Register Number:……………………..

B.E. DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2009)

Seventh Semester

MECHATRONICS ENGINEERING

MAT106: Probability and Applied Statistics

(Use of statistical tables may be permitted)

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Which of the following is the most reliable measure in taking average?
   a) Mean   b) Median
   c) Mode   d) Range

2. State the nature of correlation in "The amount of rain fall and the yield of crops"
   a) Negative   b) Positive
   c) No correlation   d) Not possible to define

3. Given $P(A) = 3/8$, $P(B) = 5/8$ and $P(A \cup B) = 3/4$, then $P(A/B)$ is
   a) 0.2   b) 0.1
   c) 0.4   d) 0.3

4. What is the variance of $(5 - 3X)$ where the mean and standard deviation of X are 5 and 4?
   a) 25   b) 16
   c) 316   d) 144

5. If X is the random variable defined under Binomial distribution with mean 9 and the standard deviation 3/2. What is the sample size?
   a) 12   b) 10
   c) 4   d) 9

6. The area occupied between $\mu - 2\sigma$ and $\mu + 2\sigma$ under the normal curve is
   a) 68%   b) 95.5%
   c) 99.7%   d) 100%

7. The standard error of the test concerning proportion successes is
   a) $\sqrt{\dfrac{pq}{n}}$ b) P

   c) Q   d) $\sqrt{pq}$

8. What is the degrees of freedom for R- rows and C- columns in a chi-square distribution?
   a) C R   b) (R-1) (C-1)
   c) R-1   d) C-1

9. Select the correction factor in a two way classification from the following.
   a) T x N   b) $T^2 \, x \, N$

   c) $\dfrac{T}{N}$ d) $\dfrac{T^2}{N}$

10. Choose the lower control limit of C- chart from the following.

   a) $\overline{C} - 3\sqrt{C}$
   b) $\overline{C} + 3\sqrt{C}$
   c) $3\sqrt{C}$
   d) $\overline{C} - 3C$

PART B (10 x 2 = 20 Marks)

11. List out the merits of standard deviation.
12. Define negative correlation and give an example.
13. A card is drawn from a well shuffled pack of playing cards. Solve for finding the probability that it is either a king or a queen?
14. A random variable X has the following probability distribution:

   X   : 0   1   2   3
   P(X) : 1/3   ½   0   1/6 . Discover the value of E (2X - 1).
15. In a Poisson distribution 3 P (x = 2) = P (x = 4). Find P (x = 3).
16. List out any four properties of Binomial distribution.
17. Summarize the types of errors in the testing of hypothesis.
18. What are the uses of ψ^2 test?
19. Write down the principles of experimental design.
20. What are the advantages of Control charts?

PART C (5 x 14 = 70 Marks)

21. a) (i) Estimate the mean deviation from the following data:

Marks less than:	80	70	60	50	40	30	20	10	(7)
No. of Students:	100	90	80	60	32	20	13	5	

   (ii) For the following data, estimate the coefficient of Rank correlation:

X:	80	91	99	71	61	81	70	59	(7)
Y:	123	135	154	110	105	134	121	106	

   (OR)

   b) Formulate a regression line for the age of husband with respect to the age of wife:

Age of husband:	25	22	28	26	35	20	22	40	20	18
Age of wife :	18	15	20	17	22	14	16	21	15	14

   Hence estimate the age of husband when the age of wife is 19.

22. a) (i) Bolts are manufactured by three machines A, B and C. A turns out twice as many bolts as B and machines B and C produce equal number of bolts. 2% of bolts produced by A and by B are defective and 4% of bolts produced by C are defective. All bolts are put into one stock pile and one is chosen from this pile. Assess the probability if the selected bolt is defective? (6)

   (ii) A random variable X has the following probability distribution

X :	-2	-1	0	1	2	3
P(X) :	0.1	k	0.2	2k	0.3	3k

   (8)

   Find i) the value of k. ii) P(X < 2). iii) Cumulative distribution of X and iv) the mean of X.

   (OR)

b) (i) Let X be a random variable with P.D.F $f(x)= \begin{cases} \dfrac{1}{3}\ e^{\frac{-x}{3}}, & x > 0 \\ 0, & otherwise \end{cases}$ (6)

Find i) $P(X > 3)$ and ii) M.G.F of X.

(ii) A man alternatively tosses a coin and throws a die, beginning with coin. What is the probability that he will get a head before he gets a 5 or 6 on the die? (8)

23. a) (i) The customer accounts at a certain departmental store have an average balance of Rs. 480 and a standard deviation of Rs. 160. Assuming that the account balance are normally distributed (6)
i) What proportion of the accounts is over Rs. 600?
ii) What proportion of the accounts is between Rs. 400 and Rs. 600?

(ii) In a city with 100 municipal wards, each having approximately the same population, the distribution in the year 2005 was found as below.

No. of cases:	0	1	2	3	4
No. of wards:	63	28	6	2	1

Fit a Poisson distribution for the above. (8)

(OR)

b) (i) Write down the properties of a normal curve. (6)

(ii) Out of 320 families with 5 children each, what percentage would be expected to have i) 2 boys and 3 girls   ii) at least 1 boy? Assume equal probability for boys and girls. (8)

24. a) (i) The mean yield of wheat from a district A was 210 kgs with standard deviation 10 kgs per acre from a sample of 100 plots. In another district B, the mean yield was 220 kgs with standard deviation 12 kg from a sample of 150 plots. Assuming that the standard deviation of the yield in the entire state was 11 kg, (7) Examine whether there is any significant difference between the mean yield of crops in the two districts.

(ii) A die is tossed for 120 times with the following results:

Number turned up:	1	2	3	4	5	6
Frequency:	30	25	18	10	22	15

Test the hypothesis that the die is unbiased. (7)

(OR)

b) (i) A salesman is expected to effect an average sales of Rs. 3500. A sample test revealed that a particular salesman had made the following sales: Rs. 3700; (7) 3400; 2500; 5200; 3000 and 2000. Using 0.05 level of significance, conclude whether his work is below standard or not.

(ii) A random sample of 400 items gives the mean 4.45 and the variance as 4. Can the sample be regarded as drawn from the normal population with mean 4? (7)

25. a) The following data represent the number of units of a product produced by 3 different workers using 3 different types of machines.

Workers	Machines		
	A	B	C
X	8	32	20
Y	28	36	38
Z	6	28	14

Test i). whether the mean productivity is the same for the different machines, and
ii). Whether the three workers differ with respect to mean productivity.

(OR)

b) (i) The following data show the values of sample mean and range for 10 samples for size 6 each. Calculate the values for central line and the control limits for mean chart. Draw the control chart.

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

(Conversion factors for n = 6 are $A_2 = 0.483$, $D_3 = 0$, $D_4 = 2.004$)

(ii) Construct a control chart for the proportion of defectives obtained in repeated random samples of size 100 from a process which is considered to be under (6) control when the proportion of defective p is equal to 0.20. Draw the control line and the upper and the lower control limits.

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