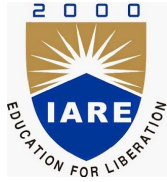


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Question Paper Code: AHSB12



# INSTITUTE OF AERONAUTICAL ENGINEERING (Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-I

B.Tech III Semester End Examinations, November 2020

Regulations: IARE - R18

## PROBABILITY AND STATISTICS (AERONAUTICAL & MECHANICAL)

Time: 3 hour

Maximum Marks: 70

Answer ONE Question from each MODULE

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

### MODULE-I

- (a) Outline the concept of simulation of random variables. Let  $X$  denotes the minimum of the two numbers that appear when a pair of fair dice is thrown once. calculate the (i) Expectation (ii) Variance. [7m]

(b) If the Probability density function of random variable is  $f(x) = k.(1 - x^2), 0 < x < 1$  then calculate (i)  $k$  (ii)  $P(0.1 < x < 0.2)$  (iii)  $P(x > 0.5)$  [7m]
- (a) State and prove Bayes law. [7m]

(b) A businessman goes to hotels  $X, Y, Z, 20\%, 50\%$  and  $30\%$  of the time respectively. It is known that  $5\%, 4\%, 8\%$  of the rooms in  $X, Y, Z$  hotels have faulty plumbing. Calculate the probability that business mans room having faulty pluming is assigned to hotel  $Z$ ? [7m]

### MODULE-II

- (a) Out of 20 tape recorders 5 are defective. Find the standard deviation of defective in the sample of 10 randomly chosen tape recorders. Find (i)  $P(X = 0)$  (ii)  $P(X = 1)$  (iii)  $P(X = 2)$  (iv)  $P(1 < X < 4)$ . [7m]

(b) The average number of phone calls per minute coming into a switch board between  $2P.M.$  and  $4P.M.$  is 2.5. Determine the probability that during one particular minute [7m] (i) 4 or fewer calls (ii) more than 6 calls.. [7m]
- (a) Explain the properties of Normal curve. [7m]

(b) The mean weight of 500 male students at a certain college is  $75kg$  and the standard deviation is  $7kg$ . Assuming that the weights are normally distributed find how many students weight (i) Between 60 and 78 kg (ii) more than 92kg. [7m]

### MODULE-III

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 shown in table. Calculate Spearman's rank correlation coefficient. [7m]

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

- (b) Explain the properties of Spearman's rank correlation coefficient. Calculate the Karl Pearson's coefficient of correlation from the following data. [7m]

Wages	100	101	102	102	100	99	97	98	96	95
Cost of living	98	99	99	97	95	92	95	94	90	91

6. (a) Interpret the properties of regression coefficients. [7m]
- (b) Outline the functions in R programming used for establishing linear regression. Construct the regression equation of Y on X from the data given below, taking deviations from actual means of X and Y. Estimate the likely demand when the price is Rs. 20. [7m]

Price (Rs.)	10	12	13	12	16	15
Amount Demanded	40	38	43	45	37	43

### MODULE-IV

7. (a) Define the standard error of sampling distribution of mean. If the mean of certain normal population is equal to the standard error of the mean of the samples of 64 from that distribution, Calculate the probability that the mean of the sample size 36 will be negative. [7m]
- (b) A population consists of 5, 10, 14, 18, 13, 24. Consider all possible samples of size two which can be drawn without replacement from this population. Find (i)  $\sigma$  (ii)  $\mu$  (iii)  $\sigma_x$  (iv)  $\mu_x$ . [7m]
8. (a) If 48 out of 400 persons in rural area possessed cell phones while 120 out of 500 in urban area. Can it be accepted that the proportion of cell phones in the rural area and Urban area is same or not. Use 5% of level of significance. [7m]
- (b) 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 15150kms and S.D is 1200 km test 0.05 level of significance. [7m]

### MODULE-V

9. (a) Pumpkins were grown under two experimental conditions. Two random samples of 11 and 9 pumpkins. the sample standard deviation of their weights as 0.8 and 0.5 respectively. Assuming that the weight distributions are normal, examine whether the true variances are equal or not. [7m]

- (b) Two independent samples of items are given respectively had the following values. Test whether there is any significant difference between their means? [7m]

Sample	11	11	13	11	15	9	12	14
Sample 2	9	11	10	13	9	8	10	-

10. (a) A sample of 26 bulbs gives a mean life of 990 hours with S.D of 20hrs. The manufacturer claims that the mean life of bulbs 1000 hrs. Examine whether the sample is up to the standard or not? [7m]

- (b) The following is the distribution of the number of trucks arriving at a company ware house for every two hours. Fit Poisson distribution as well as binomial distribution to the above table and Test for the assessment of goodness of fit of both distributions at 0.05 level. Also conclude which distribution frequencies are nearer to the original data. [7m]

Time intervals	0	2	4	6
Frequency of no of trucks <sub>j</sub>	52	130	45	3

**\*\*END OF EXAMINATION\*\***

## COURSE OBJECTIVES:

The course should enable the students to:

1	The Principles of probability, the theory of random variables, basic random variate distributions and their applications.
2	The Methods and techniques for quantifying the degree of closeness among two or more variables and linear regression analysis.
3	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.
4	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	Determine the conditional probability of interdependent events by using Bayes theorem.
CO 2	Explain simulation of random events by using the concept of random variables
CO 3	Calculate the expected values, variances of the discrete and continuous random variables for making decisions under randomized probabilistic conditions.
CO 4	Interpret the Probability distributions such as Binomial, Poisson and Normal distribution by using their probability functions and parameters.
CO 5	Apply the concepts of discrete and continuous probability distribution and CLT for solving real time problems under probabilistic conditions.
CO 6	Interpret the results of Bivariate and Multivariate Regression as well as Correlation Analysis for statistical forecasting.
CO 7	Identify the role of types of statistical hypotheses, types of errors, sampling distributions of means and confidence intervals in hypothesis testing.
CO 8	Apply tests of hypotheses for both large and small samples in making decisions over statistical claims.
CO 9	Test for the assessment of goodness of fit of the given probability distribution model by using Chi-square distribution.
CO 10	Make Use of R software package in computing confidence intervals, Regression analysis and hypothesis testing.
CO 11	Select appropriate statistical methods for solving real-time engineering problems governed by laws of probability.

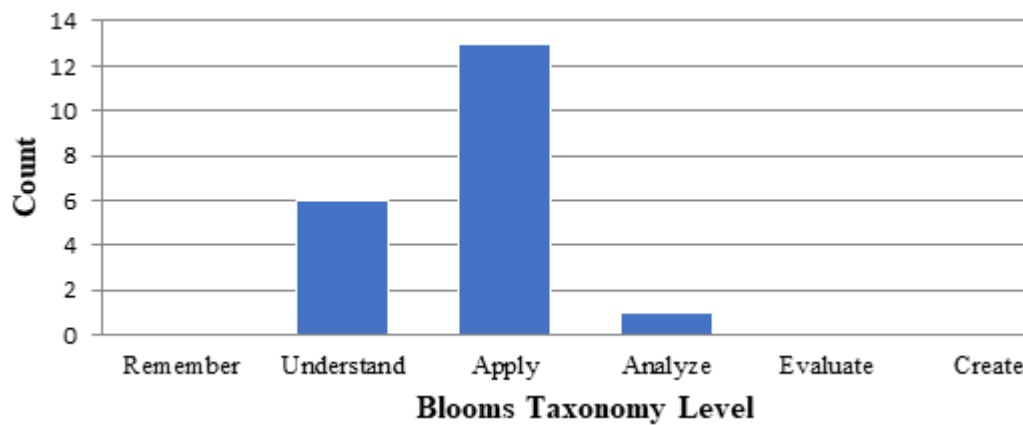
**MAPPING OF SEMESTER END EXAMINATION QUESTIONS TO COURSE OUTCOMES**

Q.No		All Questions carry equal marks	Taxonomy	CO's	PO's
1	a	Outline the concept of simulation of random variables. Let X denotes the minimum of the two numbers that appear when a pair of fair dice is thrown once. calculate the (i) Expectation (ii) Variance.	Understand	CO 2	PO 1
	b	If the Probability density function of random variable is $f(x) = k.(1 - x^2), 0 < x < 1$ then calculate (i) k (ii) $P(0.1 < x < 0.2)$ (iii) $P(x > 0.5)$	Apply	CO 3	PO 1,4
2	a	State and prove Bayes law.	Apply	CO 1	PO 1,4
	b	A businessman goes to hotels X, Y, Z, 20%, 50% and 30% of the time respectively. It is known that 5%, 4%, 8% of the rooms in X, Y, Z hotels have faulty plumbing. Calculate the probability that business mans room having faulty pluming is assigned to hotel Z?	Apply	CO 1	PO 1,4
3	a	EOut of 20 tape recorders 5 are defective. Find the standard deviation of defective in the sample of 10 randomly chosen tape recorders. Find (i) $P(X = 0)$ (ii) $P(X = 1)$ (iii) $P(X = 2)$ (iv) $P(1 < X < 4)$ .	Apply	CO 5	PO 1,2
	b	The average number of phone calls per minute coming into a switch board between 2P.M. and 4P.M. is 2.5. Determine the probability that during one particular minute (i) 4 or fewer calls (ii) more than 6 calls..	Apply	CO 5	PO 1,2
4	a	Explain the properties of Normal curve.	Understand	CO 4	PO 1
	b	The mean weight of 500 male students at a certain college is 75kg and the standard deviation is 7kg. Assuming that the weights are normally distributed find how many students weight (i) Between 60 and 78 kg (ii) more than 92kg.	Apply	CO 5	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 shown in table. Calculate Spearman's rank correlation coefficient. <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>Mathematics</td> <td>85</td> <td>60</td> <td>73</td> <td>40</td> <td>90</td> </tr> <tr> <td>Statistics</td> <td>93</td> <td>75</td> <td>65</td> <td>50</td> <td>80</td> </tr> </table>		1	2	3	4	5	Mathematics	85	60	73	40	90	Statistics	93	75	65	50	80	Understand	CO 6	PO 1,4				
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8	a	If 48 out of 400 persons in rural area possessed cell phones while 120 out of 500 in urban area. Can it be accepted that the proportion of cell phones in the rural area and Urban area is same or not. Use 5% of level of significance.	Apply	CO 8	PO 1,2																						

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## KNOWLEDGE COMPETENCY LEVELS OF MODEL QUESTION PAPER



Signature of Course Coordinator

HOD, Freshmen Dept  
Freshmen Dept