Register Number: ……..

B.E., DEGREE EXAMINATIONS: NOV/DEC 2012

Seventh Semester

MECHATRONICS ENGINEERING

MAT106 : Probability and Applied Statistics

(Statistical table to be given)

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. If $\bar{x}_1$ *and* $\bar{x}_2$ are the means of sizes n_1 & n_2 then $\bar{x}$ =

   a) $\frac{n_1x_1 + n_2x_2}{n_1 + n_2}$ b) $\frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}$

   c) $\frac{n_1\bar{x}_1 + n_2\bar{x}_2}{\bar{x}_1 + \bar{x}_2}$ d) $\frac{n_1 + n_2}{\bar{x}_1 + \bar{x}_2}$

2. If $\sum(x-y)^2 = 72$ and n = 9, then the rank correlation between x and y is

   a) 0.4 b) 0.6

   c) 0.2 d) 0.8

3. If A and B are independent events with P(A) = ½ and P(B) = 1/3, then $P(A^C \cap B^C)$ =

   a) 1/3 b) ½

   c) 1/6 d) 5/6

4. A continuous random variable X has a p.d.f f(x) = $3x^2$; $0 \le x \le 1$. If $P(X \le a) = P(X > a)$ then the value of 'a' is

   a) ½ b) ¼

   c) $1/\sqrt{4}$ d) $(1/2)^{1/3}$

5. The binomial distribution whose mean is 3 and variance 2 is given by

   a) $9C_r\left(\frac{2}{3}\right)^r\left(\frac{1}{3}\right)^{9-r}$ b) $3C_r\left(\frac{2}{3}\right)^r\left(\frac{1}{3}\right)^{3-r}$

   c) $2C_r\left(\frac{2}{3}\right)^r\left(\frac{1}{3}\right)^{2-r}$ d) $9C_r\left(\frac{1}{3}\right)^r\left(\frac{2}{3}\right)^{9-r}$

6. The mgf of a random variable X is $M_x(t) = e^{5(e^t-1)}$ then $E(x^2)$ is

   a) 5 b) 1/5

   c) 25 d) 30

7. The small sample test used for testing the equality of two variances is

   a) t – test b) normal test

   c) F – test d) χ^2 – test

8. Degrees of freedom for testing the difference between two means in the small sample is

a) $n_1 + n_2 - 2$ b) $n_1 - 2$

c) $n_2 - 2$ d) $n_1 + n_2 - 1$

9. If m = number of rows, n = number of columns, p = number of treatments in a LSD, then

a) $m = n \neq p$ b) $m \neq n = p$

c) $m = n = p$ d) $m \neq n \neq p$

10. If $\bar{x}_1, \bar{x}_2, \bar{x}_3, \ldots\ldots \bar{x}_k$ are the means of the samples then grand mean $\bar{\bar{x}}$ is given by

a) $\sum_{i=1}^{k} \bar{X}_i$ b) $\frac{\sum_{i=1}^{k} X_i}{N_i}$

c) $\sum_{i=1}^{k} \frac{X_i}{N_i}$ d) $\frac{\sum_{i=1}^{k} \bar{X}_i}{\sum_{i=1}^{k} N_i}$

PART B (10 x 2 = 20 Marks)

11. What are the different methods of measuring dispersion?
12. If r = 0.8, b_{xy} = 1.2 and SD_x = 2.4, find SD_y & b_{yx}.
13. Prove that the probability of an impossible event is zero.
14. If $F(x) = 1 - e^{-\lambda x}, 0 \leq x \leq \infty$, find the p.d.f of x.
15. Find the M.G.F of Poisson distribution.
16. Define Standard Normal distribution.
17. Write any two applications of χ^2 (chi - square) test.
18. What is the standard error of the sample proportion when the population is known & unknown.
19. What is analysis of variance? What are the assumptions made in it?
20. Why a 2 x 2 Latin Square is not possible? Explain.

PART C (5 x 14 = 70 Marks)

21. a) The index number of prices of cotton and coal shares in 2011 are as under:

Month	Cotton shares	Coal shares
January	188	131
February	178	130
March	173	130
April	164	129
May	172	129
June	183	120
July	184	127
August	185	127
September	211	130
October	217	137
November	232	140
December	240	142

Which of the two shares is more consistent?

(OR)

b) (i) Ten competitors in a beauty contest are ranked by three judges in the following order: (6)

I Judge:	1	5	4	8	9	6	10	7	3	2
II Judge:	4	8	7	6	5	9	10	3	2	1
III Judge:	6	7	8	1	5	10	9	2	3	4

Use rank correlation coefficient to discuss which pair of judges have the nearest approach to common tastes in beauty.

(ii) From the data (8)

X:	2	8	10	-2	5	-4
Y:	3	2	5	10	-2	-3

Find 1) The two regression equations 2) Coefficient of correlation
3) Most likely value of X when Y = 12.

22. a) (i) Two defective tubes get mixed up with 2 good ones. The tubes are tested, one by one, until both defective are found. What is the probability that the last defective tube is obtained on (1) the second test (2) the third test and (3) the fourth test? (6)

(ii) For a certain binary communication channel, the pro bability that a transmitted zero is received as zero is 0.95 and the probability that a transmitted 1 is received as 1 is 0.90. If the probability that a 0 is transmitted is 0.40, find the probability that (1) 1 is received 2) 1 was transmitted given that 1 was received. (8)

(OR)

b) (i) The probability function of an infinite discrete distribution is given by (7)

$P(X=j)=\frac{1}{2^j}$ $(j=1, 2, ...)$. F ind (1) Mean of X (2) $P(X \geq 5)$

(3) P(X is even) (4) P (X is divisible by 3)

(ii) Find the moment generating function of $f(x)=\begin{cases} K\, e^{-Kx}, & x>0 \\ 0 & otherwise \end{cases}$ (7)

Hence find (1) Mean and (2) Variance (3) μ_3' (4) μ_4'.

23. a) Fit the Poisson distribution for the following data:

X:	0	1	2	3	4	5	Total
f:	142	156	69	27	5	1	400

(OR)

b) The saving bank account of a customer showed an average balance of Rs.150 and a standard deviation of Rs.50. Assuming that the account balances are normally distributed, (1) What percentage of account is over Rs.200? (2) What percentage of account is between Rs.120 and Rs.170? (3) What percentage of account is less than Rs.75?

24. a) (i) Two random sample give the following information regarding weights in pounds of a group of boys and girls: (7)

	Boys	Girls
Size of sample	300	625
Mean	145	150
Standard Deviation	3	2.5

Do you think the two populations differ? You may assume that the populations are Normal.

(ii) The weight gains in pounds under two system of feeding of calves of 10 pairs of identical twins is given below: (7)

Twin pairs	1	2	3	4	5	6	7	8	9	10
Weights gains under :										
System A	43	39	39	42	46	43	38	44	51	43
System B	37	35	34	41	39	37	35	40	48	36

Discuss whether the difference between the two systems of feeding is significant. (Table value at 5% = 1.833).

(OR)

b) Two random samples gave the following results:

Sample	Size	Sample mean	Sum of the square of deviations from the mean
1	10	15	90
2	12	14	108

Examine whether the samples come from the same normal population.

25. a) The figures in the following 5x5 Latin Square are the numbers of the engines E_1, E_2, E_3, E_4 & E_5 tuned up by mechanics M_1, M_2, M_3, M_4 & M_5 ran with gallon of fuel A, B, C, D and E.

	E_1	E_2	E_3	E_4	E_5
M_1	A31	B24	C20	D20	E18
M_2	B21	C27	D23	E25	A31
M_3	C21	D27	E25	A29	B21
M_4	D21	E25	A33	B25	C22
M_5	E21	A37	B24	C24	D20

Use the level of significance $\alpha = 0.01$ to test the null hypothesis, that
(1) there is no difference in the performance of the five engines
(2) the persons who tuned up these engines have no effect on their performance
(3) the engines perform equally well with each of the fuels.

(OR)

b) (i) Given below are the values of sample mean $\overline{X}$ and sample range R for 10 samples, each of size 5, draw the appropriate mean and range charts. Comment on the state of control of the process. (7)

Sample No.	1	2	3	4	5	6	7	8	9	10
Mean	43	49	37	44	45	37	51	46	43	47
Range	5	6	5	7	7	4	8	6	4	6

(ii) 15 tape-recorders were examined for quality control test. The number of defects in each tape-recorder is recorded below. Draw the appropriate control chart and comment on the state of control. (7)

Unit no. (i): 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
No. of defects (c): 2 4 3 1 1 2 5 3 6 7 3 1 4 2 1

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