JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST- 2 EXAMINATIONS - 2022

B. Tech. - III Semester (ECE/ECM)

COURSE CODE (CREDITS): 18B11MA314 (4) MAX. MARKS: 25

COURSE NAME: PROBABILITY THEORY AND RANDOM PROCESSES

COURSE INSTRUCTORS: SST MAX. TIME: 1 Hour and 30 Minutes

Note: All questions are compulsory. Marks are indicated against each question in square brackets. Use of scientific calculator is allowed.

Q1. A student buys 1000 integrated circuits (ICs) from supplier A, 2000 ICs from supplier B, and 3000 ICs from supplier C. He tested the ICs and found that the conditional probability of an IC being defective depends on the supplier from whom it was bought. Specifically, given that an IC came from supplier A, the probability that it is defective is 0.05; given that an IC came from supplier B, the probability that it is defective is 0.10; and given that an IC came from supplier C, the probability that it is defective is 0.10. If the ICs from the three suppliers are mixed together and one is selected at random, what is the probability that it is defective? **(CO1)[3]**

Q2. The probability mass function of the number N of signals arrived at a node within a one-hour interval is defined by, $p_N(n) = \begin{cases} \frac{5^n}{n!}e^{-5}, n = 0,1,\dots \\ 0 \quad\quad , otherwise \end{cases}$. What is the probability that at most two signals arrive at the node within one hour? **(CO2)[3]**

Q3. An electronic engineer installs 2000 microcontrollers with a functional life that is normally distributed with a mean of 1000 hours and a standard deviation of 200 hours.

a) How many microcontrollers are expected to fail in the first 700 functional hours?

b) How many microcontrollers are expected to fail between 900 and 1300 functional hours?

(CO3)[4]

Q4. If first four central moments of a distribution are 0, 2, 0 and 16 respectively, find the measure of kurtosis and state the type of the frequency curve based on it. **(CO3)[2]**

Q5. Transistor gain between emitter and collector in an integrated circuit device (hFE) is related to emitter drive-in time (x, in minutes). Ten samples were observed following eposition, and the resulting data are shown in the table below. Find a linear regression model using gain as the response and emitter drive-in time as the regressor variable. **[P.T.O.]**

No. of Observation	Drive-in time (minutes)	Transistor gain (hFE)
1	195	1004
2	255	1624
3	195	852
4	255	1506
5	255	1272
6	255	1270
7	255	1269
8	195	903
9	195	915
10	335	1325

(CO3)[5]

Q6. From the following data of the scores secured by 8 students in two Olympiads A and B, compute the Spearman's rank correlation coefficient.

Olympiad *A*	15	20	28	12	40	60	20	80
Olympiad *B*	40	30	50	30	20	10	30	60

(CO4)[4]

Q7. One sample of 10 tuning indicators gives a standard deviation of 9 months of life and another sample of 11 tuning indicators gives a standard deviation of 10 months of life. Can you say the variations are different at 5 % level of significance? **(CO1)[4]**

Useful statistical values

-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
-0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
-0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545

$$t_{0.05,9df} = 2.26,\ t_{0.5,9df} = 0.70,\ t_{0.01,9df} = 3.25,\ t_{0.05,10df} = 2.23$$

$$F_{0.10,9,10} = 2.35,\ F_{0.10,10,11} = 2.25,\ F_{0.05,9,10} = 3.02,\ F_{0.05,10,11} = 2.85$$