BOARD OF INTERMEDIATE AND SECONDARY EDUCATION
SHAHEED BENAZIRABAD

INTERMEDIATE EXAMINATION – 2023 (ANNUAL)
MATHEMATICS PAPER – 1 (MODEL QUESTION PAPER)

Time: 20 minutes | Maximum Marks: 20

SECTION – A
Multiple Choice Questions

Note: (i). This section consists of20 part questions and all are to be answered. Each question carries one marks.
(ii). Do not copy the part questions in your answer-book. Fill the circle of correct option.
(iii). The use of calculator is allowed. All notations are used in their usual meanings.

Q. 1. Choose the correct answer for each of the given options.

i). The real part of $\frac{2+i}{i}$ is equal to:
• 1 • 2 • -1 • $\frac{1}{2}$

ii). $\left(\frac{1+i}{1-i}\right)^{12} =$
• 1 • -1 • i • $-i$

iii). Let k be a scalar and A, B, C be the square matrix of the same order, then $(k\,ABC)^t =$
• $k\,A^tB^tC^t$ • $k\,C^tB^tA^t$ • $k\,ABC$ • $k\,CBA$

iv). If A is idempotent matrix, then:
• $A^2 = 1$ • $A^2 = 0$ • $A^2 = A$ • $A^2 = A^t$

v). The distance of the point $(-3, 4, 5)$ from the origin is:
• 50 • $5\sqrt{2}$ • 6 • $2\sqrt{5}$

vi). A sequence is a function whose domain is set of:
• *integers* • *rational numbers* • *natural numbers* • *real numbers*

vii). Let r be the common ratio of a geometric series, if $|r| > 1$, then infinite geometric series is:
• *convergent* • *divergent* • *undefined* • *harmonic series*

viii). $\sum_{n=40}^{46} 100\, n^0 =$
• 100 • 46 • 600 • 4600

ix). The product of number $16.17.18.19$ is also equal to:
• ${}^{20}P_4$ • ${}^{20}C_4$ • ${}^{19}P_4$ • ${}^{19}C_4$

x). Two teams A and B are playing a match, the probability that team A wins is:
• $\frac{1}{3}$ • $\frac{2}{3}$ • $\frac{1}{2}$ • 1

xi) $1 + 2x + 3x^2 + 4x^3 + \cdots =$
• $(1+x)^{-1}$ • $(1-x)^{-1}$ • $(1+x)^{-2}$ • $(1-x)^{-2}$

xii). Domain of the function $f(x) = \frac{2x-3}{4x-5}$ is the set of all real numbers except
• $\frac{3}{2}$ • 3 • $\frac{5}{4}$ • 5

xiii). The function $f(\theta) = \cos^3\theta$ is an/a:
• *even* • *odd* • *linear* • *neither even nor odd*

xiv). Solution space of linear inequality $2x + 3y \le 6, \forall\, x, y \in \mathbb{R}$, includes all points
• *above the line* • *below the line*
• *on and above the line* • *on and below the line*

xv). The feasible solution which maximizes or minimizes the objective function is called the:
• *optimal solution* • *corner solution*
• *initial solution* • *complex solution*

xvi). A group of angles are allied angle of basic angle θ, if sum or difference of any two of them gives the integral multiple of:
• 90^o or $\frac{\pi}{2}$ radians • 180^o or π radians • 30^o or $\frac{\pi}{6}$ radians • 45^o or $\frac{\pi}{4}$ radians

xvii). A circle, which passes through all vertices of a triangle is called the:
• *circum circle* • *incircle* • *tri − circle* • *e − circle*

xviii). In any equilateral triangle ABC, with usual notations, $r : R : r_1 =$
• $1:2:3$ • $3:2:1$ • $1:3:2$ • $1:1:1$

xix). $\sec\left[\sin^{-1}\left(-\frac{1}{2}\right)\right] =$
• $\frac{2}{\sqrt{3}}$ • $\frac{\sqrt{3}}{2}$ • $\frac{1}{2}$ • $-\frac{2}{\sqrt{3}}$

xx). The solution of $\sqrt{2}\sin\theta - 1 = 0$ in the interval $\left[\frac{\pi}{2}, \pi\right]$ is:
• $\frac{\pi}{4}$ • $\frac{3\pi}{4}$ • $\frac{5\pi}{4}$ • $\frac{7\pi}{4}$

SECTION – B

(Short-Answer Questions – Marks 50)

Note: Attempt any TEN part questions from this section, selecting at least THREE part questions from each question. You may choose the tenth part question from any one sub-section. All questions carry equation marks.

COMPLEX NUMBER, MATRIX AND DETERMINANT, VECTORS AND FUNCTION & GRAPHS

Q. 2. i). Solve the quadratic equation $z^2 - 6z = -13$ by completing the squares, where z is a complex number.

ii). Find the period of the following period matrix.

$$\begin{bmatrix} 1 & -2 & -6 \\ -3 & 2 & 9 \\ 2 & 0 & -3 \end{bmatrix}$$

iii). Without expanding determinants, prove that.

$$\begin{vmatrix} \alpha & \beta\gamma & \alpha\beta\gamma \\ \beta & \gamma\alpha & \alpha\beta\gamma \\ \gamma & \alpha\beta & \alpha\beta\gamma \end{vmatrix} = \begin{vmatrix} \alpha & \alpha^2 & \alpha^3 \\ \beta & \beta^2 & \beta^3 \\ \gamma & \gamma^2 & \gamma^3 \end{vmatrix}$$

iv). A force of $22N$ is applied to the end of 0.15 meter wrench at an angle of 75 degrees with the axis of rotation. Calculate the magnitude of the moment $\vec{M}_o$ produced by applied force.

v). Find the point of intersection of the following function graphically.

$f(x) = x + 2$ and $g(x) = x^2 - 4x + 6$

SEQUENCE & SERIES, PROBABILITY, MATHEMATICAL INDUCTION & BINOMIAL THEOREM

Q. 3. i). If the pth term of an H. P. is q, the qth term is p; prove that the $(p+q)th$ term is $\frac{pq}{(p+q)}$.

ii). Find the sum of the following series. $3 + 6 + 21 + 96 + 471 + \cdots to\ n\ terms$

iii). How many words can be formed by 3 vowels and 4 consonants out of 5 vowels and 7 consonants.

iv). If the probability of solving a problem by two students Ahsan and Umar are $\frac{1}{2}$ and $\frac{1}{3}$ respectively then what is the probability of the problem to be solved.

v). Prove the following statemen by mathematical induction. $7^n - 4^n$ is divisible by 3.

LINEAR PROGRAMING AND TRIGONOMETRY

Q. 4. i). Solve the following LP programming problems by graphical method when $x \geq 0, \geq 0$.
Maximize the objective function $z = f(x, y) = 10x + 11y$.
Subject to the constraints $2x + 3y \leq 8$; $6x + 3y \leq 10$.

ii). Express $4\sin\theta + 3\cos\theta$ in the form $r\sin(\theta + \varphi)$, where θ and φ are in first quadrant.

iii). Prove that. (a). $\sin 3\theta = 3\sin\theta - 4\sin^3\theta$

(b). $\frac{\sin 6\theta + \sin 4\theta}{\cos 6\theta + \cos 4\theta} = \tan 5\theta$

iv). The area of triangle is 3.346 square unit. If $\beta = 20.9^o$, $\gamma = 117.2^o$. Find a and angle α.

v). Solve the equation $\cos\theta - \theta = 0$, graphically for the interval $-\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}$.

SECTION – C

(Detailed-Answer Questions – Marks 30)

Note: Attempt any TWO questions. All questions carry equal marks.

Q. 5. a). Solve the non-homogeneous system of linear equations using Gauss Jordan method.

$2x + 2y - z = 4 \qquad x - 2y + z = 2 \qquad x + y = 0$ (Marks 08)

b). Find the volume of the tetrahedron whose vertices are $A(2,1,8)$, $B(3,2,9)$, $C(2,1,4)$, and $D(3,3,10)$. (Marks 07)

Q. 6. a). If $x = \frac{1}{3} + \frac{1.3}{3.6} + \frac{1.3.6}{3.6.9} + \frac{1.3.6.9}{3.6.9.12} + \cdots$, prove that $x^2 + 2x - 2 = 0$. (Marks 08)

b). The starting salary of a peon was $Rs. 8000/=$ and after each subsequent year his salary was increased by 15%. What total amount of salary he got for the first twelve years? (Marks 07)

Q. 7. a). Find and verify the general solution of the following trigonometric equation. (Marks 08)

$$3\tan^2 x + 2\sqrt{3}\tan x = -1$$

b). The sides of a parallelogram are $25cm$ and $35cm$ long and one of its angles is 36^o. Find the lengths of its diagonals. (Marks 07)

Good Luck