This question paper contains 4+2 printed pages]

Roll No. [ ][ ][ ][ ][ ][ ][ ][ ][ ]

S. No. of Question Paper : **618**

Unique Paper Code : **235354**   **G**

Name of the Paper : **Mathematical Awareness**

Name of the Course : **B.A. (Hons.) Interdisciplinary Course**

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*) (*i*)   Who proved that π is a transcendental number ?

   (*ii*)   Which book helped Ramanujan to teach himself mathematics in high school.

   (*iii*)   What was the topic of Emmy Noether's dissertation ?

   (*iv*)   Name the mathematician who wrote the mathematical series named 'Elements'.   4

   (*b*) (*i*)   What was Ramanujan's area of research ?

   (*ii*)   Newton had a dispute with a French mathematician over the invention of Calculus. Name the French Mathematician.

   (*iii*)   Other than Hardy name another English mathematician who came in contact with Ramanujan ?

   (*iv*)   Give the name of *three* important books that Newton wrote.   4

P.T.O.

(c) State whether the following statements are True *or* False. If false, then give the *correct* answer :

    (i) Emmy Noether showed a great relationship with her students.

    (ii) Euclid is regarded as the pioneer in the invention of Complex Analysis.

    (iii) The doctoral thesis of Riemann deal with the Number Theory.

    (iv) Srinivas Ramanujan died in London.   4

(d) (i) Which property given by Riemann remains an open question till this day.

    (ii) In which book did Newton develop the idea of gravitation based on the inverse square law ?

    (iii) One professor of mathematics at the Presidency College at Madras provided financial support to Ramanujan for a while around 1910. Who was he ?

    (iv) In which College in America did Emmy Noether find a temporary position in 1933 ?   4

2. Do any *three* parts :

    (a) (i) Show that every square integer is of the form $4k$ or $4k + 1$ where k is an integer.   4

    (ii) Using the above result show that no number in the sequence :

$$11, \ 111, \ 1111, \ 11111, \ \ldots\ldots\ldots\ldots$$

is a square.   3

(b) (i) Express greatest common divisor of 6237 and 2520 as a linear combination of 6237 and 2520. 4

(ii) Write $\dfrac{2520}{6237}$ as a continued fraction. 3

(c) (i) Verify that 2620 and 2924 form an amicable pair. 4

(ii) In how many ways the word "DAUGHTER" be arranged so that : 3

(1) All the vowels come together.

(2) Vowels occupy odd places.

(d) (i) Construct a magic square of order 7. What is its magic sum ? 4

(ii) What is a Fibonacci series ? Give *two* examples which show the existence of Fibonacci numbers in nature. 3

3. Do any *three* parts :

(a) Write short notes on :

(i) Perspective and Projection 3

(ii) Fermat and Mersenne numbers 2

(iii) Regular Polyhedra. 3

(b) (i) State the Four-Color map theorem. What is a Chromatic number ? Give the Chromatic numbers for a plane and a tours. 3

(ii) Give any *two* basic difference between the Mobius strip and the Klein Bottle.   2

(iii) Explain how the Konigsberg Bridge problem led to the discovery of Euler's formula for networks ?   3

(c) (i) Draw the graphs of the following functions and indicate where the function is increasing and decreasing :   3

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

(2) $f(x) = \sqrt{1-x^2}$.

Also, find their domain and range.

(ii) Discuss Golden triangle and Golden spiral with respect Golden ratio. What is the significance of Golden ratio in nature ?   3

(iii) Verify which of the following functions are even or odd via graphs :   2

(1) $f(x) = \tan x$

(2) $f(x) = \sec x$

(d) (i) Explain how the Snow flake curve is formed. What can be said about its perimeter and area ?   3

(ii) Explain "Fractals in nature" with examples.   3

(iii) What is Basic Tilings ? Discuss.   2

4. Do any *two* parts :

(a) (i) A die is thrown twice. What is the probability of getting a sum greater than or equal to 9 ?   3

(*ii*)　Find two numbers whose A.M. is 10 and G.M. is 8.　　　　2

(*iii*)　Use the graphical method to solve the following Linear Programming Problem :　　　　4

Max $Z = 3x + 4y$

Subject to the constraints

$$x + 4y \leq 24$$

$$7x + y \leq 21$$

$$x + y \leq 9$$

$$x, y \geq 0$$

(*b*)　(*i*)　An urn contains 7 red and 4 blue balls. Two balls are drawn at random, without replacement. What is the probability that both the balls are red ?　　　　3

(*ii*)　How are standard deviation and the variance same and how are they different ?　　　　2

(*iii*)　What is Optimal Feasible solution ? Use the graphical method to solve the following Linear Programming Problem :　　　　4

Max $Z = 2x + 3y$

Subject to the constraints

$$3x + y \leq 21$$

$$x + 4y \leq 24$$

$$x + y \leq 9$$

$$x, y \geq 0$$

(c) (i) Three envelopes are addressed for three secret letters written in invisible ink. A secretary randomly places each of the letters in an envelope and mails them. What is the probability that at least one person receives the correct letter ? 3

(ii) Explain the meaning of skewness. What are the objectives of measuring it ? 2

(iii) Define Basic Feasible Solution. Use the graphical method to solve the following Linear Programming Problem : 4

Max $Z = x - 7y$

Subject to the constraints

$$x + y \leq 8$$

$$x \leq 5$$

$$y \leq 5$$

$$x + y \geq 4$$

$$x, y \geq 0$$