ANSWER ALL QUESTIONS IN SECTION "A" AND TWO QUESTIONS IN SECTION "B"

SECTION A [50marks]

Answer all questions in this section

1. Consider the function:

$$f = \begin{cases} Kx^3(1-x), & 0 \le x \le 1; K > 0 \\ 0, & elsewhere \end{cases}$$

Find:

   a) The value of K for which the function $f(x)$ is probability density function
   b) The moment generating function
   c) Using the moment generating function, find $E(x)$ and $Var(x)$ *20marks*

2. Consider the bivariate discrete random variable X and Y with probability function:

$$p(x,y) = \frac{1}{27}(2x+y), \quad x = 0,1,2; y = 0,1,2.$$

   a) Verify that $p(x,y)$ is a legitimate probability mass function
   b) Find the joint probability $p(1 \le x \le 2; 0 \le y \le 1)$
   c) Verify whether X and Y are independent or not   *20marks*

3. The joint probability mass function X and Y is given by :

$$p(1,1) = \frac{1}{8}, \; p(1,2) = \frac{1}{4}, \; p(2,1) = \frac{1}{8}, \; p(2,2) = \frac{1}{2}$$

   a) Compute the conditional probability mass function of X , given $Y = i; \; i = 1,2.$
          10marks

Answer **two** questions Only from this section

4) The joint probability distribution of X and Y is given by

$$f(x,y) = \frac{x+y}{21}, \quad x = 1,2,3; \quad y = 1,2.$$

Find:

(a) The marginal distribution of X and hence find $\rho(x = 3)$

(b) The marginal distribution of Y and hence find $\rho(Y = 2)$ **25marks**

5) (a) Given the function

$$f(x, y) = \begin{cases} 4\,xy, & 0 \le x \le 1; 0 \le y \le 1 \\ 0, & eslewhere \end{cases}$$

Verify whether or not X and Y are independent.

(b) The joint probability density functions of X and Y is given by: **25marks**

$$f(x, y) = \begin{cases} kx, & 0 \le x \le 1; 0 \le y \le 1 \\ 0, & elsewhere \end{cases}$$

Verify whether or not X and Y are independent.

6) (a) An electric station services an area with 12,000 bulbs. The probability of switching on each of these bulbs every evening is 0.9.what are the bounds for the probability that the number of bulbs switched on in the area in one particular evening is different from its expected value in absolute terms by:

(i) Less than 100?

(ii) At least 120

(b) The mean lifetime of certain electrical device is 4 years. Find the lower bounds for the probability that a randomly selected device from a consignment of such devices will not exceed 20 years.   **25marks**