SATISH SCIENCE ACADEMY
DHANORI PUNE - 411015

Paper 5
ENTRANCE EXAM - JEE MAIN

Time Allowed: 3 hours **Maximum Marks :** 300

General Instructions:

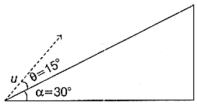
- All questions are compulsory.
- There are three parts and each part carries 25 questions where the first 20 questions are MCQs and the next 5 questions are numerical.
- You will get 4 marks for each correct response and 1 mark will be deducted for an incorrect answer.

PHYSICS

1) A simple pendulum is being used to determine the value of gravitational acceleration g at a certain place. The length of the pendulum is 25.0 cm and a stop watch with 1s resolution measures the time taken for 40 oscillations to be 50 s. The accuracy in g is: **[4]**
   a) 5.40% b) 3.40%
   c) 2.40% d) 4.40%

2) A galvanometer having a coil resistance of 100Ω gives a full - scale deflection when a current of 1 mA is passed through it. The value of the resistance which can convert this galvanometer into ammeter giving a full - scale deflection for a current of 10 A, is **[4]**
   a) 0.01Ω b) 2Ω
   c) 3Ω d) 0.1Ω

3) A plane is inclined at an angleα = 30° with respect to the horizontal. A particle is projected with a speed u = 2 ms $^{-1}$, from the base of the plane, making an angle θ = 15° with respect to the plane as shown in the figure. The distance from the base, at which the particle hits the plane is close to: [Take, g = 10 ms $^{-2}$]



[4]
   a) 14 cm b) 26 cm
   c) 18 cm d) 20 cm

4) A bag is gently dropped on a conveyor belt moving at a speed of 2 m/s. The coefficient of friction between the conveyor belt and bag is 0.4. Initially, the bag slips on the belt before it stops due to friction. The distance travelled by the bag on the belt during slipping motion is: [Take g = 10 m/s $^{-2}$]**[4]**
   a) 3.2 m b) 0.8 m
   c) 0.5 m d) 2 m

5) A particle moves from a point$(-2\hat{i}+5\hat{j})$ to $(4\hat{j}+3\hat{k})$ when a force of $(4\hat{i}+3\hat{j})$ N is applied. How much work has been done by the force? **[4]**
   a) 2 J b) 5 J
   c) 11 J d) 8 J

6) Distance of the centre of mass of a solid uniform cone from its vertex is z_0. If the radius of its base is R and its height is h, then z_0 is equal to **[4]**
   a) $\frac{5h}{8}$ b) $\frac{3h^2}{8R}$
   c) $\frac{h^2}{4R}$ d) $\frac{3h}{4}$

7) Three capillary tubes of same length but internal radii 0.3 mm, 0.45 mm and 0.6 mm are connected in series and a liquid flows steadily through them. If the pressure difference across the third capillary is 8.1 mm of mercury, the pressure difference across the first capillary (in mm of mercury) is: **[4]**
   a) 16.2 b) 129.6
   c) 2.025 d) 32.4

8) Assume that a drop of the liquid evaporates by a decrease in its surface energy so that its temperature remains unchanged. What should be the minimum radius of the drop for this to be possible? The surface tension is T, the density of the liquid isρ and L is its latent heat of vaporization. **[4]**
   a) $\frac{2T}{\rho L}$
   b) $\frac{\rho L}{T}$
   c) $\frac{T}{\rho L}$
   d) $\sqrt{\frac{T}{\rho L}}$

9) A rigid diatomic ideal gas undergoes an adiabatic process at room temperature. The relation between temperature and volume for this process is TV^X = constant, then x is **[4]**
   a) $\frac{2}{5}$ b) $\frac{5}{3}$
   c) $\frac{3}{5}$ d) $\frac{2}{3}$

10) A heavy ball of mass M is suspended from the ceiling of a car by a light string of mass m (m « M). When the car is at rest, the speed of transverse waves in the string is 60 ms $^{-1}$. When the car has acceleration a, the wave speed increases to 60.5 ms $^{-1}$. The value of a, in terms of gravitational acceleration g is closest to **[4]**
   a) $\frac{g}{10}$ b) $\frac{g}{20}$
   c) $\frac{g}{30}$ d) $\frac{g}{5}$

11) To establish an instantaneous current of 2 A through a 1μ F capacitor; the potential difference across the capacitor plates should be changed at the rate of: **[4]**
   a) 4× 10^6 V/s b) 2× 10^6 V/s
   c) 4× 10^4 V/s d) 2× 10^4 V/s

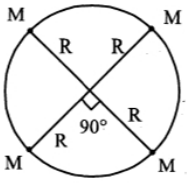
12) A long solenoid is formed by winding 70 turns cm $^{-1}$. If 2.0 A current flows, then the magnetic field produced inside the solenoid is ____ (μ_0 = 4π × 10 $^{-7}$ TmA $^{-1}$) **[4]**
   a) 176× 10 $^{-4}$T b) 1232× 10 $^{-4}$T
   c) 352× 10 $^{-4}$T d) 88× 10 $^{-4}$T

13) A magnet of total magnetic moment 10^2 $\hat{i}$ A - m^{2}is placed in a time - varying magnetic field, B$\hat{i}$ (cosω t) where B = 1 Tesla and $\hat{i}$ = 0.125 rad/s. The work done for reversing the direction of the magnetic moment at t = 1 second, is: **[4]**

a) 0.007 J b) 0.028 J
c) 0.014 J d) 0.01 J

14) A uniform magnetic field B exists in a direction perpendicular to the plane of a square loop made of a metal wire. The wire has a diameter of 4 mm and a total length of 30 cm. The magnetic field changes with time at a steady rate $\frac{dB}{dt}$ = 0.032 Ts^{-1}. The induced current in the loop is close to (Resistivity of the metal wire is 1.23 $\times$ 10^{-8} Ω m) **[4]**
a) 0.53 A b) 0.61 A
c) 0.34 A d) 0.43 A

15) Four particles each of mass M, move along a circle of radius R under the action of their mutual gravitational attraction as shown in figure. The speed of each particle is:



[4]

a) $\sqrt{\frac{GM}{R}}$
b) $\frac{1}{2}\sqrt{\frac{GM}{R}(2\sqrt{2}-1)}$
c) $\frac{1}{2}\sqrt{\frac{GM}{R}(2\sqrt{2}+1)}$
d) $\frac{1}{2}\sqrt{\frac{GM}{R(2\sqrt{2}+1)}}$

16) The rms value of conduction current in a parallel plate capacitor is 6.9μ A. The capacity of this capacitor, if it is connected to 230 V ac supply with an angular frequency of 600 rad/s, will be: **[4]**
a) 50 pF b) 200 pF
c) 100 pF d) 5 pF

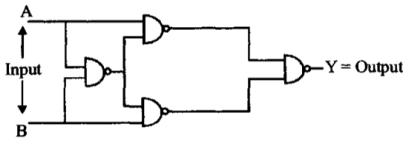
17) The electric field at the point associated with a light wave is given by
E = 200[sin(6 $\times$ 10^{15})t + sin(9 $\times$ 10^{15})Vm^{-1}
Given: h = 4.14 $\times$ 10^{-15} eVs
If this light falls on a metal surface having a work function of 2.50 eV, the maximum kinetic energy of the photoelectrons will be: **[4]**
a) 3.42eV b) 1.90eV
c) 3.27eV d) 3.60eV

18) Hydrogen atom from excited state comes to the ground by emitting a photon of wavelengthλ . The value of principal quantum number **n** of the excited state will be: **[4]**

a) $\sqrt{\frac{\lambda R}{\lambda R-1}}$
b) $\sqrt{\frac{\lambda R^2}{\lambda R-1}}$
c) $\sqrt{\frac{\lambda}{\lambda R-1}}$
d) $\sqrt{\frac{\lambda R}{\lambda-1}}$

19) The ratio of the surface area of the nuclei$_{52}Te^{125}$ to that of $_{13}Al^{27}$ is: **[4]**
a) $\frac{1}{4}$ b) $\frac{5}{3}$
c) $\frac{125}{17}$ d) $\frac{25}{9}$

20) The output Y for the inputs A and B of circuit is given by



Truth table of the shown circuit is: **[4]**

a)

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

b)

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

c)

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

d)

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

21) A ball is dropped from the top of a 100 m high tower on a 1 planet. In the last$\frac{1}{2}$ s before hitting the ground, it covers a distance of 19 m. Acceleration due to gravity (in ms^{-2}) near the surface on that planet is _____. **[4]**
22) A series combination of resistor of resistance 100Ω , inductor of inductance 1 H and capacitor of capacitance 6.25 μF is connected to an ac source. The quality factor of the circuit will be _____. **[4]**
23) A small bulb is placed at the bottom of a tank containing water to a depth of$\sqrt{7}$ m. The refractive index of water is $\frac{4}{3}$. The area of the surface of water through which light from the bulb can emerge out is xπ m^2. The value of x is _____. **[4]**
24) A galvanometer coil has 500 turns and each turn has an average area of 3$\times$ 10^{-4} m^2. If a torque of 1.5 Nm is required to keep this coil parallel to a magnetic field when a current of 0.5 A is flowing through it, the strength of the field (in T) is _____. **[4]**
25) A metal block of mass m is suspended from a rigid support through a metal wire of diameter 14 mm. The

tensile stress developed in the wire under equilibrium state is $7\times 10^5 \text{Nm}^{-2}$. The value of mass m is _____ kg. (Take, g = 9.8 ms^{-2} and $\pi = \frac{22}{7}$) **[4]**

CHEMISTRY

26) Which of the following forms of hydrogen emits low energy β^- particles? **[4]**

a) Deuterium ^2_1H
b) Proton H^+
c) Tritium ^3_1H
d) Protium ^1_1H

27) The first ionization potential of Na is 5.1 eV. The value of electron gain enthalpy of Na^+ will be **[4]**

a) - 5.1 eV b) - 2.55 eV
c) + 2.55 eV d) - 10.2 eV

28) Two solids dissociate as follows:
$A(s) \rightleftharpoons B(g) + \text{C}(g); K_{p_1} = x$ atm^2
$D(s) \rightleftharpoons \text{C}(g) + E(g); K_{p_2} = y$ atm^2
The total pressure when both the solids dissociate simultaneously is **[4]**

a) $\sqrt{x+y}$ atm
b) $2(\sqrt{x+y})$ atm
c) $\text{X}^2 + \text{y}^2$ atm
d) (x + y) atm

29) Which of the following statements/relationships is not correct in thermodynamic changes? **[4]**

a) For a system of constant volume heat involved directly changes to internal energy
b) Δ U = 0 (isothermal reversible expansion of a gas)
c) $\text{W} = \text{nRT} \ln\frac{\text{V}_2}{\text{V}_1}$ (isothermal reversible expansion of an ideal gas)
d) $\text{W} = -\text{nRT} \ln\frac{\text{V}_2}{\text{V}_1}$ (isothermal reversible expansion of an ideal gas)

30) If the equilibrium constant for $\text{N}_{2(g)} + \text{O}_{2(g)} \rightleftharpoons 2\text{NO}_{(g)}$ is K, the equilibrium constant for $\frac{1}{2}N_{2(g)} + \frac{1}{2}O_{2(g)} \rightleftharpoons NO_{(g)}$ will be: **[4]**

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

31) Consider the statements S_1 and S_2 :
S_1 : Conductivity always increases with decrease in the concentration of electrolyte.
S_2 : Molar conductivity always increases with decrease in the concentration of electrolyte.
The correct option among the following is **[4]**

a) Both Si and S_2 are wrong
b) S_1 is correct and S_2 is wrong
c) Both S_1 and $\text{S}_2$are correct
d) S_1 is wrong and S_2 is correct

32) A solution of (- l) 1 - chloro - 1 - phenylethane in toluene racemizes slowly in the presence of a small amount of SbCl_5, due to the formation of **[4]**

a) Carbene b) Free radical
c) Carbanion d) Carbocation

33) Calculate the standard cell potential (in V) of the cell in which following reaction takes place
Fe^{2+} (aq) + Ag^+(aq) $\rightarrow$ Fe^{3+}(aq) + Ag(s)
Given that,
$E^\circ_{\text{Ag}^+/\text{Ag}} = x\text{V}$
$E^\circ_{\text{Fe}^{2+}/\text{Fe}} = y\text{V}$
$E^\circ_{\text{Fe}^{3+}/\text{Fe}} = z\text{V}$ **[4]**

a) X + y - z b) X - y
c) X - z d) X + 2y - 3z

34) The major product (Y) in the following reactions is:

$$\text{CH}_3 - \overset{\text{CH}_3}{\overset{|}{\text{CH}}} - \text{C} \equiv \text{XH} \xrightarrow[\text{H}_2\text{O}]{\text{H}_g\text{SO}_4, \text{H}_2\text{SO}_4} \text{X} \xrightarrow[\text{(ii) Conc. } \text{H}_2\text{SO}_4/\triangle]{\text{(i) } \text{C}_2\text{H}_5\text{MgBr, H}_2\text{O}} \text{Y}$$

[4]

a) $\text{CH}_3 - \overset{CH_3}{\overset{|}{CH}} - \overset{}{\overset{|}{C}} = CH_2$ (with CH_2CH_3 on C)

b) $H_3C - \overset{CH_2}{\overset{||}{CH}} - \overset{}{\overset{|}{CH}} - CH_3$ (with C_2H_5 on CH)

c) $\text{CH}_3 - \overset{CH_3}{\overset{|}{CH}} = \overset{}{\overset{|}{C}} - CH_3$ (with CH_2CH_3 on C)

d) $\text{CH}_3 - \overset{CH_3}{\overset{|}{CH}} - \overset{}{\overset{|}{C}} = CH - CH_3$ (with CH_3 on C)

35) 5 g of Na_2SO_4 was dissolved in x g of H_2O. The change in freezing point was found to be 3.82°C. If Na_2SO_4 is 81.5% ionised, the value of x
(K_f for water = 1.86°C kg mol^{-1}) is approximately:
(molar mass of S = 32 g mol^{-1} and that of Na = 23 g mol^{-1}) **[4]**

a) 45 g b) 65 g
c) 25 g d) 15 g

36) An open beaker of water in equilibrium with water vapour is in a sealed container. When a few grams of glucose are added to the beaker of water, the rate at which water molecules: **[4]**

a) Leaves the solution decreases
b) Leaves the vapour decreases
c) Leaves the vapour increases
d) Leaves the solution increases

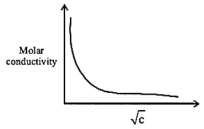
37) If the standard electrode potential for a cell is 2 V at 300 K, the equilibrium constant (K) for the reaction
Zn(s) + Cu^{2+} (aq) $\rightleftharpoons$ Zn^{2+} (aq) + Cu(s)
at 300 K is approximately (R = 8 $\text{JK}^{-1}\text{mol}^{-1}$, F = 96000 C mol^{-1}) **[4]**

a) E^{320} b) E^{160}
c) E^{-80} d) E^{-160}

38) The decomposition of H_2O_2 follows a first - order reaction. In 50 min, the concentration of H_2O_2 decreases from 0.5 to 0.125 M in one such decomposition. When the concentration of H_2O_2reaches 0.05 M, the rate of formation of O_2 will be **[4]**

a) 6.93×10^{-2} mol min^{-1}
b) 2.66 L min^{-1} at STP
c) 1.34×10^{-2} mol min^{-1}
d) 6.93×10^{-4} mol min^{-1}

39) The variation of molar conductivity with concentration of an electrolyte (X) in aqueous solution is shown in the given figure.



The electrolyte X is: **[4]**

a) NaCl b) CH_3COOH
c) HCl d) KNO_3

40) HF has highest boiling point among hydrogen halides, because it has: **[4]**

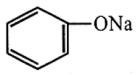
a) Strongest hydrogen bonding
b) Strongest van der Waals' interactions
c) Lowest ionic character
d) Lowest dissociation enthalpy

41) Which of the following are the example of double salt?
i. $FeSO_4 \cdot (NH_4)_2 SO_4 \cdot 6H_2O$
ii. $CuSO_4.4NH_3.\ H_2O$
iii. $K_2SO_4.Al_2(SO_4)_3.24H_2O$
iv. $Fe(CN)_2.4KCN$
Choose the correct answer **[4]**
a) B and D only b) A and C only
c) A, B and D only d) A and B only

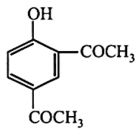
42) In S_N2 reactions, the correct order of reactivity for the following compounds CH_3Cl,CH_3CH_2Cl, $(CH_3)_2CHCl$ and $(CH_3)_3CCl$ is **[4]**

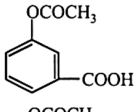
a) $CH_3CH_2Cl > CH_3Cl > (CH_3)_2CHCl > (CH_3)_3CCl$
b) $(CH_3)_2CHCl > CH_3CH_2Cl > CH_3Cl > (CH_3)_3CCl$
c) $CH_3Cl > (CH_3)_2CHCl > CH_3CH_2Cl > (CH_3)_3CCl$
d) $CH_3Cl > CH_3CH_2\ Cl > (CH_3)_2\ CHCl > (CH_3)_3CCl$

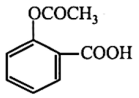
43) Sodium phenoxide when heated with CO_2 under pressure at 125 °C yields a product which on acetylation produces C

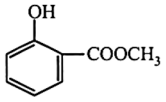


+ $CO_2 \xrightarrow[5\ Atm]{125^o} B \xrightarrow[Ac_2O]{H^+} C$
The major product C would be **[4]**

a) 

b) 

c) 

d) 

44) Oxidation of toluene to Benzaldehyde can be easily carried out with which of the following reagents? **[4]**

a) $KMnO_4$/HCl, H_3O^+
b) CrO_3/acetic acid, H_3O^+
c) CO/HCl, anhydrous $AlCl_3$
d) CrO_3/acetic anhydride, H_3O^+

45) Conversion of benzene diazonium chloride to chlorobenzene is an example of which of the following reactions? **[4]**
a) Sandmeyer b) Claisen
c) Friedel - craft d) Wurtz

46) A ball weighing 10 g is moving with a velocity of 90 ms^{-1}. If the uncertainty in its velocity is 5%, then the uncertainty in its position is _____ $\times 10^{-33}$ m. (Rounded off to the nearest integer)
[Given: h = 6.63 $\times 10^{-34}$ Js]**[4]**

47) For a first order reaction A→ B, the rate constant, K = 5.5 $\times$ $10^{-14} s^{-1}$. The time required for 67% completion of reaction is x $\times$ 10^{-1} times the half life of reaction. The value of x is _____. (Nearest integer)
(**Given:** log 3 = 0.4771) **[4]**

48) The sum of oxidation states of two silver ions in $[Ag(NH_3)_2][Ag(CN)_2]$complex is _____. **[4]**

49) The electrode potential of the following half cell at 298 K $X|X^{2+}$ (0.001 M)$|\ |Y^{2+}$ (0.01 M)$|$ Y is _____ $\times 10^{-2}$ V (Nearest integer).
Given: $E^0_{X^{2+}|X}$ = - 2.36 V; $E^0_{Y^{2+}|Y}$ = +0.36 V
$\frac{2.303RT}{F}$ = 0.06 V **[4]**

50) The maximum number of lone pairs of electrons on the central atom from the following species is _____.
ClO_3^- , XeF_4, SF_4, and I_3^- **[4]**

MATHEMATICS

51) The inverse of $y = 5^{\log x}$ is **[4]**

a) $X = y^{\frac{1}{\log 5}}$
b) $X = 5^{\log y}$
c) $X = 5^{\log x}$
d) $X = 5^{\frac{1}{\log y}}$

52) If the set $\mathrm{Re}\left(\frac{z-\bar{z}+z\bar{z}}{2-3z+5\bar{z}}\right) : z \in C, \mathrm{Re}(z) = 3$ is equal to the interval $(\alpha, \beta]$, then $24(\beta - \alpha)$ is equal to **[4]**
a) 30 b) 42
c) 36 d) 27

53) The total number of three - digit numbers, divisible by 3, which can be formed using the digits 1, 3, 5, 8, if repetition of digits is allowed, is: **[4]**
a) 22 b) 21
c) 20 d) 18

54) The number of ways to distribute 30 identical candies among four children C_1, C_2, C_3 and C_4 so that C_2 receives atleast 4 and atmost 7 candies, C_3 receives atleast 2 and atmost 6 candies, is equal to **[4]**
a) 615 b) 510
c) 430 d) 205

55) The common difference of the A.P. b_1, b_2, ...,b_m is 2 more than the common difference of A.P. a_1, a_2, ..., a_n. If a_{40} = - 159, a_{100} = - 399 and $b_{100} = a_{70}$, then b_1 is equal to: **[4]**
a) - 127 b) 81
c) 127 d) - 81

56) Let f(x) = $\log_e$ (sin x), (0 < x < π) and g(x) = $\sin^{-1}(e^{-x})$, (x ≥ 0). If α is a positive real number such that a = (fog)' (α) and b = (fog) (α), then: **[4]**

a) $a\alpha^2 + b\alpha$ - a = - $2a^2$
b) $a\alpha^2 - b\alpha - a$ = 1
c) $a\alpha^2 - b\alpha$ - a = 0
d) $a\alpha^2$ + $b\alpha$ + a = 0

57) Let S be the set of all integral values ofα for which the sum of squares of two real roots of the quadratic equation $3x^2$ + (α - 6)x + (α + 3) = 0 is minimum. Then S: **[4]**

a) Contains more than two elements
b) Is a singleton
c) Is an empty set
d) Contains exactly two elements

58) The integral $\int_0^{\frac{\pi}{2}} \frac{1}{3+2\sin x+\cos x} dx$ is equal to: **[4]**

a) $\frac{1}{2}\tan^{-1}(2) - \frac{\pi}{8}$

b) $\tan^{-1}(2) - \frac{\pi}{4}$
c) $\frac{1}{2}$
d) $\tan^{-1}(2)$

59) If in a parallelogram ABDC, the coordinates of A, B and C are respectively (1, 2), (3, 4) and (2, 5), then the equation of the diagonal AD is **[4]**
a) 3x - 5y + 7 = 0 b) 3x + 5y - 13 = 0
c) 5x - 3y + 1 = 0 d) 5x + 3y - 11 = 0

60) The straight - line x + 2y = 1 meets the coordinate axes at A and B. A circle is drawn through A, B and the origin. Then, the sum of perpendicular distances from A and B on the tangent to the circle at the origin is **[4]**
a) $\frac{\sqrt{5}}{2}$ b) $4\sqrt{5}$
c) $2\sqrt{5}$ d) $\frac{\sqrt{5}}{4}$

61) If the area of the triangle whose one vertex is at the vertex of the parabola, $y^2 + 4(x - a^2) = 0$ and the other two vertices are the points of intersection of the parabola and Y - axis, is 250 sq units, then a value of 'a' is **[4]**
a) $5\sqrt{5}$ b) $(10)^{2/3}$
c) 5 d) $5(2^{1/3})$

62) Let y = y(x) be the solution of the differential equation $x \log_e x \frac{dy}{dx} + y = x^2 \log_e x$, (x > 1). If y(2) = 2, then y(e) is equal to **[4]**
a) $\frac{4+e^2}{4}$
b) $\frac{2+e^2}{2}$
c) $\frac{1+e^2}{2}$
d) $\frac{1+e^2}{4}$

63) If the length of the perpendicular from the point (β, 0, β) ($\beta \neq 0$) to the line, $\frac{x}{1} = \frac{y-1}{0} = \frac{z+1}{-1}$ is $\sqrt{\frac{3}{2}}$, then β is equal to: **[4]**
a) - 2 b) 2
c) 1 d) - 1

64) If a unit vector $\vec{a}$ makes angles $\frac{\pi}{3}$ with $\hat{i}$, $\frac{\pi}{4}$ with $\hat{j}$ and $\theta \in (0, \pi)$ with $\hat{k}$, then a value of is: **[4]**
a) $\frac{5\pi}{12}$ b) $\frac{2\pi}{3}$
c) $\frac{5\pi}{6}$ d) $\frac{\pi}{4}$

65) The mean and variance of 5 observations are 5 and 8 respectively. If 3 observations are 1, 3, 5, then the sum of cubes of the remaining two observations is **[4]**
a) 1216 b) 1072
c) 1792 d) 1456

66) If A and B are two events such that P (A∪ B) = P (A ∩ B), then the incorrect statement amongst the following statements is: **[4]**
a) A and B are equally likely
b) P(A'∩ B) = 0
c) P(A) + P(B) = 1
d) P(A∩ B') = 0

67) If the angle of elevation of a cloud from a point P which is 25 m above a lake be 30° and the angle of depression of reflection of the cloud in the lake from P be 60°, then the height of the cloud (in meters) from the surface of the lake is **[4]**
a) 60 b) 42
c) 45 d) 50

68) If a hyperbola passes through the point P($\sqrt{2}$, $\sqrt{3}$) and has foci at ($\pm$ 2,0), then the tangent to this hyperbola at P also passes through the point **[4]**
a) $(\sqrt{3}, \sqrt{2})$
b) $(3\sqrt{2}, 2\sqrt{3})$
c) $(2\sqrt{2}, 3\sqrt{3})$
d) $(-\sqrt{2}, -\sqrt{3})$

69) Let S = 1, 2, 3,..., 100. The number of non - empty subsets A of S such that the product of elements in A is even is: **[4]**
a) $2^{50} + 1$ b) $2^{50} - 1$
c) $2^{100} - 1$ d) $2^{50}(2^{50} - 1)$

70) Let A = $\begin{pmatrix} m & n \\ p & q \end{pmatrix}$, d = |A| $\neq$ 0 |A - d(Adj A)| = 0. Then **[4]**
a) $(1 + d)^2 = m^2 + q^2$ b) $1 + d^2 = (m + q)^2$
c) $1 + d^2 = m^2 + q^2$ d) $(1 + d)^2 = (m + q)^2$

71) Let $\vec{a}, \vec{b}, \vec{c}$ be three vectors such that $|\vec{a}| = \sqrt{31}, 4|\vec{b}| = |\vec{c}| = 2$ and $2(\vec{a} \times \vec{b}) = 2(\vec{c} \times \vec{a})$. If the angle between $\vec{b}$ and $\vec{c}$ is $\frac{2\pi}{3}$, then $\left(\frac{\vec{a} \times \vec{c}}{\vec{a} \cdot \vec{b}}\right)^2$ is equal to _____. **[4]**

72) Let f(x) = max |x + 1|, |x + 2|,.. ,|x + 5|. Then $\int_{-6}^{0} f(x)dx$ is equal to _____. **[4]**

73) The total number of 3× 3 matrices A having entries from the set 0, 1, 2, 3 such that the sum of all the diagonal entries of AA^T is 9, is equal to _____. **[4]**

74) Let x_1, x_2, x_3, x_{20} be in geometric progression with x_1 = 3 and the common ratio $\frac{1}{2}$. A new data is constructed replacing each x_i by $(x_i - i)^2$. If $\bar{x}$ is the mean of new data, then the greatest integer less than or equal to $\bar{x}$ is _____. **[4]**

75) In an examination, 5 students have been allotted their seats as per their roll numbers. The number of ways, in which none of the students sits on the allotted seat, is _____. **[4]**