



Reg. No. :

Name :

**Fourth Semester B.Tech. Degree (Suppl. – Including Part Time)
Examination, May 2018
(2007 Admission Onwards)**

PT2K6/2K6 CE/ME/EE/EC/CS/IT/AEI 401 : ENGINEERING MATHEMATICS – III

Time : 3 Hours

Max. Marks : 100

Instruction : Answer all questions.**PART – A**

1. a) Show that the function $u = 3x^2y - y^3$ is harmonic and find a corresponding analytic function $f(z) = u(x, y) + iv(x, y)$.
- b) Find the image of the semi-infinite strip $x > 0, 0 < y < 2$ under the transformation $w = iz + 1$. Show the regions graphically.
- c) Using Cauchy's integral formula, evaluate $\int_C \frac{\cos \pi z^2}{(z-1)(z-2)} dz$ where $C: |z| = \frac{3}{2}$.
- d) Expand $f(z) = \sin z$ in a Taylor's series about $z = \frac{\pi}{4}$.
- e) Show that the correlation coefficient is less than or equal to 1 in magnitude.
- f) Define joint probability mass function on two random variables X and Y.
- g) Find a solution of the Laplace equation $u_{xx} + u_{yy} = 0$ by the method of separation of variables.
- h) Using D'Alembert's method, find the deflection of a vibrating string of unit length having fixed ends with initial velocity zero and initial displacement $f(x) = a \sin^2(\pi x)$.

(8×5=40)

PART – B

2. a) Find the bilinear transformation which maps the point $z = -2i, i, \infty$ onto the points $w = 0, -3, \frac{1}{3}$ respectively. Find the image of $|z| < 1$.

15

OR**P.T.O.**

- b) 1) Derive the Cauchy-Riemann differential equations of analytic functions. 8
 2) Show that $u = xy$ is harmonic and find a corresponding analytic function $f(z) = u + iv$. 7
3. a) 1) Evaluate $\int_0^{2\pi} \frac{1}{(25 + 7 \cos \theta)} d\theta$ using residues. 8
 2) Prove that $\int_0^{\infty} \frac{x^2}{x^2 + 1)(x^2 + 4)} dx = \frac{\pi}{6}$. 7
- OR
- b) 1) Find Laurent's series in the region $2 < |z| < 3$ if $f(z) = \frac{z^2 - 1}{(z+2)(z+3)}$. 8
 2) State and prove Cauchy's residue theorem. 7
4. a) For the joint probability distribution of two random variables X and Y is given below.

X \ Y	1	2	3	4	Total
1	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$	$\frac{10}{36}$
2	$\frac{1}{36}$	$\frac{3}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{9}{36}$
3	$\frac{5}{36}$	$\frac{1}{36}$	$\frac{1}{36}$	$\frac{1}{36}$	$\frac{8}{36}$
4	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{1}{36}$	$\frac{5}{36}$	$\frac{9}{36}$
Total	$\frac{11}{36}$	$\frac{9}{36}$	$\frac{7}{36}$	$\frac{9}{36}$	1

Find :

- 1) Marginal distributions of X and Y.
- 2) Conditional distribution of X given the value of Y = 1 and that of Y given the value of X = 2.

OR

(7+8=15)

b) From the following data, find

- 1) The two regression equations
- 2) The coefficient of correlation between the marks in Economics and Statistics.

3) The most likely marks in Statistics when marks in Economics are 30. 15

Marks in Economics	25	28	35	32	31	36	29	38	34	32
Marks in Statistics	43	46	49	41	36	32	31	30	33	39

5. a) A string of length l is initially at rest in equilibrium position and each of its points is given the velocity $\left(\frac{\partial u}{\partial t}\right)_{t=0} = b \sin^3\left(\frac{\pi x}{l}\right)$. Find the displacement $y(x, t)$. 15

OR

b) 1) Derive one dimensional heat flow equation. 7

2) Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ with boundary conditions $u(x, 0) = 3 \sin n\pi x$,
 $u(0, t) = 0, u(1, t) = 0$, where $0 < x < 1, t > 0$. 8

**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,
LONERE - RAIGAD - 402 103
Summer Semester Examination, May - 2019**

Branch: B. Tech. (CE / CSE / CS)

Semester: IV

Subject with Subject Code: Probability and Statistics [BTCOC402]

Marks: 60

Date: 16 / 05 / 2019

Time: 3 Hrs.

Instructions: 1] Attempt any 5 Questions from Q. No. 1 to Q. No. 6.

- 2] Figures / structures to the right indicate full marks.
- 3] Assume suitable data, if necessary and mentioned it clearly.
- 4] Neat diagrams must be drawn wherever necessary.

Q. No. 1 Solve the following questions:

- A) A box contains 3 red and 7 white balls. One ball is drawn at random and its place a ball of other [3] color is put in the box. Now the ball is drawn at random from the box. Find the probability it is of red color.
- B) The probability that a management trainee will remain with the company is 0.6. The [3] probability that an employee earn more than Rs. 10,000 per month is 0.50. The probability that an employee is a management trainee who remained with the company or who earns more than Rs. 10,000 per month is 0.70. What is the probability that an employee earns more than Rs. 10,000 per month, given that he is a management trainee who stay with the company?
- C) A piece of equipment will function only when all the three components A, B and C are working. [3] The probability that A failing over one year is 0.15, that of the B failing is 0.05 and that of the C failing is 0.10. What is the probability that equipment will fail before the end of one year?
- D) In a class of 75 students, 15 were considered to be very intelligent, 45 as medium and the rest [3] below average. The probability that a very intelligent student fails in viva-voce examination is 0.005; the medium student failing has probability 0.05; and corresponding probability for a below average student is 0.15. If a student is known to have passed the viva-voce examination, what is the probability that he is below average?

Q. No. 2 Attempt any THREE of the Followings:

- A) For any Three random variables X_1, X_2, X_3 show that [4]
$$\text{Cov}(X_1 + X_2, X_3) = \text{Cov}(X_1, X_3) + \text{Cov}(X_2, X_3)$$
- B) Find the variance of the number obtained on a throw of an unbiased die. [4]
- C) An urn contains 7 white and 3 red balls. Two balls are drawn together, at random, from this [4] urn. Compute the probability that neither of them is white. Find also the probability of getting one white and one red ball. Hence compute the expected number of white balls drawn.
- D) A die is tossed twice. Getting 'a number greater than 4' is considered a success. Find the mean [4] and variance of the probability distribution of number of successes.

Q. No. 3 Attempt any THREE of the Followings:

Q. No. 4 Solve the following questions:

- A)** Prove that limits of Correlation Coefficient are lies between $-1 \leq r \leq 1$. [4]

B) From the following data, calculate the coefficient of rank correlation between x and y . [4]

x:	32	35	49	60	43	37	43	49	10	20
y:	40	30	70	20	30	50	72	60	45	25

C) Test the significance of the correlation for the following values based on the number of observations: [4]

(i) 10 and (ii) 100, $r = +0.4$, and $r = +0.9$

Q. No. 5 Solve the following questions:

- A)** For 100 students of a class, the regression equation of marks in Statistics (X) on the marks in commerce in (Y) is $3Y - 5X + 180 = 0$. The mean mark in Commerce is 50 and variance of marks in Statistics is $\frac{4}{9}$ th of the variance of marks in Commerce. Find the mean marks in Statistics and the coefficient of correlation between marks in the two subjects. [4]

- B)** The data about the sales and advertisement expenditure of a firm is given below: [4]

	Sales (In crores of Rs.)	Advertisement expenditure (In crores of Rs.)
Means	40	6
Standard Deviations	10	1.5
Coefficient of correlation = $r = 0.9$		

Coefficient of correlation = $r = 0.9$

- (i) Estimate the likely sales for a proposed advertisement expenditure of Rs. 10 crores.
 - (ii) What should be the advertisement expenditure if the firm proposes a sales target of 60 crores of rupees?

- C)** Prove that "Regression coefficients are independent of change of origin but not of scale." [4]

Q. No. 6 Attempt any THREE of the Following:

- A)** Find the equation of line by using Least Square Method: [4]

X	2	3	5	7	9
Y	4	5	7	10	15

- B)** Fit the Second Degree Parabola to the following: [4]

X	0	1	2	3	4
Y	1	1.8	1.3	2.5	6.3

- C)** In a sample of 1000 people, 540 are rice eaters and the rest are wheat eaters. Can we assume [4] that both rice and wheat are equally popular at 1% level of significance?

[Z value at 1% level of significance is 2.58]

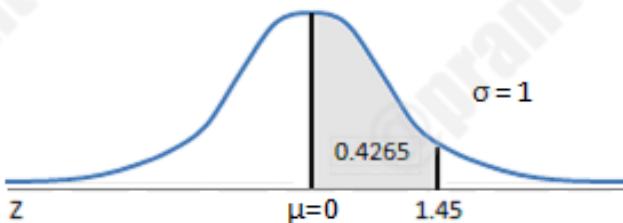
- D)**
- (i) The school principal wants to test if it is true what teachers say – that high school [4] juniors use the computer an average 3.2 hours a day. What are our null and alternative hypotheses?
 - (ii) We have a medicine that is being manufactured and each pill is supposed to have 14 milligrams of the active ingredient. What are our null and alternative hypotheses?

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Areas Under the One-Tailed Standard Normal Curve

This table provides the area between the mean and some Z score.

For example, when Z score = 1.45
the area = 0.4265.



Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.7	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.8	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.9	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000

**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,
LONERE – RAIGAD - 402 103**

Supplementary Winter Semester Examination, 2019

SY

B.Tech. in Computer Engineering

Subject: Probability and Statistics [BTCOC402]

Date: 28/11/2019

Semester: IV

Marks: 60

Time: 3 Hr.

Instructions to the Students:

1. Each question carries 12 marks.
2. Attempt any **FIVE** questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.

Que. 1 Attempt any TWO of the following.

**Marks
[12]**

- A) A committee of 12 is to be formed from 9 women and 8 men. In how many ways this can be done if at least five women have to be included in a committee? In how many of these committees.
- (a) The women are in majority?
(b) The men are in majority?
- B) How many arrangements of the letters of the word 'BENGALI' can be made
- (i) if the vowels are never together
(ii) if the vowels are to occupy only odd places
- C) In bolt factory, machines A, B and C manufacture respectively 25%, 35% and 40% of the total. Of their output 5, 4, 2 percent are known to be defective bolts. A bolt is drawn at random from the product and is found to be defective. What is the probabilities that it was manufactured by
- (i) machine A
(ii) machine B or C

Que. 2 Attempt the following questions.

[12]

A)

Let X be a discrete random variable with the following PMF

$$P(X=k) = \begin{cases} 0.1 & \text{for } k=0 \\ 0.4 & \text{for } k=1 \\ 0.3 & \text{for } k=2 \\ 0.2 & \text{for } k=3 \\ 0 & \text{otherwise} \end{cases}$$

- (a) Find $E(X)$.
(b) Find $\text{var}(X)$.
(c) If $Y = (X-2)^2$, find $E(Y)$.

- B) The random variable X has a range of $\{0, 1, 2\}$ and the random variable Y has a range of $\{1, 2\}$. The joint distribution of X and Y is given by the following table:

x	y	$P(X=x, Y=y)$
0	1	0.2
0	2	0.1
1	1	0.0
1	2	0.2
2	1	0.3
2	2	0.2

- (i) Write down tables for the marginal distributions of X and of Y
- (ii) Write down a table for the conditional distribution of X given that $Y=2$
- (iii) Compute $E(X)$ and $E(Y)$

Que. 3 Attempt any TWO of the following questions. [12]

- A) A (blindfolded) marksman finds that on the average he hits the target 4 times out of 5. If he fires 4 shots, what is the probability of
 (i) more than 2 hits?
 (ii) at least 3 misses?
- B) Vehicles pass through a junction on a busy road at an average rate of 300 per hour.
 i. Find the probability that none passes in a given minute.
 ii. What is the expected number passing in two minutes?
 iii. Find the probability that this expected number actually pass through in a given two-minute period.
- C) Time taken by the crew, of a company, to construct a small bridge is a normal variate with mean 400 labour hours and standard deviation of 100 labour hours.
 i.) What is the probability that bridge gets constructed between 350 to 450 labour hours?
 ii.) If company promises to construct the bridge in 450 labour hours or less and agrees to pay penalty of Rs. 100 for each labour hour spent in excess of 450, what is the probability that a company pays a penalty of at least Rs. 2000?

Que. 4 Attempt the following questions. [12]

- A) Calculate a Spearman rank-order correlation on data without any ties we will use the following data:

	Marks									
English	56	75	45	71	62	64	58	80	76	61
Maths	66	70	40	60	65	56	59	77	67	63

- B) The table below shows the number of absences x, in a Calculus course and the final exam grade y, for 7 students. Find the correlation coefficient and interpret your result.

x	1	0	2	6	4	3	3
y	95	90	90	55	70	80	85

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Que. 5 Attempt the following questions.

[12]

- A) The values of y and their corresponding values of x are shown in the table below

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

a) Find the least square regression line $y = ax + b$.

b) Estimate the value of y when $x = 10$.

- B) The data about the sales and advertisement expenditure of a firm is given below:

	Sales	Advertisement Expenditure
Mean	40	6
Standard Deviation	10	1.5

Coefficient of correlation, $r = 0.9$

- (i) Estimate the likely sales for a proposed advertisement expenditure of Rs. 10 Cr.
(ii) What should be the advertisement expenditure if the firm proposes a sales target of 60 crores of rupees?

Que. 6 Solve the following.

[12]

- A) A full-time PhD students received an average salary of \$12,837 according to U.S. Department of Education. The dean of graduate studies at a large state University feels that PhD. Students in his state earn more than this. He surveys 44 randomly selected students and finds their average salary is \$14,445 with a standard deviation of \$150. With a $\alpha=0.05$, is the dean correct?

- B) i.) We have a medicine that is being manufactured and each pill is supposed to have 14 milligrams of the active ingredient. What are our null and alternative hypotheses?
ii.) The school principal wants to test if it is true what teachers say – that high school juniors use the computer an average 3.2 hours a day. What are our null and alternative hypotheses?
iii.) If the difference between the hypothesized population mean and the mean of the sample is large, we _____ the null hypothesis. If the difference between the hypothesized population mean and the mean of the sample is small, we _____ the null hypothesis.

#####Paper End#####

B. TECH
(SEM-III) THEORY EXAMINATION 2019-20
MATHEMATICS-IV

Time: 3 Hours**Total Marks: 100**

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief.

2 x 10 = 20

Q no.	Question	Marks	CO								
a.	Solve the following partial differential equation $yq - xp = z$.	2	1								
b.	Solve the Cauchy's problem $u_x - u_y = 0$. $u(x, 0) = x$	2	1								
c.	Classify the following equation. $x^2 \frac{\partial^2 u}{\partial t^2} - \frac{\partial^2 u}{\partial x^2} = u$	2	2								
d.	Solve the partial differential equation $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial x \partial y} = 0$.	2	2								
e.	Find the median of 6,8,9,10,11,12,13.	2	3								
f.	The first three central moments of a distribution are 0,15,-31. Find the moment of coefficient of skewness.	2	3								
g.	If the p.m.f of a discrete random variable X is <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>X</td><td>1</td><td>2</td><td>3</td></tr> <tr> <td>f(x)</td><td>$\frac{1}{2}$</td><td>$\frac{1}{3}$</td><td>$\frac{1}{6}$</td></tr> </table> Determine E(X) and V(X).	X	1	2	3	f(x)	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{6}$	2	4
X	1	2	3								
f(x)	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{6}$								
h.	The probability density function f(x) of a continuous random variable X is defined by $f(x) = \begin{cases} \frac{A}{x^2}, & 5 \leq x \leq 10 \\ 0, & \text{otherwise} \end{cases}$ Find the value of A.	2	4								
i.	Find the mean of the Binomial Distribution $B\left(4, \frac{1}{3}\right)$.	2	4								
j.	A machine which produces mica insulating washers for use in electric device to turn out washers having a thickness of 10 mm. A sample of 10 washers has an average thickness 9.52 mm with a standard deviation of 0.6 mm. Find out t.	2	5								

SECTION B

2. Attempt any three of the following:

3 x 10 = 30

Q no.	Question	Marks	CO
a.	Solve $(D^2 - DD' - 2D'^2)z = (y - 1)e^x$	10	1
b.	A rectangular plate with insulated surface is 10 cm wide and so long compared to its width that it may be considered infinite in length without introducing an appreciable error. If the temperature along the short edge $y=0$ is given by: $u(x, 0) = \begin{cases} 20x & 0 \leq x \leq 5 \\ 20(10-x) & 5 < x < 10 \end{cases}$ While the two edges $x=0$ and $x=10$ as well as the other short edge are kept at 0°C . Find the steady state temperature at any point (x, y) of the plate.	10	2

c.	Find an exponential curve $PV^y = k$ for the data: <table border="1"> <tr><td>V</td><td>50</td><td>100</td><td>150</td><td>200</td></tr> <tr><td>P</td><td>135</td><td>48</td><td>26</td><td>17</td></tr> </table>	V	50	100	150	200	P	135	48	26	17	10	3														
V	50	100	150	200																							
P	135	48	26	17																							
d.	Fit a Poisson distribution to the following data which give the number of yeast cells per square for 400 squares <table border="1"> <tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr> <tr><td>F</td><td>103</td><td>143</td><td>98</td><td>42</td><td>8</td><td>4</td><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> </table> It is given that $e^{-1.52} = 0.2674$.	X	0	1	2	3	4	5	6	7	8	9	10	F	103	143	98	42	8	4	2	0	0	0	0	10	4
X	0	1	2	3	4	5	6	7	8	9	10																
F	103	143	98	42	8	4	2	0	0	0	0																
e.	To test the effectiveness of inoculation against cholera , the following table was obtained <table border="1"> <tr><td></td><td>Attached</td><td>Not attached</td><td>Total</td></tr> <tr><td>Inoculated</td><td>30</td><td>160</td><td>190</td></tr> <tr><td>Not inoculated</td><td>140</td><td>460</td><td>600</td></tr> <tr><td>Total</td><td>170</td><td>620</td><td>790</td></tr> </table> (The figure represents the number of persons) Use Chi square test to defend or refute the statement. The inoculation prevents attack from cholera. The value of χ^2 for 1 degree of freedom at 5% level is 3.841.		Attached	Not attached	Total	Inoculated	30	160	190	Not inoculated	140	460	600	Total	170	620	790	10	5								
	Attached	Not attached	Total																								
Inoculated	30	160	190																								
Not inoculated	140	460	600																								
Total	170	620	790																								

3. Attempt any one part of the following: **1 x 10 = 10**

Q no.	Question	Marks	CO
a.	Solve $(D + 1)(D + D' - 1)z = \sin(2x + 3y)$	10	1
b.	In a partial destroyed laboratory record of an analysis of correlation data, the following result only are legible : Variance of x = 9 Regression equation: $8x - 10y + 66 = 0$, $40x - 18y = 214$. What were (a) the mean value of x and y (b) the standard deviation of y and the co-efficient of correlation between x and y?	10	3

4. Attempt any one part of the following: **1 x 10 = 10**

Q no.	Question	Marks	CO
a.	Solve $x^2 \frac{\partial^2 z}{\partial x^2} - 4y^2 \frac{\partial^2 z}{\partial y^2} - 4y \frac{\partial z}{\partial y} - z = x^2 y^2 \log y$	10	1
b.	A tightly stretched string with fixed end points $x=0$ and $x = l$ is initially in a position given by $y = y_0 \sin^3 \frac{\pi x}{l}$. If it is released from rest from this position, find the displacement $y(x,t)$.	10	2

5. Attempt any one part of the following: **1 x 10 = 10**

Q no.	Question	Marks	CO
a.	An insulated rod of length l itsends A and B maintained at $0^\circ C$ and $100^\circ C$ respectively until the steady state condition prevails. If B is suddenly reduced to $0^\circ C$ and maintained at $0^\circ C$, Find the temperature at a distance x from A at time t .	10	2

b.	Find the multiple regression equation of X_1 on X_2 and X_3 from the data Given below:	10	3																					
	<table border="1"> <tr><td>X_1</td><td>3</td><td>5</td><td>6</td><td>8</td><td>12</td><td>10</td></tr> <tr><td>X_2</td><td>10</td><td>10</td><td>5</td><td>7</td><td>5</td><td>2</td></tr> <tr><td>X_3</td><td>20</td><td>25</td><td>15</td><td>16</td><td>15</td><td>2</td></tr> </table>	X_1	3	5	6	8	12	10	X_2	10	10	5	7	5	2	X_3	20	25	15	16	15	2		
X_1	3	5	6	8	12	10																		
X_2	10	10	5	7	5	2																		
X_3	20	25	15	16	15	2																		

6. Attempt any one part of the following: 1 x 10 = 10

Q no.	Question	Marks	CO
a.	State the Bayes' theorem. The probability that a civilian can hit a target is $\frac{2}{5}$ and the probability that an army officer can hit the same target is $\frac{3}{5}$. While the civilian can fire 8 shots in the time, the army officer fires 10 shots. If they fire together, then what is the probability that army officer shoots the target?	10	4
b.	Define the Normal distribution. The daily wages of 1000 workers are distributed around a mean of Rs. 140 and with a standard deviation of Rs. 10. Estimate the number of workers whose daily wage will be (i) between Rs. 140 and Rs. 144, (ii) less than Rs. 126 (iii) more than Rs. 160.	10	4

7. Attempt any one part of the following: 1 x 10 = 10

Q no.	Question	Marks	CO																																				
a.	An IT company wants to appoint an effective trainer to improve the performance of their engineers. Four groups of 7, 8, 10 and 11 engineers from total 36 engineers were given 5 days training by the 4 trainers. Scores were awarded to the engineers at the end of the training on their skills. Let us examine the preference of one engineer of one trainer over other three trainers. Given that $\alpha=0.05$ i.e. at 5% level of significance the value of $F(3,32)=3.29$.	10	5																																				
b.	<p>Distinguish between p chart and C chart. The number of defectives in 17 samples of size 500 each from 17 lots is shown below:</p> <table border="1"> <tr><td>Samples</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr> <tr><td>No. of defectives</td><td>20</td><td>25</td><td>35</td><td>45</td><td>15</td><td>65</td><td>15</td><td>20</td><td>35</td><td>23</td><td>12</td><td>9</td><td>21</td><td>22</td><td>32</td><td>35</td><td>38</td></tr> </table> <p>Find out the control limits for the number of defective units and also check whether the process is under control or not.</p>	Samples	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	No. of defectives	20	25	35	45	15	65	15	20	35	23	12	9	21	22	32	35	38	10	5
Samples	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17																						
No. of defectives	20	25	35	45	15	65	15	20	35	23	12	9	21	22	32	35	38																						

**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,
LONERE-RAIGAD-402103**

Summer Semester Examination, 2022

B.Tech. Computer Engineering /CSE/ CSE(AI&ML).

Semester: IV Max. Marks: 60

**Subject: Probability Theory & Random Processes/Probability
and Statistics [BTBS404]**

Date: 24/08/2022

Time: 3.45 Hrs

Instructions to the Student:

1. Each question carries 12 marks
2. All Questions are compulsory
3. Illustrate your answers with neat sketches diagram etc. wherever necessary.
4. If some pare or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.

Marks

Que: 1 Attempt any TWO of the following questions. [12]

A] i) What is the chance that a non-leap year should have fifty three Sundays?

ii) Urn A contains 5 red and 3 white memory chips; the urn B contains 2 red and 6 white memory chips. If a chip is drawn from each box what is the probability that they are both of the same colour?

B] A committee of 4 persons is to be appointed from 3 officers of the production department, 4 officers of the purchase department, 2 officers of the sales department and 1 chartered accountant. Find the probability of the committee in the following manner:

- i) There must be one from each category.
- ii) It should have at least one from the purchase department.
- iii) The chartered accountant must be in the committee

C] In a certain college 25% of boys and 10% of girls are studying mathematics. The girls constitute 60% of the students. If a student is selected at random and is found to be studying mathematics, find the probability that the student is a (i) girl and (ii) a boy.

Que: 2 Attempt any TWO of the following questions. [12]

A] i) A continuous random variable has the probability density function $f(x)f(x)$ as

$$f(x) = \begin{cases} ke^{-x}, & x > 0 \\ 0, & \text{elsewhere} \end{cases}$$

Determine the constant k .

ii) Obtain the probability distribution of X , the number of heads in three tosses of a coin. Also find the expected number of heads appearing when a fair coin is tossed three times.

B] Fit a Binomial distribution to the following observation:

x	0	1	2	3	4	5
f	2	14	20	34	22	8

C] Sacks of sugar packed by an atomic loader having an average weight of 100 kg with standard deviation 0.250 kg. Assuming normal distribution find chance of sack get weighing less than 99.5 kg. (Given: $A(2) = 0.4772$ $A(2) = 0.4772$)

Que: 3 Attempt the following questions.

[12]

A] From the following data, calculate the rank correlation coefficient by Karl Pearson's method

x	6	2	10	4	8
y	9	11	?	8	7

Arithmetic means of X and Y series are 6 and 8 respectively.

B] From the following table, calculate the coefficient of correlation by Karl Pearson's method

x	48	33	40	9	16	16	65	24	16	57
y	13	13	24	6	15	4	20	9	6	19

Que: 4 Attempt the following questions.

[12]

A] Obtain the least square regression line of y on x for the following data.

x_i	6	2	10	4	8
y_i	9	11	5	8	7

Also, obtain an estimate of y which should correspond on the average to $\bar{x} = 5$. $\bar{x} = 5$.

B] The equation of two lines are $2x = 8 - 3y$ $2x = 8 - 3y$ and $2y = 5 - x$ $2y = 5 - x$. Find the mean values of x and y . Find the value of correlation coefficient.

Que: 5 Attempt the following questions.

[12]

A] i) A die was thrown 6000 times and a throw of 5 or 6 was obtained 3240 times. On the assumption of random throwing, do the data indicate an unbiased die?

ii) There are 30% and 25% respectively of fair-haired people in the two large populations. Is this difference likely to be hidden in samples of 1200 and 900 respectively from the two populations?

B] A full-time Ph.D. students received an average salary of \$12,837 according to U.S. Department of Education. The dean of graduate studies at a large state University feels that Ph.D. students in his state earn more than this. He surveys 44 randomly selected students and finds their average salary is \$14,445 with a standard deviation of \$150. With $\alpha = 0.05$, $\alpha = 0.05$, is the dean correct?

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Summer Examination – 2023

Course: SY B.Tech.

Branch : Computer Science and Allied Engineering

Semester

:IV

Subject Code & Name: Probability and Statistics BTBSC404

Max Marks: 60

Date:26/07/2023

Duration: 3 Hrs.

Instructions to the Students:

1. All the questions are compulsory.
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

		(Level/CO)	Marks														
Q. 1	Solve Any Two of the following.	CO1	12														
A)	State and Prove "Addition theorem of Probability".		6														
B)	If A & B are two possible outcomes of a random experiment such that $P(\bar{A}) = 0.6$, $P(A \cup B) = 0.7$ and $P(B) = k$, then find value of "k" if (i) A & B are mutually exclusive (ii) A & B are independent		6														
C)	The factory F_1 produces 1000 articles, 20 of them being defective; the factory F_2 produces 4000 articles, 40 of them being defective and the F_3 produces 5000 articles, 50 of them being defective. If one article is chosen from all these articles put in one stockpile and is found to be defective, find the probability that it is from the factory F_1 .		6														
Q.2	Solve Any Two of the following.	CO2	12														
A)	A random variable X has the following distribution: <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>X:</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> </tr> <tr> <td>P(X):</td> <td>2k</td> <td>4k</td> <td>6k</td> <td>8k</td> <td>10k</td> <td>12k</td> </tr> </table> Determine (i) k (ii) $P(X < 4)$ (iii) $P(2 \leq X < 5)$	X:	1	2	3	4	5	6	P(X):	2k	4k	6k	8k	10k	12k		6
X:	1	2	3	4	5	6											
P(X):	2k	4k	6k	8k	10k	12k											
B)	Fit the Binomial Distribution to the following data <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>X:</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>F:</td> <td>28</td> <td>62</td> <td>46</td> <td>10</td> <td>4</td> </tr> </table>	X:	0	1	2	3	4	F:	28	62	46	10	4		6		
X:	0	1	2	3	4												
F:	28	62	46	10	4												
C)	In a sample of 1000 students, the mean and standard deviation of marks obtained by the students in a certain test are 14 and 2.5. Assuming the distribution to be normal find the number of students getting marks (i) between 12 and 15, (ii) above 18, (iii) below 8 [Given: For a S.N.V. z area between $z = 0$ to $z = 0.4$ is 0.1554, between $z = 0$ to $z = 0.8$ is 0.2881, that between $z = 0$ to $z = 1.6$ is 0.4452, between $z = 0$ to $z = 2.4$ is 0.4918]		6														
Q. 3	Solve Any Two of the following.	CO3	12														

A)	Define "Karl Pearson's Correlation Coefficient". Also show that $-1 < r < +1$.			6																						
B)	For the following data, <table border="1"> <tr> <td>X:</td> <td>6</td> <td>8</td> <td>12</td> <td>15</td> <td>18</td> <td>20</td> <td>24</td> <td>28</td> <td>31</td> </tr> <tr> <td>Y:</td> <td>10</td> <td>12</td> <td>15</td> <td>15</td> <td>18</td> <td>25</td> <td>22</td> <td>26</td> <td>28</td> </tr> </table> Calculate (i) Karl Pearson's coefficient of correlation (ii) Standard Error (S.E) (iii) Probable Error (P.E)	X:	6	8	12	15	18	20	24	28	31	Y:	10	12	15	15	18	25	22	26	28			6		
X:	6	8	12	15	18	20	24	28	31																	
Y:	10	12	15	15	18	25	22	26	28																	
C)	Obtain Rank Correlation Coefficient (ρ), for the following data, <table border="1"> <tr> <td>X</td> <td>68</td> <td>64</td> <td>75</td> <td>50</td> <td>64</td> <td>80</td> <td>75</td> <td>40</td> <td>55</td> <td>64</td> </tr> <tr> <td>Y</td> <td>62</td> <td>58</td> <td>68</td> <td>45</td> <td>81</td> <td>60</td> <td>68</td> <td>48</td> <td>50</td> <td>70</td> </tr> </table>	X	68	64	75	50	64	80	75	40	55	64	Y	62	58	68	45	81	60	68	48	50	70			6
X	68	64	75	50	64	80	75	40	55	64																
Y	62	58	68	45	81	60	68	48	50	70																
Q.4	Solve Any Two of the following.		CO4	12																						
A)	Obtain the equation of the regression lines from the following data, <table border="1"> <tr> <td>X</td> <td>91</td> <td>97</td> <td>108</td> <td>121</td> <td>67</td> <td>124</td> <td>51</td> <td>73</td> <td>111</td> <td>57</td> </tr> <tr> <td>Y</td> <td>71</td> <td>75</td> <td>69</td> <td>97</td> <td>70</td> <td>91</td> <td>39</td> <td>61</td> <td>80</td> <td>47</td> </tr> </table>	X	91	97	108	121	67	124	51	73	111	57	Y	71	75	69	97	70	91	39	61	80	47			6
X	91	97	108	121	67	124	51	73	111	57																
Y	71	75	69	97	70	91	39	61	80	47																
B)	At the time of estimation of the regression equations of the two variables x and y, the following results were obtained : $\bar{x} = 90$; $\bar{y} = 70$; $n = 10$; $\sum x^2 = 6360$; $\sum y^2 = 2860$, $\sum xy = 3900$, where x and y are the deviations from the respective means. Obtain the equations.			6																						
C)	Determine which one of the following is the regression line of y on x; $4x - 5y + 30 = 0$; $20x - 9y - 107 = 0$. Also, find r_{xy} and σ_y when $\sigma_x = 3$			6																						
Q. 5	Solve Any Two of the following.		CO5	12																						
A)	A coin was tossed 200 times and the head turned up 108 times. Test the hypothesis that the coin is unbiased at 5% level of significance.			6																						
B)	A sample of 100 electric bulbs produced by manufacturer A showed a mean life time of 1190 hours and a standard deviation of 90 hours. A sample of 75 bulbs produced by manufacturer B showed a mean life time of 1230 hours with the standard deviation of 120 hours. Is there a difference between the mean life time of two brands is significance i) at 5% level of significance ii) at 1% level of significance			6																						
C)	In a city A, 20% of a random sample of 900 school boys had a certain slight physical defect. In another city B, 18.5% of a random sample of 1600 school boys had the same defect. Is the difference between the proportion significant?			6																						

*** End ***

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DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Supplementary Semester Examination – January 2023

Course: B. Tech.

Branch : CE / CSE / CS

Semester : IV

Subject Code & Name: Probability & Statistics [BTCOC402]

Max Marks: 60

Date:

Duration: 3 Hrs.

Instructions to the Students:

1. All the questions are compulsory.
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

(Level/CO) Marks

Q. 1 Solve Any Two of the following.

[12]

A) Four cards are drawn at random from a pack of 52 cards. Find the probability that, **Understand**

- (i) They are a king, a queen, a jack and an ace.
- (ii) There is one card of each suit.
- (iii) There are two cards of Clubs and two cards of diamonds.

B) If events A and B are independent then the events

Understand

- (i) A and \bar{B} are independent
- (ii) \bar{A} and B are independent

C) In a bolt factory, machines A, B, C manufacture respectively 25%, 35%, and 40% of the total. Of their output 5, 4, 2 per cent are known to be defective bolts. A bolt is drawn at random from the product and is found to be defective. What are the probabilities that it was manufactured by

- (i) Machine A,
- (ii) Machine B or C

Q.2 Attempt the following questions.

[12]

A) (i) Two dice are rolled at random. Obtain the probability distribution of sum of the numbers on them. **Understand**

- (ii) Three cards are drawn at random successively, without replacement from a well shuffled pack of cards. Obtain the probability distribution of the number of face cards (jack, queen, king, and ace).

B) Write the proof for the following: **Evaluate**

$$\text{Var}(ax + by) = a^2 \text{Var}(x) + b^2 \text{Var}(y) + 2ab \text{Cov}(x, y)$$

Q. 3 Solve Any Two of the following.

[12]

A) Write the proof to find mean and variance of the Binomial Distribution. **Evaluate**

B) If 5% of the electric bulbs manufactured by a company are defective, use Poisson distribution to find the probability that in a sample of 100 bulbs

- (i) none is defective
- (ii) 5 bulbs will be defective. ($e^{-5} = 0.007$)

- C)** The hourly wages of 1000 workmen are normally distributed around a mean of **Understand** Rs. 70 and with a standard deviation of Rs. 5. Estimate the number of workers whose hourly wages will be:
- between Rs. 69 and Rs. 72
 - more than Rs. 75
 - less than Rs. 63

Q.4 Solve the following questions.

[12]

- A)** Calculate Karl Pearson's coefficient of correlation between expenditure on **Understand** advertising and sales from the data given below:

Advertising expenses	39	65	62	90	82	75	25	98	36	78
Sales	47	53	58	86	62	68	60	91	51	84

- B)** Ten competitors in a beauty contest are ranked by three judges in the following **Understand** order :

1 st Judge:	1	6	5	10	3	2	4	9	7	8
2 nd Judge:	3	5	8	4	7	10	2	1	6	9
3 rd Judge:	6	4	9	8	1	2	3	10	5	7

Q. 5 Solve Any Two of the following.

[12]

- A)** The data of marks in the Statistics and Economics are given in the table. Find the **Understand** following:

- The two regression coefficients
- The two regression equations
- The coefficient of correlation between the marks in Economics and Statistics.

Marks in Economics	25	28	35	32	31	36	29	38	34	32
Marks in Statistics	43	46	49	41	36	32	31	30	33	39

- B)** If the two lines of regression are:

$$4x - 5y + 30 = 0 \quad \text{and} \quad 20x - 9y - 107 = 0$$

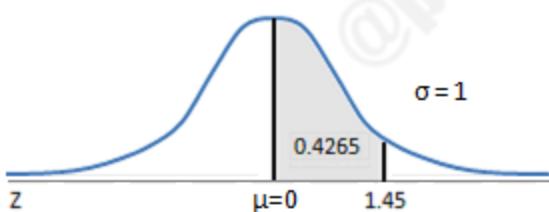
are line of regressions x on y , and y on x respectively. Find r_{xy} and σ_y when $\sigma_x = 3$.

- C)** A packaging device is set to fill detergent powder packets with a mean weight of **Understand** 5 kg, with a standard deviation of 0.31 kg. The weight of packets can be assumed to be normally distributed. The weight of packets is known to drift upwards over a period of time due to machine fault, which is not tolerable. A random sample of 100 packets is taken and weighed. The sample has mean weight of 5.03 kg. Can we conclude that the mean weight produced by the machine has increased? Use a 5 per cent level of significance. (Given $Z_\alpha = 1.645$)

Areas Under the One-Tailed Standard Normal Curve

This table provides the area between the mean and some Z score.

For example, when Z score = 1.45
the area = 0.4265.



Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.7	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.8	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.9	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000

*** End ***

**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,
LONERE**

Regular End Semester Examination – SUMMER 2023

Course: B. Tech. Branch: IT Semester: IV

Subject Code & Name: BTITC402 (Probability and Statistics)

Max Marks: 60 Date: 15/07/2023 Duration: 3.00 Hr.

Instructions to the Students:

1. All the questions are compulsory.
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

		(Level/ CO)	Mark
Q. 1	Solve Any Two of the following.		
A)	<p>A committee of 4 persons is to be appointed from 3 officers of the production department, 4 officers of the purchase department, 2 officers of the sales department, and 1 chartered account. Find the probability of forming the committee in the following manner.</p> <ol style="list-style-type: none"> i. There must be one from each category ii. It should have at least one from the purchase department. iii. The chartered account must be in the committee. 	CO1	6
B)	<p>A company has two plants to manufacture scooters. Plant I manufactures 80 per cent of scooters and plant II manufactures 20 per cent. At plant I, 85 out of 100 scooters are rated standard quality or better. At plant II, 65 out of 100 scooters are rated standard quality or better.</p> <ol style="list-style-type: none"> i. What is the probability that scooter selected at random came from plant I, if it is known that the scooter is of standard quality? ii. What is probability that scooter selected at random came from plant II, if it is known that the scooter is of standard quality. 	CO1	6
C)	<p>Explain following terms</p> <ol style="list-style-type: none"> i. Random variable ii. Probability density function iii. Mathematical Expectation 	CO1	6
Q. 2	Solve Any Two of the following.		
A)	<p>A tyre manufacturing company kept a record of the distance covered before a tyre needed to be replaced. The table shows the results of 1000 cases.</p>	CO2	6

Distance (in km)	Less than 4000	4000 to 9000	9000 to 14000	More than 14000	
Frequency	20	210	325	445	

If a tyre is bought from this company, what is the probability that :

- (i) it has to be substituted before 4000 km is covered?
- (ii) it will last more than 9000 km?
- (iii) it has to be replaced after 4000 km and 14000 km is covered by it?

B)	Find the binomial distribution of getting a six in three tosses of an unbiased dice.	CO2	6
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C)	A coin is tossed three times, consider the following events. P: 'No head appears'. Q: 'Exactly one head appears' and R: 'At Least two heads appear'. Check whether they form a set of mutually exclusive and exhaustive events.	CO1	6
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Q. 3	Solve Any Two of the following.		
A)	D) Find Karl Pearson's coefficient of correlation between the values of X and Y in given data:	CO4	6

D) Find Karl Pearson's coefficient of correlation between the values of X and Y in given data:

X	128	129	130	140	132	135	125	130	132	135
Y	80	89	90	95	96	94	80	100	96	100

B)	In a poem recitation competition, ten participants were recorded following marks by two different judges X and Y.	CO4	6
	X 15 17 14 13 11 12 16 18 10 9 Y 15 12 4 6 7 9 3 10 2 5		

Calculate the coefficient of rank correlation.

C)	Find linear regression equation for the following two sets of data:	CO4	6										
	<table border="1"> <tr> <td>x</td> <td>2</td> <td>4</td> <td>6</td> <td>8</td> </tr> <tr> <td>y</td> <td>3</td> <td>7</td> <td>5</td> <td>10</td> </tr> </table>	x	2	4	6	8	y	3	7	5	10		
x	2	4	6	8									
y	3	7	5	10									

Q. 4	Solve Any Two of the following.	CO3	6
A)	Write a short note on a) Hypothesis testing		

~~Q~~ Single and two tailed test
of Type I and Type II errors

- B) A machine claimed to produce nails of mean length 5 cm and standard deviation of 0.45cm. A random sample of 100 nails gave 5.1cm as their average length. Does the performance of the machine justify the claim? Mention the level of significance you apply.

- C) The following table gives the number of accidents in a city during a week. Find whether the accidents are uniformly distributed over a week.

Day	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Total
No. of Accident	13	15	9	11	12	10	14	84

(Note: Critical value = For 6 degrees of freedom at 5% level of significance' table value is 12.59)

~~Q. 5~~ Solve Any Two of the following.

- A) What is regression analysis? How does it differ from correlation? Why there are, in general, two regression equations?

- B) Consider the Markov chain with three states, $S=\{1,2,3\}$, that has the following transition matrix

$$P = \begin{pmatrix} 1/2 & 1/4 & 1/4 \\ 1/3 & 0 & 2/3 \\ 1/2 & 1/2 & 0 \end{pmatrix}$$

- a. Draw the state transition diagram for this chain.
 b. If we know $P(X_1=1)=P(X_1=2)=1/4$, find $P(X_1=3, X_2=2, X_3=1)$

- C) By the method of least squares, find a straight line that best fits the following data points.

x	0	1	2	3	4
y	1.0	2.9	4.8	6.7	8.6

*** End ***

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Supplementary Winter Semester Examination – 2023

Course: B. Tech. Branch : Computer Science & Engineering Semester: IV

Subject Code & Name: Probability Theory and Random Processes (BTBS404)

Max Marks: 60

Date:23-01-24

Duration: 3 Hr.

Instructions to the Students:

1. All the questions are compulsory.
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

(Level/CO) Marks

Q. 1 Solve Any Two of the following. 12

- A) A card is drawn from a well shuffled pack of playing cards. Find the probability that it is either a diamond or a king. Understand
- B) In a random arrangement of the letters of the word “MATHEMATICS”. Understand
Find the Probability that all the vowels come together
- C) Derive equation of Bayes' Theorem Application

Q.2 Solve Any Two of the following. 12

- A) Ten unbiased coin are tossed simultaneously. Find the probability of obtaining, Application
i) exactly 6 heads ii) No head
- B) A continuous random variable has probability density function Evaluation
 $f(x) = 6(x - x^2)$ where $0 \leq x \leq 1$.
Find mean, variance, median.
- C) A die is tossed twice. Getting ‘an odd number’ is termed as success. Find the Understand
probability distribution of the number of successes.

Q. 3 Solve Any Two of the following. 12

- A) Calculate probable error. If the coefficient of correlation is 0.92 and number of Application pairs of items are 25.
- B) The ranks of some 16 students in Mathematics and Physics are as follows. Application
Two numbers within brackets denote the ranks of the students in Mathematics and Physics:
(1,1), (2,10), (3,3), (4,4), (5,5), (6,7), (7,2), (8,6), (9,8), (10,11), (11,15),
(12,9), (13,14), (14,12), (15,16), (16,13).
Calculate the rank correlation coefficient for the proficiencies of this group in Mathematics & Physics.
- C) What is Correlation? Explain its types and causation. Understand

Q.4

Solve Any Two of the following.

12

A) Obtain the angle between the two lines of regression.

B) From the following data of the age of husband and age of wife, find two regression lines and calculate the husband's age when wife's age is 16. Analysis

Husband age	36	23	27	28	28	29	30	31	33	35
Wife age	29	18	20	22	27	21	29	27	29	28

C) If $\bar{x} = 8.2$; $\bar{y} = 12.4$; $\sigma_x = 6.2$; $\sigma_y = 20$; $r(x,y) = 0.9$, find the lines of Application regression. Estimate the value of x for $y = 10$ and estimate y for $x = 10$.

Q. 5 Solve Any Two of the following.

12

A) A random sample of size 36 is taken from a normal population with known variance $\sigma^2 = 25$. If the mean of the samples is $\bar{x} = 42.6$ test the null hypothesis $\mu = 45$ against the alternative hypothesis $\mu < 45$ with $\alpha = 0.05$ Application

B) Explain Null Hypothesis and Alternative Hypothesis. Evaluation

C) In a random sample of 340 students, 178 of the 210 females and 90 of the 130 males passed Statistics and Probability on their first take. Construct a 90% confidence interval for the population proportion of students who passed the subject. Application

*** End ***

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Supplementary Winter-2023

Course: B. Tech. Branch :Computer Engineering and Allied

Semester :IV

Subject Code & Name: BTBSC404 Probability &Statistics

Max Marks: 60

Date:23/01/24

Duration: 3 Hr.

Instructions to the Students:

1. All the questions are compulsory.
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

(Level
/CO) Marks

Q. 1 Solve Any Two of the following.

12

A) There are 3 true coins and 1 false coin with ‘head’ on both sides. A coin is chosen at random and tossed 4 times. If ‘head’ occurs all the 4 times, what is the probability that the false coin has been chosen and used?

CO-2 **6**

B) If A and B are any 2 events such that $P(A) = \frac{3}{4}$ and $P(B) = \frac{5}{8}$. Prove that

$$\frac{3}{8} \leq P(A \cap B) \leq \frac{5}{8}$$

CO-2 **6**

C) A box contains 5 green pencils and 7 yellow pencils. Two pencils are chosen at random from the box without replacement. What is the probability that both are yellow?

CO-2 **6**

Q.2 Solve Any Two of the following.

12

A) Find the value of k , if the following function is a probability density function.

$$f(x) = \begin{cases} k(x-1)^3 & 1 \leq x \leq 3 \\ 0 & \text{otherwise} \end{cases}$$

CO-1 **6**

B) A firm has two cars which it hires out day by day. The number of demands of a car each day is distributed as a Poisson variate of mean 1.5. Calculate the probable number of days in a year on which (i) neither car is in demand (ii) a demand is refused.

CO-1 **6**

C) Five coins are tossed 100 times and the following results were obtained

No. of heads	0	1	2	3	4	5
frequency	10	20	30	15	15	10

Fit a Binomial distribution.

Q. 3 Solve Any Two of the following.

12

A) Calculate Karl Pearson’s co-efficients of correlation from the following data

CO-3 **6**

x	28	45	40	38	35	33	40	32	36	33
y	23	34	33	34	30	26	28	31	36	35

B)	Calculate the value of rank correlation coefficient from the following data regarding marks of six students in statistics and accountancy in a test	CO-4	6																		
	Marks in statistics 40 42 45 35 36 39 Marks in accountancy 46 43 44 39 40 43																				
C)	Prove that limits of correlation coefficients are lies between $-1 \leq r \leq 1$.	CO-4	6																		
Q.4	Solve Any Two of the following.		12																		
A)	Find the equations of the lines of regression on (i) Y on X and (ii) X on Y and also a co-efficient of correlation from the following table. <table border="1"> <tr> <td>X</td><td>62</td><td>64</td><td>65</td><td>69</td><td>70</td><td>71</td><td>72</td><td>74</td></tr> <tr> <td>Y</td><td>126</td><td>125</td><td>139</td><td>145</td><td>165</td><td>152</td><td>180</td><td>208</td></tr> </table>	X	62	64	65	69	70	71	72	74	Y	126	125	139	145	165	152	180	208	CO-3	6
X	62	64	65	69	70	71	72	74													
Y	126	125	139	145	165	152	180	208													
B)	The equations to the two lines of regression are $6y = 5x + 90$ and $15x = 8y + 130$. Find (i) the means of x and y , (ii) the coefficient of correlation , (iii) if variance of $x = 16$, find also the standard deviation of y .	CO-3	6																		
C)	If the coefficient of correlation between two variables x and y is 0.5 and the acute angle between their lines of regression is $\tan^{-1} \left(\frac{3}{5} \right)$. Prove that $\sigma_x = \frac{1}{2} \sigma_y$.	CO-3	6																		
Q. 5	Solve Any Two of the following.		12																		
A)	A manufacturer claims that only 4% of his products supplied by him are defective. A random sample of 600 products contained 36 defectives. Test the claim of the manufacturer.	CO-4	6																		
B)	A machine produced 16 defectives articles in a batch of 500. After overhauling it produced 3 defectives in a batch of 100. Has the machine improved?	CO-4	6																		
C)	A soap manufacturing company was distributing a particular brand of soap through a large number of retail soap. Before a heavy advertisement campaign, the mean sale per week per shop was 140 dozens. After the campaign a sample of 26 shops was taken and the mean sale was found to be 147 dozens with standard deviation of 16. Can you consider the advertisement effective?	CO-5	6																		
	*** End ***																				

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular & Supplementary Summer - 2024

Course: B.Tech.**Branch : Computer and Allied****Semester : IV****Subject Code & Name: BTBSC404 Probability and Statistics****Max Marks: 60****Date: 20/06/2024****Duration: 3.00 Hr.****Instructions to the Students:**

1. All the questions are compulsory.
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

(Level/CO) Marks

Q. 1 Solve Any Two of the following.**C0 1**

- A) State and prove Multiplication theorem of Probability. 6
- B) An urn contains 8 white and 3 red balls. If two balls are drawn at random, find the probability that 6
(i) Both are white (ii) both are red (ii) one is of each colour
- C) In a bolt factory, machines A,B,C manufacture respectively 25%, 35% and 6
40% of the total. Of their total output 5, 4, 2 per cent are known to be defective bolts. A bolt is drawn at random from the product and is found to be defective.

What are the probabilities that it was manufacture by

- (I) Machine A (II) Machine B or C

Q.2 Solve Any Two of the following.**CO 2**

- A) Find the Mean, Variance and Standard Deviation of the discrete random variable x whose probability distribution is given as 6

X	1	2	3	4	5
P(x)	0.1	0.1	0.3	0.3	0.2

- B) A car hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as a Poisson variate with mean 1.5. Calculate the proportion of the days on which 6

- (i) Neither Car is used (ii) Some Demand is refused.

- C) The hourly wages of 1,000 workmen are normally distributed around a mean of Rs.70 and with a standard deviation of Rs.5. Estimate the number of workers whose hourly wages will be: 6

i) Between Rs. 69 and Rs. 72 ii) more than Rs. 75 iii) Less than Rs. 63

[(Area between Z=0 and Z=0.4)=0.1554, (Area between Z=0 and

Z=0.2)=0.0793, (Area between Z=0 and Z=1)=0.3413

(Area between Z=0 and Z=1.4)=0.4192]

Q. 3 Solve Any Two of the following.

CO 3

- A) From the following data calculate Karl Pearson's correlation coefficient. 6

x	6	2	10	4	8
y	9	11	5	8	7

Also find standard error (S.E) and probable error (P.E).

- B) From the following data calculate rank correlation coefficient. 6

x	32	35	39	60	43	37	43	49	10	20
y	40	30	70	20	30	50	72	60	45	25

- C) Prove that Correlation Coefficient r is independent of change of origin and scale. 6

Q.4 Solve Any Two of the following.

CO 4

- A) Obtain the equation of line of Regression of y on x and x on y for the following data. 6

x	1	2	3	4	5	6	7	8	9
y	9	8	10	12	11	13	14	16	15

Also find the value of y when x = 6.2

- B) The lines of regression of a bivariate population are $8x-10y+66=0$ and $40x-18y=214$. The variance of x is 9. Find (i) Mean values of x and y (ii) Correlation coefficient between x and y (iii) Standard deviation of x and y. 6

- C) At the time of estimation of the regression equations of the two variables x and y ,the following results were obtained: $\bar{x} = 90$; $\bar{y} = 70$; $n = 10$; $\sum x^2 = 6360$; $\sum y^2 = 2860$, $\sum xy = 3900$, where x and y are the deviations from the respective means. Obtain the equations. 6

Q. 5 Solve Any Two of the following.

CO 5

- A) In a random sample of 400 persons from a large population, 120 are females. Can it be said that males and females are in the ratio 5:3 in the population? Use 1% level of significance. 6

- B) It is claimed that a random sample of 100 tyres with a mean life of 15269 kms is drawn from a population of tyres which has a mean life of 15200 kms and a standard deviation of 1248 kms. Test validity of claim at 5% level of significance. 6

- C) In two large populations there are 30% and 25% respectively of fair haired peoples. Is this difference likely to be hidden in sample of 1200 and 900 respectively from the two populations? Use 5% level of significance. 6

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Supplementary Winter Examination – 2024

Course: B.Tech.

Branch : Computer Science & Engineering and Allied

Semester : IV

Subject Code & Name:

BTBSC404 Probability and Statistics

Max Marks: 60

Date: 27/12/2024

Duration: 3 Hr.

Instructions to the Students:

- 1. Each question carries 12 marks.**

2. Question No. 1 will be compulsory and include objective-type questions.

3. Candidates are required to attempt any four questions from Question No. 2 to Question No. 6.

4. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.

5. Use of non-programmable scientific calculators is allowed.

6. Assume suitable data wherever necessary and mention it clearly.

**(Level Marks
/CO)**

Q. 1 Objective type questions. (Compulsory Question)

12

- | | | | |
|---|---|------|---|
| 1 | Given that $P(A) = 0.8$, $P(B) = 0.7$ and $P(A \cup B) = 0.9$ What is $P(A \cap B)$ | CO 1 | 1 |
| | a) 0.56 b) 0.06 c) 0.6 d) Any value between 1 to 100 | | |
| 2 | The probability of drawing 1 white ball from a bag containing 6 red, 8 black, 10 yellow and 1 green ball is ? | CO 1 | 1 |
| | a) $1/25$ b) $14/25$ c) 1 d) 0 | | |
| 3 | For any two events A and B if $P(A) = 0.5$, $P(B) = 0.4$ and $P(A \cap B) = 0.2$.Then the conditional probability $P(B/A)$ is ? | CO 1 | 1 |
| | a) 0.5 b) 1.25 c) 0.67 d) 0.4 | | |
| 4 | The p.m.f. of discrete random variable is given by | CO 2 | 1 |

X	1	2	3	4	5
P(X)	0.1	0.25	0.25	0.2	0.2

What is $P(2 < X < 5)$

- | | | | | | | |
|---|---|-------------------------|------------------------|------------------|------|---|
| | a) 0.9 | b) 0.5 | c) 0.45 | d) 0.3 | | |
| 5 | For any random variable X the variance $\text{Var}(X) =$ | | | | CO 2 | 1 |
| | a) $E(X^2) - [E(X)]^2$ | b) $E(X) - [E(X)]^2$ | c) $[E(X)]^2 - E(X^2)$ | d) $E(X^2)$ | | |
| 6 | If X is a continuous r.v. with probability density function $f(x)$ then $\int_{-\infty}^{\infty} f(x)dx =$ | | | | CO 2 | 1 |
| | a) 0 | b) 0.5 | c) -1 | d) 1 | | |
| 7 | State the type of correlation between ‘supply of vegetables and price of vegetable’ | | | | CO 3 | 1 |
| | a) positive correlation | b) negative correlation | c) no correlation | d) None of these | | |

- 8 If the regression coefficients of x on y and y on x are b_{xy} and b_{yx} then the coefficient of correlation r is given by CO 3 1
- a) $r = b_{xy}b_{yx}$ b) $r = \sigma_x\sigma_y$ c) $r = \sqrt{b_{xy}b_{yx}}$ d) $r = \sqrt{\sigma_x\sigma_y}$
- 9 If the Cor(X,Y) = 0 then the regression lines will be CO 4 1
- a) Parallel to each other b) Perpendicular to each other
- c) Coincident d) None of these
- 10 If r is coefficient of correlation between X and Y and σ_x and σ_y are standard deviations. Then the regression coefficients of y on x is given by CO 4 1
- a) $r \frac{\sigma_y}{\sigma_x}$ b) $r \frac{\sigma_x}{\sigma_y}$ c) $\frac{\sum xy - n\bar{x}\bar{y}}{\sigma_x\sigma_y}$ d) $\frac{\sum xy - n\bar{x}\bar{y}}{n}$
- 11 A probability of rejecting H_0 when it is true is called as CO 5 1
- a) Statistic b) Hypothesis c) Level of Significance d) Critical Region
- 12 A statement made about a population for testing purpose is called? CO 5 1
- a) Statistic b) Hypothesis c) Level of Significance d) Test-Statistic
- Q. 2 Solve the following.** 12
- A) Four cards are drawn from pack of 52 cards. Find the probability that the cards drawn are: CO 1 6
- i) Two are red and two are black ii) All cards are of different suits
- iii) All are of same suits
- B) The lottery tickets numbered from 1 to 10 were distributed randomly. Let A be the event that an odd number occurs and B be the event that a number divisible by 3 occurs. CO 1 6
- Obtain: i) $P(A/B)$ ii) $P(B/A)$ iii) $P(A'/B')$
- Q.3 Solve the following.** 12
- A) Let the p.m.f. of a random variable X be $P(x) = \frac{3-x}{10}$ where $x = -1, 0, 1, 2$ CO 2 6
- Calculate: i) $E(X)$ ii) $Var(X)$
- B) Verify which of the following can be regarded as a p.m.f. for the given values of X CO 2 6
- i) $P(x) = \frac{x^2}{30}$; for $x = 0, 1, 2, 3, 4$ ii) $P(x) = \frac{x-2}{5}$; for $x = 1, 2, 3, 4, 5$
- iii) $P(x) = \frac{x+1}{10}$; for $x = 0, 1, 2, 3$
- Q. 4 Solve Any Two of the following.** 12
- A) The following data gives number of seeds germinated in 100 rows of 5 seeds each. Fit a binomial distribution and calculate expected frequencies CO 2 6
- | X | 0 | 1 | 2 | 3 | 4 | 5 |
|------|----|----|----|----|----|----|
| F(X) | 10 | 20 | 30 | 15 | 15 | 10 |

- B)** Compute coefficient of correlation between values of X and Y given below :

CO 3 6

X	2	4	5	6	8	11
Y	18	12	10	8	7	5

- C)** The runs scored by 11 cricketers in two test matches M_1 and M_2 are as follows:

CO 3 6

Cricketers	A	B	C	D	E	F	G	H	I	J	K
Runs in M_1	50	50	55	73	52	33	55	35	85	82	33
Runs in M_2	65	64	62	50	87	37	66	31	93	50	50

Compute Spearman's rank correlation coefficient between runs in two test matches M_1 and M_2

Q.5 Solve Any Two of the following.

- A)** Obtain the two regression lines of X on Y and Y on X for the following data :

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CO 4 6

Import value (X)	7	6	10	14	13
Export value (Y)	22	18	20	26	24

- i) Estimate X when Y = 4 ii) Estimate Y when X = 4

- B)** The population of state is given below. Fit the exponential curve $y = ab^x$

CO 4 6

Year	1951	1961	1971	1981	1991
Population in Millions	140	170	200	250	300

- C)** The regression equations are $8x - 10y + 66 = 0$ and $40x - 18y = 21$. The value of variance of x is 9. Find :

CO 4 6

- i) The mean value of x and y ii) The standard deviation of x and y
iii) The coefficient of correlation between x and y

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Q. 6 Solve Any Two of the following.

- A)** Explain the terms : i) Null Hypothesis ii) Type I error iii) Type II error
iv) Critical region

CO 5 6

- B)** A sample of 400 electric bulbs from company A gave an average life of 1225 hours with s.d. of 42 hours, whereas sample of 200 bulbs from company B gave an average life of 1265 hours with a s.d. of 60 hours. Can we say that the two companies are producing bulbs of same average life. (Use 5% level of significance)

CO 5 6

- C)** Certain pesticide is packed into bags by a machine. A random sample of 10 bags is drawn and their weights (in kg) are found as follows : 50,49,52,44,45,48,46,49,45. Test whether the average weight of a bag can be taken as 50 kg?

CO 5 6

[Given table value $t_9 = 2.262$ at 5% l.o.s.]

*** End ***