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JEE

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

ALL INDIA SKY TEST SERIES

SAARTHAK BATCH – JEE [12th]

Date : 20/08/2023

SYLLABUS

PHYSICS	CHEMISTRY	MATHEMATICS
Ray Optics, wave optics, Capacitor	**Nitrogen family, IUPAC, d, f block,**	**Matrix & Determinant, ITF, Relation function, limit, Continuity, Differentiability**

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:_____

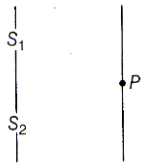
Signature of the candidate: _____**Signature of the invigilator:**_____

PHYSICS

Section - A

Single Choice Question

1. Coherent light is incident on two fine parallel slits S_1 and S_2 as shown in figure,



If a dark fringe occurs at P, which of the following gives possible phase difference for the light wave arriving at P from S_1 and S_2 ?

(a) $2\pi, 4\pi, 6\pi, ...$

(b) $\pi/6, 3\pi/6, 5\pi/6, ...$

(c) $\pi, 3\pi, 5\pi, ...$

(d) $\pi/4, 3\pi/4, 5\pi/4, ...$

2. Two coherent waves of intensities I_1 and I_2 pass through a region at the same time in the same direction. The sum of the maximum and minimum intensities is

(a) $I_1 + I_2$ (b) $\left(\sqrt{I_1} + \sqrt{I_2}\right)^2$

(c) $\left(\sqrt{I_1} - \sqrt{I_2}\right)^2$ (d) $2(I_1 + I_2)$

3. In a YDSE, the central bright fringe can be identified

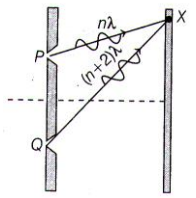
(a) as it has greater intensity than the other bright fringes

(b) as it is wider than the other bright fringes

(c) as it is narrower than the other bright fringes

(d) by using white light instead of single wavelength light

4. The figure shows a double slit experiment with P and Q as the slits. The path lengths PX and QX are $n\lambda$ and $(n+2)\lambda$ respectively, where n is a whole number and λ is the wavelength. Taking the central fringe as zero, what is formed at X ?



(a) First bright (b) First dark

(c) Second bright (d) Second dark

5. At two points P and Q on a screen in Young's double slit experiment, waves from slits S_1 and S_2 have a path difference of 0 and $\frac{\lambda}{4}$, respectively. The ratio of intensities at P and Q will be

(a) 2 : 1 (b) $\sqrt{2}$: 1 (c) 4 : 1 (d) 3 : 2

6. Angular width of the central maxima in a Fraunhofer diffraction obtained by a single slit using light of wavelength 6000 Å is measured. If light of another wavelength is used, the angular width of the central maxima is found to decreased by 30%. Find the other wavelength.

(a) 6000 Å (b) 4200 Å

(c) 5400 Å (d) 1400 Å

7. If we observe the single slit Fraunhofer diffraction with wavelength λ and slit width d, the width of the central maxima is 2θ. On decreasing the slit width for the same λ.

(a) θ increases

(b) θ remains unchanged

(c) θ decreases

(d) θ increases or decreases depending on the intensity of light

8. The angle of polarization for any medium is 60°. What will be the critical angle for this medium at air interface ?

(a) $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (b) $\sin^{-1}\left(\sqrt{3}\right)$

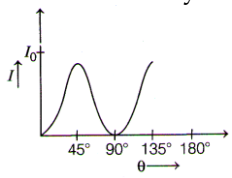
(c) $\cos^{-1}\left(\sqrt{3}\right)$ (d) $\tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$

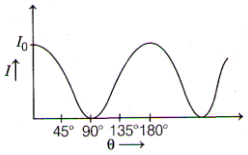
9. When the angle of incidence on a material is 60°, the reflected light is completely polarized. The velocity (in m/s) of the refracted ray inside the material is

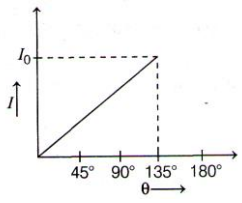
(a) 3×10^8 (b) $\left(\frac{3}{\sqrt{2}}\right)\times10^8$

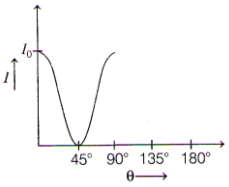
(c) $\sqrt{3}\times10^8$ (d) 0.5×10^8

10. The graph showing the dependence of intensity of transmitted light on the angle between polariser and analyser is

(a) 

(b) 

(c) 

(d) 

11. In young's double slit interference experiment, the fringe pattern is observed on a screen placed at a distance D. The slits are separated by d and are illuminated by light of wavelength λ. The distance from the centre point, where the intensity falls to half the maximum is

(a) $\frac{\lambda D}{3d}$ (b) $\frac{\lambda D}{2d}$ (c) $\frac{\lambda D}{d}$ (d) $\frac{\lambda D}{4d}$

12. Two polaroids are placed in the path of unpolarised beam of intensity l_0 such that no light is emitted from the second polaroid. If a third polaroid polarization axis makes an angle θ with the polarization axis of first polaroid, is placed between these polaroids, then the intensity of light emerging from the last polaroid will be

(a) $\left(\frac{l_0}{8}\right)\sin^2 2\theta$ (b) $\left(\frac{l_0}{4}\right)\sin^2 2\theta$

(c) $\left(\frac{l_0}{2}\right)\cos^4\theta$ (d) $l_0\cos^4\theta$

13. In a YDSE, the coherent sources are at 2d distance from each other and screen is placed a distance D from the slits. If nth bright fringe is formed on the screen exactly opposite to a slit, the value of n must be

(a) $\frac{d^2}{4\lambda D}$ (b) $\frac{d^2}{\lambda D}$ (c) $\frac{2d^2}{\lambda D}$ (d) $\frac{d^2}{2\lambda D}$

14. The ratio of resolving powers of an optical microsope for two wavelengths $\lambda_1 = 4000$ Å and $\lambda_2 = 6000$ Å is

(a) 8 : 27 (b) 9 : 4 (c) 3 : 2 (d) 16 : 81

15. Young's double slit experiment is first performed in air and then in a medium other than air. It is found that 8th bright fringe in the medium lies where 5th dark fringe lies in air. The refractive index of the medium is nearly

(a) 1.25 (b) 1.59 (c) 1.69 (d) 1.78

16. Focal length of a magnifying lens is 12.5 cm. Ratio of maximum and minimum magnifying power is

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

17. In a compound microscope, the focal lengths of objective and eye lenses are 1.2 cm and 3 cm, respectively. If the object is put 1.25 cm away from the objective lens and the final image is formed at infinity, the magnifying power of the microscope is (Take, D = 25 cm)

(a) 150 (b) 200 (c) 250 (d) 400

18. An astronomical telescope has objective and eyepiece of focal lengths 40 cm and 4 cm respectively. To view an object 200 cm away from the objective, the lenses must be separated by a distance

(a) 46.0 cm (b) 50.0 cm
(c) 54.0 cm (d) 37.3 cm

19. The plates of parallel plate capacitor are pulled apart with a velocity v. If any instant their mutual distance of separation is x, then magnitude of rate of change of capacitance with respect to time varies as.

(a) $\frac{1}{x}$ (b) $\frac{1}{x^2}$ (c) x^2 (d) x

20. An uncharged capacitor is connected to a battery. On charging the capacitor

(A) All the energy supplied is stored in the capacitor
(B) Half the energy supplied is stored in the capacitor
(C) Half the energy supplied is dissipated in form of heat in connecting wires
(D) The energy stored depends upon the time for which the capacitor is charged.

(a) A, C (b) B, C (c) A, D (d) C, D

Section - B

Integer Type Questions

21. In young's double slit experiment. the phase difference between the light waves reaching to third bright fringe will be $n\pi$. Find *n*

22. A beam of light of wavelength 600 nm from a distant source falls on a single slit 1 mm wide and the resulting diffraction pattern is observed on a screen 2m away. The distance between the first dark fringes on either side of the central bright fringe is $\frac{24}{n}$ mm. Find *n*

23. Three polaroids are kept coaxially. Angle between the first and third polaroid is 90°. Angle between the first and second polaroid is 60°. if unpolarised light intensity incident on the first polaroid is I_0, light intensity that emerges from the system is $\frac{\sqrt{n}\, I_o}{8}$. Find *n*

24. In a Young's double slit experiment, slits are separated by 0.5 mm and the screen is placed 150 cm away. A beam of light consisting of two wavelengths 600 nm and 500 nm is used to obtain interference fringes on the screen. The least distance from the common central maximum to the point, where the bright fringes due to both the wavelength coincide is $900x$ μm . Find *x*

25. The maximum number of possible interference maxima for slit separation equal to twice the wavelength in Young's double slit experiment is……

26. In a young's double slit experiment, a student observes 8 fringes in a certain segment of screen when a monochromatic light of 600 nm wavelength is used. If the wavelength of light is changed to 400 nm, then the number of fringes he would observe in the same region of the screen is……

27. The focal length of the objective of an astronomical telescope is 1 m. if the magnifying power of the telescope is 20, for a relaxed eye, the length of telescope should be 7x cm. Find *x*

28. The resolution limit of eye is 1 min. At a distance of x km from the eye, two persons stand with a lateral separation of 3 m. For the two persons to be just resolved by the naked eye, approximately x should be…….

29. The plates of parallel plate capacitor are charged up to 100 V. A 2 mm thick plate is inserted between the plates. Then to maintain the same potential difference, the distance between the plates is increased by 1.6 mm. The dielectric constant of the plate is…….

30. A parallel plate capacitor of capacity C_o is charged to a potential V_o. E_1 is the energy stored in the capacitor when the battery is disconnected and the plate separation is doubled, and E_2 is the energy stored in the capacitor when the charging battery is kept connected and the separation between the capacitor plates is doubled. Find the ratio E_1/E_2.

CHEMISTRY

Section - A

Single Choice Question

31. Concentrated HNO_3 reacts with Iodine to give
(a) HI, NO_2 and H_2O
(b) HIO_2, N_2O and H_2O
(c) HIO_3, NO_2 and H_2O
(d) HIO_4, N_2O and H_2O

32. The number of bridged oxygen atoms present in compound B formed from the following reactions is $Pb(NO_3)_2 \xrightarrow{673K} A + PbO + O_2$
$A \xrightarrow{\text{Dimerise}} B$
(a) 0 (b) 1 (c) 2 (d) 3

33. Consider the following reaction:
A + alkali $\rightarrow$B (Major product)
If B is an oxoacid of phosphorus with no P – H bond, then A is
(a) white P_4 (b) red P_4
(c) P_2O_3 (d) H_3PO_3

34. Among the given oxides of nitrogen ; N_2O, N_2O_3, N_2O_4 and N_2O_5, the number of compound /(s) having N – N bond is
(a) 1 (b) 2 (c) 3 (d) 4

35. Chemical nature of the nitrogen oxide compound obtained from a reaction of concentrated nitric acid and P_4O_{10} (in 4 : 1 ratio) is
(a) amphoteric (b) neutral
(c) acidic (d) basic

36. Match **List – I** with **List – II**

List-I Name of oxo acid		**List – II Oxidation state of 'P'**	
(A)	Hypophoshorous acid	(i)	+5
(B)	Orthophosphoric acid	(ii)	+4
(C)	Hypophosphoric acid	(iii)	+3
(D)	Orthophosphorous acid	(iv)	+2
		(v)	+1

Choose the correct answer from the option given below.
(a) (A) – (iv), (B) – (v), (C)-(ii), (D)-(iii)
(b) (A) – (iv), (B)-(i), (C)-(ii), (D)-(iii)
(c) (A)-(v), (B)-(iv), (C)-(ii), (D)-(iii)
(d) (A)-(v), (B)-(i), (C)-(ii), (D) – (iii)

37. On heating, lead (II) nitrate gives a brown gas (A). The gas (A) on cooling changes to a colourless solid/liquid (B). (B) on heating with NO changes to a blue solid (C). The oxidation number of nitrogen in solid (C) is
(a) +5 (b) +4 (c) +3 (d) +2

38. A metal (A) on heating in nitrogen gas gives compound (B). (B) on treatment with H_2O gives a colourless gas which when passed through $CuSO_4$ solution gives a dark blue-violet coloured solution. (A) and (B) respectively, are
(a) Na and Na_3N (b) Mg and Mg_3N_2
(c) Mg and $Mg(NO_3)_2$ (d) Na and $NaNO_3$

39. Phosphine is produced by adding H_2O to
(a) $CaCl_2$ (b) HPO_3 (c) Ca_3P_2 (d) P_4O_{10}

40. Thermal decomposition of Mn compound (X) at 513 K result in compound Y, MnO_2 and a gaseous product. MnO_2 reacts with NaCl and concentrated H_2SO_4 to give a pungent gas Z. X, Y, and Z, respectively, are
(a) K_3MnO_4, K_2MnO_4 and Cl_2
(b) K_2MnO_4, $KMnO_4$ and Cl_2
(c) K_2MnO_4, $KMnO_4$ and SO_2
(d) $KMnO_4$, K_2MnO_4 and Cl_2

41. At 40^oC, the vapour pressure of pure liquids, benzene and toluene are 160 mm Hg and 60 mm Hg respectively. At the same temperature, the vapour pressure of an equimolar solution of two liquids, assuming the ideal solution should be
(a) 140 mm Hg (b) 110 mm Hg
(c) 220 mm Hg (d) 100 mm Hg

42. When XO_2 is fused with an alkali metal hydroxide in presence of an oxidizing agent such as KNO_3, a dark green product is formed which disproportionates in acidic solution to afford a dark purple solution. X is
(a) Ti (b) Cr (c) V (d) Mn

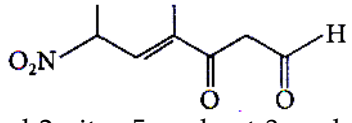
43. $Ni\left|Ni^{2+}(1M)\right\|Au^{3+}(1M)\left|Au\right.$. if $E^o_{Ni^{2+}/Ni}$ and $E^o_{Au^{3+}/Au}$ respectively are -0.25V and 1.5V, EMF of the cell is
(a) 1V (b) 1.25 V
(c) 1.75 V (d) -1.75 V

44. Which one of the following statements is correct?
(a) Manganese salts give a violet borax test in the reducing flame.
(b) From a mixed precipitate of AgCl and AgI, ammonia solution dissolves only AgCl.
(c) Ferric ions give a deep green precipitate on adding potassium ferrocyanide solution.
(d) On boiling a solution having K^+, Ca^{2+} and HCO_3^- ions we get a precipitate of $K_2Ca(CO_3)_2$.

45. On treating a compound with warm dil. H_2SO_4, gas X is evolved which turns $K_2Cr_2O_7$ paper acidified with dil. H_2SO_4 to a green compound Y. X and Y respectively are
(a) X = SO_2, Y = $Cr_2(SO_4)_3$
(b) X = SO_2, Y = Cr_2O_3
(c) X = SO_3, Y = $Cr_2(SO_4)_3$
(d) X = SO_3, Y = Cr_2O_3

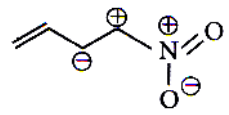
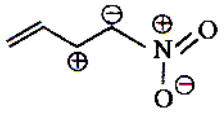
46. The correct decreasing order of priority of functional groups in naming an organic compound as per IUPAC system of nomenclature is
(a) –COOH > $–CONH_2$ > – COCl > – CHO
(b) $–SO_3H$ > –COCl > $–CONH_2$ > –CN
(c) –COOR > –COCl > $–NH_2$ > CO
(d) –COOH > –COOR > $–CONH_2$ > –COCl

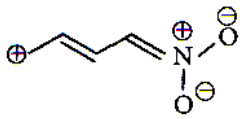
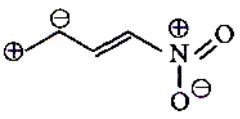
47. The correct IUPAC name of the following compound is



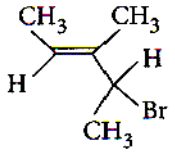
(a) 4-methyl-2-nitro-5-oxohept-3-enal
(b) 4-methyl-5-oxo-2-nitrohept-3-enal
(c) 4-methyl-6-nitro-3-oxohept-4-enal
(d) 6-formyl-4-methyl-2-nitrohex-3-enal

48. Which one among the following resonating structures is not correct?

(a)  (b) 

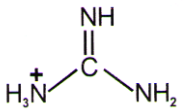
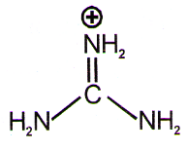
(c)  (d) 

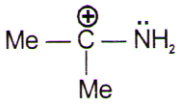
49. What is the IUPAC name of the following compound?



(a) 4-Bromo-3-methylpent-2-ene
(b) 2-Bromo-3-methylpent-3-ene
(c) 3-Bromo-3-methyl-1, 2-dimethylprop -1-ene
(d) 3-Bromo-1, 2-dimethylbut-1-ene

50. In which of the following molecule positive charge is not detocalized because of resonance ?

(a)  (b) 

(c)  (d) 

Section - B

Integer Type Questions

51. The number of non-ionisable protons present in the product B obtained from the following reactions is _____.

$C_2H_5OH + PCl_3 \rightarrow C_2H_5Cl + A$

$A + PCl_3 \rightarrow B$

52. Consider the following reactions:

$PCl_3 + H_2O \rightarrow A + HCl$

$A + H_2O \rightarrow B + HCl$

The number of ionisable protons present in the product B is _____.

53. How many resonance structure are possible for

54. Among the following, the number of halide(s) which is/are inert to hydrolysis is _____.

A. BF_3 B. $SiCl_4$ C. PCl_5 D. SF_6

55. Among Co^{3+}, Ti^{2+}, V^{2+} and Cr^{2+} ions, one if used as a reagent cannot liberate H_2 from dilute mineral acid solution, its spin-only magnetic moment in gaseous state is_____ B.M. (Nearest integer)

56. The number of statement(s) correct from the following for copper (at. No. 29) is/are _____

(A) Cu(II) complexes are always paramagnetic.
(B) Cu(I) complexes are generally colourless.
(C) Cu(I) is easily oxidised
(D) In Fehling solution, the active reagent has Cu(I).

57. The spin-only magnetic moment value of M^{3+} ion (in gaseous state) from the pairs $Cr^{3+}/Cr^{2+}, Mn^{3+}/Mn^{2+}, Fe^{3+}/Fe^{2+}$ and Co^{3+}/Co^{2+} that has negative standard electrode potential, is _____ B.M. [Nearest integer]

58. The number of terminal oxygen atoms present in the product B obtained from the following reaction is _____.

$FeCr_2O_4 + Na_2CO_3 + O_2 \longrightarrow$
$A + Fe_2O_3 + CO_2$
$A + H^+ \longrightarrow B + H_2O + Na^+$

59. The number of 4*f* electrons in the ground state electronic configuration of Gd^{2+} is _____. (Atomic number of Gd = 64)

60. In mildly alkaline medium, thiosulphate ion is oxidized by MnO_4^- to "A". The oxidation state of sulphur in "A" is _____.

MATHEMATICS

Section - A

Single Choice Question

61. If *R* is a relation from a finite set *A* having *m* elements to a finite set *B* having *n* elements, then the number of relations from *A* to *B* is

(a) 2^{mn} (b) $2^{mn}-1$ (c) 2mn (d) m^n

62. The relation *R* defined on the set *A* = {1, 2, 3, 4, 5} by $R = \{(x, y) : |x^2 - y^2| < 16\}$ is given by

(a) {(1, 1), (2, 1), (3, 1), (4, 1), (2, 3)}
(b) {(2, 2), (3, 2), (4, 2), (2, 4)}
(c) {(3, 3), (3, 4), (5, 4), (4, 3), (3, 1)}
(d) None of these

63. In the set $A = \{1, 2, 3, 4, 5\}$, a relation R is defined by $R = \{(x, y) \mid x, y \in A \text{ and } x < y\}$. Then R is
(a) Reflexive (b) Symmetric
(c) Transitive (d) None of these

64. $\tan\left[\frac{\pi}{4}+\frac{1}{2}\cos^{-1}\frac{a}{b}\right]+\tan\left[\frac{\pi}{4}-\frac{1}{2}\cos^{-1}\frac{a}{b}\right]$ equal to
(a) $\frac{2a}{b}$ (b) $\frac{2b}{a}$ (c) $\frac{a}{b}$ (d) $\frac{b}{a}$

65. α, β and γ are three angles given by $\alpha = 2\tan^{-1}(\sqrt{2}-1), \beta = 3\sin^{-1}\frac{1}{\sqrt{2}}+\sin^{-1}\left(-\frac{1}{2}\right)$ and $\gamma = \cos^{-1}\left(\frac{1}{3}\right)$. Then
(a) $\alpha > \beta$ (b) $\beta > \gamma$
(c) $\alpha < \gamma$ (d) None of these

66. $\cot\left[\cos^{-1}\left(\frac{7}{25}\right)\right] =$
(a) $\frac{25}{24}$ (b) $\frac{25}{7}$ (c) $\frac{24}{25}$ (d) N.O.T.

67. The greatest and the least values of $(\sin^{-1}x)^3 + (\cos^{-1}x)^3$ are
(a) $\frac{-\pi}{2}, \frac{\pi}{2}$ (b) $\frac{-\pi^3}{8}, \frac{\pi^3}{8}$
(c) $\frac{\pi^3}{32}, \frac{7\pi^3}{8}$ (d) None of these

68. If $5f(x)+3f\left(\frac{1}{x}\right) = x+2$ and $y = xf(x)$ then $\left(\frac{dy}{dx}\right)_{x=1}$ is equal to
(a) 14 (b) $\frac{7}{8}$ (c) 1 (d) N.O.T.

69. If $y = |\cos x| + |\sin x|$ then $\frac{dy}{dx}$ at $x = \frac{2\pi}{3}$ is
(a) $\frac{1-\sqrt{3}}{2}$ (b) 0
(c) $\frac{1}{2}(\sqrt{3}-1)$ (d) N.O.T.

70. $\frac{d}{dx}\tan^{-1}\left[\frac{\cos x - \sin x}{\cos x + \sin x}\right]$
(a) $\frac{1}{2(1+x^2)}$ (b) $\frac{1}{1+x^2}$ (c) 1 (d) – 1

71. If $x = \frac{1-t^2}{1+t^2}$ and $y = \frac{2t}{1+t^2}$, then $\frac{dy}{dx} =$
(a) $\frac{-y}{x}$ (b) $\frac{y}{x}$ (c) $\frac{-x}{y}$ (d) $\frac{x}{y}$

72. The value of the determinant $\begin{vmatrix} 10! & 11! & 12! \\ 11! & 12! & 13! \\ 12! & 13! & 14! \end{vmatrix}$ is
(a) 2(10! 11!) (b) 2(10! 13!)
(c) 2(10! 11! 12!) (d) 2(11! 12! 13!)

73. The value of the determinant $\Delta = \begin{vmatrix} 1! & 2! & 3! \\ 2! & 3! & 4! \\ 3! & 4! & 5! \end{vmatrix}$ is
(a) 2! (b) 3! (c) 4! (d) 5!

74. If every element of a third order determinant of value Δ is multiplied by 5, then the value of new determinant is
(a) Δ (b) 5Δ (c) 25Δ (d) 125Δ

75. $\lim_{x\to\infty}\left[x-\sqrt{x^2+x}\right] =$
(a) $\frac{1}{2}$ (b) 1 (c) $-\frac{1}{2}$ (d) 0

76. If $f(x) = \begin{cases} \sin x & , x \neq n\pi \\ 0 & , \text{other wise} \end{cases}, n \in Z$
$g(x) = \begin{cases} x^2+1 & , x \neq 0, 2 \\ 4 & , x = 0 \\ 5 & , x = 2 \end{cases}$, then $\lim_{x\to 0} g\{f(x)\} =$
(a) 1 (b) 0 (c) $\frac{1}{2}$ (d) $\frac{1}{4}$

77. $\lim_{x\to 0}\left[\tan\left(\frac{\pi}{4}+x\right)\right]^{1/x}$ is equal to
(a) e^{-1} (b) e (c) e^2 (d) $\sqrt{e}$

78. $\lim\limits_{x\to 0}\left\{\dfrac{\sin x - x + \dfrac{x^3}{6}}{x^5}\right\} =$

(a) $\dfrac{1}{120}$ (b) $-\dfrac{1}{120}$

(c) $\dfrac{1}{20}$ (d) None of these

79. The function

$$f(x)=\begin{cases} x^2/a & ,\ 0\le x<1 \\ a & ,\ 1\le x<\sqrt{2} \\ (2b^2-4b)/x^2 & ,\ \sqrt{2}\le x<\infty \end{cases}$$ is

continuous for $0\le x<\infty$, then the most suitable values of *a* and *b* are

(a) $a=1, b=-1$ (b) $a=-1,\ b=1+\sqrt{2}$

(c) $a=-1, b=1$ (d) None of these

80. Let $f(x)=[2x^3-5]$, [.] denotes the greatest integer function. Then number of points in (1, 2) where the function is discontinuous, is

(a) 0 (b) 13 (c) 10 (d) 3

SECTION - B

Integer Type Questions

81. Let $f: R-\left\{\dfrac{\alpha}{6}\right\}\to R$ be defined by $f(x)=\dfrac{5x+3}{6x-\alpha}$. Then the value of α for which $(fof)(x)=x$, for all $x\in R-\left\{\dfrac{\alpha}{6}\right\}$, is

82. If $[x]$ be the greatest integer less than or equal to x, then $\sum\limits_{n=8}^{100}\left[\dfrac{(-1)^n n}{2}\right]$ is equal to

83. Let $\sum\limits_{k=1}^{10} f(a+k)=16(2^{10}-1)$, where the function f satisfies $f(x+y)=f(x)f(y)$ for all natural numbers x, y and $f(1)=2$. Then the natural number 'a' is

84. Let $f(x)$ and $g(x)$ be two real polynomial of degree 2 and 1 respectively. If $f(g(x))=8x^2-2x$, and $g(f(x))=4x^2+6x+1$, then the value of $f(2)+g(2)$ is

85. The value of $\lim\limits_{n\to\infty} 6\tan\left\{\sum\limits_{r=1}^{n}\tan^{-1}\left(\dfrac{1}{r^2+3r+3}\right)\right\}$ is

86. If the function

$$f(x)=\begin{cases} \dfrac{\log_e(1-x+x^2)+\log_e(1+x+x^2)}{\sec x-\cos x} & ,\ x\in\left(\dfrac{-\pi}{2},\dfrac{\pi}{2}\right)-\{0\} \\ k & ,\ x=0 \end{cases}$$

is continuous at x = 0, then k is equal to

87. If the function $f; R\to R$ be defined as.

$$f(x)=\begin{cases} \sin x-e^x & if \quad x\le 0 \\ a+[-x] & if \quad 0<x<1 \\ 2x-b & if \quad x\ge 1 \end{cases}$$

Where [x] is the greater integer less than or equal to x. If f is continuous on R, then (a + b) is equal to

88. Let $f: R\to R$ be defined as

$$f(x)=\begin{cases} \dfrac{x^3}{(1-\cos 2x)^2}\log_e\left(\dfrac{1+2xe^{-2x}}{(1-xe^{-x})^2}\right) & ,\ x\ne 0 \\ \alpha & ,\ x=0 \end{cases}$$

If f is continuous at x = 0, then α is equal to

89. The derivative of $\tan^{-1}\left(\dfrac{\sin x-\cos x}{\sin x+\cos x}\right)$ with respect to $\dfrac{x}{2}$, where $\left(x\in\left(0,\dfrac{\pi}{2}\right)\right)$ is

90. Let *k* be a non – zero real number. If

$$f(x)=\begin{cases} \dfrac{(e^x-1)^2}{\sin\left(\dfrac{x}{k}\right)\log\left(1+\dfrac{x}{4}\right)} & ,\ x\ne 0 \\ 12 & ,\ x=0 \end{cases}$$

is a continuous function, then the value of *k* is