

This question paper contains 7 printed pages.]

Your Roll No.

5261

CONCURRENT COURSES FOR J
B.A. (Hons.) Programme
(Interdisciplinary)
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) Do any **two** parts :
- (i) When and what was Ramanujan's first job work other than tuitions ?
 - (ii) Mention any two achievements of Newton ?
 - (iii) What did the doctoral thesis of Riemann deal with ?

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

(i) Where did Euclid establish a mathematical school ?

(ii) What is the full name of Riemann ?

(iii) The branch of algebra named after Emmy Noether is called _____.

(iv) Which famous law was given by Newton ?

(v) Name the city where Euclid used to teach.

(vi) When did Noether die ? 4

(c) (i) What is there in the first book of "Elements" ?

(ii) What was principia based upon ?

(iii) When was Riemann appointed as a professor and to whom did he succeed ? 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. 3

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

11, 111, 1111, 11111, -----

is a square. $2\frac{1}{2}$

OR

- (i) Express greatest common divisor of 6237 and 2520 as a linear combination of 6237 and 2520. 3
- (ii) Write $\frac{2520}{6237}$ as a continued fraction. $2\frac{1}{2}$
- (b) (i) Define algebraic and transcendental numbers. Are algebraic numbers rational, irrational or both. $3\frac{1}{2}$
- (ii) If $a \equiv b \pmod{m}$ then $a^n \equiv b^n \pmod{m}$.
Using the above fact show that
 $2^{2^n} \equiv 1 \pmod{3}$ 2
- (c) (i) Using Fibonacci and Lucas numbers write the ascending integer powers of the golden number ϕ from ϕ^1 to ϕ^4 . $3\frac{1}{2}$
- (ii) Define even and odd permutation. Find which of the following are even permutations :
- (1) (1 2 3) (1 2)
- (2) (1 2) (1 4) (1 5 3) 2

OR

(ii) A student taking a history examination is directed to answer any seven of ten essay questions. In how many ways can the student answer the examination ? If the student has to answer three questions from the first five and four questions from the last five.

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(d) Show that eight different 3-rd order magic squares can be obtained from a given 3-rd order magic square formed with numbers 1 to 9. Illustrate.

$5\frac{1}{2}$

3. Do any **three** parts :

(a) (i) Explain how the Königsberg Bridge Problem led to the discovery of Euler's formula.

$3\frac{1}{2}$

(ii) Give any two basic difference between the Möbius strip and the Klein Bottle.

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- (b) Explain any **two** of the following with examples :
- (i) Regular Polyhedra
 - (ii) Symmetry Groups
 - (iii) Fractals in nature $5\frac{1}{2}$
- (c) (i) State the Four Color Map Theorem. What is a chromatic number ? Give the chromatic numbers for a plane and a torus. 4
- (ii) Name any four types of Fire-Altars used in Ancient India. $1\frac{1}{2}$
- (d) (i) Trace the graph of the function $f(x) = \sin x$ in the interval $[0, 2\pi]$. Indicate its inflection points and the points of absolute maximum and minimum. $3\frac{1}{2}$
- (ii) State which of the following are functions and which are non-functions. Give reasons.
- (1) $x = y^2$, where y is the independent variable and x , the dependent variable.

(2) $x = |y|$, where x is the independent variable and y , the dependent variable.

(3) $x = y^2$, where x is independent variable and y , the dependent variable.

(4) $y^2 = 1 - x^2$, where x is the independent variable, and y , the dependent variable. 2

4. Do any two parts :

(a) Find two numbers whose arithmetic mean is 10 and G.M. is 8. $4\frac{1}{2}$

(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 the other is black. $4\frac{1}{2}$

(c) Use graphical method to solve the following L.P. problem :

$$\text{Max } Z = 3x + 5y$$

$$\text{w.r.t. } 5x + y \geq 10$$

$$x + y \geq 6$$

$$x + 4y \geq 12$$

$$x, y \geq 0$$

Also shade the feasible region

$4\frac{1}{2}$