B.Tech Even Semester (CBCS) Exam. July 2021

Computer Science & Engineering / Agricultural Engineering / Electronics & Communication Engineering

(2nd Semester)

Course No: ASH-202

(Mathematics-II)

Full Marks: 50

Pass Marks : 25

Time: 2 hours

1. Answer any five questions.
2. Begin each answer in a new page.
3. Answer parts of a question at a place.
4. Assume reasonable data wherever required.
5. The figures in the right margin indicate full marks for the question.

1. (a) Define a normal distribution and discuss the utility of the same.

   (b) In a normal distribution, 7% of observations are below 35 and 11% are above 63. What are the mean and standard deviation? Given that $P(-1.48 < Z < 0) = 0.43$. 4+6=10

2. (a) A large number of automobile batteries have an average life length of 24 months. 34% of them have average life between 22 and 26 months and 272 of them last longer than 29 months. If life of the batteries follows normal distribution, how many batteries were tested? What is the standard deviation? Given that $P(0 < Z < 0.44) = 0.17$ and $P(0 < Z < 1.1) = 0.3643$.

(b) What is Chybychev inequality? What is it used for? 6+4=10

3. Let the probability density function of a random variable X be

$$f(x) = \begin{cases} 630x^4\ (1-x^4), & 0<x<1, \\ 0, & \text{elsewhere} \end{cases}$$

What is the exact value of $P(|X - \mu| < 2\sigma)$, where μ and σ are mean and standard deviation of X respectively? What is the approximate value of $P(|X - \mu| < 2\sigma)$ when we use Chebychev inequality? 5+5=10

4. (a) Fit a straight line to the following data using the method of least squares:

x	0	1	2	3	4	
y	1	7	5	9	6	

(b) What are the applications of curve fitting techniques? 7+3

5. (a) Derive the mean and variance of the exponential distribution.

(b) If X is exponentially distributed, prove that the probability that X exceeds its expected value is less than 0.5. 5+5=10

6. (a) Define the term correlation coefficient between two random variables X and Y. Show that if X and Y are independent, then the correlation coefficient between X and Y is zero.

(b) If X and Y are two independent random variables with E(X) = 0 = E(Y), show that Var(XY) = Var(X) Var (Y). 5+5=10

7. Let two random variables X and Y have the joint density function

$$f(x,y) = \begin{cases} x+y & 0 < x < 1,\ 0 < y < 1 \\ 0, & \text{elsewhere} \end{cases}$$

What $P(2X < 1 \mid X+Y < 1)$ is? 10

8. Discuss the following terms with examples in connection with test of significance:

(a) alternate hypothesis

(b) null hypothesis

(c) level of significance

(d) type I error

(e) type II error. 10

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