This question paper contains **4+1** printed pages]

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

All questions are compulsory.

1. Do any *three* parts. Each part carries *four* marks.

    (*a*)   Answer in short :

        (*i*)   What distinction was Ramanujan awarded on graduating from school ?

        (*ii*)   What was Newton's achievement in 1703 ?

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

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

(*b*)   Answer briefly :

   (*i*)   Why was Emmy Noether not allowed to teach in Germany until 1900 but was

   allowed in France since 1861 ?

   (*ii*)   What did Riemann introduce in the only single paper he published on Number

   Theory ?

   (*iii*)   Name the mathematician with whom Newton was involved in a dispute over the

   invention of Calculus.

   (*iv*)   Name one work of Euclid on Mathematical astronomy.

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

   answer :

   (*i*)   Euclid is regarded as the pioneer in the invention of calculus.

   (*ii*)   Ramanujan passed away at the ripe old age of 82.

   (*iii*)   Riemann investigated the mechanism of the human ear.

   (*iv*)   Newton's father died three months before Newton was born.

(*d*)   Answer briefly :

   (*i*)   Euclid's work was his own, culminating in the construction of five regular solids.

   What are these solids known as ?

(*ii*)   Name the first *two* Cambridge Professors who returned Ramanujan's work.

(*iii*)   All his life "he" found it difficult to relate to other people. Who is "he" in the above line ?

(*iv*)   Who invited Noether to join them at Gottingen ?

2.   Attempt any *three* parts. Each part carries *eight* marks.

(*a*)   (*i*)   State Vinogradov's Theorem and give examples in support of the theorem.   4

(*ii*)   State properties of perfect numbers with examples.   4

(*b*)   (*i*)   State Prime testing method given by Fermat. Is the converse true ?   4

(*ii*)   Find the value of *x* if :

$$1! + 2! + 3! + 4! + ... + 100! \equiv x \pmod 5.$$ 4

(*c*)   (*i*)   Define unit fractions and express $\dfrac{98}{100}$ and $\dfrac{25}{13}$ as unit fractions.   4

(*ii*)   Show that the sequence of the ratio of one Fibonacci number to one preceding it converges to the golden ratio.   4

(*d*)   (*i*)   Explain Durer's magic square.   4

(*ii*)   Define continued fraction and express $\dfrac{156}{46}$ as continued fraction.   4

P.T.O.

3. Do any *three* parts. Each part carries *eight* marks.

    (a) (i) Define Euler path and Hamiltonian path and give an example of a Euler path which is not a Hamiltonian path.

                        4

        (ii) Sketch the graph of the function $f(x) = x^2$ for $x \geq 0$. What are its domain and range ?

                        4

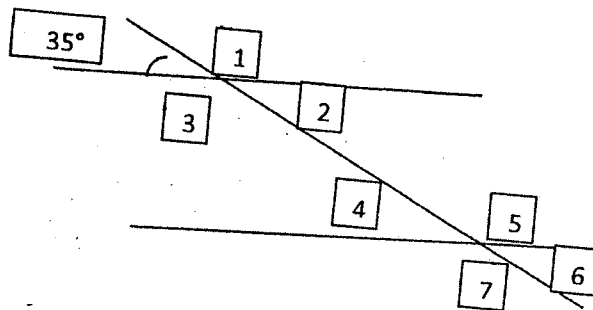   (b) (i) Explain how a Snowflake curve is formed ?

                        4

        (ii) What are the sets of symmetries of an isosceles triangle ?

                        4

    (c) (i) If $\sin x = (-7)/25$, find the values of the other trigonometric functions.   4

        (ii) Explain the difference between Euclidean and non-Euclidean Geometry.   4

    (d) (i) Define genus of a surface and give genus of a mobius Strip.

                        4

        (ii) Find the angles in the following figure :

                         · 4

4. Do any *three*. Each part carries *five* marks.

(a) Find two numbers whose arithmetic mean is 10 and geometric mean is 8.

(b) A bag contains 6 white and 4 black balls and a second bag contains 4 white and 8 black balls. One of the bags is chosen at random and a draw of 2 balls is made. Find the probability that one is white and other black.

(c) (i) Why range is a crude measure of dispersion ?

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

(d) Define Optimal solution of a Linear Programming Problem. Solve the following Linear Programming Problem :

Maximize : $Z = x_1 - x_2$

Subject to : $3x_1 + 2x_2 \leq 6$

$$x_1 - x_2 \leq 2$$

$$x_1, x_2 \geq 0.$$