(3 Hours)   Total Marks : 100

N. B. : (1) **Question 1 is compulsory.**
       (2) Answer any **three** from **Question 2 to 5**
       (3) Figures to the right indicate **full** marks.
       (4) **Draw** neat labelled diagrams wherever **necessary.**

1. (a) If $\overline{F} = (y^2 \cos x + z^3)\,\overline{i} + (2y \sin x - 4)\,\overline{J} + (3xz^2 + 2)\overline{K}$ is a force field, find   5
    the work done in moving an object in this field from $(0, 1, -1)$ to
    $\left(\dfrac{\pi}{2}, -1, 2\right)$.

  (b) Two urns contain respectively 5 white and 3 black balls; 2 white and 3   5
    black balls. One ball is drawn from each urn. Find the expected number of
    white balls drawn.

  (c) The probability distribution of a random variable is given by   5
    X   : -2   -1   0   1   2   3
    P (x =x): 0.1   k   0.2   2k   0.3   k
    find k, the mean and variance.

  (d) Determine the nature of singalarities of the following function   5
    $(z+1) \sin\left(\dfrac{1}{z+2}\right)$

2. (a) Evaluate $\displaystyle\int_c \dfrac{\sin \pi z^2 + \cos \pi z^2}{z^2 + 3z + 2}$, where C is   6

    (i) $|Z| = 1$ (ii) $|Z| = 2$

  (b) gf $z = ax+by$ and r is the correlation coefficient between x and y brove that   6
    $\sigma z^2 = a^2 \sigma x^2 + b^2 \sigma y^2 + 2ab r \sigma x \sigma y$

  (c) Verify the stokes theorem for the vector field $\overline{F} = x^2\,\overline{i} + xy\,\overline{J}$ and curve is   8
    boundary of the rectangle $x = 0$, $y = 0$, $x = a$, $y = b$

3. (a) The marks obtained by 10 students in an examination were as follows   6
    70,65,68,70,75,73,80,70,83,86. Find the mode,median, mean deviation
    about the mean.

  (b) If x denotes the outcome when a fair dice is tosed, find moment generating   6
    function of x and hence find the mean and variance of x.

  (c) Obtain Taylor's and Laurent's series explansion of $f(z) = \dfrac{z-1}{z^2 - 2z - 3}$ about   8
    origin indicating the regions of convergence.

4. (a) The marks obtained by students in an university are normally distributed   6
    with mean 65 and variance 25. If 3 students are selected at random, what is
    the probability that at least one of them would have scored more than 75
    marks?

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(b) Show that in a Possion distribution with unit mean, the mean diviation about mean is $\dfrac{2}{e}$ times standard deviation.   6

(c) Using Residece thorem evaluate $\displaystyle\int_0^{2\pi}\dfrac{d\theta}{1-2a\sin\theta+a^2}$ where $0<a<1$.   8

5. (a) Evaluate $\displaystyle\iint_s \overline{F}.d\overline{s}$ where $\overline{F}=4xy\overline{i}-2y^2\overline{J}+z^2\overline{k}$ and S is the region bounded by $y^2=4x$, $x=1$, $z=0$, $z=3$.   6

(b) Evaluate $\displaystyle\int_c\dfrac{z^2}{z^4-1}dz$ where C is the cirde   6

   (i) $|z|=\dfrac{1}{2}$ (ii) $|z+i|=1$

(c) In a sample of 600 men from a certain large city of south Africa, 450 are Ebala infected. In one of 900 from another large city 450 are infected. Do the data indicate a significant difference between the two cities as Ebola infection is concerned?   8

6. (a) Find the work done in moving a paritcle once around the ellipse $\dfrac{x^2}{16}+\dfrac{y^2}{9}=1$ in the plane $Z=0$ in the force field given by $\overline{F}=(3x-2y)\overline{i}+(2x+3y)\overline{j}+y^2\overline{k}$.   6

(b) Evaluate $\displaystyle\int_c\dfrac{dz}{z^3(z+4)}$, Where C is the circle $|z|=2$.   6

(c) A certain injection administered to 12 patients resulted in the following charges of bload pressure:
5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4, can it be conducted that the injection will be in general accompanied by an increse in blood pressure?   8

7. (a) Locate the mode from the following data   6

Marks	6	7	8	9	10	11	12	13	14
No.of Studsents	5	12	18	25	19	9	5	3	2

(b) Using Residue theorem evaluate $\displaystyle\int_c\dfrac{\sin^6 z}{\left(z-\dfrac{x}{6}\right)^3}dz$ where C is $|z|=1$.   6

(c) A transmission channel has a per-diget error probability $p=0.01$. Calculate the probability of more than one error in 10 received digits using.   8

   (i)   Binomial distribution

   (ii)   Poisson Distribution