Total No. of Questions – [6] Total No. of Printed Pages: 04

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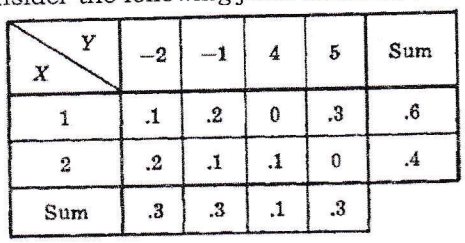
S. Y. B.TECH. (E & TC) (SEMESTER –III)
COURSE NAME: Probability and Statistics
COURSE CODE: ES21182ET
(PATTERN 2018)

Time: [2 Hours] [Max. Marks: 50]

(*) Instructions to candidates:
1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of scientific calculator is allowed.
4) Assume suitable data where ever required.

Q.1)	Attempt any **one**		
	a)	The probability that India wins a cricket match against Australia is 2/5. If three matches are played between the two teams, what is the probability that i. India win at least one match ii. India win at most one match	[4]
	b)	In a class 10 boys and 5 girls, three students are selected random one after the other. Find the probability that i. first two are boys and third is girl ii. first and third is of same gender and third is of opposite gender	[4]
Q.2)	Attempt any **one**		
	a)	A shipment of 8 similar microcomputers to a retail outlet contains 3 that are defective. If a school makes a random purchase of 2 of these computers, find and sketch the probability distribution (pdf) for number of defective pieces. Also find and sketch cdf.	[4]
	b)	A continuous random variable T is used to model number of days, t, and a mosquito survives after hatching. The CDF is given by $F(t) = 1 - \frac{225}{(t+15)^2}$, $t > 0$ i. Find the probability that a randomly selected mosquito will die within 3 days of hatching. ii. Given that mosquito survived for 3 days, find the probability that it will survive for at least 5 more days.	[4]

Q.3)	Attempt any **one**		
	a)	Let X and Y be jointly continuous RVs. With joint Pdf $F_{XY}(X,Y) = cx^2y \ for \ 0 \leq y \ll x \ll 1$ i. Find constant c ii. Find marginal Pdfs $f_X(x) and \ f_Y(y)$	[6]
	b)	Consider the following joint distribution of X and Y  Find COV (X,Y)	[6]

X \ Y	−2	−1	4	5	Sum
1	.1	.2	0	.3	.6
2	.2	.1	.1	0	.4
Sum	.3	.3	.1	.3	

Q.4)	Attempt any **one**		
	a)	1. Calculate the skew and kurtosis of an Uniform distribution, distributed over an interval [0,1] 2. Busses arrive at a stop at 15 min. interval starting at 7AM. If a passenger arrives at the stop at a random time that is uniformly distributed between 7 AM and 7:30 AM. Find probability that he waits i. <5min. ii. at least 12 min.	[6] [4]
	b)	1. The time taken to assemble a car in a certain plant is a random variable having a normal distribution of 20 hours and a standard deviation of 2 hours. What is the probability that a car can be assembled at this plant in a period of time a) Less than 19.5 hours? b) between 20 and 22 hours? 2. The service rate at a supermarket checkout is 6 customers per hour. If the service time is exponential, find the following probabilities. a) A service is completed in 5 min. b) A customer leaves the counter more than 10 minutes after arriving (Hint: Use CDF of exponential distribution : $F(x) = 1 - e^{-x/\lambda}, \ x \geq 0$	[6] [4]
Q.5)	Attempt any **one**		

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	a)	i. Show that the Random process $X(t) = A\cos(w_c t + \emptyset)$, where $\emptyset$ is uniformly distributed over [0,2π] is wide sense stationary process ii. The random process $X(t) = a\cos(w_c t + \emptyset)$, where A is uniformly distributed between [2, 3] and w_c and $\emptyset$ are constants. a. Sketch the ensemble of the random process. b. Justify whether it is stationary or non-stationary process	[7] [6]
	b)	i. Consider the power signal x(t) with autocorrelation Rx(τ)=200 sinc(200t). Find and plot. a. Power spectral density of input b. The process is passed through ideal LPF with cutoff 50 Hz. Find output power. For each of the following functions, state whether it can be a valid PSD? Give the justification (a) $\frac{\omega^2}{\omega^2+16}$ (b) $\frac{1}{\omega^2-16}$ (c) $\frac{\omega}{\omega^2+16}$ (d) $\delta(\omega)+\frac{1}{\omega^2+16}$ (e) $\delta(\omega+\omega_0)-\delta(\omega-\omega_0)$ (f) $j[\delta(\omega+\omega_0)+\delta(\omega-\omega_0)]$	[7] [6]
Q.6)	Attempt any one		
	a)	1. A doctor believes that the proportions of births in the country on each day of the week are equal. A random sample form 700 births in recent year is selected and the results are shown in the table below. At a significance level of 0.01, is there enough evidence to support doctor's claim?	[7]

Day	Sun	Mon	Tue	Wed	Thurs	Fri	Sat
Frequency	65	103	114	116	115	112	75

		2. A bank teller serves customers in a queue one by one. Suppose that the service time Xi for customer i has mean =2 and var=1. Let Y be the total time spent serving 50 customers. Find P(90 <Y <110)	[6]
	b)	1. The values of x and their corresponding values of y are shown in the table below	[7]

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x	0	1	2	3	4
y	2	3	5	4	6

a) Find the least square regression line y = a x + b.
b) Estimate the value of y when x = 10.

2. The side effects of a new drug are being tested. A sample of 565 patients yields the results below. At a significance level of 0.05, is there enough evidence to conclude that the treatment is independent of the side effects. [6]

Result	Drug1	Drug2
Nausea	36	13
No nausea	254	262

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