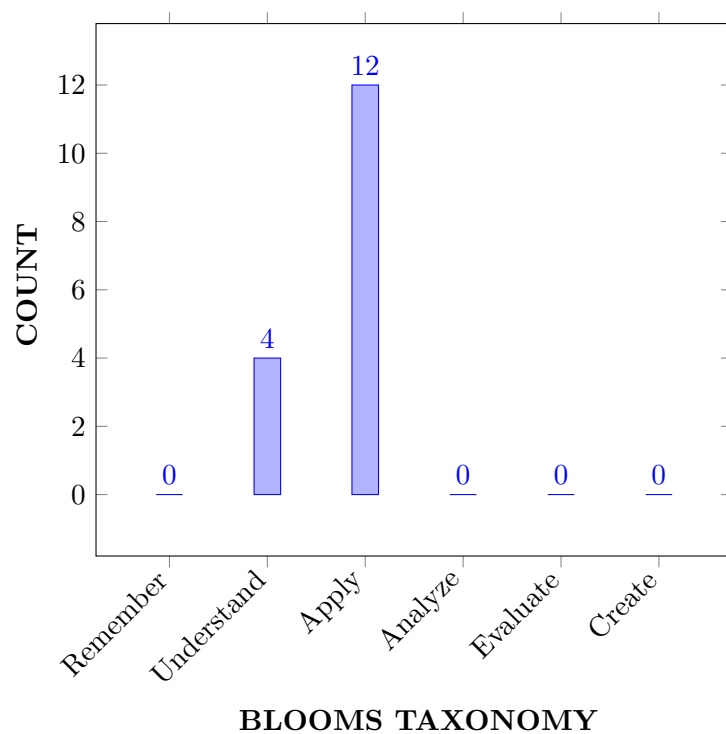
QUESTION PAPER 1: MAPPING OF SEMESTER END EXAMINATION QUESTIONS TO COURSE OUTCOMES

Q.No		All Questions carry equal marks	Taxonomy	CO's	PO's
1	a	Out of $(2n + 1)$ tickets consecutively numbered, three tickets are drawn at random. find the probability that the numbers on them are in Arithmetical Progression (A.P).	Apply	CO 1	PO 1,4

	b	A problem in statistics is given to the three students A, B and C whose chances of solving it or $\frac{1}{2}, \frac{3}{4}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved if all of them try independently.						Apply	CO 1	PO 1,4	
2	a	Outline the concept of random variables. A random variable x has the following probability function: Calculate (i) k (ii) $P(x < 6)$ (iii) $P(X \geq 6)$						Apply	CO 1	PO 1,4	
		x	0	1	2	3	4	5	6	7	
		P(X)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2 + k$	
	b	Is the function defined by a probability density function? Estimate the probability that a variate having $f(x) = \begin{cases} 0, x < 2 \\ \frac{1}{18}(2x + 3), 2 \leq x \leq 4 \\ 0, x > 4 \end{cases}$ a probability density function? Estimate the probability that a variate having $f(x)$ as density function will fall in the interval $2 \leq x \leq 3$						Apply	CO 1	PO 1,4	
3	a	Show that the Poisson distribution is a limiting case of Binomial distribution.						Understand	CO 2	PO 1,2	
	b	The life of electronic tubes of a certain type may be assumed to be normal distributed with mean 155 hours and standard deviation 19 hours. Calculate the probability that the life of a randomly chosen tube is (i) between 136 hours and 174 hours. (ii) less than 117 hours (iii) will be more than 195 hours						Apply	CO 2	PO 1,2	
4	a	Explain the properties of Binomial distribution. Obtain the formula for mean of Binomial Distribution.						Understand	CO 2	PO 1,2	
	b	If X is a normal variate with mean 30 and standard deviation 5. Calculate the probabilities that $i) P(26 \leq x \leq 40)$ $ii) P(X \geq 45)$.						Apply	CO 2	PO 1,2	
5	a	Outline the properties of Spearman's rank correlation coefficient. A random sample of 5 college students is selected and their grades in mathematics and statistics are found to be calculate Spearman's rank correlation coefficient.						Apply	CO 2	PO 1,2	
			1	2	3	4	5				
		Mathematics	85	60	73	40	90				
		Statistics	93	75	65	50	80				

	b	Ten competitors in a musical test were ranked by the three judges A, B and C in the following order. Using rank correlation method, estimate which pair of judges has the nearest approach to common likings in music.	Apply	CO 2	PO 1,2								
		Rank A	1	6	5	10	3	2	4	9	7	8	
		Rank B	3	5	8	4	7	10	2	1	6	9	
		Rank C	6	4	9	8	1	2	3	10	5	7	
6	a	Outline the proof of the formula for angle between two regression lines.	Understand	CO 2	PO 1,2								
	b	If $\sigma_x=\sigma_y=\sigma$ and the angle between the regression lines are $\theta = Tan^{-1}(3)$.Outline the formula of angle between two regression lines. Obtain r.	Understand	CO 2	PO 1,2								
7	a	It is claimed that a random sample of 49 tires has a mean life of 15200 kms This sample was taken from population whose mean is 15150 kms and S.D is 1200 km Examine the truth value of the claim at 0.05 level of significant.	Apply	CO 2	PO 1,2								
	b	A cigarette manufacturing firm claims that brand A line of cigarettes outsells its brand B by 8%. if it is found that 42 out of a sample of 200 smokers prefer brand A and 18 out of another sample of 100 smokers prefer brand B. Examine whether 8% difference is a valid claim.	Apply	CO 2	PO 1,2								
8	a	The measurements of the output of two units have given the following results. Assuming that both samples have been obtained from the normal populations at 10% significant level, examine whether the two populations have the same variance.	Apply	CO 2	PO 1,2								
			Unit A	14.1	10.1	14.7	13.7	14.0					
			Unit B	14.0	14.5	13.7	12.7	14.1					
	b	From the following data, calculate whether there is any significant liking in the habit of taking soft drinks among the categories of employees.	Apply	CO 2	PO 1,2								
		Soft drinks	Clerks	Teachers	officers								
		Pepsi	10	25	65								
		Thumbs up	15	30	65								
		Fanta	50	60	30								

KNOWLEDGE COMPETENCY LEVELS OF MODEL QUESTION PAPER



Signature of Course Coordinator

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