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. If the smallest positive solution of the equation $\sqrt{\sin(1-x)} = \sqrt{\cos x}$ is $\frac{a}{2}+\frac{b\pi}{c}$ then $(a,b,c \in N)$

A) $a+b=8$ B) $bc=28$ C) $\left[\frac{b}{c}\right]=1$ D) $a<c$

42. Let A,B,C be the angles in $\left(0,\frac{\pi}{2}\right)$ and if $\tan A, \tan B, \tan C$ are integers such that $\frac{\sqrt{2}\tan A+\tan B}{\sqrt{2}\tan B+\tan C}$ is a rational number then which of the following is always, an integer

A) $\frac{2\tan^2 A+\tan^2 B}{2\tan^2 B+\tan^2 C}$ B) $\frac{\tan^2 A+\tan^2 B+\tan^2 C}{\tan A+\tan B-\tan C}$

C) $\frac{\tan^2 A+2\tan^2 B}{\tan^2 B+2\tan^2 C}$ D) $\frac{\tan^2 A+\tan^2 B+\tan^2 C}{\tan A+\tan C-\tan B}$

43. $\tan(\log_2 6) - \tan(\log_2 3) - \tan 1$ equals

A) $\frac{\tan^2 1 \tan(\log_2 3) + \tan 1 \tan^2(\log_2 3)}{1 - \tan 1 \tan(\log_2 3)}$ B) $\tan(1 + \log_2 3).\tan(\log_2 3).\tan 1$

C) $\left(\tan(\log_2 6) + \tan(\log_2 3)\right)\tan 1$ D) to a negative real number

44. If $\frac{\tan 3A}{\tan A} = k \quad (k \neq 1)$ then which is / are true

A) $\frac{\cos A}{\cos 3A} = \frac{k-1}{2}$ B) $\frac{\sin 3A}{\sin A} = \frac{2k}{k-1}$ C) $k < \frac{1}{3}$ D) $k > 3$

45. If the equation $|\sin 2x| + |\cos 2x| = |\sin y|, x \in R, y \in [-2\pi, 2\pi]$ is satisfied for 'p' number of 'y' values then the equation(s) having number of solutions $\geq p$ is/are

A) $|\cos x| = 2[x]$, ([] is G.I.F), $x \in [-2\pi, 2\pi]$

B) $\sin \pi x = |\ln|x||$

C) $|\cos x| = \sin x, 0 \leq x \leq 4\pi$

D) $\frac{\sqrt{3}-1}{\sin x} + \frac{\sqrt{3}+1}{\cos x} = 4\sqrt{2}, 0 < x < \frac{\pi}{2}$

46. Which is / are correct

A) $\dfrac{\sin 3\alpha}{\cos 2\alpha} > 0$ for $\alpha \in \left(\dfrac{3\pi}{8}, \dfrac{23\pi}{48}\right)$ B) $\dfrac{\sin 3\alpha}{\cos 2\alpha} < 0$ for $\alpha \in \left(\dfrac{13\pi}{48}, \dfrac{14\pi}{48}\right)$

C) $\dfrac{\sin 2\alpha}{\cos \alpha} < 0$ for $\alpha \in \left(\dfrac{-\pi}{2}, 0\right)$ D) $\dfrac{\sin 2\alpha}{\cos \alpha} > 0$ for $\alpha \in \left(\dfrac{13\pi}{48}, \dfrac{14\pi}{48}\right)$

47. Let $f(\theta) = \left(\cos\theta - \dfrac{\cos\pi}{8}\right)\left(\cos\theta - \cos\dfrac{3\pi}{8}\right)\left(\cos\theta - \cos\dfrac{5\pi}{8}\right)\left(\cos\theta - \dfrac{\cos 7\pi}{8}\right)$ then

A) Number of solutions of $f(\theta) = 0$ in $[0, \pi]$ is8

B) maximum value of $f(\theta)$ $(\theta \in R)$ is 1/8

C) maximum value of $f(\theta)$ $(\theta \in R)$ is ¼

D) $8f(0) = 1$

48. If the number of solutions of the equation $(\sin x - 1)^3 + (\cos x - 1)^3 + (\sin x)^3 = (2\sin x + \cos x - 2)^3$ in $[0, 2\pi]$ is n_1 and if the value of $[x + y] - 2005$ is n_2 where $x + \sin y = 2014$ and $x + 2014\cos y = 2013,\ 0 \le y \le \dfrac{\pi}{2}$ then

A) $n_1 < n_2$ B) $n_2 = 2n_1 - 1$

C) $n_1^2 = n_2$ D) $\left[\dfrac{n_1 + n_2}{n_2 - n_1}\right] = 3$ $\left([\ ]\, is\, GIF\right)$

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 Questions 49 and 50

If $\alpha = \frac{\pi}{7}, \beta = 3\alpha, \gamma = 5\alpha$ and if $\cos\alpha, \cos\beta, \cos\gamma$ are roots of $8x^3 - 4x^2 - 4x + 1 = 0$ then

49. The value of $\sin\frac{\alpha}{2}\sin\frac{\beta}{2}\sin\frac{\gamma}{2} =$

A) $\frac{1}{4}$ B) $\frac{\sqrt{7}}{4}$ C) $\frac{\sqrt{7}}{8}$ D) $\frac{1}{8}$

50. The value of $\sec\alpha\sec\beta + \sec\beta\sec\gamma + \sec\gamma\sec\alpha =$

A) -4 B) 4 C) 8 D) 1

Paragraph for Questions 51 and 52

Consider the cubic equation
$x^3 - \left(\sin\theta + \cos\theta\left(1 + \sin\theta\right)\right)x^2 + \sin\theta\cos\theta\left(1 + \sin\theta + \cos\theta\right)x - \sin^2\theta\cos^2\theta = 0$ whose roots are λ, μ, δ then

51. The maximum value of $\lambda^2 + \mu^2 + \delta^2$ equals

A) $\frac{5}{4}$ B) $\frac{5}{2}$ C) 1 D) $\frac{6}{5}$

52. If $\frac{\pi}{4} < \theta < \frac{\pi}{2}$ and if $\lambda < \mu < \delta$ then the maximum value of $\lambda + \delta$ equals

A) $\frac{\sqrt{3}}{2}$ B) $\frac{3\sqrt{3}}{4}$ C) $\sqrt{3}$ D) $\frac{\sqrt{3}}{4}$

Paragraph for Questions 53 and 54

Let $A=\{(x,y)/x^2+y^2\le 16\}, B=\{(x,y)/x^2+y^2\ge 12\}$,

$C=\{(x,y)/\sin(x+y)\ge 0\}, D=\{(x,y)/\sin(x+y)\le 0\}$ then answer the following

53. The area of the region formed by the points (x,y) satisfying $A\cap B\cap C$ equals

A) 2π B) $\frac{3\pi}{2}$ C) $\frac{\pi}{2}$ D) $\frac{3\pi}{2}-\sin^{-1}\left(\frac{2}{3}\right)$

54. The area of the region bounded by the points (x,y) satisfying $A\cap B\cap D$ equals

A) π B) 2π C) $\frac{3\pi}{2}$ D) $\frac{3\pi}{2}+\sin^{-1}\left(\frac{2}{3}\right)$

Paragraph for Questions 55 and 56

Let the value of $\tan\left(\frac{19\pi}{24}\right)=a+\sqrt{a}-\sqrt{b}-\sqrt{ab}$ where $b>a>0(a,b\in N)$ then

55. The value of $\cos\frac{2\pi}{15}\cos\frac{4\pi}{15}\cos\frac{8\pi}{15}\cos\frac{14\pi}{15}$ equals

A) $\frac{b}{a^2}$ B) $\frac{1}{a^2}$ C) $\frac{1}{b^2}$ D) $\frac{a+b}{b^3}$

56. The value of $\prod_{r=0}^{3}\left(1+\cos(2r+1)\frac{\pi}{8}\right)$ equals

A) $\frac{1}{b^3}$ B) $\frac{1}{2a+b}$ C) $\frac{1}{2b+a}$ D) $\frac{b}{a+b}$

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. If x,y,z are such that $\left(\cos x^2+\frac{1}{\cos^2 x}\right)\left(1+\tan^2 2y\right)\left(3+\sin 3z\right)=4$ match the following of List-I with List-II

	List – I		List – II
(A)	x can be	(P)	Integral multiple of $\frac{\pi}{2}$
(B)	y can be	(Q)	Integral multiple of π
(C)	z can be	(R)	Integral multiple of $\frac{\pi}{3}$
(D)	x +y can be	(S)	Integral multiple of $\frac{\pi}{6}$

A) A-PQRS,B-PQRS,C-PS,D-PQRS

B) A-PQRS,B-PQRS,C-S,D-PQRS

C) A-PQRS,B-PQRS,C-PQS,D-PS

D) A-PQRS,B-PQRS,C-PQRS,D-PQRS

58. Match the following

	List – I		List – II
(A)	The equation $3\sin\theta+4\cos\theta=5\left(x^2+ax+1\right)\left(\theta,x\in R\right)$ has real solution then 'a' can take the value(s)	(P)	-7
(B)	If the number of solutions of $\left\|\ln\|x\|\right\|+\left\|\sin\pi x\right\|=0$ is n then $n-5$ equals	(Q)	-4
(C)	If the sum of solutions $\cos^5 x+\sin^3 x=1\ in\,x\in[0,2\pi]$ is $\frac{a\pi}{b}$ $(a,b\in N\ and\ relative\ prime)$ then $b-a-1$ equals	(R)	-8
(D)	Let $\frac{\sin^4 x}{a}+\frac{\cos^4 x}{b}=\frac{1}{a+b}\left(0\le x\le\frac{\pi}{2}\right)$ then the value of $\frac{\sin^4 x}{a^2}-\frac{\cos^4 x}{b^2}$ equals	(S)	0

A) A-PQRS,B-Q,C-Q,D-S
B) A-PQRS,B-Q,C-R,D-Q
C) A-PQRS,B-QR,C-QR,D-RS
D) A-PQRS,B-QRS,C-RS,D-Q

59.

	List – I		List – II
(A)	If the range of 'a' which is a parameter , for which the equation $a\sin\frac{x}{2}=\sin x+\sin\frac{3x}{2}(\cos x\neq 1)$ possesses at least one solution is $[l,m]$ then $\left\|\frac{m}{l}\right\|$ equals	(P)	3
(B)	The number of distinct real solutions of the equation $\tan\left(\frac{2\pi x}{x^2+x+1}\right)=-\sqrt{3}$ is equal to	(Q)	8
(C)	Number of distinct values of 'a' $\in N$ and $1\leq a\leq 100$ satisfying $\int_0^x\left(t^2-8t+39\right)dx=x.\sin\frac{\pi a}{x}$	(R)	5
(D)	If $\sum_{n=1}^{\infty}\frac{\tan\left(\frac{\theta}{2^n}\right)}{2^{n-1}.\cos\left(\frac{\theta}{2^{n-1}}\right)}=\frac{a}{\sin 2\theta}-\frac{b}{2\theta}$ then a+b equals	(S)	4

A) A-S,B-R,C-Q,D-S
B) A-S,B-Q,C-R,D-P
C) A-S,B-R,C-P,D-Q
D) A-S,B-R,C-Q,D-P

60.

	List – I		List – II
(A)	If $\sin\frac{\pi}{14}$ is a root of cubic equation $8x^3-4x^2-4x+\alpha=0$ then the value of $\left[\frac{\alpha}{2}\right]$ equals where [ ] is GIF	(P)	1
(B)	Number of positive integral divisors of the reciprocal of the number $\prod_{r=1}^{7}\sin\left(\frac{(2r-1)\pi}{14}\right)$ equals	(Q)	3
(C)	The number of distinct real solutions of $\cos\left(\frac{\sqrt{2}+1}{2}x\right).\cos\left(\frac{\sqrt{2}-1}{2}x\right)=1$ is P then P is less than	(R)	7
(D)	The number of distinct solutions of $\int_0^x \cos\left(t+x^2\right)dt=\sin x, 2\le x\le 3$ is less than	(S)	0

A) A-S,B-R,C-QR,D-QR

B) A-S,B-R,C-QR,D-PR

C) A-S,B-R,C-PQ,D-PS

D) A-S,B-P,C-R,D-QR