MATHEMATICS (M016)

Maximum Marks: 50

Time allowed: ***90 minutes***

Answers to this Paper must be written on the paper provided separately.

You will ***not*** *be allowed to write during first* ***10*** *minutes.*

This time is to be spent in reading the question paper.

The time given at the head of this Paper is the time allowed for writing the answers

Attempt ***all*** *questions from* ***Section A*** *and* ***any three*** *questions from* ***Section B****.*

All working, including rough work, must be clearly shown, and must be done on the same sheet as the rest of the answer.

Omission of essential working will result in loss of marks.

The intended marks for questions or parts of questions are given in brackets [ ]

Mathematical tables and graph papers are provided

SECTION A (20 marks)

(Attempt ***all*** *questions from this* ***Section****)*

Question 1

Choose the correct answers to the questions from the given options. [7]
(Do not copy the questions, write the correct answers only.)

(i) Mr. Sharma deposited ₹ 500 every month in a cumulative deposit account for 2 years. If the bank pays interest at the rate of 7% per annum, then the amount he gets on maturity is:

(a) ₹ 8,750

(b) ₹ 6,875

(c) ₹ 10,875

(d) ₹ 12,875

(ii) If $\dfrac{\sqrt{3x+4}+\sqrt{3x-5}}{\sqrt{3x+4}-\sqrt{3x-5}} = 9$, then, the value of x is:

(a) 2 (c) 4

(b) 7 (d) 9

(iii) What is the remainder when $2x^2 + 8x - 5$ is divided by $(x - 2)$?

(a) 17 (c) 18

(b) 16 (d) 19

(iv) If $A = \begin{bmatrix} -1 & 1 \\ a & b \end{bmatrix}$ and $A^2 = I$, then the values of a and b are:

(a) $a = b = 1$ (c) $a = b = 0$

(b) $a = 1, b = 0$ (d) $a = 0, b = 1$

(v) A cylinder and a cone are of the same base and of same height. The ratio of their volumes is:

(a) 1 : 2 (c) 3 : 1

(b) 2 : 1 (d) 3 : 2

(vi) $\sqrt{\dfrac{1+\cos A}{1-\cos A}} =$

(a) cosec $A + \cot A$ (c) cosec $A \cot A$

(b) cosec $A - \cot A$ (d) None of these

(vii) In a cylinder, if the radius is one-fourth and height is halved, then the volume will be:

(a) doubled (c) $\dfrac{1}{16}$ times

(b) $\dfrac{1}{8}$ times (d) $\dfrac{1}{32}$ times

Question 2

(i) When $x^3 + 3x^2 - kx + 4$ is divided by $(x - 2)$, the remainder is k. Find the value of k. [4]

(ii) Prove that: [4]

$$\frac{\sin\theta - 2\sin^3\theta}{2\cos^3\theta - \cos\theta} \times \cot\theta = 1$$

(iii) A solid metallic sphere of radius 6 cm is melted and made into a solid cylinder of height 32 cm. Find the: [5]

(a) Radius of the cylinder

(b) Curved surface area of the cylinder

SECTION B (30 marks)

*(Attempt **any three** questions from this **Section**)*

Question 3

(i) Solve for θ [3]

$$\frac{\cos^2\theta - 3\cos\theta + 2}{\sin^2\theta} = 1$$

(ii) If x, $2y$, $3z$ are in A.P., where the distinct numbers x, y, z are in G.P., then what is the common ratio of the G.P.? [3]

(iii) A circus tent is cylindrical to a height of 3 m and conical above it. If its base radius is 52.5 m and the slant height of the conical portion is 53 m, find the area of canvas required to make the tent. [4]

Question 4

(i) Find the roots of the following equation. [3]

$$\frac{1}{x+4} - \frac{1}{x-7} = \frac{11}{30},\ x \neq -4, 7$$

(ii) If $(x-9) : (3x+6)$ is the duplicate ratio of $4 : 9$, find the value of x. [3]

(iii) If $\begin{bmatrix} (2p+q) & (p-2q) \\ (5r-s) & (4r+3s) \end{bmatrix} = \begin{bmatrix} 4 & -3 \\ 11 & 24 \end{bmatrix}$, then the value of $p+q-r+2s$ is? [4]

Question 5

(i) Determine which term of the A.P. 121, 117, 113, ... is its first negative term? [3]

(ii) Using the remainder theorem, find the remainders obtained when $x^3+(kx+8)x+k$ is divided by $(x+1)$ and $(x-2)$. Hence, find k if the sum of the two remainders is 1. [3]

(iii) Find the roots of the following equation by using the quadratic formula. [4]

$$\sqrt{3}x^2 - 2\sqrt{2}x - 2\sqrt{3} = 0$$

Question 6

(i) Harshit has a cumulative bank account and deposits ₹ 600 per month for a period of 4 years. If he gets ₹ 5880 as interest at the time of maturity, find the rate of interest per annum. [4]

(ii) If $x = \dfrac{\sqrt{2a+1}+\sqrt{2a-1}}{\sqrt{2a+1}-\sqrt{2a-1}}$, then prove that $x^2 - 4ax + 1 = 0$. [6]