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Full Syllabus Rehearsal Test

JEE Mains Pattern

TIME : 3 hrs **MM : 300**

IMPORTANT INSTRUCTIONS :

1. **There are 75 questions in this paper. Each question carries 4 marks for correct response.**
2. For Each incorrect response, (–1) of the total marks allotted to the question would be deducted from the total score. No deduction from the total score, however, will be made if no response is indicated for the item in the answer sheet.
3. **No negative marking in Integer Type Questions.**
4. Use blue/black ball point pen only for writing particulars/marking responses on the answer sheet.
5. **Use of PENCIL is STRICTLY PROHIBITED.**
6. ATTEMPT ALL THE QUESTIONS.
7. Blank papers, clip boards, log tables, slide rule, calculators, cellular phones, pagers and electronic gadgets, in any form are not allowed.
8. On completion the test, the candidate must hand over the Answer Sheet to the invigilator on duty in the room. However the candidate are allowed to take away this Test Paper.
9. **Only one alternative is correct, integer type question is a single digit integer, ranging from 0 to 9.**

Filling the OMR SHEET :

1. Choose the correct/most appropriate response for each question among the options (a), (b), (c), (d) and single digit integer 0 to 9. Darkent the circle of the appropriate response completely. The incompletely darkened circle is not correctly read by the OMR scanner and no complaint to this effect shall be entertained.
2. Do not make any stray mark on the OMR sheet.
3. OMR Answer Sheet must be handled carefully and it should not be folded or mutilated in which case it will not be evaluated. At the end of the examination, hand over the OMR Answer Sheet to the Invigilator.

PHYSICS

01. A particle of positive charge 'q' and mass 'm' enters with velocity $V\hat{j}$ at the origin in a magnetic field $B(-\hat{k})$ which is present in the whole space. The charge makes a perfectly inelastic collision at its maximum positive y-coordinate with an identical particle (having same charge) at rest but free to move. After collision, the combined charge will move on trajectory; (where r=mV/qB)

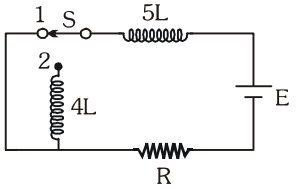
(a) $y=(mv/qB)x$.

(b) $(x + r)^2 + (y - r/2)^2 = r^2/4$.

(c) $(x + r)^2 + (y - r/2)^2 = r^2/8$.

(d) $(x - r)^2 + (y + r/2)^2 = r^2/4$.

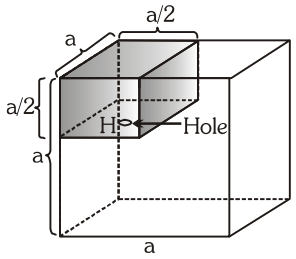
02. In the circuit shown in the **figure**, switch S is shifted to position 2 from position 1 at t=0, having been in position 1 for a long time. The current in the circuit just after shifting of switch will be; (battery and both the inductors are ideal)



(a) $\frac{4}{5}\frac{E}{R}$ (b) $\frac{5}{4}\frac{E}{R}$

(c) $\frac{5}{9}\frac{E}{R}$ (d) $\frac{E}{R}$

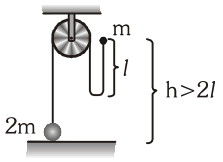
03. **Figure** shows a hollow cube of side 'a' and volume V. There is a small chamber of volume V/4 in the cube as shown in the **figure**. The chamber is completely filled by 'm' kg of water. Water leaks through a hole H and spreads in the whole cube. Then the work done by gravity in this process assuming that the complete water finally lies at the bottom of the cube is;



(a) $\frac{1}{2}mga$ (b) $\frac{3}{8}mga$

(c) $\frac{5}{8}mga$ (d) $\frac{1}{8}mga$

04. In the **figure**, a heavy ball of mass 2m rests on the horizontal surface and the lighter ball of mass 'm' is dropped from a height $h>2l$. At the instant the string gets taut, the upward velocity of the heavy ball will be;

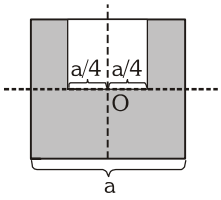


SPACE FOR ROUGH WORK

(a) $\frac{2}{3}\sqrt{gl}$ (b) $\frac{4}{3}\sqrt{gl}$

(c) $\frac{1}{3}\sqrt{gl}$ (d) $\frac{1}{2}\sqrt{gl}$

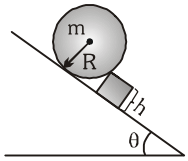
05. A square plate of edge a/2 is cut out from a uniform square plate of edge 'a' as shown in the **figure**. The mass of the remaining portion is M. The moment of inertia of the shaded portion about an axis passing through O (centre of the square of side 'a') and perpendicular to the plane of plate is;



(a) $\frac{9}{64}Ma^2$ (b) $\frac{3}{16}Ma^2$

(c) $\frac{5}{12}Ma^2$ (d) $\frac{Ma^2}{6}$

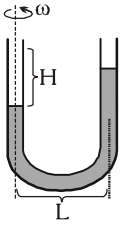
06. Find the minimum height of the obstacle so that the sphere can stay in equilibrium;



(a) $\frac{R}{1+\cos\theta}$ (b) $\frac{R}{1-\sin\theta}$

(c) $R(1-\sin\theta)$ (d) $R(1-\cos\theta)$

07. A U-shaped tube contains a liquid of density ρ and it is rotated about the left dotted line as shown in the **figure**. Find the difference in the levels of the liquid column.



(a) $\frac{\omega^2L^2}{2\sqrt{2}g}$ (b) $\frac{\omega^2L^2}{2g}$

(c) $\frac{2\omega^2L^2}{g}$ (d) $\frac{2\sqrt{2}\omega^2L^2}{g}$

08. A number of water droplets, each of radius 'r', combine to form a drop of radius R. If T is the surface tension, the rise in temperature will be;

(a) $\frac{2T}{r}$ (b) $\frac{3T}{R}$

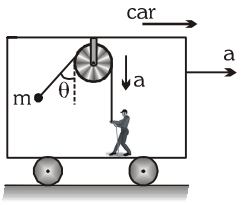
(c) $2T\left[\frac{1}{r}-\frac{1}{R}\right]$ (d) $3T\left[\frac{1}{r}-\frac{1}{R}\right]$

09. A cavity of radius R/2 is made inside a solid sphere of radius R. The centre of the cavity is located at a distance R/2 from the centre of the sphere. The gravitational force on a particle of mass 'm' at a distance R/2 from the centre of the sphere on the line joining both the centres of the sphere and the

SPACE FOR ROUGH WORK

cavity is; (opposite to the centre of the cavity) [g=(GM)/r^2, where M is the mass of the sphere]
(a) mg/2 (b) 3mg/8
(c) mg/16 (d) none of these

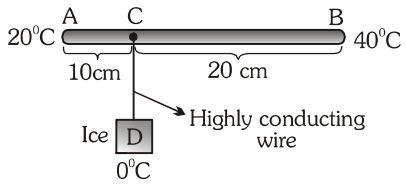
10. A bob is hanging over a pulley inside a car through a string. The second end of the string is in the hands of a person standing in the car. The car is moving with constant acceleration 'a' directed horizontally as shown in the **figure**. Other end of the string is pulled with constant acceleration 'a' vertically. The tension in the string is equal to;



(a) $m\sqrt{g^2+a^2}$
(b) $m\sqrt{g^2+a^2}-ma$
(c) $m\sqrt{g^2+a^2}+ma$
(d) $m(g+a)$

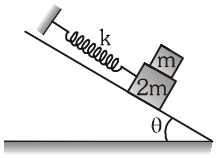
11. A diatomic ideal gas is heated at constant volume until the pressure is doubled and again heated at constant pressure until the volume is doubled. The average molar heat capacity for the whole process is;
(a) 13R/6 (b) 19R/6
(c) 23R/6 (d) 17R/6

12. As shown in the **figure**, AB is a rod of length 30 cm and area of cross section 1.0 cm^2 and thermal conductivity 336 SI units. The ends A and B are maintained at temperatures 20^{0}C and 40^{0}C, respectively. Point C of this rod is connected to a box D, containing ice at 0^{0}C, through a highly conducting wire of negligible heat capacity. The rate at which ice melts in the box is; (assume latent heat of fusion for ice L_f=80 cal/g)



(a) 84 mg/s (b) 84g/s
(c) 20 mg/s (d) 40 mg/s

13. The coefficient of friction between block of mass 'm' and 2m is $\mu=2\tan\theta$. There is no friction between block of mass 2m and inclined plane. The maximum amplitude of the two block system for which there is no relative motion between both the blocks is;



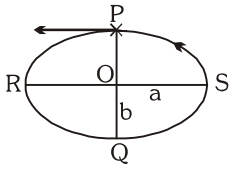
(a) $g\sin\theta\sqrt{\frac{k}{m}}$ (b) $\frac{mg\sin\theta}{k}$
(c) $\frac{3mg\sin\theta}{k}$ (d) none of these

SPACE FOR ROUGH WORK

14. A stretched rope having linear mass density 5×10^{-2} kg/m is under a tension of 80 N. The power that has to be supplied to the rope to generate harmonic waves at a frequency of 60 Hz and an amplitude of $2\sqrt{2}/15\pi$ is;

(a) 215 W (b) 251 W
(c) 512 W (d) 521 W

15. A train is moving in an elliptical orbit in anticlockwise sense with a speed of 1010 m/s. guard is also moving in the given direction with same speed as that of train. The ratio of the length of major and minor axes is 4/3. Driver blows a whistle of 1900 Hz at P, which is received by guard at S. The frequency received by guard is; (velocity of sound v=330 m/s)

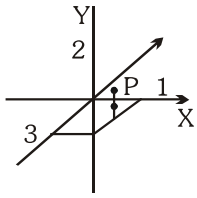


(a) 1900 Hz (b) 1800 Hz
(c) 2000 Hz (d) 1500 Hz

16. A closed organ pipe has length *l*. The air in it is vibrating in 3rd overtone with maximum amplitude 'a'. The amplitude at a distance of *l*/7 from closed end of the pipe is equal to;

(a) a (b) a/2
(c) $a\sqrt{3}/2$ (d) zero

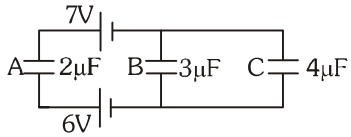
17. Find the electric field vector at P(a, a, a) due to three infinitely long lines of charges along the x, y and z-axes, respectively. The charge density, i.e. charge per unit length of each wire is λ.



(a) $\frac{\lambda}{3\pi\varepsilon_0 a}(\hat{i}+\hat{j}+\hat{k})$ (b) $\frac{\lambda}{2\pi\varepsilon_0 a}(\hat{i}+\hat{j}+\hat{k})$

(c) $\frac{\lambda}{2\sqrt{2}\pi\varepsilon_0 a}(\hat{i}+\hat{j}+\hat{k})$ (d) $\frac{\sqrt{2}\lambda}{\pi\varepsilon_0 a}(\hat{i}+\hat{j}+\hat{k})$

18. Three capacitors A, B and C are connected in a circuit as shown in the **figure**. What is the charge in μC on the capacitor B ?



(a) 1/3 (b) 2/3
(c) 1 (d) 4/3

19. An object is kept at a distance of 16 cm from a thin lens and the image formed is real. If the object is kept at a distance of 6 cm from the same lens, the

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image formed is virtual. If the sizes, of the images formed are equal, the focal length of the lens will be;

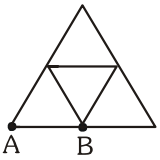
(a) 15 cm (b) 17 cm
(c) 21 cm (d) 11 cm

20. In a Young's double-slit experiment, the slits are 2 mm apart and are illuminated with a mixture of two wavelengths λ_0=750 nm and λ=900 nm. The minimum distance from the common central bright fringe on a screen 2m from the slits, where a bright fringe from one interference pattern coincides with a bright fringe from the other is;

(a) 1.5 mm (b) 3 mm
(c) 4.5 mm (d) 6 mm

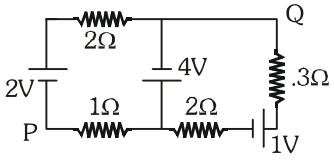
INTEGER TYPE QUESTIONS

21. In the diagram resistance between any two junctions is R=11/6 Ω. Equivalent resistance across terminals A and B is ;

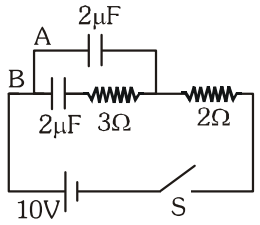


24. An electric field is expressed as $\vec{E} = 2\hat{i} + 3\hat{j}$. Find the potential difference ($V_B - V_A$) between two points A and B whose position vectors are given by $r_A = \hat{i} + 2\hat{j}$ and $r_B = 2\hat{i} + \hat{j} + 3\hat{k}$;

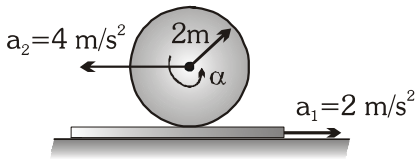
22. In the circuit shown, what is the potential difference V_{PQ}?



23. Current through the battery at instant when the switch S is closed is;



25. In the **figure**, a sphere of radius 2m rolls on a plank. The accelerations of the sphere and the plank are indicated. The value of α is;



SPACE FOR ROUGH WORK

CHEMISTRY

26. How many moles of potassium chlorate to be heated to produce 11.2 litre oxygen:–
(a) 1/2 mol (b) 1/3 mol
(c) 1/4 mol (d) 2/3 mol

27. Which type of radition is not emitted by the electronic structure of atoms?
(a) Ultraviolet (b) X–rays
(c) Visible light (d) γ – rays

28. Which of the following order is correct for acidic property:–
(a) $SiH_4 > PH_3 > H_2S$ (b) $SiH_4 = PH_3 = H_2S$
(c) $SiH_4 < PH_3 > H_2S$ (d) $SiH_4 < PH_3 < H_2S$

29. What is the density of sulphur dioxide (SO_2) at STP:–
(a) 2.86 gm/lit (b) 1.76 gm/lit
(c) 1.86 gm/lit (d) None of these

30. What is the true regarding complete combustion of gaseous isobutane:–
(a) $\Delta H = \Delta E$ (b) $\Delta H > \Delta E$
(c) $\Delta H = \Delta E = O$ (d) $\Delta H < \Delta E$

31. The equilibrium constant for the reaction $H_2(g) + S(s) \rightleftharpoons H_2S(g)$; is 18.5 at 935 K and 9.25 at 1000 K respectively. The change in enthalpy of the reaction will be:–
(a) 0 (b) +ve
(c) –ve (d) can not be predicted

32. Both Be and Al become passive on reaction with conc. nitric acid due to:–
(a) The non reactive nature of the metal
(b) The non reactive nature of the acid
(c) The formation of an inert layer oxide on the surface of the metals (d) None of these

33. Which one of the following is strongest acid:–
(a) 2–chloropentanoic acid
(b) 3–chloropentanoic acid
(c) 5–chloropentanoic acid
(d) 4–chloropentanoic acid

34. Suitable for preparation of higher alkanes from a lower alkyl halide is subjected to:–
(a) Reduction
(b) Hoffmann bromamide reaction
(c) Hunsdiecker reaction
(d) Wurtz reaction

35. When HCl gas is passed through propene in the presence of benzoyl peroxide, it gives:–
(a) n–Propyl chloride (b) 2–Chloropropene
(c) Allyl chloride (d) No reaction

36. Of the following the compound that will most readily react with gaseous Br_2 is:–
(a) C_3H_6 (b) C_4H_{10}
(c) C_2H_2 (d) C_6H_6

37. Benzene can be obtained form trimerization of:–
(a) Hexane (b) Ethyne
(c) Cyclohexane (d) Cyclopropane

38. In hypobromite reaction of amide, carbonyl carbon atom is lost as:–
(a) CO (b) CO_2
(c) CO_3^{2-} (d) None of above

SPACE FOR ROUGH WORK

39. Which one of the following will give primary amine on hydrolysis?
(a) Nitroparaffins (b) Alkyl cyanide
(c) Amide (d) Alkyl isocyanide

40. Which one of the following is not present in RNA:–
(a) Uracil (b) Thymine
(c) Ribose (d) Phosphate

41. Enzyme is made up of:–
(a) Proteins (b) Minerals
(c) Oil (d) Fatty acids

42. A raw material used in making nylon – 6,6 is:–
(a) Adipic acid (b) Butadiene
(c) Ethylene (d) Methyl methacrylate

43. Which of the following statements is not correct:–
(a) soaps act by lowering surface tension between water and oil/insoluble material.
(b) The soap form insoluble salt with Ca^{+2} ions.
(c) The COO^- group in soaps acts as hydrophillic and alkyl chain as hydrophobic.
(d) Soaps work more efficiently in hard water than in soft water.

44. Most vigorous alkaline hydrolysis will be shown by:–
(a) CH_3COCl (b) CH_3CH_2COCl
(c) $(CH_3)_2CHCOCl$ (d) $(CH_3)_3CCOCl$

45. Which of the following statement is not correct in formic acid:–
(a) Hydrogen bond is absent in formic acid
(b) Formic acid gives CO_2 on heating
(c) Acetic acid does not give CO_2 on heating
(d) CO is formed on heating HCOOH with H_2SO_4.

INTEGER TYPE QUESTIONS

46. How many stereoisomers does this molecule have?
$CH_3CH=CHCH_2CHBrCH_3$

47. V litre of SO_2 at 0°C and 1 atm is required to reduce 16.9 g of $HClO_3$ to HCl. The number of moles in '5 V' litre of SO_2 at 273°C and 2 atm is?

48. What will be the temperature difference (in °C) needed in a hot air balloon to lift $\frac{10.0}{8.314}$ kg of mass? Assume that the volume of the balloon is 91.0 m^3, the temperature of the ambient air is 17°C, the pressure is 1.0 bar, and air is an ideal gas with an average molar mass of 29 g/mole.

49. A quantity of 8g oxygen gas is expanded isothermally at 27°C from 2 dm^1 to 8 dm^3 at a constant external pressure of 4 bar. If the magnitude of work done in this process is used in lifting body of mass 40 kg, the height (in meter) up to which the body can be lifted is($g=10\ ms^{-2}$).

50. For the reaction : $3BrO^- \rightarrow BrO_3^- + 2Br^-$ in alkaline aqueous solution, the value of the second-order rate constant (in BrO^-) in rate law for $-\frac{d[BrO^-]}{dt}$ was found to be 0.06 $M^{-1}s^{-1}$. The rate constant (in $M^{-1}\ s^{-1}$), when the rate law is written as $+\frac{d[BrO_3^-]}{dt}$ is a and as $+\frac{d[Br^-]}{dt}$ is b, then the value of (a + b) × 100 is?

SPACE FOR ROUGH WORK

MATHEMATICS

51. Let $f'(x) < 0$ and $g'(x) > 0$ for all real x, then;

(a) $f[g(x + 1)] > f[g(x + 5)]$

(b) $f[g(x)] < f[g(x + 1)]$

(c) $g[f(x)] < g[f(x + 2)]$

(d) $g[f(x)] > g[f(x - 2)]$

52. Let $f(x) = \begin{cases} \cos\frac{\pi x}{2}, & x > 0 \\ x + a, & x \le 0 \end{cases}$. Then $x = 0$ will be a point of local maxima for f(x) if;

(a) $a \in (-1, 1)$ (b) $a \in (0, 1)$

(c) $a \le 0$ (d) $a \ge 1$

53. Let $f : R \to (-1, 1)$ defined by $f(x) = \frac{e^{x^3} + e^{-x^3}}{e^{x^3} - e^{-x^3}}$, then 'f' is;

(a) a many-one function

(b) an increasing function

(c) an into function

(d) an onto function

54. If $I = \int \frac{5x^8 + 7x^6}{(x^2 + 1 + 2x^7)^2} dx$, then I is equal to;

(a) $\frac{x^7}{2x^7 + x^2 + 1} + C$ (b) $\frac{x^5}{x^2 + 1 + 2x^7} + C$

(c) $\frac{-1}{2x^7 + x^2 + 1} + C$ (d) all of these

55. $\int_0^{200\pi} \sqrt{\frac{1 - \cos 2x}{2}} dx$ is equal to;

(a) 100 (b) 200

(c) 400 (d) 500

56. The area bounded by $\min.(|x|, |y|) = 2$ and $\max.(|x|, |y|) = 4$ is;

(a) 8 sq. units

(b) 16 sq. units

(c) 24 sq. units

(d) 32 sq. units

57. Equation of the plane passing through (–1, 1, 4) and containing the line $\frac{x - 1}{3} = \frac{y - 2}{1} = \frac{z}{5}$, is;

(a) $9x - 22y + 2z + 23 = 0$

(b) $x + 22y + z = 25$

(c) $9x + 22y - 3z = 1$

(d) $22y - 9x + z = 35$

58. If $Q(\vec{q})$ is the image of $P(\hat{i} + 3\hat{j} + \hat{k})$ in the plane $\vec{r}.(-2\hat{i} + \hat{j} - 4\hat{k}) = 3$, then $\vec{q}$ is;

(a) $\frac{1}{7}(\hat{i} - 25\hat{j} - 12\hat{k})$ (b) $\frac{1}{7}(\hat{i} - 25\hat{j} + 12\hat{k})$

(c) $\frac{1}{7}(\hat{i} + 25\hat{j} - 12\hat{k})$ (d) $\frac{1}{7}(-\hat{i} + 25\hat{j} - 9\hat{k})$

SPACE FOR ROUGH WORK

59. If $\vec{d}=\lambda(\vec{a}\times\vec{b})+\mu(\vec{b}\times\vec{c})+\nu(\vec{c}\times\vec{a})$ and $[\vec{a}\,\vec{b}\,\vec{c}]=\frac{1}{8}$, then $\lambda+\mu+\nu$ is equal to;

(a) $\vec{d}.(\vec{a}+\vec{b}+\vec{c})$ (b) $2\vec{d}.(\vec{a}+\vec{b}+\vec{c})$

(c) $4\vec{d}.(\vec{a}+\vec{b}+\vec{c})$ (d) $8\vec{d}.(\vec{a}+\vec{b}+\vec{c})$

60. If f(x) = x + tan x and 'f' is inverse of 'g', then g'(x) is equal to;

(a) $\frac{1}{1+(g(x)-x)^2}$ (b) $\frac{1}{1-(g(x)-x)^2}$

(c) $\frac{1}{2+(g(x)-x)^2}$ (d) $\frac{1}{2-(g(x)-x)^2}$

61. Value of f(0) such that $f(x)=\left(\frac{1+\tan x}{1+\sin x}\right)^{cosec\,x}$ can be made continuous at x=0, is equal to;

(a) 1 (b) e

(c) –1 (d) e^{-1}

62. The function f(x) = max.{(1 – x),(1+x), 2} is, where $x\in(-\infty,\infty)$;

(a) discontinuous at all points.

(b) differentiable at all points.

(c) differentiable at all point except –1.

(d) continuous at all point except –1 and 1.

63. For the hyperbola $\frac{x^2}{3}-y^2=3$, which of the following statement is wrong ?

(a) It's eccentricity is $\frac{2}{\sqrt{3}}$.

(b) Angle between it's asymptotes is $\pi/3$.

(c) Length of it's latus rectum is 2 units.

(d) Product of distances of any point of the curve from the asymptotes of the curve is less than 2.

64. If a normal chord of $y^2 = 4ax$ subtends an angle $\pi/2$ at the vertex of the parabola, then it's slope is equal to;

(a) ±1 (b) $\pm\sqrt{2}$

(c) ±2 (d) 0

65. The number of integral values of λ for which $x^2+y^2+\lambda x+(1-\lambda)y+5=0$ is the equation of a circle whose radius cannot exceed 5, is;

(a) 14 (b) 18

(c) 16 (d) 20

66. If $a^2 + b^2 + c^2 + d^2 = 1$ and $A=\begin{bmatrix} a+ib & c+id \\ -c+id & a-ib \end{bmatrix}$, then A^{-1} is equal to;

SPACE FOR ROUGH WORK

(a) $\begin{bmatrix} a+ib & c-id \\ c-id & a+ib \end{bmatrix}$ (b) $\begin{bmatrix} a-ib & c-id \\ c-id & a+ib \end{bmatrix}$

(c) $\begin{bmatrix} a-ib & -c-id \\ c-id & a+ib \end{bmatrix}$ (d) $\begin{bmatrix} a+ib & -c-id \\ c-id & a+ib \end{bmatrix}$

67. If the equations $a(y + z)=x$, $b(z+x)=y$ and $c(x+y)=z$, where $a \neq -1, b \neq -1, c \neq -1$ admit of non-trivial solutions, then

$(1+a)^{-1}+(1+b)^{-1}+(1+c)^{-1}$ is;

(a) 2 (b) 1

(c) 1/2 (d) 4

68. A pair of dice is rolled together till a sum of either 5 or 7 is obtained. Then, the probability that 5 comes before 7 is;

(a) 1/5 (b) 4/7

(c) 2/3 (d) 2/5

69. The sum of the coefficient in the binomial expansion of $\left(\frac{1}{x}+2x\right)^n$ is equal to 6561. The constant term in the expansion is;

(a) ${}^8C_4$ (b) $16.{}^8C_4$

(c) ${}^6C_4.2^4$ (d) $8.{}^8C_4$

70. The sum of the series $1 + 2 \times 3 + 3 \times 5 + 4 \times 7 + \ldots\ldots$ upto 11th term is;

(a) 915 (b) 946

(c) 916 (d) 945

INTEGER TYPE QUESTIONS

71. The number of polynomials of the form $x^3 + ax^2 + bx + c$ that are divisible by $x^2 + 1$, where $a, b, c \in \{1, 2, 3, \ldots\ldots, 9\}$ is _____.

72. If the range of $f(x) = \sin^{-1}x + \tan^{-1}x + \cos^{-1}x$ is [a, b], then the value of $\frac{2b}{a}$ is_____.

73. The number of solutions of the equation $1+\sin x \sin^2(x/2)=0$ is _____.

74. If $S_n = 1+\frac{1}{2}+\frac{1}{2^2}+\ldots.+\frac{1}{2^{n-1}}$ and $2-S_n < \frac{1}{100}$, then the least value of 'n' must be_____.

75. The least integral value of 'm' for which every solution of the inequality $1 \le x \le 2$ is a solution of the inequality $x^2 - mx + 1 < 0$ is _____.

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