

**SECTION A (40 MARKS)**

1. Two events A and B are neither independent nor mutually exclusive, such that  $P(A) = \frac{1}{3}$ ,

$$P(B) = \frac{2}{9} \text{ and } P\left(\frac{A}{B}\right) = \frac{1}{2}. \text{ Find the;}$$

(a)  $P(A \cap B)$

(b)  $P\left(\frac{B}{A}\right)$

2. A particle of mass 0.2kg and velocity  $(5i + 7j)ms^{-1}$  collides with another particle of mass 0.3kg and velocity  $(2i - 3j)ms^{-1}$ . If the particles stick together, find the;

(i) common velocity

(ii) loss in kinetic energy

3. The number A = -4.261 and B = 9.3194 are each rounded off to the given number of decimal places. Find the minimum and maximum values of  $\frac{A}{B}$  correct to 4 decimal places

4. An overloaded tax travelling at a constant speed of  $25ms^{-1}$  passes a stationary traffic police car. Two seconds later, the police car sets off in pursuit of the taxi accelerating at  $6ms^{-2}$ . Calculate the distance covered by the police car before catching up with the tax.

5. The probability distribution of the number of heads, X, when a coin is tossed 4 times is given by;

$$f(x) = \begin{cases} \binom{4}{x}, & x = 0, 1, 2, 3, 4 \\ k & \text{elsewhere} \\ 0 & \end{cases}$$

Find the value of k and the expectation of X

6. Use the trapezium rule with six subintervals to estimate the  $\int_0^{\pi} (x \sin x) dx$  correct to 3 decimal places.

7. The following table gives the distribution of the interest paid to 500 shareholders of Coffee Growers Association at the end of 2014.

Interest(000's)	25 -	30 -	40-	60-	80-	110 -	120 - < 130
No of Shareholders	17	55	142	153	93	20	20

Draw a histogram to illustrate the data and use it to estimate the modal interest

8. A body of mass 8kg in contact with a rough plane inclined at  $50^\circ$  to the horizontal is just prevented from sliding down the plane by a horizontal force P. If the angle of friction between the plane and the body is  $25^\circ$ . Calculate the magnitude of P

**SECTION B (60 MARKS)**

9. (a) In a box containing 12 pieces of chalk, 3 are broken. If a random sample of 40 such boxes is taken, calculate the probability that between 8 and 13 boxes contain broken pieces of chalk.  
(b) A computer company produces a component whose masses are normally distributed with mean 30 and standard deviation 7 grams. If a random sample of 9 such a component is taken, find the probability that the mean mass lies between 27 and 29 grams
10. (a) A particle of mass 40 grams performs simple harmonic motion about point O between two points A and B on a horizontal plane. If  $AB=10\text{cm}$  and the period of motion is  $\frac{\pi}{10}$  seconds. Find the work done by the particle in moving from O to A.  
(b) A body of mass 0.5kg is suspended from the end of a light elastic string of length 0.5m and modulus of elasticity 196N. If the body is pulled vertically down through a distance of 0.2m from the equilibrium position and then released from rest;  
(i) Show that the body moves with simple harmonic motion  
(ii) Calculate the time taken by the body to move from its lowest point through a distance of 0.15m.
11. (a) By drawing a suitable graph, estimate the negative root of the equation  $2e^x + x^2 - 4 = 0$   
(b) Derive the simplest iterative formula based on Newton-Raphson's method for finding a better approximation to the negative root of the equation in (a) above. Hence find the root of the equation correct to 3 decimal places.

12. The probability density function of a random variable X is given by;

$$f(x) = \begin{cases} kx^2 & 0.1 \leq x \leq 0.25 \\ \frac{1}{4}k(0.5 - x) & 0.25 \leq x \leq 0.5 \\ 0 & \text{Otherwise} \end{cases}$$

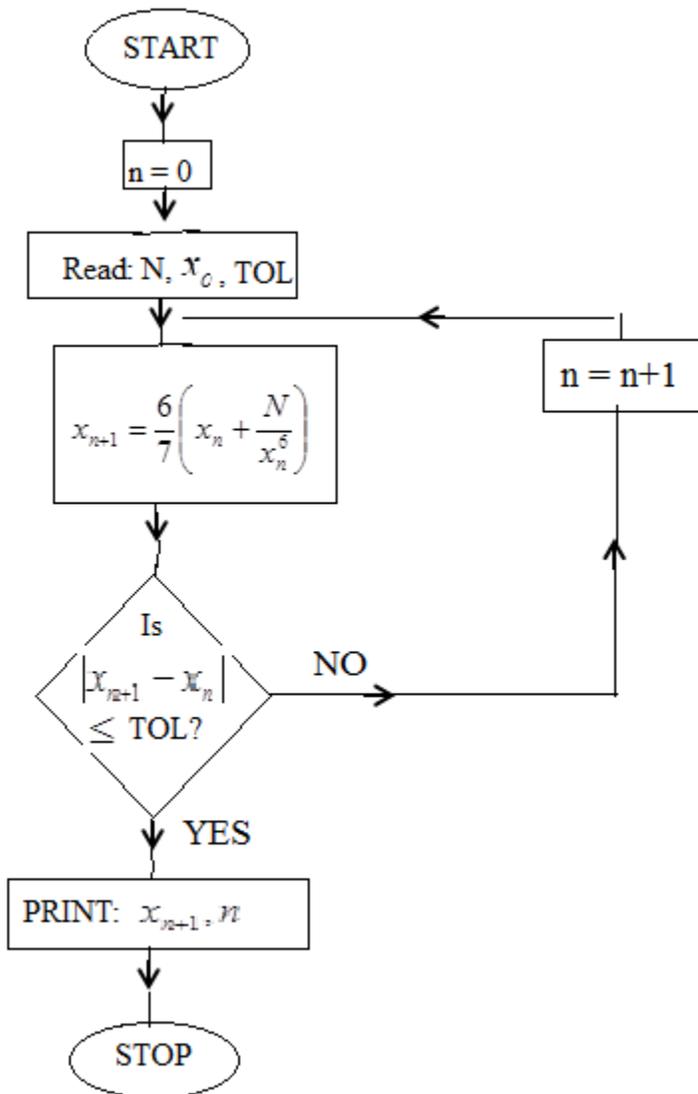
- (a) Sketch the function  $f(x)$   
(b) Find the;  
(i) value of k  
(ii) mean of X

13. (a) The table below shows the value of tanx

x	1.11	1.15	1.19	1.23
tanx	2.0143	2.2345	2.4979	2.8198

Use linear interpolation/extrapolation to find;

- (i) tanx when x = 1.17
- (ii) x when tanx = 3.0096
- (b) Study the flow chart below;



- (i) Perform a dry run for  $x_o = 1.8$ ,  $N = 70$  and  $ToL = 0.00005$
- (ii) State the purpose of the flowchart

14. (a) A rally car increased speed from  $108\text{kmh}^{-1}$  to  $72\text{kmh}^{-1}$  in a distance of  $0.05\text{km}$ , the acceleration being constant. Find the speed when the car has covered a distance  $0.5\text{m}$

(b) A stone is thrown from the top of a hill  $100\text{m}$  high at an angle of  $30^\circ$  below the horizontal. If it hits the ground  $20\text{m}$  from the foot of the hill, find the;

(i) initial speed of the stone

(ii) direction in which the stone is moving when it hits the ground

15. (a) Show that the centre of mass of a hemisphere of radius,  $r$  is  $\frac{3r}{8}$ , from the plane face

of the hemisphere

(b) A body consists of a solid hemisphere of radius  $8\text{cm}$  with its plane face fixed to the base of a solid right circular cone of radius  $8\text{cm}$  and height  $15\text{cm}$ . find the distance of the centre of mass of the body from the centre of the common face.

16. The table shows the ages of people who attended a certain function.

Age(years)	10 – 19	20 – 34	35 – 44	45 – 64	65 – 79	80 – 89
Frequency	6	16	27	39	18	8

(a) Draw a cumulative frequency curve and use it to estimate the semi-interquartile range.

(b) Calculate the;

(i) mean age

(ii) standard deviation of the data

END