SATISH SCIENCE ACADEMY
DHANORI PUNE - 411015

Paper 3
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) If the screw on a screw - gauge is given six rotations, it moves by 3 mm on the main scale. If there are 50 divisions on the circular scale the least count of the screw gauge is: **[4]**
   a) 0.001 mm b) 0.02 mm
   c) 0.01 cm d) 0.001 cm

2) In a large building, there are 15 bulbs of 40 W, 5 bulbs of 100 W, 5 fans of 80 W and 1 heater of 1 kW. The voltage of the electric mains is 220 V. The minimum capacity of the main fuse of the building will be **[4]**
   a) 10 A b) 8 A
   c) 14 A d) 12 A

3) Ship A is sailing towards north - east with velocity km/hr where points east and, north. Ship B is at a distance of 80 km east and 150 km north of Ship A and is sailing towards west at 10 km/hr. A will be at minimum distance from B in: **[4]**
   a) 2.2 hrs b) 2.6 hrs
   c) 3.2 hrs d) 4.2 hrs

4) A block of mass m is placed on a surface with a vertical cross - section given by $y = x^3 / 6$. If the coefficient of friction is 0.5, the maximum height above the ground at which the block can be placed without slipping is **[4]**
   a) $\frac{1}{6}m$ b) $\frac{1}{3}m$
   c) $\frac{2}{3}m$ d) $\frac{1}{2}m$

5) A body of mass starts moving from rest along x - axis so that its velocity varies as $v = a\sqrt{s}$ where a is a constant s and is the distance covered by the body. The total work done by all the forces acting on the body in the first second after the start of the motion is: **[4]**
   a) $\frac{1}{8}$ ma^4t^2 b) 8 ma^4t^2
   c) 4 ma^4t^2 d) $\frac{1}{4}$ ma^4t^2

6) A thin bar of length L has a mass per unit lengthλ , that increases linearly with distance from one end. If its total mass is M and its mass per unit length at the lighter end is λ_O , then the distance of the centre of mass from the lighter end is: **[4]**
   a) $\frac{2\ L}{3} - \frac{\lambda_0\ L^2}{6M}$
   b) $\frac{L}{3} + \frac{\lambda_0 L^2}{4M}$
   c) $\frac{L}{3} + \frac{\lambda_0 L^2}{8M}$
   d) $\frac{L}{2} - \frac{\lambda_0 L^2}{4M}$

7) The ratio of surface tensions of mercury and water is given to be 7.5 while the ratio of their densities is 13.6. Their contact angles, with glass, are close to 135° and 0°, respectively. It is observed that mercury gets depressed by an amount h in a capillary tube of radius r_1, while water rises by the same amount h in a capillary tube of radius r_2. The ratio, $(\frac{r_1}{r_2})$, is then close to: **[4]**
   a) $\frac{2}{3}$ b) $\frac{4}{5}$
   c) $\frac{3}{5}$ d) $\frac{2}{5}$

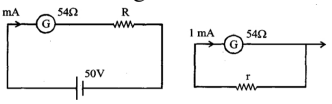
8) An unknown metal of mass 192 g heated to a temperature of 100°C was immersed into a brass calorimeter of mass 128 g containing 240 g of water at a temperature of 8.4°C. Calculate the specific heat of the unknown metal if water temperature stablizes at 21.5°C. (Specific heat of brass is 394 J kg^{-1} K^{-1}) **[4]**
   a) 1232 J kg^{-1} K^{-1} b) 916 J kg^{-1} K^{-1}
   c) 654 J kg^{-1} K^{-1} d) 458 J kg^{-1} K^{-1}

9) When heat Q is supplied to a diatomic gas of rigid molecules, at constant volume, its temperature increases byΔ T. The heat required to produce the same change in temperature, at a constant pressure is **[4]**
   a) $\frac{7}{5}Q$ b) $\frac{2}{3}Q$
   c) $\frac{5}{3}Q$ d) $\frac{3}{2}Q$

10) Equation of travelling wave on a stretched string of linear density 5 g/m is $y = 0.03\sin(450t - 9x)$, where distance and time are measured in SI units. The tension in the string is **[4]**
   a) 12.5 N b) 7.5 N
   c) 10 N d) 5 N

11) A uniformly charged solid sphere of radius R has potential V_0 (measured with respect to ∞) on its surface. For this sphere, the equipotential surfaces with potentials $\frac{3V_0}{2}, \frac{5V_0}{4}, \frac{3V_0}{4}$ and $\frac{V_0}{4}$ have radius R_1, R_2, R_3 and R_4 respectively. Then **[4]**
   a) $R_1 \neq 0$ and $(R_2 - R_1) > (R_4 - R_3)$
   b) $R_1 = 0$ and $R_2 > (R_4 - R_3)$
   c) $2R = R_4$
   d) $R_1 = 0$ and $R_2 < (R_4 - R_3)$

12) For designing a voltmeter of range 50 V and an ammeter of range 10 mA using a galvanometer which has a coil of resistance 54Ω showing a full scale deflection for 1 mA as in figure.



   i. For voltmeter R≈ 50 kΩ
   ii. For ammeter r≈ 0.2 Ω
   iii. For ammeter r≈ 6 Ω
   iv. For voltmeter R≈ 5 kΩ
   v. For voltmeter R≈ 500 kΩ

Choose the correct answer from the options given below:

[4]

a) (C) and (E) b) (A) and (C)
c) (C) and (D) d) (A) and (B)

13) Two short bar magnets of length 1 cm each have magnetic moments 1.20 Am^2 and 1.00 Am^2, respectively. They are placed on a horizontal table parallel to each other with their N poles pointing towards the South. They have a common magnetic equator and are separated by a distance of 20.0 cm. The value of the resultant horizontal magnetic induction at the mid - point O of the line joining their centres is close to (Horizontal component of the earth's magnetic induction is 3.6×10^{-5} Wb/m^2) **[4]**

a) $2.56 \times 10^{-4} Wb/m^2$
b) $3.50 \times 10^{-4} Wb/m^2$
c) $3.6 \times 10^{-5} Wb/m^2$
d) $5.80 \times 10^{-4} Wb/m^2$

14) Identify the wrong statement:
i. Eddy currents are produced in a steady magnetic field
ii. Eddy currents can be minimized by using laminated core
iii. Induction furnace uses eddy current to produce heat
iv. Eddy current can be used to produce breaking force in moving vehicles

[4]

a) Only (i) b) Only (iv)
c) Only (ii) d) Only (iii)

15) A mass of 50 kg is placed at the centre of a uniform spherical shell of mass 100 kg and radius 50 m. If the gravitational potential at a point, 25 m from the centre is V kg/m. The value of V is: **[4]**

a) - 60 G b) - 4 G
c) +2 G d) - 20 G

16) A monochromatic beam of light has a frequency $\nu = \frac{3}{2\pi} \times 10^{12}$ Hz and is propagating along the direction $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$. It is polarized along the $\hat{k}$ direction. The acceptable form for the magnetic field is: **[4]**

a) $k\frac{E_0}{C}\left(\frac{\hat{i}-\hat{j}}{\sqrt{2}}\right)\cos\left[10^4\left(\frac{i-\hat{j}}{\sqrt{2}}\right)\cdot\vec{r}-\left(3\times10^{12}\right)t\right]$
b) $\frac{E_0}{C}\frac{(\hat{i}+\hat{j}+\hat{k})}{\sqrt{3}}\cos\left[10^4\left(\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)\cdot\vec{r}+\left(3\times10^{12}\right)t\right]$
c) $\frac{E_0}{C}\hat{k}\cos\left[10^4\left(\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)\cdot\vec{r}+\left(3\times10^{12}\right)t\right]$
d) $\frac{E_0}{C}\left(\frac{\hat{i}-\hat{j}}{\sqrt{2}}\right)\cos\left[10^4\left(\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)\cdot\vec{r}-\left(3\times10^{12}\right)t\right]$

17) When the wavelength of radiation falling on metal is changed from 500 nm to 200 nm, the maximum kinetic energy of the photoelectrons becomes three times larger. The work function of the metal is close to: **[4]**

a) 1.02 eV b) 0.52 eV
c) 0.61 eV d) 0.81 eV

18) Choose the correct option from the following options given below:
i. In the ground state of Rutherford's model electrons are in stable equilibrium. While in Thomson's model electrons always experience a net - force.
ii. An atom has a nearly continuous mass distribution in a Rutherford's model but has a highly non - uniform mass distribution in Thomson's model
iii. A classical atom based on Rutherford's model is doomed to collapse.
iv. The positively charged part of the atom possesses most of the mass in Rutherford's model but not in Thomson's model.

[4]

a) Statement (a) is correct.
b) Statement (b) is correct.
c) Statement (d) is correct.
d) Statement (c) is correct.

19) When Uranium is bombarded with neutrons, it undergoes fission. The fission reaction can be written as:
$_{92}U^{235} + {}_0n^1 \rightarrow {}_{56}Ba^{141} + {}_{36}Kr^{92} + 3x + Q$ (energy)
where three particles named x are produced and energy Q is released. What is the name of the particle x? **[4]**

a) α - particle b) Neutron
c) Electron d) Neutrino

20) If a semiconductor photodiode can detect a photon with a maximum wavelength of 400 nm, then its band gap energy is: Planck's constant, $h = 6.63 \times 10^{-34}$ J.s. Speed of light, $c = 3 \times 10^8$ m/s **[4]**

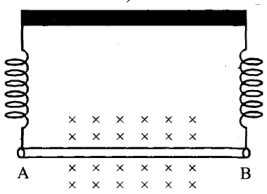
a) 2.0 eV b) 3.1 eV
c) 1.1 eV d) 1.5 eV

21) A ball of mass 0.5 kg is dropped from the height of 10 m. The height, at which the magnitude of velocity becomes equal to the magnitude of acceleration due to gravity, is _____ m. (Use $g = 10 m/s^2$). **[4]**

22) An ideal transformer with purely resistive load operates at 12 kV on the primary side. It supplies electrical energy to a number of nearby houses at 120 V. The average rate of energy consumption in the houses served by the transformer is 60 kW. The value of resistive load (Rs) required in the secondary circuit will be _____ mΩ . **[4]**

23) A parallel beam of light is allowed to fall on a transparent spherical globe of diameter 30 cm and refractive index 1.5. The distance from the centre of the globe at which the beam of light can converge is _____ mm. **[4]**

24) A straight wire AB of mass 40 g and length 50 cm is suspended by a pair of flexible leads in uniform magnetic field of magnitude 0.40 T as shown in the figure. The magnitude of the current required in the wire to remove the tension in the supporting leads is _____ A. (Take $g = 10 ms^{-2}$)



[4]

25) A steel rod has a radius of 20 mm and a length of 2.0 m. A force of 62.8 kN stretches it along its length. Young's modulus of steel is 2.0×10^{11} N/m^2. The longitudinal strain produced in the wire is _____ $\times 10^{-5}$. **[4]**

CHEMISTRY

26) If p is the momentum of the fastest electron ejected from a metal surface after the irradiation of light having wavelength λ , then for 1.5 p momentum of the photo-electron, the wavelength of the light should be
(Assume kinetic energy of ejected photoelectron to be very high in comparison to work function) **[4]**

a) $\frac{4}{9}\lambda$ b) $\frac{3}{4}\lambda$
c) $\frac{1}{2}\lambda$ d) $\frac{2}{3}\lambda$

27) The correct decreasing order for metallic character is **[4]**

a) Be > Na > Mg > Si > P
b) Na > Mg > Be > Si > P
c) Si > P > Be > Na > Mg
d) P > Si > Be > Mg > Na

28) For the reaction:
$Fe_2N(s) + \frac{3}{2}H_2(g) \rightleftharpoons 2\ Fe(s) + NH_3(g)$ **[4]**

a) $K_c = K_p(RT)^{\frac{-1}{2}}$
b) $K_c = K_p(RT)^{\frac{1}{2}}$
c) $K_c = K_p(RT)$
d) $K_c = K_p(RT)^{\frac{3}{2}}$

29) For the complete combustion of ethanol,
$C_2H_5OH(l) + 3O_2(g) \longrightarrow 2CO_2(g) + 3H_2O(l)$,
the amount of heat produced as measured in bomb calorimeter, is 1364.47 kJ mol^{-1} at 25°C. Assuming ideality the enthalpy of combustion, $\Delta_C H$, for the reaction will be ($R = 8.314\ JK^{-1}\ mol^{-1}$) **[4]**

a) - 1366.95 kJ mol^{-1}
b) - 1350.50 kJ mol^{-1}
c) - 1460.50 kJ mol^{-1}
d) - 1361.95 kJ mol^{-1}

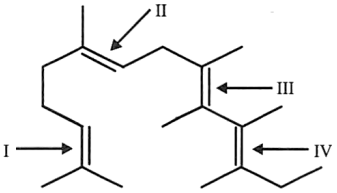
30) The values of $\frac{K_p}{K_C}$ for the following reactions at 300 K are, respectively (At 300 K, RT= 24.62dm^3 atm mol^{-1})
$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$
$N_2O_4(g) \rightleftharpoons 2NO_2(g)$
$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ **[4]**

a) 1, 24.62 dm^3 atm mol^{-1}, 1.65 × 10^{-3} dm^{-6} atm^{-2} mol^2
b) 24.62 dm^3 atm mol^{-1}, 606.0 dm^6 atm^{-2} mol^2, 1.65 × 10^{-3} dm^{-6} atm^{-2} mol^2
c) 1, 24.62 dm^3 atm mol^{-1}, 606.0 dm^6 atm^2 mol^2
d) 1, 4.1× 10^2 $dm^{-3}atm^{-1}$ mol, 606 dm^6 atm^2 mol^{-2}

31) Oxidation number of potassium in K_2O, K_2O_2 and KO_2, respectively, is: **[4]**

a) +1, +1 and +1
b) +1, +4 and +2
c) +1, +2 and +4
d) +2, +1 and $+\frac{1}{2}$

32) In the following structure, the double bonds are marked as I, II, III and IV



Geometrical isomerism is not possible at site (s): **[4]**

a) I
b) III and IV
c) L and III
d) III

33) Given, $E^\circ_{Cl_2/Cl^-} = 1.36V$, $E^\circ_{Cr^{3+}/Cr}$ = - 0.74 V
$E^\circ_{Cr_2O_7^{2-}/Cr^{3+}} = 1.33V$, $E^\circ_{MnO_4^-/Mn^{2+}}$ = 1.51 V
Among the following, the strongest reducing agent is **[4]**

a) Cl^-
b) Cr^{3+}
c) Mn^{2+}
d) Cr

34) In the hydroboration - oxidation reaction of propene with diborane, $H_2O_2$and NaOH, the organic compound formed is: **[4]**

a) $CH_3CHOHCH_3$
b) $CH_3CH_2CH_2OH$
c) CH_3CH_2OH
d) $(CH_3)_3COH$

35) The observed osmotic pressure for a 0.10 M solution of $Fe(NH_4)_2(SO_4)_2$ at 25 °C is 10.8 atm. The expected and experimental (observed) values of van't Hoff factor (i) will be respectively::
($R = 0.082$ L atm K^{-1} mol^{-1}) **[4]**

a) 5 and 3.42
b) 4 and 4.00
c) 5 and 4.42
d) 3 and 5.42

36) 18 g of glucose ($C_6H_{12}O_6$) is added to 178.2 g water. The vapour pressure of water (in torr) for this aqueous solution is **[4]**

a) 76.0
b) 752.4
c) 7.6
d) 759.0

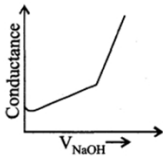
37) At 298 K, the standard reduction potentials are 1.51 V forMnO_4^- | Mn^{2+}, 1.36 V for $Cl_2|Cl^-$, 1.07 V for Br_2 | Br^-, and 0.54 V for I_2 | I^-. At pH = 3, permanganate is expected to oxidize: $\left(\frac{RT}{F} = 0.059\ V\right)$ **[4]**

a) Cl^- and Br^-
b) Br^- and I^-
c) Cl^-, Br^- and I^-
d) I^- only

38) If 50% of a reaction occurs in 100 seconds and 75% of the reaction occurs in 200 seconds, the order of this reaction is: **[4]**

a) 0
b) 2
c) 3
d) 1

39) Choose the correct representation of conductometric titration of benzoic acid vs sodium hydroxide. **[4]**

a)


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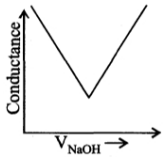

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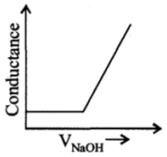

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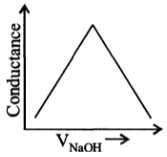


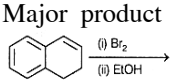
40) Electron gain enthalpy with negative sign of fluorine is less than that of chlorine due to: **[4]**

a) Bigger size of 2p orbital of fluorine
b) Smaller size of chlorine atom
c) High ionization enthalpy of fluorine
d) Smaller size of fluorine atom

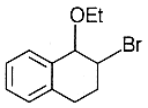
41) Which of these statements about $[Co(CN)_6]^{3-}$ is TRUE? **[4]**

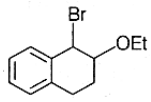
a) $[Co(CN)_6]^{3-}$ has four unpaired electrons and will be in a high - spin configuration.
b) $[Co(CN)_6]^{3-}$ has no unpaired electrons and will be in a high - spin configuration.
c) $[Co(CN)_6]^{3-}$ has four unpaired electrons and will be in a low - spin configuration.
d) $[Co(CN)_6]^{3-}$ has no unpaired electrons and will be in a low - spin configuration.

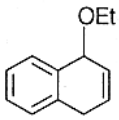
42) Major product of the following reaction is

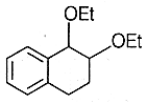


[4]

a) 

b) 

c) 

d) 

43) The correct match between item**I** and item **II** is

Item I (Compound)	**Item II** (Reagent)
(A) Lysine	(P) 1 - naphthol
(B) Furfural	(Q) Ninhydrin
(C) Benzyl alcohol	(R) $KMnO_4$
(D) Styrene	(S) Ceric ammonium nitrate

[4]

a)

A	B	C	D
R	P	Q	S

b)

A	B	C	D
Q	P	R	S

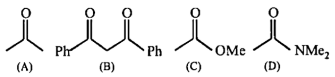
c)

A	B	C	D
Q	P	S	R

d)

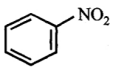
A	B	C	D
Q	R	S	P

44) The increasing order of the acidity of theα - hydrogen of the following compounds is:

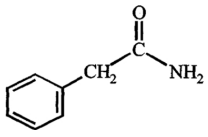


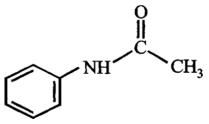
[4]

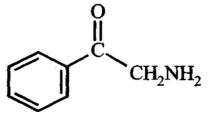
a) (D) < (C) < (A) < (B)
b) (A) < (C) < (D) < (B)
c) (B) < (C) < (A) < (D)
d) (C) < (A) < (B) < (D)

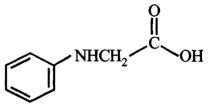
45) 

$\xrightarrow[C2H_5OH]{H_2/Pd}$ [A] $\xrightarrow[Pyridine]{(CH_3CO)_2O}$ [B] **[4]**

a) 

b) 

c) 

d) 

46) The orbital angular momentum of an electron in 3s orbital is$\frac{xh}{2\pi}$. The value of x is _____. **[4]**

47) N_2O_5 (g) $\rightarrow$ $2NO_2$(g) + $\frac{1}{2}O_2$ (g)
In the above first order reaction, the initial concentration of $N_2O_5$is 2.40 $\times$ 10^{-2} mol L^{-1} at 318 K. The concentration of N_2O_5after 1 hour was 1.60 $\times$ 10^{-2} mol L^{-1}.The rate constant of the reaction at 318 K is _____ $\times$ 10^{-3} min^{-1}. (Nearest integer) **[4]**

48) The spin - only magnetic moment value ofB_2^+ species is _____$\times$ 10^{-2} BM. (Nearest integer) [Given: $\sqrt{3}$ = 1.73]**[4]**

49) Consider the cell
Pt(s)|H_2, (s)(1 atm)|H^+ (aq, [H^+]= 1)| |Fe^{3+}(aq), Fe^{2+} (q)| Pt(s)
Given: $E^0_{\frac{Fe^{3+}}{Fe^{2+}}}$ = 0.771 V and $E^\circ_{H^+/\frac{1}{2}H_2}$ = 0 V, T = 298 K
If the potential of the cell is 0.712 V the ratio of concentration of Fe^{2+} to Fe^{2+} is _____ (Nearest integer) **[4]**

50) The number of species having a square planar shape from the following is _____.
XeF_4,SF_4, SiF_4, BF_4^- , BrF_4^- , $[Cu(NH_3)_4]^{2+}$, $[FeCl_4]^2$, $[PtCl_4]^2$ **[4]**

MATHEMATICS

51) Let f(x) = a^x(a > 0) be written as f(x) = f_1(x) + f_2(x), where f_1(x) is an even function and f_2(x) is an odd function. Then f_1(x + y) + f_1(x - y) equals **[4]**

a) $2f_1(x).f_2(y)$
b) $2f_1(x).f_1(y)$
c) $2f_1(x + y).f_1(x - y)$
d) $2f_1(x + y).f_2(x - y)$

52) Let$z = \left(\frac{\sqrt{3}}{2} + \frac{i}{2}\right)^5 + \left(\frac{\sqrt{3}}{2} - \frac{i}{2}\right)^5$. If R(z) and I(z) respectively denote the real and imaginary parts of z, then **[4]**

a) R(z) = - 3
b) I(z) = 0
c) R(z) > 0 and l(z) > 0
d) R(z) < 0 and I(z) >0

53) A committee of 11 members is to be formed from 8 males and 5 females. If m is the number of ways the committee is formed with at least 6 males and n is the number of ways the committee is formed with at least 3 females, then **[4]**

a) M + n = 68
b) M = n = 78
c) N = m - 8
d) M = n = 68

54) The sum of the coefficients of all even degree terms is x in the expansion of$(x+\sqrt{x^3-1})^6+(x-\sqrt{x^3-1})^6, (x>1)$ is equal to **[4]**

a) 32
b) 29
c) 26
d) 24

55) Let a_1, a_2, a_3, ..., a_{49} be in AP such that $\sum_{k=0}^{12} a_{4k+1}$ = 416 and $a_9 + a_{43}$ = 66. If $a_1^2 + a_2^2 + \ldots + a_{17}^2$ =140 m, then m is equal to **[4]**

a) 34 b) 33
c) 66 d) 68

56) If f(x) = [x]- $\left[\frac{x}{4}\right]$, x $\in$ R where [x]denotes the greatest integer function, then **[4]**

a) $\lim\_x \to 4-f(x)$ exists but $\lim\_x \to 4+f(x)$ does not exist
b) F is continuous at x = 4
c) $\lim\_x \to 4+f(x)$ exists but $\lim\_x \to 4-f(x)$ does not exist
d) Bothlim $\_x \to 4-f(x)$ and $\lim\_x \to 4+f(x)$ exist but are not equal

57) The function f(x) $xe^{x(1 - x)}$, x $\in$ R, is: **[4]**

a) Decreasing in$\left(-\frac{1}{2}, \frac{1}{2}\right)$
b) Increasing in$\left(-1, \frac{1}{2}\right)$
c) Decreasing in$\left(\frac{1}{2}, 2\right)$
d) Increasing in$\left(-\frac{1}{2}, 1\right)$

58) The value of$\int_0^{2\pi} \frac{x \sin^8 x}{\sin^8 x + \cos^8 x}$ dx is equal to: **[4]**

a) 2π b) $2\pi^2$
c) π^2 d) 4π

59) Letα_1 , α_2 (α_1 < α_2) be the values of a for the points (α , - 3), (2, 0) and (1, α) to be collinear. Then the equation of the line, passing through (α_1 , α_2) and making an angle of $\frac{\pi}{3}$ with the positive direction of the x - axis, is: **[4]**

a) $\sqrt{3}$ x - y + $\sqrt{3}$ - 3 = 0
b) $\sqrt{3}$ x - y + $\sqrt{3}$ + 3 = 0
c) X - $\sqrt{3}$ y - $3\sqrt{3}$ + 1 = 0
d) X - $\sqrt{3}$ y + $3\sqrt{3}$ + 1 = 0

60) A square is inscribed in the circle $x^2 + y^2$ - 6x + 8y - 103 = 0 with its sides parallel to the coordinate axes. Then, the distance of the vertex of this square which is nearest to the origin is **[4]**

a) 6 b) $\sqrt{41}$
c) $\sqrt{137}$ d) 13

61) The locus of a point which divides the line segment joining the point (0, - 1) and a point on the parabola, x^2 = 4y, internally in the ratio 1 : 2, is: **[4]**

a) $4x^2$ - 3y = 2 b) $9x^2$ - 12y = 8
c) X^2 - 3y = 2 d) $9x^2$ - 3y = 2

62) Let f be a differentiable function such that$f'(x) = 7 - \frac{3}{4}\frac{f(x)}{x}, (x > 0)$ and f(1) $\neq$ 4. Then, $\lim\_x \to 0^+ x f\left(\frac{1}{x}\right)$ **[4]**

a) Exists and equals 0
b) Exists and equals$\frac{4}{7}$
c) Exists and equals 4
d) Does not exist

63) The line l_1 passes through the point (2, 6, 2) and is perpendicular to the plane 2x + y - 2z = 10. Then the shortest distance between the line l_1 and the line $\frac{x+1}{2} = \frac{y+4}{-3} = \frac{z}{2}$ is: **[4]**

a) 7 b) $\frac{19}{3}$
c) 9 d) $\frac{19}{2}$

64) Let the vectors$\vec{a}, \vec{b}, \vec{c}$ represent three coterminous edges of a parallelopiped of volume V. Then the volume of the parallelopiped, whose coterminous edges are represented by $\vec{a}, \vec{b} + \vec{c}$ and $\vec{a} + 2\vec{b} + 3\vec{c}$ is equal to **[4]**

a) 2V b) 6V
c) 3V d) V

65) If the data x_1, x_2, ..., x_{10} is such that the mean of first four of these is 11, the mean of the remaining six is 16 and the sum of squares of all of these is 2,000; then the standard deviation of this data is: **[4]**

a) $2\sqrt{2}$ b) 2
c) $\sqrt{2}$ d) 4

66) If 10 different balls are to be placed in 4 distinct boxes at random, then the probability that two of these boxes contain exactly 2 and 3 balls is: **[4]**

a) $\frac{945}{2^{10}}$ b) $\frac{965}{2^{10}}$
c) $\frac{945}{2^{11}}$ d) $\frac{965}{2^{11}}$

67) α = sin 36° is a root of which of the following equation **[4]**

a) $16x^4$ + $20x^2$ - 5 = 0 b) $10x^4$ - $10x^2$ - 5 = 0
c) $16x^4$ - $20x^2$ + 5 = 0 d) $16x^4$ - $10x^2$ + 5 = 0

68) The eccentricity of the hyperbola whose length of the latusrectum is equal to 8 and the length of its conjugate axis is equal to half of the distance between its foci, is **[4]**

a) $\sqrt{3}$ b) $\frac{4}{\sqrt{3}}$
c) $\frac{2}{\sqrt{3}}$ d) $\frac{4}{3}$

69) Let the number of elements in sets A and B be five and two respectively. Then the number of subsets of A$\times$ B each having at least 3 and at most 6 element is: **[4]**

a) 792 b) 782
c) 772 d) 752

70) The system of linear equations
λx + 2y + 2z = 5
$2\lambda x$ + 3y + 5z = 8
4x + λy + 6z = 10 has: **[4]**

a) No solution whenλ = 8
b) A unique solution whenλ = - 8
c) No solution whenλ = 2
d) Infinitely many solutions whenλ = 2

71) Let$\vec{a}, \vec{b}$ and $\vec{c}$ be three non - zero non coplanar vectors. Let the position vectors of four points A, B, C and D be $\vec{a} - \vec{b} + \vec{c}, \lambda\vec{a} - 3\vec{b} + 4\vec{c}$, $-\vec{a} - 2\vec{b} - 3\vec{c}$ and $2\vec{a} - 4\vec{b} + 6\vec{c}$ respectively. If $\overrightarrow{AB}, \overrightarrow{AC}$ and $\overrightarrow{AD}$ are coplanar, then λ is: **[4]**

72) If the area bounded by the curve $2y^2$ = 3x, lines x + y = 3, y = 0 and outside the circle $(x - 3)^2 + y^2 = 2$ is A, then 4(π + 4A) is equal to ____. **[4]**

73) Lf X = $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$, Y = aI + BX + gX^2 and Z = $\alpha^2 I$ - $\alpha\beta X$ + (β^2 - $\alpha\gamma$)X^2, α , β , γ $\in$ R . If Y^{-1} = $\begin{bmatrix} \frac{1}{5} & \frac{-2}{5} & \frac{1}{5} \\ 0 & \frac{1}{5} & \frac{-2}{5} \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$, then (α - β + γ)^2 is equal to ____. **[4]**

74) Let a_1, a_2,... a_{10} be an AP with common difference - 3 and b_1, b_2,.., b_{10} be a GP with common ratio 2. Let c_k = a_k+ b_k, ,k = 1, 2,..., 10. If c_2 = 12 and c_3 = 13, then $\sum_{k=1}^{10} c_k$ is equal to ____. **[4]**

75) A test consists of 6 multiple choice questions, each having 4 alternative answers of which only one is correct. The number of ways, in which a candidate answers all six questions such that exactly four of the answers are correct, is ____. **[4]**