5260   *Your Roll No.* ....

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Concurrent Courses for B.A. (Hons.) Programme

(Qualifying)

MATHEMATICAL AWARENESS

Time : 2 Hours   *Maximum Marks : 50*

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

*Note :– The maximum marks printed on the question paper are
applicable for the candidates registered with the School of
Open Learning for the B.A. (Hons.). These marks will,
however, be scaled down proportionately in respect of the
students of regular colleges, at the time of posting of
awards for compilation of result.*

Attempt **all** *questions as per
directed questionwise.*

1.   (a)   (i) Name four areas on which Riemann worked.

         (ii) Mention any two achievements of Newton ?
                                                              (4)

OR

(i) Who are the two mathematicians with whom Ramanujan collaborated in Cambridges ?

(ii) Give the result about perfect number that was established by Euclid.

(iii) What did Weyl write about Noether ?

(4)

(b) Answer in **one** or **two** words :

(i) When was Noether born ?

(ii) Who proved that $\sqrt{2}$ is an irrational number ?

(iii) When did Riemann present his doctoral thesis ?

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

(v) What was the name given to the geometry created by Euclid ?

(vi) What distinction was Ramanujan awarded on graduating from school ? (4)

2. Do any **three** parts :

(a) (i) Show that the square of any integer is of the form 3k or 3k + 1. (3½)

OR

Using Division. Algorithm establish that $\dfrac{a(a^2+2)}{3}$ is an integer for all $a \geq 1$.   (3½)

(ii) Express $\dfrac{53}{170}$ as a continued fraction.   (2)

(b) (i) State the Prime Number Theorem as conjectured by Legendre.   (3½)

(ii) If $a \equiv b \pmod{m}$ then $a^n \equiv b^n \pmod{m}$. Using this show that $2^{2^n} \equiv 1 \pmod 3$.   (2)

OR

Verify Goldbach's Conjecture for all even integers between 4 and 10.   (2)

(c) (i) Write the Binet's formula for the general term of the Lucas sequence and hence find the values of L_1, L_2, L_3.   (3½)

(ii) Construct an Albrecht Dürer's Magic square.   (2)

(d) (i) What is the standard form of a Latin square.   (3½)

OR

Define even and odd permutations. Give examples.   (3½)

(ii) The student welfare committee has 2 faculty, 2 administration members and 5 students on it. In how many ways can a sub-committee of 1 faculty, 1 administrative member and 2 students be formed ?   (2)

3. Do any **three** parts :

(a) What is the Königsberg Bridge Problem. Give the graphical representation of the problem by Euler, explaining why the solution to the problem did not exist.   (5½)

(b) Make a comparative study of any **two** of the following :

(i) Möbius Strip and Klein Bottle

(ii) Snowflakes and Coastlines

(iii) Even and odd functions   (5½)

(c) (i) Verify Euler's formula for the five regular polyhedra.   (3½)

(ii) Explain the relation between the golden ratio and the golden rectangle. Give examples of where they have been extensively used.

(2)

(d) (i) Draw the graphs of the following functions and indicate where the function is increasing or decreasing.

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

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

Also, find their domain and range.   (5½)

4. Do any **two** parts :

(a) The sum of deviations of a certain number of observations measured from 4 is 72 and the sum of observations of the same value from 7 is −3. Find the number of observation and their mean.   (4½)

(b) Find the probability of drawing a queen, a king and a knave in that order from a pack of cards in three consecutive draws, the cards drawn not being replaced.   (4½)

(c) Use graphical method to solve the following LP–problem

Min $P = 2X + 5Y$

w.r.t.

$$X + 3Y \geq 21$$

$$4X + Y \geq 24$$

$$X + Y \geq 9$$

$X, Y \geq 0$ (4½)