This question paper contains 4 printed pages. *Your Roll No. .....*

Sl. No. of Ques. Paper : **5926** **F**

Unique Paper Code : **235354**

Name of Paper : **Mathematical Awareness**

Name of Course : **B.A. (Hons.) Programme**

Semester : **III**

Duration : **3 hours** *Maximum Marks* : **75**

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt all questions as per directed questionwise.

1. Do any three parts:-

a) Answer in one or two words

i) Which American President mastered six books of Euclid.

ii) Name the mathematician with whom Newton was involved in a dispute over the invention of calculus.

iii) Who are the two mathematicians with whom Ramanujan collaborated in Cambridge?

iv) When was Riemann appointed as the professor in Gottingen University? 4

b) State whether the following statement are true or false. If false, then give the correct answer.

i) Euclid's 'elements' mainly deal with the postulate and axioms of Graph theory.

ii) Newton's father died 3 months before Newton was born.

iii) Euclid is regarded as the pioneer in the invention of Graph Theory.

iv) Srinivasa Ramanujan died in London. 4

c) Answer the following briefly

i) What are the famous words of Euclid about geometry, said to king Ptolemy I ?

ii) What was the title of Emmy Noether's doctoral thesis?

iii) Differential Geometry grew from Newton's which idea?

iv) What was the name of Euclid's work on mathematical astronomy? 4

d) i) Name the mathematician who wrote the mathematical series named 'Element'.

ii) Mention any two achievements of Newton.

iii) Give the result about perfect numberthat was established by Euclid.

P.T.O

iv) What did Weyl write about Emmy Noether. 4

2. Do any three parts :

a) i) If $\varphi = \frac{1+\sqrt{5}}{2}$

Give a connection between the Fibonacci recurrence relation and φ. 2

ii) State the prime testing method of Fermat. Does converse hold? justify your answer by giving an example. 3

iii) Give four characteristics of William Beverley's 8^{th} order magic square. 2

b) i) What do the letters RSA stand for in the RSA system? 1

ii) Construct 9^{th} order composite magic square and give its magic sum. 3

iii) Using Euclidean algorithm, calculate gcd (12378, 3054) and find integers satisfying gcd (12378, 3054) = $12378x + 3054y$ 3

c) i) Does cancellation law hold true in modular arithmetic? Justify this by giving an example. 2

ii) Write $\frac{116}{367}$ as a finite continued fraction. 2

iii) Write three uses of prime numbers in daily life. 3

d) i) A licensing agency uses a system of any two letters from the English alphabet, followed by three digits (1 through 9), followed by any one of the letter from the English alphabet. Find the greatest possible number of licenses that can be issued using this system. 2

ii) Mark true or false. If false, then correct the statement.

(i) $9^{100} \equiv 9 \pmod{10}$

(ii) $12 \equiv (-8) \pmod{5}$

(iii) $10^{2001} \equiv (-1) \pmod{11}$ 3

iii) Define Primitive Pythagorean triples. State the Pythagorean number theorem. 2

3. Do any three parts

a) i) Write short notes on Mobius Strip and Klein Bottle emphasizing on their similarities and differences. 4

ii) Draw the graph of the following functions and indicate where the function is increasing and decreasing:

(I) $f(x) = |x|$ in $[-1, 1]$

(II) $f(x) = \sqrt{1-x^2}$ in $[-1, 1]$ 3

iii) State the Four-Color Map Problem. 1

b) i) Explain how the snowflake curve is formed. What can be said about its perimeter and area? Also show that the area of the snowflake curve is finite. 4

ii) Define Reflection and Rotational symmetries. What are the set of symmetries of an equilateral triangle? Show that it forms a group. 4

c) i) Define a regular polyhedron. Describe the types of regular polyhedra. Also verify Euler's formula for the five regular Polyhedra. 4

ii) Briefly explain any four of the following :

(i) Perspective and projection

(ii) Golden ratio

(iii) Basic tilings

(iv) Even functions

(v) Fire Alters 4

d) i) How did perspective geometry bring a change in the paintings after the Renaissance period. 2

ii) Show that perimeter of the snowflake curve in infinite. 3

iii) Define complete graph and regular graph. Give one example of each. 3

4. Do any two parts :

a) i) Explain the meaning of skewness. What are the objective of measuring it. 2

ii) A die is loaded so that :

$P(1) = P(2) = P(3) = \frac{1}{4}$

$P(4) = P(5) = P(6) = \frac{1}{12}$

If $E = \{1, 2\}$, $F = \{1, 4\}$, then

Show that E and F are not independent and are not mutually exclusive. 3

iii) Define basic solution and feasible region. Use the graphical method to solve the following Linear programming problem :

Max $Z = 3x + 4y$

subject to the constraints

$x + 4y \leq 24$

$7x + y \leq 21$

$x + y \leq 9$

$x, y \geq 0.$ **4**

b) i) Under what conditions would you use the median rather than mean as a measure of central tendency? Why? **2**

ii) A bag contains 8 white and 4 red balls. Five balls are drawn at random. What is the probability that 2 of them are red and 3 white? **3**

iii) Draw a graph of the following problem, show the feasible region and solve :

Max $Z = 3x + 2y$

subject to the constraints

$x + y \geq 1,$

$3x + 2y \leq 6,$

$x, y \geq 0$ **4**

c) i) How are the standard deviation and variance the same, and how are they different? **3**

ii) Graph the set of following inequalities and indicate the feasible region :

$2x + y \geq 10,$

$x \geq 6,$

$y \geq 2,$

$x, y \geq 0.$ **3**

iii) Use the graphical method to solve the following Linear Programming Problem :

Max $Z = x - y$

subject to the constraints

$x + y \leq 1$

$2x + y \geq 3$

$x, y \geq 0.$ **3**