JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST 3 EXAMINATION- 2025
B.Tech-III Semester (BT/BI)

COURSE CODE (CREDITS): 25B11MA313 (4) MAX. MARKS: 35
COURSE NAME: PROBABILITY AND STATISTICAL TECHNIQUES
COURSE INSTRUCTORS: MDS MAX. TIME: 2 Hours

Note: (a)All questions are compulsory.
(b) The candidate is allowed to make suitable numeric assumptions wherever required for solving problems
(c) Scientific calculator is allowed.

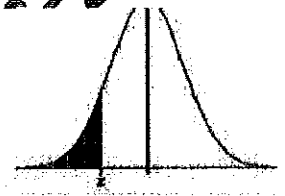
Q.No	Question	CO	Marks
Q1	The following frequency distribution has two missing frequencies: Class Interval: 0–20 | 20–40 | 40–60 | 60–80 | 80–100 Frequency: 17 | f_1 | 32 | f_2 | 19 The total frequency is 120, and the mean of the distribution is 50. Find the missing frequencies f_1 and f_2.	CO-1	4
Q2	A bag X contains 8 white and 4 black balls. A second bag Y contains 5 white and 6 black balls. One ball is drawn at random from bag X and placed in Bag Y. Now, a ball is drawn at random from bag Y. It is found that this ball is white. Find the probability that a black ball has been transferred from bag X.	CO-2	3
Q3	The diameters of balls produced by a machine are normally distributed with a mean of 5 cm and a standard deviation of 0.02 cm, that is, $X \sim N(5, 0.02^2)$. Find the percentage of balls whose diameters lie between 4.97 cm and 5.02 cm.	CO-2	3
Q4	A DNA extraction kit claims that the mean DNA yield per extraction is 35 µg. The population standard deviation is known to be 5 µg. A biotechnology research laboratory tests a random sample of 50 DNA extractions and obtains a sample mean yield of 33.7 µg. At the 5% level of significance, test whether the true mean DNA yield is different from the claimed mean of 35 µg.	CO-3	4
Q5	A company tests life times (hours) of two LED bulb processes. Process A: 1120 | 1150 | 1110 | 1130 | 1140 Process B: 1080 | 1100 | 1090 | 1095 | 1110 Test at the 5% significance level whether the mean lifetimes differ. Assume population variances unknown but equal.	CO-3	5
Q6	For the following data: X: 65 | 66 | 67 | 67 | 68 | 69 | 70 | 72 Y: 67 | 68 | 65 | 68 | 72 | 72 | 69 | 71 Calculate the Karl Pearson's coefficients between X and Y.	CO-4	5
Q7	A company claims that its customers choose among four brands A, B, C, and D in the ratio 4 : 3 : 2 : 1. To verify this claim, a random sample of 200 customers was collected, and the following distribution was observed: Brand: A | B | C | D Observed Frequency: 84 | 60 | 38 | 18 Using the chi-square (χ^2) goodness-of-fit test, calculate the value of χ^2.	CO-3	5
Q8	A retail store wants to compare the performance of its three billing counters in terms of customer waiting time. To study this, the waiting time (in minutes) of four customers at each counter was recorded as follows: Counter 1: 8 | 9 | 7 | 10 Counter 2: 6 | 7 | 6 | 8 Counter 3: 9 | 11 | 10 | 12 Using a One-Way ANOVA, test at the 5% level of significance whether there is any	CO-5	6

	significant difference in the mean waiting times among the three counters. Prepare the ANOVA table and state your conclusion.		

t Distribution: Critical Values of t

Degrees of freedom	*Two-tailed test:* / *One-tailed test:*	*Significance level* 10% / 5%	5% / 2.5%	2% / 1%	1% / 0.5%	0.2% / 0.1%	0.1% / 0.05%
1		6.314	12.706	31.821	63.657	318.309	636.619
2		2.920	4.303	6.965	9.925	22.327	31.599
3		2.353	3.182	4.541	5.841	10.215	12.924
4		2.132	2.776	3.747	4.604	7.173	8.610
5		2.015	2.571	3.365	4.032	5.893	6.869
6		1.943	2.447	3.143	3.707	5.208	5.959
7		1.894	2.365	2.998	3.499	4.785	5.408
8		1.860	2.306	2.896	3.355	4.501	5.041
9		1.833	2.262	2.821	3.250	4.297	4.781
10		1.812	2.228	2.764	3.169	4.144	4.587

Standard Normal Cumulative Probability Table



Cumulative probabilities for NEGATIVE z-values are shown in the following table:

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
-1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
-1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
-1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
-1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
-1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
-1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
-1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
-1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379

Z-Critical Values Table

Level of significance, α	0.10	0.05	0.01	0.005	0.002
Critical values of z for one-tailed tests	-1.28 *or* 1.28	-1.645 *or* 1.645	-2.33 *or* 2.33	-2.58 *or* 2.58	-2.88 *or* 2.88
Critical values of z for two-tailed tests	-1.645 *and* 1.645	-1.96 *and* 1.96	-2.58 *and* 2.58	-2.81 *and* 2.81	-3.08 *and* 3.08

Critical Values of the *F*-Distribution

$f_{0.05}(v_1, v_2)$

v_2 \ v_1	1	2	3	4	5	6	7	8	9
1	161.45	199.50	215.71	224.58	230.16	233.99	236.77	238.88	240.54
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02