SATISH SCIENCE ACADEMY
DHANORI PUNE - 411015

JEE MAIN
ENTRANCE EXAM - JEE MAIN

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

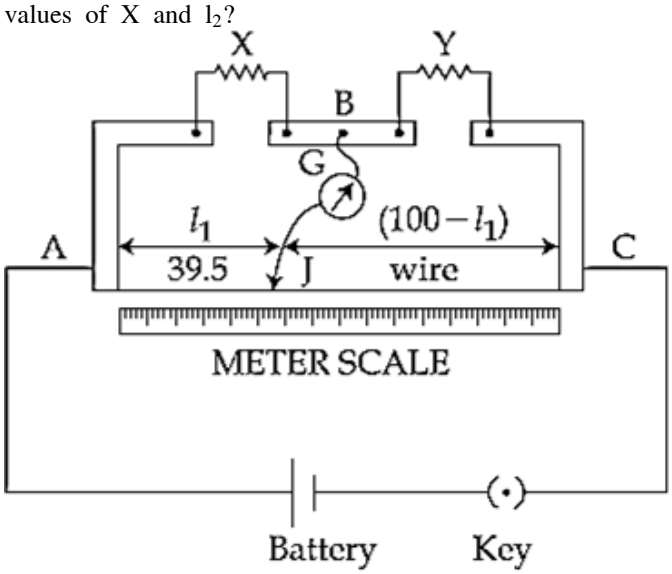
General Instructions:

- 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) Amount of solar energy received on the earth's surface per unit area per unit time is defined a solar constant. Dimension of solar constant is: **[4]**
   a) $M^2L^0T^{-1}$ b) MLT^{-2}
   c) ML^0T^{-3} d) ML^2T^{-2}

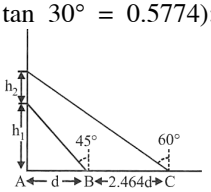
2) In a meter bridge, as shown in the figure, it is given that resistance Y = 12.5Ω and that the balance is obtained at a distance 39.5 cm from end A (by jockey J). After interchanging the resistances X and Y, a new balance point is found at a distance l_2 from end A. What are the values of X and l_2?



[4]

a) 8.16Ω and 60.5 cm
b) 8.16Ω and 39.5 cm
c) 19.15Ω and 39.5 cm
d) 19.15Ω and 60.5 cm

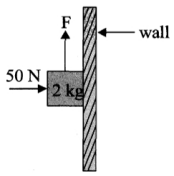
3) A balloon is moving up in air vertically above a point A on the ground. When it is at a height h_1, a girl standing at a distance d (point B) from A (see figure) sees it at an angle 45° with respect to the vertical. When the balloon climbs up a further height h_2, it is seen at an angle 60° with respect to the vertical if the girl moves further by a distance 2.464 d (point C). Then the height $h_2$is (given tan 30° = 0.5774):



[4]

a) D b) 0.464 d
c) 1.464 d d) 0.732 d

4) A 2 kg block is pushed against a vertical wall by applying a horizontal force of 50 N. The coefficient of static friction between the block and the wall is 0.5. A force F is also applied on the block vertically upward (as shown in figure). The maximum value of F applied, so that the block does not move upward, will be:



[4]

a) 20 N b) 45 N
c) 25 N d) 10 N

5) The ratio of powers of two motors is $\frac{3\sqrt{x}}{\sqrt{x}+1}$, that are capable of raising 300kg water in 5 minutes and 50kg water in 2 minutes respectively from a well of 100m deep. The value of x will be **[4]**
   a) 24 b) 2
   c) 4 d) 16

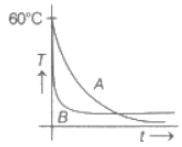
6) A homogeneous solid cylindrical roller of radius R and mass m is pulled on a cricket pitch by a horizontal force. Assuming rolling without slipping, angular acceleration of the cylinder is
[4]

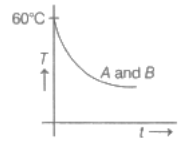
a) $\frac{2F}{3mR}$
b) $\frac{3F}{2mR}$
c) $\frac{F}{3mR}$
d) $\frac{F}{2mR}$

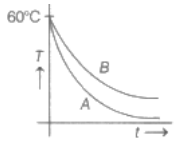
7) Air of density 1.2 kg m^{-3} is blowing across the horizontal wings of an aeroplane in such a way that its speeds above and below the wings are 150 ms^{-1} and 100 ms^{-1}, respectively. The pressure difference between the upper and lower sides of the wings, is: **[4]**
   a) 12500 Nm^{-2} b) 180 Nm^{-2}
   c) 60 Nm^{-2} d) 7500 Nm^{-2}

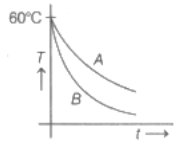
8) A metal ball of mass 0.1 kg is heated upto 500°C and dropped into a vessel of heat capacity 800 JK^{-1} and containing 0.5 kg water. The initial temperature of water and vessel is 30°C. What is the approximate percentage increment in the temperature of the water? [Specific Heat Capacities of water and metal are, respectively, 4200 $Jkg^{-1}K^{-1}$ and 400 $Jkg^{-1}K^{-1}$][4]
   a) 25% b) 15%
   c) 30% d) 20%

9) Two identical beakers A and B contain equal volumes of two different liquids at 60°C each and left to cool down. The liquid in A has density of 8×10^2kg/m^3 and specific heat of 2000 Jkg^{-1}K^{-1} while liquid in B has density of 10^3 kgm^{-3} and specific heat of 4000 Jkg^{-1}K^{-1}. Which of the following best describes their temperature versus time graph schematically? (Assume the emissivity of both the beakers to be the same) **[4]**

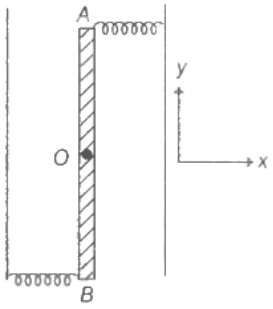
a) 

b) 

c) 

d) 

10) Two light identical springs of spring constant k are attached horizontally at the two ends of an uniform horizontal rod AB of length l and mass m The rod is pivoted at its centre 'O' and can rotate freely in horizontal plane. The other ends of the two springs are fixed to rigid supports as shown in figure.



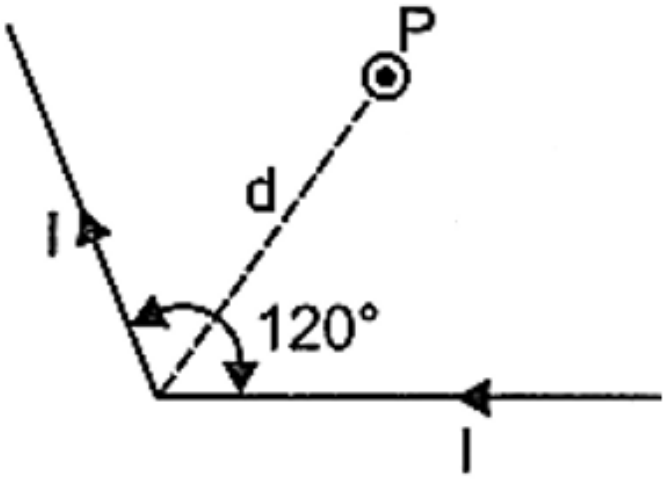
The rod is gently pushed through a small angle and released. The frequency of resulting oscillation is **[4]**

a) $\frac{1}{2\pi}\sqrt{\frac{2k}{m}}$
b) $\frac{1}{2\pi}\sqrt{\frac{6k}{m}}$
c) $\frac{1}{2\pi}\sqrt{\frac{3k}{m}}$
d) $\frac{1}{2\pi}\sqrt{\frac{k}{m}}$

11) A slab of dielectric constant K has the same cross sectional area as the plate of a parallel plate capacitor and thickness $\frac{3}{4}$ d, where d is the separation of plates.
The capacitance of the capacitor when the slab is inserted between the plates will be:
(Given C_0 = capacitance of capacitor with air as medium between plates.) **[4]**

a) $\frac{K}{4+K}$ b) $\frac{4KC_0}{3+K}$
c) $\frac{3+K}{4KC_0}$ d) $\frac{3KC_0}{3+K}$

12) A long conducting wire carrying a current I is bent at 120° (see figure). The magnetic field B at a point P on the right bisector of bending angle at a distance d from the bend is : (μ_0 is the permeability of free space).



[4]

a) $\frac{3\mu_0 I}{2\pi d}$
b) $\frac{\mu_0 I}{2\pi d}$
c) $\frac{\sqrt{3}\mu_0 I}{2\pi d}$
d) $\frac{\mu_0 I}{\sqrt{3}\pi d}$

13) A soft ferromagnetic material is placed in an external magnetic field. The magnetic domains: **[4]**

a) May increase or decrease in size and change its orientation
b) Decrease in size and changes orientation
c) Have no relation with external magnetic field
d) Increase in size but no change in orientation

14) An ideal capacitor of capacitance 0.2μ F is charged to a potential difference of 10 V. The charging battery is then disconnected. The capacitor is then connected to an ideal inductor of self inductance 0.5 mH. The current at a time when the potential difference across the capacitor is 5V, is: **[4]**

a) 0.17 A b) 0.25 A
c) 0.34 A d) 0.15 A

15) The percentage decrease in the weight of a rocket, when taken to a height of 32 km above the surface of earth will, be: (Radius of earth = 6400 km) **[4]**

a) 1% b) 3%
c) 4% d) 0.5%

16) The waves emitted when a metal target is bombarded with high energy electrons are **[4]**

a) Radio waves b) Microwaves
c) Infrared rays d) X - rays

17) An electron with speed v and a photon with speed c have the same de Broglie wavelength. If the kinetic energy and momentum of electrons is E_e and P_e and that of photon is E_{ph} and P_{ph} respectively, then the correct option is: **[4]**

a) $\frac{P_e}{P_{ph}} = \frac{2c}{v}$
b) $\frac{E_e}{E_{ph}} = \frac{2c}{v}$
c) $\frac{P_e}{P_{ph}} = \frac{v}{2c}$
d) $\frac{E_e}{E_{ph}} = \frac{v}{2c}$

18) A particle of mass m moves in a circular orbit in a central potential field U(r) =$\frac{1}{2}kr^2$. If Bohr's quantization conditions are applied, radii of possible orbitals and energy levels vary with quantum number n as **[4]**

a) $r_n \propto \sqrt{n}, E_n \propto n$
b) $r_n \propto \sqrt{n}, E_n \propto \frac{1}{n}$
c) $r_n \propto n^2, E_n \propto \frac{1}{n^2}$
d) $r_n \propto n, E_n \propto n$

19) Imagine that a reactor converts all given mass into energy and that it operates at a power level of 10^9 watt. The mass of the fuel consumed per hour in the reactor will be: (velocity of light, c is 3×10^8m/s) **[4]**

a) 0.8 gm
b) 6.6×10^{-5} gm
c) 0.96 gm
d) 4×10^{-2} gm

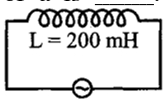
20) With increasing biasing voltage of a photodiode, the photocurrent magnitude: **[4]**

a) Increases linearly
b) Increases initially and saturates finally
c) Increases initially and after attaining certain value, it decreases
d) Remains constant

PHYSICS (Section-B)

21) A particle is moving in a straight line such that its velocity is increasing at 5 ms^{-1} per meter. The acceleration of the particle is _____ ms^{-2} at a point where its velocity is 20 ms^{-1}. **[4]**

22) As shown in the figure an inductor of inductance 200 mH is connected to an AC source of emf 220 V and frequency 50 Hz. The instantaneous voltage of the source is 0 V when the peak value of current is $\frac{\sqrt{a}}{\pi}$ A. The value of a is _____.



[4]

23) A ray of light is incident at an angle of incidence 60° on the glass slab of refractive index $\sqrt{3}$. After refraction, the light ray emerges out from other parallel faces and lateral shift between incident ray and emergent ray is $4\sqrt{3}$ cm. The thickness of the glass slab is _____ cm. **[4]**

24) A proton with a kinetic energy of 2.0 eV moves into a region of uniform m agnetic field of magnitude $\frac{\pi}{2} \times 10^{-3}$ T. The angle between the direction of magnetic field and velocity of proton is 60°. The pitch of the helical path taken by the proton is___cm . (Take, mass of proton = 1.6×10^{-27} kg and Charge on proton = 1.6×10^{-19} C). **[4]**

25) A certain pressure**P** is applied to 1 litre of water and 2 litre of a liquid separately. Water gets compressed to 0.01% whereas the liquid gets compressed to 0.03%. The ratio of Bulk modulus of water to that of the liquid is $\frac{3}{x}$. The value of x is _____. **[4]**

CHEMISTRY (Section-A)

26) The de - Broglie wavelength (λ) associated with a photoelectron varies with the frequency (ν)of the incident radiation as, [ν_o is threshold frequency]**[4]**

a) $\lambda \propto \frac{1}{(\nu-\nu_0)^{\frac{1}{2}}}$
b) $\lambda \propto \frac{1}{(\nu-\nu_0)^{\frac{3}{2}}}$
c) $\lambda \propto \frac{1}{(\nu-\nu_0)^{\frac{1}{4}}}$
d) $\lambda \propto \frac{1}{(\nu-\nu_0)}$

27) The set of elements that differ in mutual relationship from those of the other sets is **[4]**

a) Li - Na
b) B - Si
c) Be - Al
d) Li - Mg

28) Following four solutions are prepared by mixing different volumes of NaOH and HCl of different concentrations, pH of which one of them will be equal to 1? **[4]**

a) 55 mL $\frac{M}{10}$ HCl + 45 mL $\frac{M}{10}$ NaOH
b) 60 mL $\frac{M}{10}$ HCl + 40 mL $\frac{M}{10}$ NaOH
c) 100 mL $\frac{M}{10}$ HCl + 100 mL $\frac{M}{10}$ NaOH
d) 75 mL $\frac{M}{5}$ HCl + 25 mL $\frac{M}{5}$ NaOH

29) Given:

i. C(graphite) + $O_2(g) \longrightarrow CO_2(g)$; $\Delta_r H^{\ominus}$ = x kJ mol^{-1}
ii. C(graphite) + $\frac{1}{2}$ $O_2(g) \longrightarrow CO_2(g)$; $\Delta_r H^{\ominus}$ = y kJ mol^{-1}
iii. $CO(g) + \frac{1}{2} O_2(g) \longrightarrow CO_2(g)$; $\Delta_r H^{\ominus}$ = z kJ mol^{-1}

Based on the above thermochemical equations, find out which one of the following algebraic relationships is correct? **[4]**

a) Z = x + y
b) X = y + z
c) Y = 2z - x
d) X = y - z

30) The gas phase reaction $2NO_2(g) \longrightarrow N_2O_4(g)$ is an exothermic reaction. The decomposition of N_2O_4, in equilibrium mixture of $NO_2(g)$ and $N_2O_4(g)$, can be increased by: **[4]**

a) Addition of an inert gas at constant volume
b) Lowering the temperature
c) Increasing the pressure
d) Addition of an inert gas at constant pressure

31) The oxidation states of sulphur in the anions $SO_3^{2-}, S_2O_4^{2-}$ and $S_2O_6^{2-}$ follow the order: **[4]**

a) $SO_3^{2-} < S_2O_4^{2-} < S_2O_6^{2-}$
b) $S_2O_6^{2-} < S_2O_3^{2-} < S_2O_4^{2-}$
c) $S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$
d) $S_2O_4^{2-} < S_2O_6^{2-} < SO_3^{2-}$

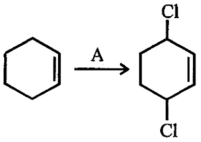
32) Compound with molecular formula C_3H_6O can show **[4]**

a) Functional group isomerism
b) Positional isomerism
c) Both positional isomerism and metamerism
d) Metamerism

33) The compound that cannot act both as oxidising and reducing agent is: **[4]**

a) H_2SO_3
b) H_2O_2
c) HNO_2
d) H_3PO_4

34)



Identify the reagent(s) **A** and condition(s) for the reaction. **[4]**

a) A = HCl; Anhydrous $AlCl_3$
b) A = Cl_2; dark, Anhydrous $AlCl_3$
c) A = HCl, $ZnCl_2$
d) A = Cl_2; UV light

35) Vapour pressure of pure benzene is 119 torr and that of toluene is 37.0 torr at the same temperature. Mole fraction of toluene in vapour phase which is in equilibrium with a solution of benzene and toluene having a mole fraction of toluene 0.50, will be: **[4]**

a) 0.205 b) 0.137
c) 0.237 d) 0.435

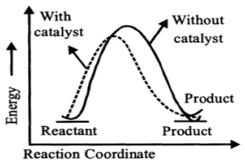
36) Two open beakers one containing a solvent and the other containing a mixture of that solvent with a non - volatile solute are together sealed in a container. Over time: **[4]**

a) The volume of the solution increases and the volume of the solvent decreases
b) The volume of the solution decreases and the volume of the solvent increases
c) The volume of the solution and the solvent does not change
d) The volume of the solution does not change and the volume of the solvent decreases

37) To find the standard potential of $\frac{M^{3+}}{M}$ electrode, the following cell is constituted: Pt/M/M^{3+}(0.001 mol L^{-1})/ Ag^{+}(0.01 mol L^{-1})/Ag
The emf of the cell is found to be 0.421 volt at 298 K. The standard potential of half reaction $M^{3+} + 3e^{-} \longrightarrow M$ at 298 K will be: (Given $\frac{E^{\circ}_{Ag+}}{Ag}$ at 298 K = 0.80 Volt) **[4]**

a) 1.28 Volt b) 0.38Volt
c) 0.32 Volt d) 0.66 Volt

38) The correct reaction profile diagram for a positive catalyst reaction. **[4]**

a)


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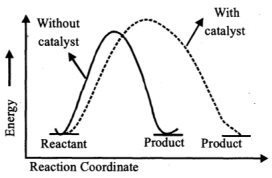

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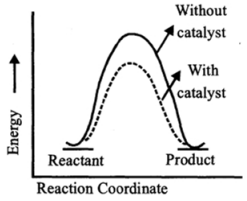

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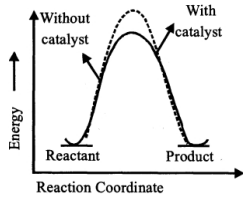


39) Aqueous solution of which of the following compounds is the best conductor of electric current? **[4]**

a) Acetic acid, $C_2H_4O_2$
b) Hydrochloric acid, HCl
c) Ammonia, NH_3
d) Fructose, $C_6H_{12}O_6$

40) When the first electron gain enthalpy $(\Delta_{e_g}H)$ of oxygen is - 141 kJ/mol, its second electron gain enthalpy is **[4]**

a) A more negative value than the first
b) Almost the same as that of the first
c) A positive value
d) Negative, but less negative than the first

41) The calculated spin only magnetic moments (BM) of the anionic and cationic species of $[Fe(H_2O)_6]_2$ and $[Fe(CN)_6]$, respectively, are **[4]**

a) 0 and 5.92 b) 2.84 and 5.92
c) 0 and 4.9 d) 4.9 and 0

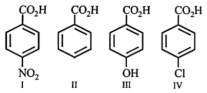
42) The major product of the following reaction is:
$CH_3CH_2C\_|\_BrH-C\_|\_BrH_2 \xrightarrow[(ii)\ NaNH_2]{(i)\ KOH\ alc.} \_in\ liq.\ NH_3$
[4]

a) $CH_3CH_2C\_|H\_NH_2 - C\_|H_2\_NH_2$
b) $CH_3CH{=}C{=}CH_2$
c) $CH_3CH{=}CHCH_2NH_2$
d) $CH_3CH_2C{\equiv}CH$

43) Phenol on heating with $CHCl_3$ and NaOH gives salicylaldehyde. The reaction is called: **[4]**

a) Cannizzaro's reaction
b) Reimer - Tiemann reaction
c) Hell - Volhard - Zelinsky reaction
d) Claisen reaction

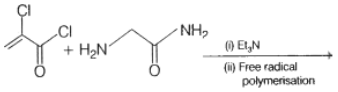
44) The increasing order of the acidity of the following carboxylic acids is:



[4]

a) I < III < II < IV b) IV < II < III < I
c) III < II < IV < I d) II < IV < III < I

45) Major product of the following reaction is



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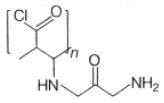
a)


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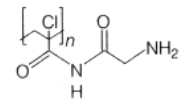

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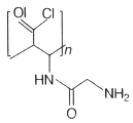

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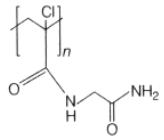
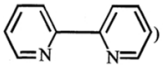


CHEMISTRY (Section-B)

46) The Azimuthal quantum number for the valence electrons of Ga^{+} ion is ____.
(Atomic number of Ga = 31) **[4]**

47) For the first order reaction A→ B the half life is 30 min. The time taken for 75% completion of the reaction is ____ min. (Nearest integer)
Given: log 2 = 0.3010
log 3 =0.4771
log 5 = 0.6989 **[4]**

48) Sum of oxidation state (magnitude) and coordination number of cobalt in Na[Co(bpy)Cl_4]is ____.

(Given bpy = )

[4]

49) The cell potential for the given cell at 298 K
$Pt|H_2(g, 1\ bar)|H^+(aq)||Cu^{2+}(aq)|Cu(s)$ is 0.31 V. The pH of the acidic solution is found to be 3, whereas the concentration of Cu^{2+} is 10^{-x} M. The value of x is ____.
(Given $E^o_{\frac{Cu^{2+}}{Cu}} = 0.34$ V and $\frac{2.303RT}{F} = 0.06$V) **[4]**

50) The number of species from the following which have square pyramidal structure is
PF_5, BrF_4^-, IF_5; BrF_5, $XeOF_4$, ICl_4^- **[4]**

MATHS (Section-A)

51) Which of the following is not correct for relation R on the set of real numbers? **[4]**

a) $(x, y) \in R \Leftrightarrow 0 < |x - y| \leq 1$ is symmetric and transitive.
b) $(x, y) \in R \Leftrightarrow 0 < |x| - |y| \leq 1$ is neither transitive nor symmetric.
c) $(x, y) \in R \Leftrightarrow |x - y) \leq 1$ is reflexive and symmetric.
d) $(x, y) \in R \Leftrightarrow |x| - |y| \leq 1$ is reflexive but not symmetric.

52) The real part of the complex number $\frac{(1+2i)^8 \cdot (1-2i)^2}{(3+2i)\cdot\overline{(4-6i)}}$ is equal to: **[4]**
a) $\frac{550}{13}$ b) $\frac{110}{13}$
c) $\frac{55}{6}$ d) $\frac{500}{13}$

53) The number of ways of selecting 15 teams from 15 men and 15 women, such that each team consists of a man and a woman, is: **[4]**
a) 1120 b) 1960
c) 1240 d) 1880

54) The positive value of λ for which the coefficient of x^2 in the expression $x^2\left(\sqrt{x} + \frac{\lambda}{x^2}\right)^{10}$ is 720, is **[4]**
a) $2\sqrt{2}$ b) $\sqrt{5}$
c) 3 d) 4

55) Let the first term a and the common ratio r of a geometric progression be positive integers. If the sum of its squares of first three terms is 33033, then the sum of these three terms is equal to **[4]**
a) 231 b) 241
c) 210 d) 220

56) If $y(\alpha) = \sqrt{2\left(\frac{\tan\alpha+\cot\alpha}{1+\tan^2\alpha}\right) + \frac{1}{\sin^2\alpha}}$, $\alpha \in \left(\frac{3\pi}{4}, \pi\right)$, then $\frac{dy}{d\alpha}$ at $\alpha = \frac{5\pi}{6}$ is: **[4]**
a) - 4 b) 4
c) $-\frac{1}{4}$ d) $\frac{4}{3}$

57) The sum of the absolute maximum and absolute minimum values of the function $f(x) = \tan^{-1}(\sin x - \cos x)$ in the interval $[0, \pi]$ is: **[4]**

a) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right) - \frac{\pi}{4}$
b) 0
c) $\tan^{-1}\left(\frac{1}{\sqrt{2}}\right) - \frac{\pi}{4}$
d) $\frac{-\pi}{12}$

58) $\int_0^2 \left(\left|2x^2 - 3x\right| + \left[x - \frac{1}{2}\right]\right) dx$, where [t] is the greatest integer function, is equal to: **[4]**
a) $\frac{3}{2}$ b) $\frac{31}{12}$
c) $\frac{19}{12}$ d) $\frac{7}{6}$

59) The combined equation of the two lines ax + by + c = 0 and a'x + b'y + c' = 0 can be written as (ax + by + c) (a'x + b'y + c') = 0.
The equation of the angle bisectors of the lines represented by the equation $2x^2 + xy - 3y^2 = 0$ is **[4]**
a) $X^2 - y^2 - 10xy = 0$ b) $3x^2 + 5xy + 2y^2 = 0$
c) $X^2 - y^2 + 10xy = 0$ d) $3x^2 + xy - 2y^2 = 0$

60) A circle cuts a chord of length 4a on the X - axis and passes through a point on the Y - axis, distant 2b from the origin. Then, the locus of the centre of this circle, is **[4]**
a) A hyperbola b) A straight line
c) A parabola d) An ellipse

61) The tangents to the curve $y = (x - 2)^2 - 1$ at its points of intersection with the line x - y = 3, intersect at the point **[4]**

a) $\left(\frac{5}{2}, -1\right)$
b) $\left(\frac{5}{2}, 1\right)$
c) $\left(-\frac{5}{2}, 1\right)$
d) $\left(-\frac{5}{2}, -1\right)$

62) The general solution of the differential equation, $\sin 2x\left(\frac{dy}{dx} - \sqrt{\tan x}\right) - y = 0$, is: **[4]**

a) $y\sqrt{\cot x} = x + c$
b) $y\sqrt{\tan x} = \cot x + c$
c) $y\sqrt{\cot x} = \tan x + c$
d) $y\sqrt{\tan x} = x + c$

63) Let the lines $l_1 : \frac{x+5}{3} = \frac{y+4}{1} = \frac{z-\alpha}{-2}$ and $l_2 : 3x + 2y + z - 2 = 0 = x - 3y + 2z - 13$ be coplanar. If the point P (a, b, c) on l_1 is nearest to the point Q(- 4, - 3, 2), then |a| + |b| + |c| is equal to **[4]**
a) 12 b) 8
c) 10 d) 14

64) Let the position vectors of the points A, B, C and D be $5\hat{i}+5\hat{j}+2\lambda\hat{k}, \hat{i}+2\hat{j}+3\hat{k}, -2\hat{i}+\lambda\hat{j}+4\hat{k}$ and $-\hat{i}+5\hat{j}+6\hat{k}$. Let the set $S = \lambda \in R$: The points A, B, C and D are coplanar. Then $\sum_{\lambda\in S}(\lambda+2)^2$ is equal to **[4]**
a) 41 b) 13
c) 25 d) $\frac{37}{2}$

65) The mean and variance of 7 observations are 8 and 16 respectively. If two observations are 6 and 8, then the variance of the remaining 5 observations is: **[4]**
a) $\frac{536}{25}$ b) $\frac{112}{5}$
c) $\frac{92}{5}$ d) $\frac{134}{5}$

66) In a box, there are 20 cards, out of which 10 are labelled as A and the remaining 10 are labelled as B. Cards are drawn at random, one after the other and with replacement, till a second A - card is obtained. The probability that the second A - card appears before the third B - card is: **[4]**
a) $\frac{13}{16}$ b) $\frac{9}{16}$
c) $\frac{15}{16}$ d) $\frac{11}{16}$

67) The angle of elevation of the top of a vertical tower standing on a horizontal plane is observed to be 45° from a point A on the plane. Let B be the point 30 m vertically above the point A. If the angle of elevation of the top of the tower from B be 30°, then the distance (in m) of the foot of the tower from the point A is **[4]**
a) $15(5 - \sqrt{3})$ b) $15(1 + \sqrt{3})$
c) $15(3 - \sqrt{3})$ d) $15(3 + \sqrt{3})$

68) If the eccentricity of the standard hyperbola passing through the point (4, 6) is 2, then the equation of the tangent to the hyperbola at (4, 6) is **[4]**

a) 3x - 2y = 0 b) 2x - 3y + 10 = 0
c) 2x - y - 2 = 0 d) X - 2y + 8 = 0

69) Let f(x) = x^2 ,x $\in$ R. For any A $\subseteq$ R, define g(A) = x $\in$ R : f(x) $\in$ A. If S = [0,4], then which one of the following statements is not true? **[4]**

a) F(g(S))$\neq$ f(S) b) G(f(S)) = g(S)
c) F(g(S)) = S d) G(f(S))$\neq$ S

70) The system of linear equations x +λ y - z = 0, λ x - y - z = 0, x + y - λ z = 0 has a non - trivial solution for **[4]**

a) Exactly one value ofλ
b) Exactly three values ofλ
c) Infinitely many values ofλ
d) Exactly two values ofλ

MATHS (Section-B)

71) A line**L** passing through origin is perpendicular to the lines
$L_1 : \vec{r} = (3+t)\hat{i} + (-1+2t)\hat{j} + (4+2t)\hat{k}$
$L_2 : \vec{r} = (3+2s)\hat{i} + (3+2s)\hat{j} + (2+s)\hat{k}$
If the co - ordinates of the point in the first octant on $\mathbf{L_2}$ at a distance of $\sqrt{17}$ from the point of intersection of **L** and $\mathbf{L_1}$ are (a, b, c) then 18(a + b + c) is equal to _____. **[4]**

72) If the area of the region bounded by the curves y^2 - 2y = - x, x + y = 0 is A, then 8 A is equal to **[4]**

73) If the matrix A = $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 3 & 0 & -1 \end{bmatrix}$ satisfies the equation $A^{20} + \alpha A^{19} + \beta A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ for some real numbers α and β , then $\beta - \alpha$ is equal to _____. **[4]**

74) Let a_1, a_2, a_3,... be a GP of increasing positive numbers. If the product of fourth and sixth terms is 9 and the sum of fifth and seventh terms is 24, then $a_1a_9 + a_2a_4a_9 + a_5 + a_7$ is equal to _____. **[4]**

75) Let the digits a, b, c be in A.P. Nine - digit numbers are to be 40. formed using each of these three digits thrice such that three consecutive digits are in A.P. at least once. How many such numbers can be formed? **[4]**