STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI - 600 086
(For candidates admitted during the academic year 2015-2016)

SUBJECT CODE : 15MT/AC/ST35

B. Sc. DEGREE EXAMINATION, NOVEMBER 2016
BRANCH I - MATHEMATICS
THIRD SEMESTER

COURSE : ALLIED – CORE
PAPER : MATHEMATICAL STATISTICS - I
TIME : 3 HOURS **MAX. MARKS : 100**

SECTION – A **(10X2=20)**
ANSWER ALL THE QUESTIONS

1. State the axioms of probability.
2. Differentiate mutually exclusive and independent events.
3. Define random variable and state it types.
4. Find the constant c such that the function $f(x)=\begin{cases} cx^2 & 0<x<3 \\ 0 & otherwise \end{cases}$ is a density function.
5. Find the expectation of the discrete random variable X whose probability function is given by $f(x)=\left(\frac{1}{2}\right)^x$, $x=1,2,3,\dots$.
6. Define characteristic function.
7. Write down the recurrence relation for binomial distribution.
8. The mortality rate for a certain disease is 7 in 1000. What is the probability for 2 deaths on account of this disease in a group of 400?
9. Under what conditions, normal distribution is a limiting form of binomial distribution.
10. Define standard normal distribution.

SECTION – B **(5X8=40)**
ANSWER ANY FIVE QUESTIONS

11. If A and B are any two events, prove that $P(A\cup B)=P(A)+P(B)-P(A\cap B)$. Using the same, write down the formula for any three events.
12. Suppose a coin is tossed twice. Find the probability and distribution functions.
13. State and prove Chebyshev's inequality.
14. Assuming that the typing mistakes per page committed by a typist follows a Poisson distribution, find the expected frequencies for the following distribution of typing mistakes.

No. of mistakes per page	0	1	2	3	4	5
No. of pages	40	30	20	15	10	5

15. The marks of the students are normally distributed such that 10% get more than 75 marks and 20% get less than 40 marks. Find the mean and standard deviation of the distribution.

16. A box contains 6 red balls, 4 white balls and 5 blue balls.
    (a) A ball is drawn at random from the box, determine the probability that it is (i) red, (ii) white, (iii) red or white.
    (b) Three balls are drawn successively from the box, find the probability that they are drawn in the order red, white, and blue if each ball is (i) replaced, (ii) not replaced.
17. The sum and the product of the mean and variance of a binomial distribution are 24 and 128 respectively. Find the distribution.

SECTION – C (2X20=40)
ANSWER ANY TWO QUESTIONS

18. (a) State and prove Bayes' theorem. Using the same solve the following problem: A box contains 3 blue and 2 red marbles while another box contains 2 blue and 5 red marbles. A marble drawn at random from one of the boxes turns out to be blue. What is the probability that it came from the first box? (10)
    (b) The joint density function of two continuous random variables *X* and *Y* is given by
    $f(x) = \begin{cases} cxy & 0 < x < 4,\ 1 < y < 5 \\ 0 & otherwise \end{cases}$. (i) Find the value of the constant *c*
    (ii) Find $P(1 < X < 2, 2 < Y < 3)$ (iii) Find $P(X \geq 3, Y \leq 2)$. (10)

19. (a) Prove that (i) If a is any constant, $Var(ax) = a^2 Var(X)$ (ii) The quantity $E[(X-a)^2]$ is minimum when $a = E(X)$. (10)
    (b) The random variable X can assume the values 1 and -1 with probability 1/2 each. Find (i) the moment generating function (ii) the first four moments about the origin. (10)

20. (a) If the probability that a man aged 60 will live to be 70 is 0.65, what is the probability that out of 10 men now 60, at least 7 will up to 70? (10)
    (b) Write down any ten properties of a normal curve. (10)

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