SATISH SCIENCE ACADEMY
DHANORI PUNE - 411015

JEE MAIN
ENTRANCE EXAM - JEE MAIN

Time Allowed : 180 mins **Maximum Marks :** 300

General Instructions:

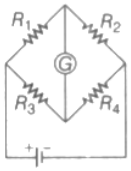
- All questions are compulsory.
- There are three parts and each part carries 25 questions where the first 20 questions are MCQs and the next 5 questions are numerical.
- You will get 4 marks for each correct response and 1 mark will be deducted for an incorrect answer.

PHYSICS (Section-A)

1) In an experiment with Vernier callipers of least count 0.1 mm, when two jaws are joined together the zero of Vernier scale lies right to the zero of the main scale and 6thdivision of Vernier scale coincides with the main scale division. While measuring the diameter of a spherical bob, the zero of vernier scale lies in between 3.2 cm and 3.3 cm marks, and 4th division of vernier scale coincides with the main scale division. The diameter of bob is measured as: **[4]**

a) 3.22 cm b) 3.25 cm
c) 3.26 cm d) 3.18 cm

2) The Wheatstone bridge shown in the figure here gets balanced when the carbon resistor is used as R_1 has the color code (orange, red, brown). The resistors R_2 and R_4 are 80 Ω and 40 Ω , respectively.
Assuming that the color code for the carbon resistors gives their accurate values, the color code for the carbon resistor is used as R_3 would be



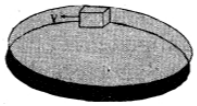
[4]

a) Grey, black, brown b) Brown, blue, black
c) Brown, blue, brown d) Red, green, brown

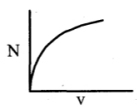
3) If two vectors$\vec{P} = \hat{i} + 2m\hat{j} + m\hat{k}$ and $\vec{Q} = 4\hat{i} - 2\hat{j} + m\hat{k}$ are perpendicular to each other. Then, the value of m will be: **[4]**

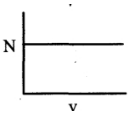
a) - 1 b) 2
c) - 3 d) 1

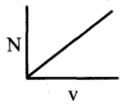
4) A smooth circular groove has a smooth vertical wall as shown in figure. A block of mass m moves against the wall with a speed v. Which of the following curve represents the correct relation between the normal reaction on the block by the wall (N) and speed of the block (v)?



[4]

a) 

b) 

c) 

d) 

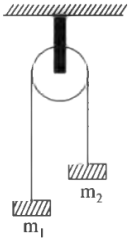
5) Identify the correct statements from the following:

i. Work done by a man in lifting a bucket out of a well by means of a rope tied to the bucket is negative.
ii. Work done by gravitational force in lifting a bucket out of a well by a rope tied to the bucket is negative.
iii. Work done by friction on a body sliding down an inclined plane is positive.
iv. Work done by an applied force on a body moving on a rough horizontal plane with uniform velocity in zero.
v. Work done by the air resistance on an oscillating pendulum in negative.

[4]

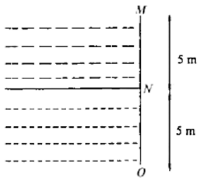
a) A and C only b) B and D only
c) B and E only d) B D and E only

6) A uniformly thick wheel with moment of inertia I and radius R is free to rotate about its centre of mass (see fig). A massless string is wrapped over its rim and two blocks of masses m_1 and m_2 ($m_1 > m_2$) are attached to the ends of the string. The system is released from rest. The angular speed of the wheel when m_1 descents by a distance h is:



[4]

a) $\left[\frac{m_1+m_2}{(m_1+m_2)R^2+1}\right]^{1/2} gh$
b) $\left[\frac{2(m_1-m_2)gh}{(m_1+m_2)R^2+1}\right]^{1/2}$
c) $\left[\frac{(m_1-m_2)}{(m_1+m_2)R^2+1}\right]^{1/2} gh$
d) $\left[\frac{2(m_1+m_2)gh}{(m_1+m_2)R^2+1}\right]^{1/2}$

7) 

Two liquids of densities ρ_1 and $\rho_2\,(\rho_2 = 2\rho_1)$ are filled up behind a square wall of side 10 m as shown in figure. Each liquid has a height of 5 m. The ratio of the forces due to these liquids exerted on upper part MN to that at the lower part NO is (Assume that the liquids are not mixing): **[4]**

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

8) An experiment takes 10 minutes to raise the temperature of water in a container from 0°C to 100°C and another 55 minutes to convert it totally into steam by a heater supplying heat at a uniform rate. Neglecting the specific heat of the container and taking specific heat of water to be 1 cal/g °C, the heat of vapourization according to this experiment will come out to be: **[4]**

a) 540 cal/g b) 560 cal/g
c) 550 cal/g d) 530 cal/g

9) When M_1 gram of ice at - 10°C (specific heat = 0.5 cal $g^{-1}°C^{-1}$) is added to M_2 gram of water at 50°C, finally no ice is left and the water is at 0°C. The value of latent heat of ice, in cal g^{-1} is **[4]**

a) $\frac{50M_2}{M_1}$
b) $\frac{50M_2}{M_1} - 5$
c) $\frac{50M_1}{M_2} - 50$
d) $\frac{5M_2}{M_1} - 5$

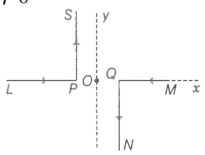
10) Two particles are performing simple harmonic motion in a straight line about the same equilibrium point. The amplitude and time period for both particles are same and equal to A and T, respectively. At time t = 0 one particle has displacement A while the other one has displacement $\frac{-A}{2}$ and they are moving towards each other. If they cross each other at time t, then t is: **[4]**

a) $\frac{5T}{6}$ b) $\frac{T}{4}$
c) $\frac{T}{3}$ d) $\frac{T}{6}$

11) There is a uniform electrostatic field in a region. The potential at various points on a small sphere centred at P, in the region, is found to vary between in the limits 589.0 V to 589.8 V. What is the potential at a point on the sphere whose radius vector makes an angle of 60° with the direction of the field? **[4]**

a) 589.5 V b) 589.4 V
c) 589.2 V d) 589.4 V

12) As shown in the figure, two infinitely long, identical wires are bent by 90° and placed in such a way that the segments LP and QM are along the X - axis, while segments PS and QN are parallel to the Y - axis. If OP = OQ = 4 cm and the magnitude of the magnetic field at O is 10^{-4} T and the two wires carry equal currents (see figure), the magnitude of the current in each wire and the direction of the magnetic field at O will be (Take, $\mu_0 = 4\pi \times 10^{-7}$ NA^{-2})



[4]

a) 20 A, perpendicular out of the page
b) 20 A, perpendicular into the page
c) 40 A, perpendicular out of the page
d) 40 A, perpendicular into the page

13) A short bar magnet is placed in the magnetic meridian of the earth with north pole pointing north. Neutral points are found at a distance of 30 cm from the magnet on the East - West line, drawn through the middle point of the magnet. The magnetic moment of the magnet in Am^2 is close to:
(Given $\frac{\mu_0}{4\pi} = 10^{-7}$ in SI units and B_H = Horizontal component of earth's magnetic field = 3.6×10^{-5} tesla) **[4]**

a) 9.7 b) 14.6
c) 19.4 d) 4.9

14) The self - inductance of an air - core solenoid of 100 turns is 1 mH. The self - inductance of another solenoid of 50 turns (with the same length and cross - sectional area) with a core having relative permeability 500 is: **[4]**

a) 60 mH b) 30 mH
c) 125 mH d) 24 mH

15) A satellite is in an elliptical orbit around a planet P. It is observed that the velocity of the satellite when it is farthest from the planet is 6 times less than that when it is closest to the planet. The ratio of distances between the satellite and the planet at closest and farthest points is: **[4]**

a) 3 : 4 b) 1 : 2
c) 1 : 6 d) 1 : 3

16) Sun light falls normally on a surface of area 36 cm^2 and exerts an average force of 7.2×10^{-9} N within a time period of 20 minutes. Considering a case of complete absorption, the energy flux of incident light is **[4]**

a) 25.92×10^2 W/cm^2
b) 8.64 x 10^{-6} W/cm^2
c) 6.0 W/cm^2
d) 0.06 W/cm^2

17) A particle A of mass 'm' and charge 'q' is accelerated by a potential difference of 50 V. Another particle B of mass '4m' and charge 'q' is accelerated by a potential difference of 2500 V. The ratio of de - Broglie wavelength $\frac{\lambda_A}{\lambda_B}$ is close to **[4]**

a) 10.00 b) 4.47
c) 0.07 d) 14.14

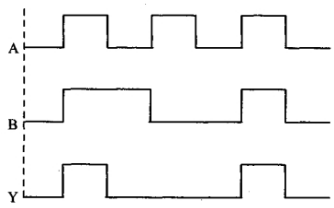
18) Find the ratio of energies of photons produced due to transition of an election of hydrogen atom from its (i) second permitted energy level to the first level, and (ii) the highest permitted energy level to the first permitted level. **[4]**

a) 3 : 4 b) 4 : 3
c) 1 : 4 d) 4 : 1

19) The masses of neutron and proton are 1.0087 amu and 1.0073 amu respectively. If the neutrons and protons combine to form a helium nucleus (alpha particles) of mass 4.0015 amu. The binding energy of the helium nucleus will be (1 amu = 931 MeV) **[4]**

a) 14.2 MeV b) 28.4 MeV
c) 27.3 MeV d) 20.8 MeV

20) A logic gate circuit has two inputs A and B and output Y. The voltage waveforms of A, B and Y are shown below



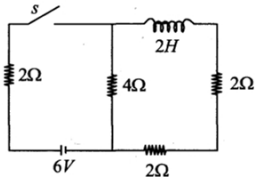
[4]

a) NAND gate b) NOR gate
c) OR gate d) AND gate

PHYSICS (Section-B)

21) If the velocity of a body related to displacement x is given by$v = \sqrt{5000 + 24x}$ m/s, then the acceleration of the body is _____ m/s^2. **[4]**

22) For the given circuit the current through battery of 6 V just after closing the switch**S** will be _____ A.



[4]

23) In an experiment for estimating the value of focal length of converging mirror, image of an object placed at 40 cm from the pole of the mirror is formed at distance 120 cm from the pole of the mirror. These distances are measured with a modified scale in which there are 20 small divisions in 1 cm. The value of error in measurement of focal length of the mirror is 1/K cm. The value of K is _____. **[4]**

24) The ratio of magnetic field at the centre of a current carrying coil of radius r to the magnetic field at distance r from the centre of coil on its axis is$\sqrt{x}$: 1. The value of x is _____. **[4]**

25) A metal wire of length 0.5 m and cross - sectional area $10^{-4}m^2$ has breaking stress $5 \times 10^8 Nm^{-2}$. A block of 10kg is attached at one end of the string and is rotating in a horizontal circle. The maximum linear velocity of block will be _____ ms^{-1}. **[4]**

CHEMISTRY (Section-A)

26) For any given series of spectral lines of atomic hydrogen, let$\Delta\bar{\nu} = \bar{\nu}_{max} - \bar{\nu}_{min}$ be the difference in maximum and minimum frequencies in cm^{-1}. The ratio $\frac{\Delta\bar{\nu}_{Lyman}}{\Delta\bar{\nu}_{Balmer}}$ is **[4]**

a) 4 : 1 b) 5 : 4
c) 27 : 5 d) 9 : 4

27) Among the statements (i - iv), the correct ones are:
i. Be has smaller atomic radius compared to Mg.
ii. Be has higher ionization enthalpy than Al.
iii. Charge/radius ratio of Be is greater than that of Al.
iv. Both Be and Al form mainly covalent compounds.

[4]

a) (i), (iii) and (iv) b) (ii), (iii) and (iv)
c) (i), (ii) and (iv) d) (i), (ii) and (iii)

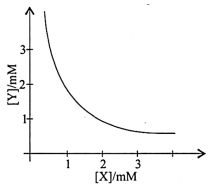
28) An acidic buffer is obtained on mixing: **[4]**

a) L00 mL of 0.1 MHCl and 200 mL of 0.1 MCH_3COONa
b) 100 mL of 0.1M HCl and 200 mL of 0.1 M NaCl
c) 100mL of 0.1 MCH_3COOH and 100 mL of 0.1 MNaOH
d) 100 mL of 0.1 MCH_3COOH and 200 mL of 0.1 MNaOH

29) During compression of a spring the work done is 10 kJ and 2 kJ escaped to the surroundings as heat. The change in internal energy,Δ U (in kJ) is **[4]**

a) 8 b) - 12
c) - 8 d) 12

30) The stoichiometry and solubility product of salt with the solubility curve given below is, respectively:



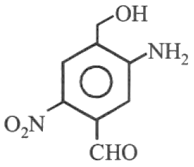
[4]

a) XY, $2\times 10^{-6}M^3$
b) X_2Y_2, $1 \times 10^{-9}M^3$
c) XY_2, $4 \times 10^{-9}M^3$
d) XY_2, $1 \times 10^{-9}M^3$

31) An example of a disproportionation reaction is: **[4]**

a) $2KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$
b) $2MnO_4^- + 10I^- + 16H^+ \rightarrow 2Mn^{2+} + 5I_2 + 8H_2O$
c) $2NaBr + Cl_2 \rightarrow 2NaCl + Br_2$
d) $2CuBr \rightarrow CuBr_2 + Cu$

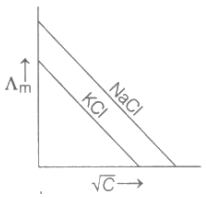
32) The IUPAC name of the following compound is:



[4]

a) 2 - nitro - 4 - hydroxymethyl - 5 - amino benzaldehyde
b) 3 - amino - 4 - hydroxymethyl - 5 - nitrobenzaldehyde
c) 4 - amino - 2 - formyl - 5 - hydroxymethyl nitrobenzene
d) 5 - amino - 4 - hydroxymethyl - 2 - nitrobenzaldehyde

33) Which one of the following graphs between molar conductivity ($\wedge_m$) versus $\sqrt{C}$ is correct? **[4]**

a)


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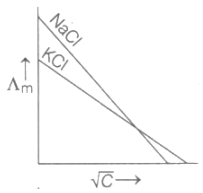

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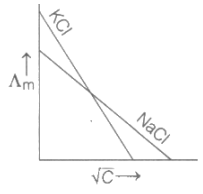
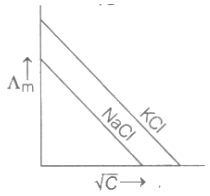


d) 

34) The product formed in the following multistep reaction is:

$$CH_3 - CH = CH_2 \xrightarrow[(iii)\,PCC]{\substack{(i)\,B_2H_6 \\ (ii)\,H_2O_2,\,NaOH}} \xrightarrow[(iv)\,CH_3MgBr]{} \textbf{[4]}$$

a) $CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}} - CH_3$

b) $CH_3 - CH_2 - CH_2 - CH_2 - OH$

c) $CH_3 - CH_2 - \overset{\overset{O}{||}}{C} - OCH_3$

d) $CH_3 - CH_2 - \underset{\underset{OH}{|}}{CH} - CH_3$

35) The molarity of a solution obtained by mixing 750 mL of 0.5(M) HCl with 250mLof 2(M) HCl will be: **[4]**

a) 0.975 M b) 1.75 M
c) 0.875 M d) 1.00 M

36) At 35 °C, the vapour pressure of CS_2 is 512 mm Hg and that of acetone is 344 mm Hg. A solution of CS_2 in acetone has a total vapour pressure of 600 mm Hg. The false statement amongst the following is: **[4]**

a) CS_2 and acetone are less attracted to each other than to themselves
b) Heat must be absorbed in order to produce the solution at 35 °C
c) Raoult's law is not obeyed by this system
d) A mixture of 100 mL CS_2 and 100 mL acetone has a volume < 200 mL

37) A variable, opposite external potential (E_{ext}) is applied to the cell $Zn|Zn^{2+}$ (1 M) || Cu^{2+} (1 M) | Cu, of potential 1.1V. When E_{ext} < 1.1 V and E_{ext} > 1.1 V, respectively electrons flow fom: **[4]**

a) Anode to cathode in both cases
b) Cathode to anode in both cases
c) Anode to cathode and cathode to anode
d) Cathode to anode and anode to cathode

38) For a reaction scheme, $A \xrightarrow{k_1} B \xrightarrow{k_2} C$, if the rate of formation of B is set to be zero then the concentration of B is **[4]**

a) $K_1k_2[A]$
b) $(k_1 + k_2)[A]$
c) $(k_1 - k_2)[A]$
d) $\left(\frac{k_1}{k_2}\right)[A]$

39) The anodic half - cell of lead - acid battery is recharged using electricity of 0.05 Faraday. The amount of $PbSO_4$ electrolyzed in g during the process is: (Molar mass of $PbSO_4$ = 303 g moL^{-1}) **[4]**

a) 15.2 b) 22.8
c) 11.4 d) 7.6

40) The correct statement among the following is **[4]**

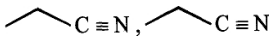
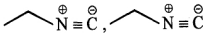
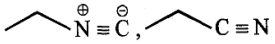
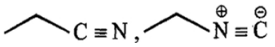
a) $(SiH_3)_3N$ is planar and less basic than $(CH_3)_3N$
b) $(SiH_3)_3$ N is pyramidal and less basic than $(CH_3)_3$ N
c) $(SiH_3)_3$ N is pyramidal and more basic than $(CH_3)_3$ N
d) $(SiH_3)_3$ N is planar and more basic than $(CH_3)_3$ N

41) The pair of metal ions that can given a spin - only magnetic moment of 3.9 BM for the complex $[M(H_2O)_6]Cl_2$, is **[4]**

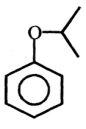
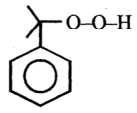
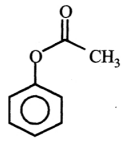
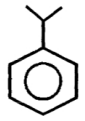
a) Co^{2+} and Fe^{2+} b) V^{2+} and Fe^{2+}
c) Cr^{2+} and Mn^{2+} d) V^{2+} and Co^{2+}

42) $\underset{\text{(Major Product)}}{\text{'A'}} \xleftarrow[C_2H_5OH - H_2O]{AgCN} \underset{}{\text{Cl}}$; $\underset{}{\text{'B'}} \xrightarrow[C_2H_5OH - H_2O]{NaCN} \text{(Major Product)}$

Considering the above reactions, the compound **A** and compound **B** respectively are: **[4]**

a) 
b) 
c) 
d) 

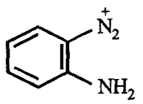
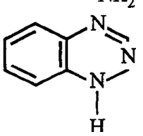
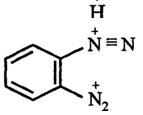
43) In the cumene to phenol preparation in presence of air, the intermediate is **[4]**

a) 
b) 
c) 
d) 

44) Hex - 4 - ene - 2 - ol on treatment with PCC gives**A**. **A** on reaction with sodium hypoiodite gives **B**, which on further heating with soda lime gives **C**. The compound **C** is **[4]**

a) 4 - methyipent - 2 - ene b) Proponaldehyde
c) 2 - butene d) 2 - pentene

45) O - Phenylenediamine $\xrightarrow{HNO_2}$ $\underset{\text{Major Product}}{'X'}$ **X is [4]**

a) 
b) 
c) 
d) 

CHEMISTRY (Section-B)

46) The number of given orbitals which have electron density along the axis is _____.
P_x, P_y, P_z, d_{xy}, d_{yz}, d_{xz}, d_{z^2} , $d_{x^2-y^2}$ **[4]**

47) For the reaction of H_2 with I_2, the rate constant is 2.5×10^{-4} $dm^3 mol^{-1} s^{-1}$ at 327°C and 1.0 dm^3 mol^{-1} s^{-1}at 527°C. The activation energy for the reaction, in kJ mol^{-1} is _____. (R = 8.314 $JK^{-1}mol^{-1}$) **[4]**

48) In the cobalt - carbonyl complex: $[Co_2(CO)_8]$, number of Co - Co bonds is **X** and terminal CO ligands is **Y**. X + Y = _____. **[4]**

49) The resistance of a conductivity cell with cell constant 1.14 cm^{-1}, containing 0.001M KCl at 298 K is 1500 Ω . The molar conductivity of 0.001 M KCl solution at 298 K in S cm^2 mol^{-1} is _____. (Integer answer) **[4]**

50) The number of molecules or ions from the following, which do not have odd number of electrons are _____.
i. NO_2
ii. ICl_4^- ,
iii. BrF_3
iv. ClO_2
v. NO_2^+
vi. NO
[4]

MATHS (Section-A)

51) Let f: R - 3→ R - 1 be defined by f(x) = $\frac{x-2}{x-3}$. Let g: R → R be given as g(x) = 2x - 3. Then, the sum of all the values of x for which $f^{-1}(x) + g^{-1}(x) = \frac{13}{2}$ is equal to **[4]**
a) 5 b) 7
c) 3 d) 2

52) The value of $\left(\frac{1+\sin\frac{2\pi}{9}+i\cos\frac{2\pi}{9}}{1+\sin\frac{2\pi}{9}-i\cos\frac{2\pi}{9}}\right)^3$ is: **[4]**
a) $\frac{1}{2}(\sqrt{3}-i)$
b) $\frac{1}{2}(1-i\sqrt{3})$
c) $-\frac{1}{2}(1-i\sqrt{3})$
d) $-\frac{1}{2}(\sqrt{3}-i)$

53) The number of natural numbers less than 7,000 which can be formed by using the digits 0, 1, 3, 7, 9 (repetition of digits allowed) is equal to **[4]**
a) 375 b) 250
c) 374 d) 372

54) The remainder when $(2021)^{2022}$ + $(2022)^{2021}$ is divided by 7 is **[4]**
a) 2 b) 1
c) 6 d) 0

55) If a, b and c be three distinct real numbers in GP and a + b + c = xb, then x cannot be **[4]**
a) - 2 b) - 3
c) 2 d) 4

56) $\lim_{x\to 0}\left(\tan\left(\frac{\pi}{4}+x\right)\right)^{\frac{1}{x}}$ is equal to: **[4]**
a) E b) E^2
c) 2 d) 1

57) Let f(x) = x $\cos^{-1}$ (- sin |x|), $x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$, then which of the following is true? **[4]**
a) $f'(0) = -\frac{\pi}{2}$
b) F' is not differentiable at x = 0
c) F' is decreasing in $\left(-\frac{\pi}{2}, 0\right)$ and increasing in $\left(0, \frac{\pi}{2}\right)$
d) F' is increasing in $\left(-\frac{\pi}{2}, 0\right)$ and decreasing in $\left(0, \frac{\pi}{2}\right)$

58) If $\lim_{n\to\infty}\frac{1^a+2^a+\ldots+n^a}{(n+1)^{a-1}[(na+2)+\ldots(na+n)]} = \frac{1}{60}$ for some positive real number a, then a is equal to: **[4]**
a) $\frac{15}{2}$ b) 7
c) $\frac{17}{2}$ d) 8

59) Let k be an integer such that the triangle with vertices (k, - 3k), (5, k) and (- k, 2) has area 28 sq units. Then, the orthocentre of this triangle is at the point **[4]**
a) $\left(1, \frac{3}{4}\right)$
b) $\left(2, -\frac{1}{2}\right)$
c) $\left(2, \frac{1}{2}\right)$
d) $\left(1, -\frac{3}{4}\right)$

60) If the area of an equilateral triangle inscribed in the circle$x^2 + y^2 + 10x + 12y + c = 0$ is $27\sqrt{3}$ sq units, then c is equal to **[4]**
a) 20 b) - 25
c) 25 d) 13

61) If y = mx + 4 is a tangent to both the parabolas, y^2 = 4x and x^2 = 2by, then b is equal to: **[4]**
a) - 64 b) - 32
c) - 128 d) 128

62) If y = y(x) is the solution of the differential equation, $e^y = e^x$such that y(0) = 0, then y(1) is equal to: **[4]**
a) 1 + $\log_e$ 2 b) 2 + $\log_e$ 2
c) 2e d) Log_e 2

63) If the length of the perpendicular drawn from the point P(a, 4, 2), a > 0 on the line$\frac{x+1}{2} = \frac{y-3}{3} = \frac{z-1}{-1}$ is $2\sqrt{6}$ units and Q(α_1 , α_2 , α_3) is the image of the point P in this line, then $a + \sum_{i=1}^{3}\alpha_i$ is equal to: **[4]**
a) 8 b) 14
c) 7 d) 12

64) Let a vector$\vec{a}$ has a magnitude 9. Let a vector $\vec{b}$ be such that for every $(x, y) \in R \times R - (0, 0)$, the vector $(x\vec{a} + y\vec{b})$ is perpendicular to the vector $(6y\vec{a} - 18x\vec{b})$. Then the value of $|\vec{a} \times \vec{b}|$ is equal to: **[4]**
a) 81 b) $27\sqrt{3}$
c) 9 d) $9\sqrt{3}$

65) Let the mean and variance of 12 observations be$\frac{9}{2}$ and 4 respectively. Later on, it was observed that two observations were considered as 9 and 10 instead of 7 and 14 respectively. If the correct variance is $\frac{m}{n}$, where m and n are co - prime, then m + n is equal to **[4]**
a) 317 b) 316
c) 315 d) 314

66) In a class of 60 students, 40 opted for NCC, 30 opted for NSS and 20 opted for both NCC and NSS. If one of these students is selected at random, then the probability that the student selected has opted neither for NCC nor for NSS is: **[4]**
a) $\frac{1}{3}$ b) $\frac{1}{6}$
c) $\frac{2}{3}$ d) $\frac{5}{6}$

67) A man is walking towards a vertical pillar in a straight path, at a uniform speed. At a certain point A on the path, he observes that the angle of elevation of the top of the pillar is 30°. After walking for 10 min from A in the same direction, at a point B, he observes that the angle of elevation of the top of the pillar is 60°. Then, the time taken (in minutes) by him, from B to reach the pillar, is **[4]**
a) 10 b) 5
c) 20 d) 6

68) Let P(3, 3) be a point on the hyperbola$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. If the normal to it at P intersects the x - axis at (9, 0)

and e is its eccentricity, then the ordered pair (a^2, e^2) is equal to: **[4]**

a) (9, 3)
b) $\left(\frac{9}{2}, 2\right)$
c) $\left(\frac{3}{2}, 2\right)$
d) $\left(\frac{9}{2}, 3\right)$

69) A survey shows that 73% of the persons working in an office like coffee, whereas 65% like tea. If x denotes the percentage of them, who like both coffee and tea, then x cannot be: **[4]**

a) 38 b) 36
c) 63 d) 54

70) If P is a 3× 3 real matrix such that P^T = aP + (a - 1)I, where a > 1, then **[4]**

a) |Adj P| > 1
b) P is a singular matrix
c) |Adj P| = 1
d) |Adj P| =$\frac{1}{2}$

MATHS (Section-B)

71) Let$\vec{a}$ and $\vec{b}$ be two vectors such that $|\vec{a}| = \sqrt{14}, |\vec{b}| = \sqrt{6}$ and $|\vec{a} \times \vec{b}| = \sqrt{48}$. Then $(\vec{a} \cdot \vec{b})^2$ is equal to _____. **[4]**

72) Let [t]denotes the greatest integer function. If$\int_0^{2.4} [x^2]\, dx = \alpha+\beta\sqrt{2}+\gamma\sqrt{3}+\delta\sqrt{5}$, then $\alpha+\beta+\gamma+\delta$ is equal to _____. **[4]**

73) The number of matrices A =$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$, where a, b, c, d ∈ - 1, 0, 1, 2, 3,..., 10 such that A = A^{-1}, is _____. **[4]**

74) For the two positive numbers a, b, if a, b and$\frac{1}{18}$ are in a geometric progression, while $\frac{1}{a}$, 10 and $\frac{1}{b}$ are in an arithmetic progression, then, 16a + 12b is equal to _____. **[4]**

75) There are ten boys B_1, B_2, ..., B_{10} and five girls G_1,G_2, ..., G_5 in a class. Then the number of ways of forming a group consisting of three boys and three girls, if both B_1 and B_2 together should not be the members of a group, is _____. **[4]**