

(3 Hours)

Total Marks : 100

- N. B. :** (1) Question No.1 is compulsory.  
(2) Attempt **any four** questions form the remaining **six** questions.  
(3) Figures to the right indicate full marks.  
(4) Use of statistical table is allowed.

1. (a) Derive wave equation for vibration of string. 5  
(b) If  $6y = 5x + 90$  and  $15x = 8y + 130$  are the two lines of regression then find  $\bar{x}$ ,  $\bar{y}$ ,  $r$ . 5  
(c) Find the furrier sevice for  $f(x) = x$  in  $(-1, 1)$  5  
(d) If  $x$  is Binomially distributed with  $E(x) = 2$  and  $v(x) = \frac{4}{3}$  then find the probability distribution of  $x$ . 5

2. (a) A discrete random variable has the probablity density function given below 6

x	-2	-1	0	1	2	3
p(x=x)	0.2	k	0.1	2k	0.1	2k

Find K and mean

- (b) Fit a Binomial distribution to the following data 6

x	0	1	2	3	4	5	6
f	5	18	28	12	7	6	4

Also calculate the expected frequencies.

- (c) Find the Fourier series expansion of  $f(x) = x^2, -\pi \leq x \leq \pi$  8
3. (a) Calculate the coefficient of correlation between  $x$  and  $y$  from the following data 6

x	3	5	4	6	2
y	3	4	5	2	6

- (b) Find the Fourier series expansion for 6

$$f(x) \begin{cases} = \pi + x, & -\pi < x < 0 \\ = \pi - x, & 0 < x < \pi \end{cases}$$

- (c) Find the equation of line of requession for  $y$  on  $x$  from the following data. 8

x	36	32	34	31	31	32	35
y	35	33	31	30	34	32	36

4. (a) Find half range cosine series for  $f(x) = x$  in  $(0, 2)$  6  
(b) Using poission distribution find the probability that atmost 4 defective bulbs will be found in a box of 200 bulbs if it is known that 2 percent of the bulbs are defective. 6

- (c) Calculate the rank correlation coefficient from the following data. 8

x	12	17	22	27	32
y	113	119	117	115	121

5. (a) If X is a normal variate with mean 10 and standard deviation 4 then find 6  
 (i)  $P(5 \leq x \leq 18)$       (ii)  $P(x \leq 12)$   
 (b) Obtain the Fourier series for  $f(x)$ , where 5

$$f(x) \begin{cases} = -c, & -a < x < 0 \\ = c, & 0 < x < a \end{cases}$$

- (c) Fit a Poisson distribution to the following data 8

x	0	1	2	3	4
y	123	59	14	3	1

Also calculate the expected frequencies.

6. (a) Expand  $f(x) = lx - x^2, 0 < x < l$  in a half range sine series. 6  
 (b) A manufacturer knows from his experience that the resistance of resistors, he produces is normal with  $\mu = 100$  ohms and standard deviation  $\sigma = 2$  ohms. What percentage of resistors will have resistance between 98 ohms and 102 ohms? 6

- (c) Determine the solution of one-dimensional heat equation  $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$  under 8  
 the boundary conditions  $u(0,t) = 0, u(l,t) = 0$  and  $u(x,0) = x (0 < x < l)$ ,  $l$  being the length of the rod.

7. (a) A machine is set to produce metal plates of thickness 1.5 cms with standard deviation 0.2 cms. A sample of 100 plates produced by the machine gave an average thickness of 1.52 cms. Is the machine fulfilling the purpose? 6  
 (b) Theory predicts that the proportion of beans in the four groups A, B, C, D should be 2 : 3 : 3 : 1. In an experiment among 1600 beans, the numbers in the four groups were 882, 313, 287 and 118. Does the experimental results support the theory? 6

- (c) A string is stretched and fastened to two points distance  $l$  apart. Motion is 8  
 started by displacing the string in the form  $y = a \sin\left(\frac{\pi x}{l}\right)$  from which it is released at time  $t = 0$ . Show that the displacement of a point at a distance  $x$  from one end at time  $t$  is given by  $y_{(x,t)} = a \sin\left(\frac{\pi x}{l}\right) \cos\left(\frac{\pi ct}{l}\right)$ .