

G.R. No.	
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**DECEMBER 2021 - ENDSEM EXAM**  
**S.Y. B. TECH. (E & TC) (SEMESTER - I)**  
**COURSE NAME: Probability and Statistics**  
**COURSE CODE: ES21201ET**  
**(PATTERN 2020)**

Time: [1Hr]

[Max. Marks: 30]

**Instructions to candidates:**

- 1) Answer Q.1 OR Q.2, Q.3 OR Q.4, Q.5 OR Q.6.
- 2) Figures to the right indicate full marks.
- 3) Use of scientific calculator is allowed
- 4) Use suitable data where ever required

- Q.1 a A fair die is rolled eight times. Calculate the probability that no more than 2 sixes come up. [4]
- Q.1 b In the article “Advances in Oxygen Equivalent Equations for Predicting the Properties of Titanium Welds” (D. Harwig, W. Ittiwattana, and H. Castner, *The Welding Journal*, 2001:126s–136s), the authors propose an oxygen equivalence equation to predict the strength, ductility, and hardness of welds made from nearly pure titanium. The equation is  $E = 2C + 3.5N + O$ , where  $E$  is the oxygen equivalence, and  $C$ ,  $N$ , and  $O$  are the proportions by weight, in parts per million, of carbon, nitrogen, and oxygen, respectively (a constant term involving iron content has been omitted). Assume that for a particular grade of commercially pure titanium, the quantities  $C$ ,  $N$ , and  $O$  are approximately independent and normally distributed with means  $\mu C = 150$ ,  $\mu N = 200$ ,  $\mu O = 1500$ , and standard deviations  $\sigma C = 30$ ,  $\sigma N = 60$ ,  $\sigma O = 100$ . Obtain the distribution of  $E$ . Calculate  $P(E > 3000)$ . [6]
- OR**
- Q2 a A student’s campus newspaper in a particular university contains an average of 1.2 typographical errors per page. [4]
- i. Evaluate probability that a randomly selected page of the newspaper will contain exactly 4 typographical errors.
  - ii. Compute probability that the number of typographical errors on a randomly selected page will be less than 4
- Q2 b A process manufactures ball bearings whose diameters are normally distributed with mean 2.505 cm and standard deviation 0.008 cm. Specifications call for the diameter to be in the interval  $2.5 \pm 0.01$  cm. What proportion of the ball bearings will meet the specification? [6]
- Q.3 a A bank Teller serves customers in a queue one by one. Suppose the [4]

service time  $X_i$  for a customer  $i$  has mean = 2 and variance = 1. Let  $Y$  be the total time the teller spends to serve 50 customers. Calculate  $P(95 < Y < 105)$

- Q.3 b In a series of experiments to determine the absorption rate of certain pesticides into skin, measured amounts of two pesticides were applied to several skin specimens. After a time, the amounts absorbed (in  $\mu\text{g}$ ) were measured. For pesticide A, the variance of the amounts absorbed in 6 specimens was 2.3, while for pesticide B, the variance of the amounts absorbed in 10 specimens was 0.6. Assume that for each pesticide, the amounts absorbed are a simple random sample from a normal population. Can we conclude that the variance in the amount absorbed is greater for pesticide A than for pesticide B? (Consider  $\alpha = 0.05$ ) [6]

OR

- Q.4 a Perform the chi-square test for the null hypothesis that the row and column outcomes are independent [4]

	Observed Values		
A	15	10	12
B	3	11	11
C	9	14	12

- Q.4 b A research claimed that there is a weight loss in mice after a disease. Following table shows weight of mice before and after the disease. (in gms) [6]

Mouse	1	2	3	4	5	6
Weight (Before)	22.3	19.8	20.5	21.6	19.4	19.5
Weight (After)	22.2	19.7	20.3	21.6	19.3	19.5

At  $\alpha = 0.05$ , is there enough evidence to support the claim? (Assume Samples normally distributed and dependent) **Hint: Use t distribution**

- Q.5 a In a table given marks of a student for two subjects are given. Calculate the correlation coefficient by the method of concurrent deviation [4]

Sub1	8	36	98	25	75	82	90	62	65	39
Sub2	84	51	91	60	68	62	86	58	53	47

- Q.5 b In the following table data for Force (N) and velocity (m/s) for an object suspended in wind tunnel is given. [6]

Velocity	10	20	30	40	50	60	70	80
Force	24	68	378	552	608	1218	831	1452

Use linear regression to determine slope and intercept of fitted line and estimate the force when velocity is 55 m/s

**OR**

Q.6 a Curing times in days ( $x$ ) and compressive strengths in MPa ( $y$ ) were recorded for several concrete specimens. [4]

The means and standard deviations of the  $x$  and  $y$  values were  $\mu_x = 5$ ,  $s_x = 2$ ,  $\mu_y = 1350$ ,  $s_y = 100$ . The correlation between curing time and compressive strength was computed to be  $r = 0.7$ . Compute the equation of the least-squares line to predict compressive strength from curing time.

Q.6 b Calculate Pearson correlation coefficient for the following data and interpret the result. [6]

X	2	4	5	6	8	11
Y	18	12	10	8	7	5