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IIT-JEE | NEET | Foundation

JEE

Time: 3 Hours **M.M. 300**

ALL INDIA SKY TEST SERIES

XI – IIT JEE (SAMARATH BATCH)

Date: 15/10/2023

SYLLABUS

PHYSICS	CHEMISTRY	MATHEMATICS
Previous + Work, Power, Energy	**Equilibrium + Chemical Bonding + Previous**	**Previous + Permutation and Combination**

Please read the instructions carefully. You are allotted **5** minutes specifically for this purpose.

INSTRUCTIONS:

1. This Question paper is divided in to three parts Physics, Chemistry and Mathematics each part is further divided into two sections.
   Section –A Contains 20 Questions Section B contains 10 questions. Please ensure that the Questions paper you have received contains **ALL THE QUESTIONS** in each Part.
2. **In Section A all the 20 Questions are compulsory and Section B Contain 10 Question, out of these 10 Questions**, candidates can choose to attempt any 5 Questions.
   Each Question has four choices (A), (B), (C), (D) out of which **only one is correct & Carry 4 marks each 1 mark** will be deducted for each wrong answer.

GENERAL INSTRUCTION

1. Use only **blue/black pen (avoid gel pen)** for darkening the bubble.
2. Indicate the correct answer for each question by filling appropriate bubble in your **OMR** answer sheet.
3. The answer sheet will be checked through computer hence, the answer of the question must be marked by –shading the circles against the question by dark **blue/black pen**
4. Blank papers, Clipboards, Log tables, Slide Rule, Calculator, Cellular Phones Papers and Electronic Gadgets in any form are **not** allowed to be carried inside the examination hall.

Name of the candidate:_____

Signature of the candidate: _____**Signature of the invigilator:** _____

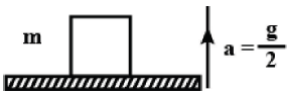
PHYSICS

Section - A

Single Choice Question

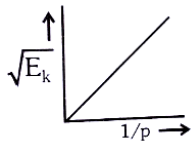
1. A force acts on a 2 kg object so that its position is given as a function of time as $x = 3t^2 + 5$. What is the work done by this force in first 5 seconds :
(a) 850 J (b) 900 J (c) 950 J (d) 875 J

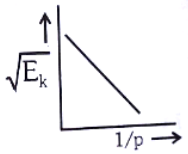
2. A block of mass m is kept on a platform which starts from rest with a constant acceleration g/2 upwards, as shown in the figure.

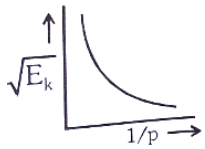


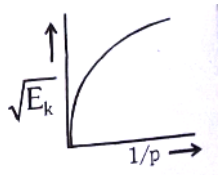
Work done by normal reaction on block in time t is:
(a) zero (b) $\frac{3mg^2t^2}{8}$ (c) $-\frac{mg^2t^2}{8}$ (d) $\frac{mg^2t^2}{8}$

3. The graph between $\sqrt{E_k}$ and $\frac{1}{p}$ is
(E_k = kinetic energy and p = momentum)

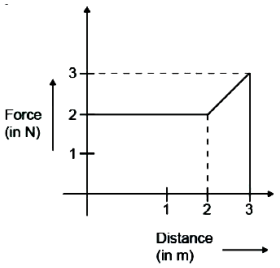
(a) 

(b) 

(c) 

(d) 

4. A particle moves in one dimension from rest under the influence of a force that varies with the distance travelled by the particle as shown in the figure. The kinetic energy of the particle after it has travelled 3m is :



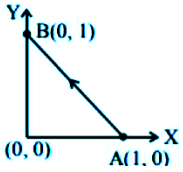
(a) 6.5 J (b) 2.5 J (c) 4 J (d) 5 J

5. A uniform cable of mass M and length L is placed on a horizontal surface such that its $\left(\frac{1}{n}\right)^{th}$ part is hanging below the edge of the surface. To lift the hanging part of the cable upto the surface, the work done should be:
(a) $\frac{MgL}{n^2}$ (b) $\frac{MgL}{2n^2}$ (c) $\frac{2MgL}{n^2}$ (d) nMgL

6. Two men with weights in the ratio 5 : 3 run up a staircase in times in the ratio 11 : 9. The ratio of power of first to that of second is : -
(a) $\frac{15}{11}$ (b) $\frac{11}{15}$ (c) $\frac{11}{9}$ (d) $\frac{9}{11}$

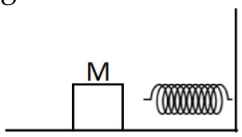
7. A force F = 20 + 10y acts on a particle in y-direction where F is in newton and y in meter. Work done by the force to move the particle from y = 0 to y = 1 m is :
(a) 30 J (b) 5 J (c) 25 J (d) 20 J

8. Consider a force vector $\vec{F} = -x\hat{i} + y\hat{j}$. The work done by this force in moving a particle from point A(1, 0) to B(0, 1) along the line segment is:



(a) 3/2 (b) 1 (c) 2 (d) 1/2

9. The block of mass M moving on the frictionless horizontal surface collides with the spring of spring constant K and compresses it by length L.



The maximum momentum of the block after collision is:
(a) zero (b) $\frac{ML^2}{K}$ (c) $\sqrt{MK}\,L$ (d) $\frac{KL^2}{2M}$

10. A body of mass m accelerates uniformly from rest to v_1 in time t_1. As a function of t, the instantaneous power delivered to the body is:
(a) $\frac{mv_1t}{t_1}$ (b) $\frac{mv_1^2t}{t_1}$ (c) $\frac{mvt^2}{t_1}$ (d) $\frac{mv_1^2t}{t_1^2}$

11. Two metal rods of length L_1 and L_2 and coefficients of linear expansion α_1 and α_2 respectively are welded together to make a composite rod of length (L_1+L_2) at 0°C. Find the effective coefficient of linear expansion of the composite rod.

(a) $\frac{L_2\alpha_1^2 - L_2\alpha_2^2}{L_1^2+L_2^2}$ (b) $\frac{L_1^2\alpha_1 - L_2^2\alpha_2}{L_1^2+L_2^2}$

(c) $\frac{L_1\alpha_1+L_2\alpha_2}{L_1-L_2}$ (d) $\frac{L_1\alpha_1+L_2\alpha_2}{L_1+L_2}$

12. If the momentum of a body increases by 20 %, the percentage increase in its K.E. is equal to :
(a) 44 (b) 66 (c) 20 (d) 88

13. A car is negotiating a curved road of radius R. The road is banked at an angle θ. The coefficient of friction between the tyres of the car and the road is μ_s . The maximum safe velocity on this road is:

(a) $\sqrt{gR^2\left(\frac{\mu_s+\tan}{1-\mu_s\tan\theta}\right)}$ (b) $\sqrt{gR\left(\frac{\mu_s+\tan\theta}{1-\mu_s\tan\theta}\right)}$

(c) $\sqrt{\frac{g}{R}\left(\frac{\mu_s+\tan\theta}{1-\mu_s\tan\theta}\right)}$ (d) $\sqrt{\frac{g}{R^2}\left(\frac{\mu_s+\tan}{1-\mu_s\tan\theta}\right)}$

14. A stone is tied to one end of a string and is rotated in a horizontal circle with a uniform angular velocity. Let T be the tension in the string. If the length of the string is halved and the angular velocity of the stone is doubled, the tension in the string will be
(a) 2T (b) 4T (c) T (d) 8T

15. The magnitude of displacement vector of a particle which is moving in a circle of radius a with constant angular velocity ω as a function of time is

(a) $2a\sin\omega t$ (b) $2a\sin\frac{\omega t}{2}$

(c) $2a\cos\omega t$ (d) $2a\cos\frac{\omega t}{2}$

16. A small coin is placed at a distance r from the centre of a gramophone record. The rotational speed of the record is gradually increased. If the coefficient of friction between the coin and the record is μ, the minimum angular frequency of the record, for which the coin will fly off, is given by

(a) $\sqrt{\frac{2\mu g}{r}}$ (b) $\sqrt{\frac{\mu g}{2r}}$ (c) $\sqrt{\frac{\mu g}{r}}$ (d) $2\sqrt{\frac{\mu g}{r}}$

17. The kinetic energy K of a particle moving along a circle of radius R depends on the distance covered s as K = a s^2 . The centripetal force acting on the particle is

(a) 2asR (b) 2as^2 (c) 2as (d) $\frac{2as^2}{R}$

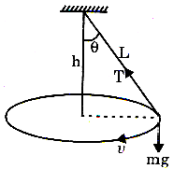
18. Coefficient of linear expansion of brass and steel rods are α_1 and α_2. Length of brass and steel rods are l_1 and l_2, respectively. If (l_2-l_1) is maintained same at all temperature, which one of the following relations holds good?

(a) $\alpha_1 l_2^2 = \alpha_2 l_1^2$ (b) $\alpha_1^2 l_2 = \alpha_2^2 l_1$

(c) $\alpha_1 l_1 = \alpha_2 l_2$ (d) $\alpha_1 l_2 = \alpha_2 l_1$

19. A horizontal uniform tube, open at both ends, is containing a liquid of certain length at some temperature. When the temperature is changed, the length of the liquid in the tube is not changed. If α is the coefficient of linear expansion of the material of the tube and γ is the coefficient of volume expansion of the liquid, then
(a) $\gamma = 2\alpha$ (b) $\gamma = 3\alpha$ (c) $\gamma = 4\alpha$ (d) $\gamma = \alpha$

20. A 2kg stone attached to a string is whirled in a horizontal circle of radius 0.5 m. The string makes an angle of 30^0 with the vertical. The resultant force on the stone due to tension and weight is : ($g = 9.8\ m/s^2$)



(a) 7.4 N (b) 11.3 N
(c) 15.6 N (d) 20.2 N

Section - B

Integer Type Questions

21. A difference of temperature of 25°C is equivalent to a difference of (in Fahrenheit)-

22. At what temperature, does the temperature in Celsius and Fahrenheit equalize is $-x$, x will be?

23. The freezing point on a thermometer is marked as -20^o and the boiling point as 130^o. A temperature of human body $\left(34^oC\right)$ on this thermometer will be read as.

24. Two temperature scales A and B are related by $\frac{A-42}{110}=\frac{B-72}{220}$. The temperature is when two scales have the same readings is-

25. The coefficient of friction between the tyres and the road is 0.25. The maximum speed with which a car can be driven round a curve of radius 40 m without skidding is (assume g = 10 ms^{-2}), (in meter per second)-

26. The speed of a particle moving in a circle of radius r = 2 m varies with time t is $v = t^2$, where t is in second and v in ms^{-1}. Value of radial, tangential and net acceleration at t = 2s are A, B and C respectively then value of $\frac{2C^2}{AB}$ will be :

27. Power supplied to a body of mass 2 kg varies with time as $P=\frac{3t^2}{2}$ watt. Here t is in seconds. If velocity of particle at t = 0 is v = 0 , the velocity of particle at time t = 2 s will be, (in meter per second)

28. A clock which keeps correct time at 20°C is subjected to 40°C. If coefficient of linear expansion of the pendulum is $12\times10^{-6}/^oC$. Then the gain or loss in time period is $\frac{x}{5}$ then the value of x is

29. The steam point and the ice point of a mercury thermometer are marked as 80° and 10°. At what temperature on centigrade scale will the reading of this thermometer be 59°?

30. In a mercury thermometer, the ice point (lower fixed point) is marked as 10° and the steam point (upper fixed point) is marked as 130°. At 40°C temperature, what will this thermometer read?

CHEMISTRY

SECTION - A

Single Choice Question

31. pH of an aqueous solution of HCl is 5. If 1 c.c. of this solution is diluted to 1000 times. The pH will become
(a) 8 (b) 5 (c) 6.9 (d) None

32. Equal volumes of two HCl solutions of pH = 3 and pH = 5 were mixed. What is the pH of the resulting solution ?
(a) 3.5 (b) 4.0 (c) 4.5 (d) 3.3

33. At infinite dilution the percentage dissociation of both weak acid and weak base is :
(a) 1% (b) 20% (c) 50% (d) 100%

34. Which one of the following is a correct set ?
(a) Cl_2O, sp^3, angular
(b) BF_3, sp^2, trigonal pyramidal
(c) SO_3, sp^3, trigonal planar
(d) NO_2, sp, linear

35. Which of the following options with respect to increasing bond order is correct ?
(a) $NO < C_2 < O_2^- < B_2$
(b) $C_2 < NO < B_2 < O_2^-$
(c) $B_2 < O_2^- < NO < C_2$
(d) $B_2 < O_2^- < C_2 < NO$

36. Match list-I solutions of salts of …) with list II (pH of the solution is given by) and select the correct answer using the codes given below the lists :

	List-I		List-II
(A)	Weak acid and strong base	(p)	$\frac{1}{2}pK_w$
(B)	Strong acid and weak base	(q)	$\frac{1}{2}(pK_w - pK_b + pK_a)$
(C)	Weak acid and weak base	(r)	$\frac{1}{2}(pK_w - pK_b - \log\ C)$
(D)	Strong acid and strong base	(s)	$\frac{1}{2}(pK_w + pK_a + \log C)$

Codes :

	A	B	C	D
(A)	p	q	r	s
(B)	s	r	q	p
(C)	s	r	p	q
(D)	r	s	q	p

37. Amongst the following, the total number of species which does/do not exist is :
$SF_6, BF_6^{3-}, SF_4, OF_4, AlF_6^{3-}, PH_5, PCl_5, NCl_5, SCl_6$

(a) 9 (b) 5 (c) 6 (d) 8

38. Arrange the following compounds in increasing order of their ionic character :
$SnCl_2, SnCl_4, SiCl_4, SnF_4, SnF_2$
(a) $SnF_2 < SnCl_2 < SnF_4 < SnCl_4 < SiCl_4$
(b) $SnF_2 < SnCl_2 < SnF_4 < SiCl_4 < SnCl_4$
(c) $SiCl_4 < SnCl_4 < SnF_4 < SnCl_2 < SnF_2$
(d) $SnCl_4 < SnF_4 < SnCl_2 < SnF_2 < SiCl_4$

39. In terms of polar character, which of the following order is correct ?
(a) $NH_2 < H_2O < HF < H_2S$
(b) $H_2S < NH_3 < H_2O < HF$
(c) $H_2O < NH_3 < H_2S < HF$
(d) $HF < H_2O < NH_3 < H_2S$

40. The correct order of strength of H-bond in the following compound :
(a) $H_2O > H_2O_2 > HF > H_2S$
(b) $HF > H_2O_2 > H_2O > H_2S$
(c) $HF > H_2O > H_2S > H_2O_2$
(d) $HF > H_2O > H_2O_2 > H_2S$

41. The ratio of σ-bond in tetracyano ethylene is :
(a) 2 : 1 (b) 1 : 1
(c) 1 : 2 (d) None of these

42. The bond length of the S-O bond is maximum in which of the following compounds :
(a) $SOCl_2$
(b) $SOBr_2$
(c) SOF_2
(d) All have same length

43. 5.1 g of solid NH_4HS is introduced in a 16.4 lit. vessel & heated upto 500 K. K_p for equilibrium $NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g)$ is 0.16. The maximum pressure developed in the vessel will be :
(a) 0.8 atm (b) 0.40 atm
(c) 0.5 atm (d) None of these

44. For a reversible reaction $K_C < K_P$ & $\Delta H = -100\,kJ$ the reverse reaction is favoured if :
(a) Both P & T are reduced
(b) P increased & T decreased
(c) Both P & T are increased
(d) P decreased & T increased

45. n mole of PCl_3 and n mole of Cl_2 are allowed to react at constant temperature T to have a total equilibrium pressure P, as
$PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g)$
If y mole of PCl_5 are formed at equilibrium, find K_P for the given reaction.
(a) $\frac{(2n-y)y}{(n-y)^2.P}$ (b) $\frac{y}{(n-y)^2(2n-y)P}$
(c) $\frac{(n-y)^2.P}{(2n-y)y}$ (d) $\frac{(n-y)^2(2n-y)P}{y}$

46. The ionisation energy of H is 13.6 eV. Calculate the ionization energy of Li^{2+} ions.
(a) 54.4 eV (b) 122.4 eV
(c) 244.8 eV (d) 108.8 eV

47. Principal quantum number of an atom represents
(a) Size of the orbital
(b) Spin angular momentum
(c) Orbital angular momentum
(d) Space orientation of the orbital

48. The ratio of magnetic moments of Fe(III) and Co(III) is :
(a) $\sqrt{5}:\sqrt{7}$ (b) $\sqrt{35}:\sqrt{15}$
(c) 7 : 3 (d) $\sqrt{24}:\sqrt{15}$

49. Which of the following reactions represents disproportionation?
(a) $CrO_5 \rightarrow Cr^{3+} + O_2$
(b) $IO_3^- + I^- + H^+ \rightarrow I_2$
(c) $CrO_2Cl_2 + NaOH \rightarrow Na_2CrO_4 + NaCl + H_2O$
(d)
$Na_2S_2O_3 + H_2SO_4 \rightarrow Na_2SO_4 + SO_2 + S_8 + H_2O$

50. The hybridization of the central atom will change when.
(a) NH_3 combines with H^-
(b) H_3BO_3 combines with OH^-
(c) NH_3 forms NH_2^-
(d) H_2O combines with H^+

SECTION - B

Integer Type Questions

51. AX is a covalent diatomic molecule where A and X are second row elements of periodic table. Based on molecular orbital theory, the bond order of AX is 2.5. The total number of electrons in AX is ……(Round off to the nearest integer)

52. pH of a solution containing 0.1 M HCl and 0.001 M $CH_3COOH(K_a = 2\times10^{-5})$ is :

53. How many molecule have $p\pi - d\pi$ bonding.
(i) CO_3^{2-} (ii) SO_3^{2-} (iii) PO_4^{3-} (iv) NO_2^-
(v) R_3PO (vi) ClO_4^- (vii) ClO_3^-

54. X is the number of maximum atom (s) is/are present in same plane of $B_3N_3H_6$. Find value of $\frac{X}{2}$.

55. If there were 10 periods in periodic table then maximum number of elements which 10^{th} period can have.

56. The maximum number of electrons that can have principal quantum number, n = 3 and spin quantum number, $m_s = -1/2$, is

57. pH of 0.1 M CH_3COONa is (Ka) CH_3COOH = 10^{-5}

58. A $3d_{x^2-y^2}$ orbital has x angular and y radial nodes. x + y is.

59. 500 mL of 2M CH_3COOH solution is mixed with 600 mL 12% w/V CH_3COOH solution, then calculate the final molarity of solution.

60. Volume of 1M HCl (in litre) required to completely neutralize 80 g NaOH is :

MATHEMATICS

Section - A

Single Choice Question

61. The value of $\left(\frac{1}{\log_3 12}+\frac{1}{\log_4 12}\right)$ is
(a) 0 (b) 1/2 (c) 1 (d) 2

62. If $\log_2\left(9^{x-1}+7\right)-\log_2\left(3^{x-1}+1\right)=2$ then x value are
(a) 1, 2 (b) 0, 2 (c) 0, 1 (d) 1, 4

63. If $\left(\frac{1+i}{1-i}\right)^m = 1$, then the least integral value of in m is
(a) 2 (b) 4 (c) 8 (d) N.O.T

64. $\frac{3+2i\sin\theta}{1-2i\sin\theta}$ will be real, if θ =
(a) $2n\pi$ (b) $n\pi+\frac{\pi}{2}$ (c) $n\pi$ (d) N.O.T

65. $\frac{3+2i\sin\theta}{1-2i\sin\theta}$ will be purely imaginary, if θ =
(a) $2n\pi+\frac{\pi}{3}$ (b) $n\pi+\frac{\pi}{3}$
(c) $n\pi\pm\frac{\pi}{3}$ (d) None of these

66. The complex number $\sin x + i\cos 2x$ and $\cos x - i\sin 2x$ are conjugate to each other for
(a) $x = n\pi$ (b) $x=\left(n+\frac{1}{2}\right)\pi$
(c) $x = 0$ (d) No value of x

67. If $\frac{c+i}{c-i}=a+ib$, where a, b, c are real, then $a^2+b^2=$
(a) 1 (b) – 1 (c) c^2 (d) $-c^2$

68. If the sum of the series 2 + 5 + 8 + 11….. is 60100, then the number of terms are
(a) 100 (b) 200 (c) 150 (d) 250

69. The ratio of sum of m and n terms of an A.P. is $m^2:n^2$, then the ratio of m^{th} and n^{th} term will be.
(a) $\frac{m-1}{n-1}$ (b) $\frac{n-1}{m-1}$ (c) $\frac{2m-1}{2n-1}$ (d) $\frac{2n-1}{2m-1}$

70. If the nth term of geometric progression $5,-\frac{5}{2},\frac{5}{4},-\frac{5}{8}.....$ is $\frac{5}{1024}$, then the value of n is
(a) 11 (b) 10 (c) 9 (d) 4

71. If $x=a\cos^3\theta\, y=b\sin^3\theta$, then
(a) $\left(\frac{a}{x}\right)^{2/3}+\left(\frac{b}{y}\right)^{2/3}=1$
(b) $\left(\frac{b}{x}\right)^{2/3}+\left(\frac{a}{y}\right)^{2/3}=1$
(c) $\left(\frac{x}{a}\right)^{2/3}+\left(\frac{y}{b}\right)^{2/3}=1$
(d) $\left(\frac{x}{b}\right)^{2/3}+\left(\frac{y}{a}\right)^{2/3}=1$

72. If $\sin\theta_1+\sin\theta_2+\sin\theta_3=3$, then $\cos\theta_1+\cos\theta_2+\cos\theta_3=$
(a) 3 (b) 2 (c) 1 (d) 0

73. If $\cos(\alpha+\beta)=\frac{4}{5},\sin(\alpha-\beta)=\frac{5}{12}$ and α,β lie between 0 and $\frac{\pi}{4}$, then $\tan 2\alpha=$
(a) $\frac{16}{63}$ (b) $\frac{56}{33}$ (c) $\frac{28}{33}$ (d) N.O.T.

74. If $\frac{\pi}{2}<\alpha<\pi,\pi<\beta<\frac{3\pi}{2}$; $\sin\alpha=\frac{15}{17}$ and $\tan\beta=\frac{12}{5}$, then the value of $\sin(\beta-\alpha)$
(a) $\frac{-171}{221}$ (b) $\frac{-21}{221}$ (c) $\frac{21}{221}$ (d) $\frac{171}{221}$

75. If $\cos 7\theta=\cos\theta-\sin 4\theta$, then the general value of θ is
(a) $\frac{n\pi}{4},\frac{n\pi}{3}+\frac{\pi}{18}$ (b) $\frac{n\pi}{3},\frac{n\pi}{3}+(-1)^n\frac{\pi}{18}$
(c) $\frac{n\pi}{4},\frac{n\pi}{3}+(-1)^n\frac{\pi}{18}$ (d) $\frac{n\pi}{6},\frac{n\pi}{3}+(-1)^n\frac{\pi}{18}$

76. If $\frac{1-\tan^2\theta}{\sec^2\theta}=\frac{1}{2}$, then the general value of θ is
(a) $n\pi\pm\frac{\pi}{6}$ (b) $n\pi\pm\frac{\pi}{6}$
(c) $2n\pi\pm\frac{\pi}{6}$ (d) None of these

77. If $\cos 2\theta=\left(\sqrt{2}+1\right)\left(\cos\theta-\frac{1}{\sqrt{2}}\right)$, then the value of θ is
(a) $2n\pi+\frac{\pi}{4}$ (b) $2n\pi\pm\frac{\pi}{4}$
(c) $2n\pi-\frac{\pi}{4}$ (d) None of these

78. The general solution of the equation $\left(\sqrt{3}-1\right)\sin\theta+\left(\sqrt{3}+1\right)\cos\theta=2$ is
(a) $2n\pi\pm\frac{\pi}{4}+\frac{\pi}{12}$ (b) $n\pi+(-1)^n\frac{\pi}{4}+\frac{\pi}{12}$
(c) $2n\pi\pm\frac{\pi}{4}-\frac{\pi}{12}$ (d) $n\pi+(-1)^n\frac{\pi}{4}-\frac{\pi}{12}$

79. In triangle PQR, $\angle R=\frac{\pi}{2}$. If $\tan\left(\frac{P}{2}\right)$ and $\tan\left(\frac{Q}{2}\right)$ are the roots of the equation $ax^2+bx+c=0(\alpha\neq 0)$, then
(a) a + b = c (b) b + c = a
(c) a + c = b (d) b = c

80. If $\sec 4\theta-\sec 2\theta=2$, then the general value of θ is
(a) $(2n+1)\frac{\pi}{4}$ (b) $(2n+1)\frac{\pi}{10}$
(c) $n\pi+\frac{\pi}{2}or\frac{n\pi}{5}+\frac{\pi}{10}$ (d) None of these

Section - B

Integer Type Questions

81. If $4n\alpha = \pi$, then
$\cot\alpha \cot 2\alpha \cot 3\alpha....\cot(2n-1)\alpha$ is equal t

82. If $\sin x + \sin^2 x + \sin^3 x = 1$, then
$\cos^6 x - 4\cos^4 x + 8\cos^2 x =$

83. The maximum value of
$1 + \sin\left(\frac{\pi}{4} + \theta\right) + 2\cos\left(\frac{\pi}{4} - \theta\right)$ for real value of θ is

84. The maximum value of the expression $\frac{1}{\sin^2\theta + 3\sin\theta\cos\theta + 5\cos^2\theta}$, is

85. The posifive integral value of n > 3 satisfying $\frac{1}{\sin\left(\frac{\pi}{n}\right)} = \frac{1}{\sin\left(\frac{2\pi}{n}\right)} + \frac{1}{\sin\left(\frac{3\pi}{n}\right)}$, is

86. The number of solution of $\tan x + \sec x = 2\cos x$ in $[0, 2\pi]$, is

87. The number of value of x in the interval $[0, 3\pi]$ satisfying the equation $2\sin^2 x + 5\sin x - 3 = 0$, is

88. The number of solution of the pair of equation $2\sin^2\theta - \cos 2\theta = 0$ and $2\cos^2\theta - 3\sin\theta = \theta$ in the interval $[0, 2\pi]$ is

89. The number of value of θ in the interval $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ such that $\theta \neq \frac{n\pi}{5}$ for $n = 0, \pm 1, \pm 2$ and $\tan\theta = \cot 5\theta$ as well as $\sin 2\theta = \cos 4\theta$

90. The number of solution of the equation $\cos^2\left(x + \frac{\pi}{6}\right) + \cos^2 x - 2\cos\left(x + \frac{\pi}{6}\right)\cos\left(\frac{\pi}{6}\right) = \sin^2\frac{\pi}{6}$ in the interval is