MATHEMATICS: **Max. Marks : 60**

SECTION – I

(MULTIPLE CORRECT CHOICE TYPE)

This section contains **8 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONE OR MORE is/ are correct**

41. Let $f(x)=1-x-x^3$ then real value of x satisfying the inequality $1-f(x)-f^3(x)>f(1-5x)$ is

A) 3 B) 4 C) 5/2 D) 6

42. The solution set of the equation $\left|\left|x-2012\right|+\log_2^a\right|=3$ has exactly four elements then range of a is

A) $\left(0,\frac{1}{8}\right)$ B) $\left(\frac{1}{8},\infty\right)$ C) $\left(-\infty,-\frac{1}{8}\right)$ D) none

43. Let $f(x)=\min\left(\{x+1\},\{x-1\},\{x+2\}\right),\forall x\in R$ where $\{.\}$ denotes the fractional part function then which is necessarily true

A) $\lim\limits_{x\to\frac{\pi}{2}} f(x)=\frac{\pi}{2}-1$

B) $\lim\limits_{x\to 2} f(x)=1$

C) $f(2x)$ is periodic function having period ½

D) $f(x)=f(-x)$ has infinite number of solutions

44. If $a(>0), c, d, u, v$ are non-zero constants and if the graphs of $f(x) = |ax + c| + d$, and $g(x) = -|ax + u| + v$ intersect at exactly two points (1,4) and (3,1) then

A) $4a + 2c = -3$ B) $4a + 2u = 3$ C) $\frac{u + c}{a} = -4$ D) $2a + c = 1$

45. Let $f(x) = \left([k]^2 - 5[k] + 4\right)x^3 - \left(6\{k\}^2 - 5\{k\} + 1\right)x - \tan x.\operatorname{sgn} x$ be an even function then k can be (where $x \in R$,[.] is G.I.F and {.} denotes fractional part of function) (sgn is signum)

A) 3/2 B) 7/2 C) 4/3 D) 13/3

46. Which is correct

A) $\lim_{n\to\infty}\left(\frac{2n^2 - 3}{2n^2 - n + 1}\right)^{\frac{n^2-1}{n}} = \sqrt{e}$ B) $\lim_{x\to\infty} x\left(\frac{1}{e} - \left(\frac{x}{x+1}\right)^x\right) = -\frac{1}{2e}$

C) $\lim_{x\to 1} \sin\left(\sin^{-1} x\right) = 1$ D) $\lim_{x\to 0^+}\left(1^{1/x} + 2^{1/x} + \pi^{1/x}\right)^x = \pi$

47. Possible integral values of x which can be in the domain of definition of the function $f(x)=\ln\left(ax^3+(a+b)x^2+(b+c)x+c\right)$ if $b^2-4ac<0$ and $a>0$ is__

A) -1 B) 0 C) 1 D) 2

48. Let $f:R\to[1,\infty)$ be defined as $f(x)=\log_{10}\left(\sqrt{3x^2-4x+k+1}+10\right)$. If $f(x)$ is a surjection then k can be

A) 1/3 B) 2/3 C) 4/3 D) 1

SECTION - II
(COMPREHENSION TYPE)

This section contains **4 groups of questions.** Each group has 2 multiple choice questions based on a paragraph. Each question has 4 choices A), B), C) and D) for its answer, out of which **ONLY ONE** is **correct.**

Paragraph for Question 49 and 50

Let A and B are two sets such that $A\cup B=\{1,2,3,4,5,6\}, A\cap B=\{4,5\}$ then

49. The maximum number of possible functions from set A to set B is N then sum of digits of N is

A) 9 B) 8 C) 10 D) 13

50. The minimum number of possible functions from set B to set A is M then product of digits of M is

A)18 B) 10 C) 24 D) 60

Paragraph for Question 51 and 52

Let $f(x)=\frac{1}{x}, g(x)=\frac{1}{4x^2-1}, h(x)=\frac{5x}{x+2}$ be three functions and $\phi(x)=h\left(g\left(f(x)\right)\right)$

51. If the domain of $\phi(x)$ is $R-\{a_1,a_2,a_3,....,a_n\}$ then the value of $\left(\sum_{i=1}^{n} a_i\right)+n$ equals

A) 4 B) 5 C) 6 D) 7

52. If the range of $\phi(x)$ is R-A where R is set of real numbers then the number of integers in set A is

A) 5 B) 6 C) 7 D) 8

Paragraph for Question 53 and 54

Consider the limit given by $\lim_{x\to 0}\frac{1}{x^3}\left(\frac{1}{\sqrt{1+x}}-\frac{1+x\sin\alpha}{1+x\sin\beta}\right)$ exists and has finite value where $\alpha,\beta\in[-\pi,2\pi]$ then

53. The number of value of α is

A) 2 B) 3 C) 4 D) 0

54. The number of values of β is

A) 1 B) 4 C) 0 D) 2

Paragraph for Question 55 and 56

Let $f:R\to[1,\infty)$ be a quadratic function which is surjective, such that $f(2+x)=f(2-x)$ and $f(1)=2$. If $g:(-\infty,\ln 2]\to[1,5]$ is given by $g(\ln x)=f(x)$ then

55. $g^{-1}(x)$ is given by

A) $\ln\left(2-\sqrt{x-1}\right)$ B) $\ln\left(2+\sqrt{x-1}\right)$ C) $\ln\left(2-\sqrt{1-x}\right)$ D) $\ln\left(2+\sqrt{1-x}\right)$

56. The sum of the values of x satisfying the equation $f(x)=5$ is

A) 2 B) 4 C) 6 D) -2

SECTION – III
(MATRIX MATCH TYPE)

This section contains **4 multiple choice questions.** Each question has matching lists. The codes for the lists have choices (A), (B), (C), and (D) out of which **ONLY ONE** is correct.

57. Let $\lim_{x\to\infty}\left(2^x+e^x+a^x\right)^{1/x}=L$ then match the range of values of 'a' with 'L' value (e is exponent a is constant)

	List – I		**List – II**
(P)	$a\in\left(\frac{\pi}{2},e\right)$	(1)	e
(Q)	$a\in(e,\infty)$	(2)	a
(R)	$a\in(0,e)$	(3)	a/2
(S)	$a\in\{2e\}$	(4)	2e

A) P-1,Q-2,R-1,S-4 B) P-2,Q-1,R-2,S-4

C) P-2,Q-1,R-1,S-4 D) P-1,Q-2,R-4,S-1

58. Match the following

	List – I	List – II
(P)	$\lim_{n\to\infty}\left(\frac{1+\sqrt[n]{16}}{2}\right)^n =$	(1) 1
(Q)	If $\lim_{x\to 0}\frac{\ell n\left(\cot\left(\frac{\pi}{4}-\beta x\right)\right)}{\tan\alpha x}=1$ then $\frac{\alpha}{\beta}=$	(2) 2
(R)	$\lim_{x\to 0}\frac{\pi\sin\left(\pi\cos^2\left(\tan\left(\sin x\right)\right)\right)}{\sin^2\left(\pi x\right)}=$	(3) 3
(S)	If $\lim_{x\to\infty}\left[\left(x^5+10x^4+3\right)^c-x\right]$ is finite non-zero, for certain value of c then value of the limit is	(4) 4

A) P-4,Q-1,R-2,S-2 B) P-2,Q-4,R-1,S-1

C) P-4,Q-2,R-1,S-1 D) P-4,Q-2,R-1,S-2

59.

	List – I	List – II
(P)	The number of values of a such that $\lim_{x\to a}\left[\sin^{-1}\left(\frac{2x}{1+x^2}\right)\right]$ (where [.] is G.I.F) doesn't exist is	(1) 4
(Q)	If $f(x)=\{x+[\log_2(2016+x)]\}+\{x+[\log_2(2016+x^2)]\}$ $+\ldots+\{x+[\log_2(2016++x^{10})]\}$ then $f(e)$ equals (where [.] is G.I.F {.} F.P.F)	(2) 8
(R)	The number of solutions of $f(f(f(x)))=\frac{x}{4}$ where $f(x)=4x(1-x), 0\le x\le 1$ is	(3) 7
(S)	The number of elements in the range of $f(x)=\operatorname{sgn}([\lvert\sin x\rvert+\lvert\cos x\rvert])$ is, k then 4k (where [.] is G.I.F, sgn is signum)	(4) 5

A) P-4,Q-1,R-2,S-3

B) P-4,Q-2,R-3,S-1

C) P-4,Q-3,R-2,S-1

D) P-1,Q-3,R-2,S-4

60.

	List – I		List – II
(P)	The number of integers in the range of the function, $f(x)=\cos^3 x-6\cos^2 x+11\cos x-6,\ (x\in R)$	(1)	13
(Q)	$\lim\limits_{x\to 0}\dfrac{1-\cos x\cos 2x\cos 3x\cos 4x}{x^2}$ equals	(2)	24
(R)	$A=\{1,3,5,7\}, B\{2,4,6,8\}$ then the number of functions from A to B such that $i+f(i)<10$	(3)	25
(S)	Let $f(x)$ be a function such that $f(x+2)+6f(x)=5f(x+1)\ \forall x\in R$ where $f(0)=2, f(1)=5$ then $f(2)$ equals	(4)	15

A) P-3,Q-4,R-2,S-1 B) P-3,Q-4,R-1,S-2

C) P-3,Q-1,R-4,S-2 D) P-3,Q-4,R-4,S-1