PART (C) : MATHEMATICS

SINGLE CORRECT ANSWER TYPE

This section contains 20 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.

61. If $3\tan\theta = \cot\theta$, then $\theta = ...$

(A) $\pm 30^\circ$

(B) $\pm 60^\circ$

(C) $\pm 45^\circ$

(D) $\pm 15^\circ$

62. The principal value of $\left(\theta + \frac{\pi}{4}\right)$ where $\sin\theta + \cos\theta = 1$ is

(A) 0

(B) $\frac{\pi}{3}$

(C) $\frac{\pi}{4}$

(D) $\frac{\pi}{2}$

63. If $\cos 2\theta = 2\sin^2\theta$, then $\theta =$

(A) $\pm 30^\circ$

(B) $\pm 60^\circ$

(C) $\pm 45^\circ$

(D) $\pm 90^\circ$

64. If $\tan(\pi\cos\theta) = \cot(\pi\sin\theta)$, then the value(s) of $\cos\left(\theta - \frac{\pi}{4}\right)$ is (are)

(A) $\frac{1}{2}$

(B) $\frac{1}{\sqrt{2}}$

(C) $\frac{1}{2\sqrt{2}}$

(D) $\frac{1}{3\sqrt{2}}$

65. If A and B a acute angles such that $\sin A = \sin^2 B$ and $2\cos^2 A = 3\cos^2 B$, then $A =$

(A) $\frac{\pi}{4}$

(B) $\frac{\pi}{6}$

(C) $\frac{\pi}{3}$

(D) $\frac{\pi}{2}$

66. The general solution of $\frac{\tan 5x - \tan 4x}{1 + \tan 5x \tan 4x} = 1$ is

(A) $n\pi + \frac{\pi}{4}; \forall\, n \in Z$

(B) $n\pi \pm \frac{\pi}{4}; \forall\, n \in Z$

(C) ϕ

(D) $n\pi + \frac{\pi}{6}; \forall\, n \in Z$

67. Solution of $\cot^2\theta + \left(\sqrt{3} + \frac{1}{\sqrt{3}}\right)\cot\theta + 1 = 0$ is

(A) $n\pi - \frac{\pi}{6}, n\pi - \frac{\pi}{3}, \forall n \in Z$

(B) $n\pi + \frac{\pi}{6}, n\pi + \frac{\pi}{3}, \forall n \in Z$

(C) $n\pi + \frac{\pi}{12}, \forall\, n \in Z$

(D) $n\pi + \frac{\pi}{4}, \forall\, n \in Z$

68. If $4x^4 - (a-1)x^3 + ax^2 - 6x + 1$ is divisible by $(2x-1)$, then 'a' is equal to

(A) 13
(B) –13
(C) 11
(D) –11

69. Number of real solution(s) of the equation $|x-3|^{3x^2-10x+3} = 1$ is

(A) exactly four
(B) exactly three
(C) exactly two
(D) exactly one

70. $7\log_{10}\frac{16}{15}+5\log_{10}\frac{25}{24}+3\log_{10}\frac{81}{80}$ equals

(A) $\log_{10}2$

(B) $\log_{10}3$

(C) $\log_{10}5$

(D) Zero

71. The number of real solutions of the equation $\log_{10}(7x-9)^2+\log_{10}(3x-4)^2=2$ is

(A) 1

(B) 2

(C) 3

(D) 4

72. Assuming all logarithms to be well defined, the value of $\frac{1}{\log_{bc^2} abc}+\frac{1}{\log_{ca^2} abc}+\frac{1}{\log_{ab^2} abc}$ equals

(A) 3

(B) 2

(C) 1/2

(D) 3/2

73. The solution set of the equation $\log_{10}(3x^2+12x+19)-\log_{10}(3x+4)=1$ is

(A) a null set

(B) a singleton

(C) a set consisting of exactly two elements

(D) a set consisting of more than two elements

74. The solution set of the inequality, $2-\log_2(x^2+3x)\geq 0$ is

(A) $[-4, 1]$

(B) $[-4,-3)\cup(0,1]$

(C) $(-\infty,-3)\cup(0,\infty)$

(D) $(-\infty,-4)\cup[1,\infty)$

75. If $\log_e 2\log_b 625=\log_{10}16\log_e 10$, then b is

(A) 4

(B) 5

(C) 6

(D) 7

76. If α, β are the roots of the equations $ax^2 + bx + c = 0$, then the quadratic equation whose roots are $\frac{\alpha}{1+\alpha}$ and $\frac{\beta}{1+\beta}$ is

(A) $(a-b+c)x^2 + (b-2c)x + c = 0$

(B) $(a-b+c)x^2 - (b-2c)x + c = 0$

(C) $(a-b+c)x^2 + (b-2c)x - c = 0$

(D) None of these

77. The greatest value of $\frac{4}{4x^2+4x+9}$ is

(A) 4/9

(B) 4

(C) 9/4

(D) ½

78. If roots of the equation $x^2 - bx + c = 0$ are two successive integers, then $b^2 - 4c$ equal

(A) 1

(B) 2

(C) 3

(D) 4

79. If the equation $\frac{a}{x-a} + \frac{b}{x-b} = 1$ has roots equal in magnetic but opposite in sign, then the value of $a+b$ is

(A) –1

(B) 0

(C) 1

(D) None of these

80. If one root of the equation $x^2 + bx + a = 0$ and $x^2 + ax + b = 0$ is common and $a \neq b$, then

(A) $a+b=0$

(B) $a+b=-1$

(C) $a-b=1$

(D) $a+b=1$

NUMERICAL VALUE TYPE

This section contains 10 questions. **Attempt any 5 questions out of 10.** Each question is numerical value type. For each question, enter the correct numerical value (in decimal notation (e.g. 6.25, 7.00, 7, –0.33, –.30, 30.27, –127.30).

Marking scheme: +4 for correct answer, 0 if not attempted and 0 in all other cases.

81. Number of integral solution of $2x-1=|x+7|$ is

82. The total number of pairs of consecutive odd natural numbers both of which are larger than 10, such that their sum is less than 40, is

83. Number of integral solution satisfying $x+\sqrt{3-x}\geq\sqrt{3-x}+3$ is

84. If $\left(\sqrt{2}\right)^x+\left(\sqrt{3}\right)^x=\left(\sqrt{13}\right)^{x/2}$, then the number of values of x is

85. If $x=2+2^{2/3}+2^{1/3}$, then $x^3-6x^2+6x=$

86. The value of x obtained from equation $4^{\log_9 3}+9^{\log_2 4}=10^{\log_x 83}$ will be $2p$. Then $p=$ _____.

87. If sum of roots of the equation $x+1=2\log\left(2^x+3\right)-2\log_4\left(1980-2^{-x}\right)$ is $\log_a b$.
Find $b-a=$ _____.

88. If the roots of $\left(5+2\sqrt{6}\right)^{x^2-3}+\left(5-2\sqrt{6}\right)^{x^2-3}=10$ are $\pm A$ and $\pm\sqrt{A}$. Find A.

89. If the quadratic equations $ax^2+2cx+b=0$ and $ax^2+2bx+c=0$ have a common root, the find the value of $a+4b+4c=$ ____ .

90. Let $N=\alpha\alpha\alpha\alpha\alpha\alpha$ be a 6 digit number (all digits equal) & N is divisible by 924. Let α,β be the roots of the equation $x^2-11x+\lambda=0$. If the product all possible values of λ is $112M$. Find $M=$ ___.