Register Number:………….

B.TECH DEGREE EXAMINATIONS: NOV/DEC 2014
(Regulation 2009)
Third Semester
MAT106: PROBABILITY AND APPLIED STATISTICS
(Common to FT/BT/TXT)

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

Answer all the Questions:-
PART A (10 x 1 = 10 Marks)

1. 10 is a mean of set of 7 observations and 5 is the mean of a set of 3 observations. The mean of the combined set is
   a) 15
   b) 7.5
   c) 10
   d) 8.5

2. Spearman's rank correlation coefficient is
   a) $r = 1 - \sum_{i=1}^{n} di^2$
   b) $r = 1 - \dfrac{\sum_{i=1}^{n} di^2}{n(n^2 - 1)}$
   c) $r = \dfrac{\sum_{i=1}^{n} di^2}{n(n^2 - 1)}$
   d) $r = 1 - \dfrac{\sum_{i=1}^{n} di}{n^2 - 1}$

3. var (ax + b) =
   a) a var (ax + b)
   b) a^2var (ax + b)
   c) a^2var(X)
   d) a var(X)

4. Let A, B & C be the three exhaustive and mutually exclusive events associated with an experiment and let P(B) = 3/2 P(A), P(C) = 1/3 P(B) then P(A) is
   a) 2/3
   b) 3/2
   c) 1
   d) 1/3

5. In a binomial distribution, mean is 2.4 and variance is 1.44. Then the probability of success p is
   a) 0.3
   b) 0.6
   c) 0.4
   d) 0.7

6. If X is a normal variate with mean 30 and S.D 5 , then $P(26 \leq X \leq 40) is$
   a) 0.7653
   b) 0.5
   c) 0.4772
   d) 0.2881

7. When testing hypothesis about a population proportion from a large sample, standard error is
   a) $\sqrt{\dfrac{PQ}{n}}$
   b) $p - P$
   c) $\dfrac{p - P}{\sqrt{\dfrac{PQ}{n}}}$
   d) $\sqrt{PQ}$

8. Type I error is
   a) Accepting a lot when it is good
   b) Accepting a lot when it is bad
   c) Rejecting a lot when it is bad
   d) Rejecting a lot when it is good

9. Assigning the same number of plots in different blocks is called
   a) grouping
   b) blocking
   c) repeating
   d) balancing
10. It is impossible to have a Latin square of size
   a) 2 x 2
   b) 4 x 4
   c) 3 x 3
   d) 5 x 5

PART B (10 x 2 = 20 Marks)

11. Calculate the standard deviation for the following data:
    14, 22, 9, 15, 20, 17, 12, 11.
12. Define regression.
13. State Baye's theorem.
14. When a die is thrown, X denotes the number that turns up. Find $E(X)$, $E(X^2)$ and variance.
15. Define a Poisson distribution.
16. What are the characteristics of Normal distribution?
17. Write the 95% and 99% fiducial limits of the mean of the population corresponding to a given sample.
18. Define level of significance in testing a hypothesis.
19. Define Analysis of Variance.
20. Define tolerance limits in control charts.

PART C (5 x 14 = 70 Marks)

21. a) (i) Calculate arithmetic mean for the following data: (7)

Value	Frequency
0-9	678
10-19	720
20-29	664
30-39	598
40-49	524
50-59	378
60-69	244

   (ii) A computer while calculating correlation coefficient between two variables X and (7)
   Y from 25 pairs of observation obtained the following results:
   $$N = 25; \sum x = 125; \sum x^2 = 650; \sum y = 100 \sum y^2 = 460; \sum XY = 508$$
   It was, however, discovered at the time of checking that two pairs of observations
   were not correctly copied. They were taken as (6, 14) and (8, 6) while the correct
   values were (8, 12) and (6, 8). Prove that the correct value of the correlation
   coefficient should be 2/3.

(OR)

   b) (i) The following table gives the marks obtained by 65 students in statistics in a (7)
   certain examination. Calculate median

Marks	No. of students
More than 70%	7
More than 60%	18
More than 50%	40
More than 40%	45
More than 30%	50
More than 20%	63
More than 10%	65

   (ii) Calculate the two regression equations of X on Y and Y on X from the data (7)

given below, taking the deviations from actual means of X and Y

Price (Rs): 10 12 13 12 16 15
Amount Demanded : 40 38 43 45 37 43

Estimate the likely demand when the price is Rs.20.

22. a) (i) A discrete random variable X has the probability mass function given below: (7)

Values of X = x 0 1 2 3 4 5 6 7
P(X = x) 0 k $2k$ $2k$ $3k$ k^2 $2k^2$ $7k^2 + k$

Find a) The value of k

b) $P(X<6)$, $P(X\geq6)$ & $P(0< X < 4)$

c) The distribution function of X.

(ii) Find the moment generating function and the rth moment (μ_r') for the (7) distribution whose probability density function is $f(x)=k\,e^{-x}$; $0\leq x<\infty$. Find also the standard deviation.

(OR)

b) (i) A bag contains 5 balls and it is not known how many of them are white. Two (7) balls are drawn at random from the bag and they are noted to be white. What is the chance that all the balls in the bag are white?

(ii) Let X be a continuous RV with p.d.f $f(x)=\begin{cases} ax & 0\leq x\leq1 \\ a & 1\leq x\leq2 \\ -ax+3a & 2\leq x\leq3 \\ 0 & otherwise \end{cases}$ (7)

a) Determine 'a'

b) Find the cumulative distribution function of X

c) If x_1, x_2 and x_3 are 3 independent observations of X, what is the probability that exactly one of these 3 is greater than 1.5?

23. a) (i) Find the moment generating function of binomial distribution. Hence find its (6) mean and variance.

(ii) A machine manufacturing screws, is known to produce 5% defective. In a (8) random sample of 15 screws, what is the probability that there are

1) Exactly 3 defectives

2) Not more than 3 defectives

(OR)

b) (i) Fit a Poisson distribution to the following data and test the goodness of fit. (7)

X : 0 1 2 3 4 5 6
Frequency f : 275 72 30 7 5 2 1

(ii) For a normal distribution with mean 2 and variance 9, find the value of x_1, of the (7) variable such that the probability of the variable lying in the interval (2, x_1) is 0.4115.

24. a) (i) In order to compare the intelligence quotient of students, two schools were (7) selected. A random sample of 90 students was selected from each school. At school A, the mean I.Q is 109 and the standard deviation is 11. At school B, the mean I.Q is 98 and standard deviation is 9. Test whether there is any significance difference between schools by means of their I.Q levels.

(ii) The following data are collected on two characters. (7)

	Smokers	Non – Smokers
Literates	83	57
Illiterates	45	68

Based on this, can you say that there is no relation between smoking and literacy?

(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 at 5% level of significance.

25. a) (i) The table given below shows the yield of a certain crop in kgs per plot. The (9) letters A, B, C, D refer to 4 different manorial treatments. Carry out and analysis of variance.

A260   B300   C335   D371
B280   A300   D300   C410
D320   C345   B340   A254
C372   D395   A290   B328

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

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

(OR)

b) (i) The following data represents the number of units of productions per day turned (7) out by different workers using four different types of machines.

		Machine Type			
		A	B	C	D
	1	44	38	47	36
Workers	2	46	40	52	43
	3	34	36	44	32
	4	43	38	46	33
	5	38	42	49	39

a)Test whether the 5 men differ with respect to mean productivity
b) Test whether the mean productivity is the same for the four different machine types.

(ii) The number of defects found in 20 rolls are given below. Find whether the (7) process is under control or not, using appropriate control chart

12, 14, 7, 6, 10, 10, 11, 12, 5, 18, 12, 4, 4, 9, 21, 14, 8, 9, 13, 21

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