SHIKSHA CLASSES, BHANDARA

TEST-6

CHEMISTRY , PHYSICS, MATHEMATICS

Time : - 3 Hours **Max. Marks:- 300** **Date : .....**

INSTRUCTIONS :

1. The test is of 3 hours duration.
2. The Test Booklet consists of 90 questions. The maximum marks are **300.**
3. There are three parts in the question paper A, B, C consisting of Chemistry, Physics and Mathematics having **30questions** in each part of equal weightage. **20 questions** will be **MCQs** and **10 questions** (**ATTEMPT ANY FIVE QUESTIONS OUT OF 10**)will have answer to be filled as **numerical value**.
   Marking Scheme for MCQs
   Correct Answer Four mark (+4), Incorrect Answer Minus one mark (–1), Unanswered No mark (0)
   Marking Scheme for questions for which answer is a **Numerical value**
   Correct Answer Four mark (+4), Incorrect Answer No mark (0), Unanswered No mark (0)
4. There is only one correct response for each question. Filling up more than one response in each question will be treated as wrong response and marks for wrong response will be deducted accordingly.

SYLLABUS

CHEMISTRY: GENERAL PRINCIPLES AND PROCESSES OF ISOLATION OF METALS, p- BLOCK ELEMENTS - GROUP 15, 16, 17 AND GROUP 18, d- AND f-BLOCK ELEMENTS, CO-ORDINATION COMPOUNDS.

PHYSICS : ELECTROMAGNETIC INDUCTION AND ALTERNATING CURRENTS, ELECTROMAGNETIC WAVES

MATHEMATICS : LIMITS, CONTINUITY AND DIFFERENTIABILITY, DIFFERENTIATION, APPLICATION OF DERIVATIVES

The art of being wise is the art of knowing what to overlook.

Today a reader, tomorrow a leader

Name : .....

Address : .....

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Phone/Mobile No. .....

Roll No. .....

PART A – CHEMISTRY

SECTION - 1 (Q.1 - Q.20)

Each question has FOUR options (1), (2), (3) and (4). ONLY ONE of these four options is correct.

Q.1 Which of following species represent mixed anhydride ?

(1) N_2O_5 (2) Cl_2O_6

(3) N_2O_4 (4) Both 2 and 3

Q.2 Which of the following complex ion is the most stable?

(1) $[Co(NH_3)_6]^{3+}$ (2) $[CoCl_6]^{3-}$

(3) $[CoF_6]^{3-}$ (4) $[Co(H_2O)_6]^{3+}$

Q.3 Which of the following gives chromyl chloride test

(1) KCl (2) $PbCl_2$

(3) $HgCl_2$ (4) All

Q.4 Which of the following does not give oxygen on heating ?

(1) $(NH_4)_2Cr_2O_7$ (2) $KClO_3$

(3) $Zn(ClO_3)_2$ (4) $K_2Cr_2O_7$

Q.5 Compounds with spin-only magnetic moment equivalent to five unpaired electrons are

(a) $K_4[Mn(CN)_6]$ (b) $[Fe(H_2O)_6]Cl_3$

(c) $K_3[FeF_6]$ (d) $K_4[MnF_6]$

(1) a, b, c (2) b, c, d

(3) a, c, d (4) a, b, d

Q.6 Which of the following complexes possess meridional isomer?

(1) $[Co(NH_3)_3Cl_3]$ (2) $[Co(NH_3)_4Cl_2]$

(3) $[Co(NH_3)_2Cl_4]$ (4) $[Co(NH_3)_5Cl]$

Q.7 Which of the following group of compounds are extinguisher, antiseptic, insecticide and anesthetic respectively?

(1) $CHCl_3$, CHI_3, DDT, CCl_4

(2) DDT, $CHCl_3$, CCl_4, CHI_3

(3) CCl_4, CHI_3, DDT, $CHCl_3$

(4) CCl_4, CHI_3, $CHCl_3$, DDT

Q.8 Which of the following mineral of Iron is in the form of carbonate?

(1) Haematite (2) Siderite

(3) Magnetite (4) Iron Pyrites

Q.9 Among the following oxoacid, the correct decreasing order of acid strength is ?

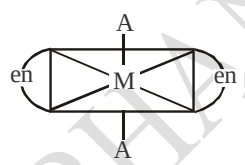
(1) $HClO_4 > HClO_3 > HClO_2 > HOCl$

(2) $HClO > HClO_3 > HClO_2 > HClO_4$

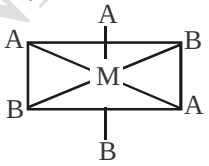
(3) $HOCl > HClO_2 > HClO_3 > HClO_4$

(4) $HClO_2 > HClO_4 > HClO > HClO_3$

Q.10 The one that will show optical activity is :
(en = ethane-1,2-diamine)



(1)



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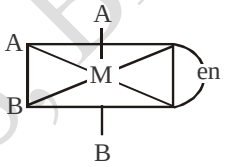

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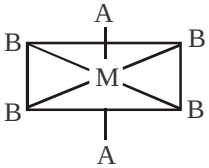

(4)

Q.11 Match the refining methods (Column I) with metals (Column II).

Column I (Refining methods)	**Column II (Metals)**
(I) Liquation	(a) Zr
(II) Zone Refining	(b) Ni
(III) Mond Process	(c) Sn
(IV) Van Arkel Method	(d) Ga

(1) (I) – (b); (II) – (c); (III) – (d); (IV) – (a)

(2) (I) – (b); (II) – (d); (III) – (a); (IV) – (c)

(3) (I) – (c); (II) – (a); (III) – (b); (IV) – (d)

(4) (I) – (c); (II) – (d); (III) – (b); (IV) – (a)

Q.12 **Assertion :** For the extraction of iron, haematite ore is used.

Reason : Haematite is a carbonate ore of iron.

(1) Only the reason is correct.

(2) Both the assertion and reason are correct and the reason is the correct explanation for the assertion.

(3) Only the assertion is correct.

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(4) Both the assertion and reason are correct, but the reason is not the correct explanation for the assertion.

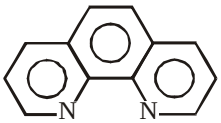
Q.13 The correct statement is :

(1) leaching of bauxite using concentrated NaOH solution gives sodium aluminate and sodium silicate.

(2) the blistered appearance of copper during the metallurgical process is due to the evolution of CO_2.

(3) pig iron is obtained from cast iron

(4) the Hall-Heroult process is used for the production of aluminium and iron.

Q.14 The complex ion that will lose its crystal field stabilization energy upon oxidation of its metal to +3 state is (Phen = 

and ignore pairing energy)

(1) $[Fe(phen)_3]^{2+}$ (2) $[Zn(phen)_3]^{2+}$

(3) $[Ni(phen)_3]^{2+}$ (4) $[Co(phen)_3]^{2+}$

Q.15 Consider the hydrates ions of Ti^{2+}, V^{2+}, Ti^{3+} and Sc^{3+}. The correct order of their spin-only magnetic moments is :

(1) $Sc^{3+} < Ti^{3+} < Ti^{2+} < V^{2+}$

(2) $Ti^{3+} < Ti^{2+} < Sc^{3+} < V^{2+}$

(3) $Sc^{3+} < Ti^{3+} < V^{2+} < Ti^{2+}$

(4) $V^{2+} < Ti^{2+} < Ti^{3+} < Sc^{3+}$

Q.16 The total number of isomers for a square planar complex $[M(F)(Cl)(SCN)(NO_2)]$ is :

(1) 12 (2) 8

(3) 16 (4) 4

Q.17 The coordination numbers of Co and Al in $[Co(Cl)(en)_2]Cl$ and $K_3[Al(C_2O_4)_3]$, respectively, are : (en = ethane-1,2-diamine)

(1) 3 and 3 (2) 6 and 6

(3) 5 and 6 (4) 5 and 3

Q.18 Crystal field stabilization energy (CFSE) for high spin d^4 (tetrahedral complex) is :
Δt = CFSE for tetrahedral

(1) $-0.6\ \Delta t$ (2) $-1.2\ \Delta t$

(3) $-0.4\ \Delta t$ (4) $-1.6\ \Delta t$

Q.19 A Pt complex of NH_3 and Cl produces four ions per molecule in the aq. solution is :-

(1) $PtCl_4.6NH_3$ (2) $PtCl_4.5NH_3$

(3) $PtCl_4.2NH_3$ (4) $PtCl_4.4NH_3$

Q.20 Which of the following is INCORRECT about Tetraaquadithiocyanato-s cobalt(III) tris(oxalato)cobaltate (III)

(1) formula of the complex is $[Co(H_2O)_4(SCN)_2][Co(ox)_3]$

(2) It is chelating complex and show linkage isomerism.

(3) It shows optical isomerism.

(4) It shows geometrical isomerism.

SECTION - 2 (Q.21 - Q.30)

This section contains TEN (10) questions. ATTEMPT ANY FIVE (05) QUESTIONS. The answer to each question is NUMERICAL VALUE. If the numerical value has more than two decimal places truncate/round-off the value upto TWO decimal places.

Q.21 How many following molecules are paramagnetic
KO_2, Na_2O_2, CaO, KF, NO_2, NO

Q.22 Find the number of molecules, when they are undergo in hydrolysis at room temperature and the produced acid from central atom has the basicity of '2'. PCl_5, SF_6, SF_4, P_4O_6, PCl_3

Q.23 How many of the following are tetrahedral?

(a) $Ni(dmg)_2$ (b) $[Ni(CN)_4]^{2-}$

(c) $[Ni(CN)_4]^{4-}$ (d) $[Ni(CO)_4]$

(e) $[Ni(Cl)_4]^{2-}$ (f) $K_2Cr_2O_7$

(g) K_2CrO_4 (h) $KMnO_4$

(i) K_2MnO_4 (j) CrO_2Cl_2

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Q.24 Total no. of correct statements among –

(i) Correct sequence of CO bond order in given compounds : (P) $Fe(CO)_5$, (Q) CO, (R) $H_3B \leftarrow CO$, (S) $Mn(CO)_5]^-$ is $R > Q > P > S$

(ii) $Mn(CO)_6$ can act as reducing agent.

(iii) In $[CuCl_5]^{2-}$ the value of magnetic moment (spin only) is $\sqrt{3}$ BM and outer d-orbitals is used in hybridization.

(iv) [PdClBr (gly)] exhibits geometrical isomerism.

(v) In trans-$[Co(gly)_3]$ racemic mixture is obtained on mixing its mirror images (d & ℓ form) in 1 : 1 molar ratio.

Q.25 Total no. of correct statements among –

(i) NaCl on heating with solid $K_2Cr_2O_7$ and conc. H_2SO_4, Orange red vapours are evolved which turn aqueous NaOH solution yellow.

(ii) $Fe(OH)_3$ can be separated from $Al(OH)_3$ by addition of NaOH solution.

(iii) Octahedral complexes having metal cation with d^3 and d^8 configuration can not be defined in terms of high and low spin complex.

(iv) I.U.P.A.C. name of complex compound is $[Cr(NH_3)_5(CN)][Ir(NO_2)_6]$ - Hexanitrito-N-irridium (III) pentaamminecyanido chromate(II)

Q.26 The number of unpaired electrons in $Cr(CO)_6$ is/are :

Q.27 How many is/are correctly matched ?

(A) Self reduction : Extraction of Pb.
(B) Carbon reduction : Extraction of Na.
(C) Complex formation and displacement by metal Extraction of Ag
(D) Decomposition of iodide : Extraction of Ti
(E) Cyanide process : Extraction of Au
(F) Floatation process : Pine oil
(G) Electrolytic reduction : Extraction of Al
(H) Zone refining : Ultrapure Ge

Q.28 How many of the following sulphides do not dissolve in water as well as dilute HCl ?
$(NH_4)_2S$; NiS ; ZnS ; CuS ; Sb_2S_3 ; SnS ; Ag_2S; PbS ; HgS; CdS ; Na_2S.

Q.29 Consider an equation

$$\alpha\, K_4[Fe(CN)_6] + \beta\, K_2CO_3 + \gamma\, S \xrightarrow{\text{heat}} \text{Products ?}$$

The products are Fe, CO_2, KCNO and KSCN. Find the sum of $\alpha + \beta + \gamma$.

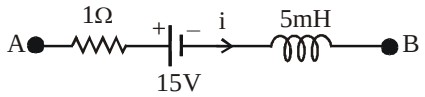
Q.30 Find the no. of unpaired electrons in $\left[Fe(H_2O)_6\right]^{2+}$.

PART B – PHYSICS

SECTION - 1 (Q.31 - Q.50)

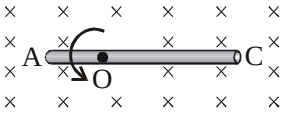
Each question has FOUR options (1), (2), (3) and (4). ONLY ONE of these four options is correct.

Q.31 The network shown in figure is a part of a complete circuit. If at a certain instant the current 'i' is 5 A and is decreasing at the rate of 10^3 A/sec. then $V_A - V_B$ is :-



(1) 5 V (2) 10 V
(3) 15 V (4) 20 V

Q.32 A conducting rod AC of length 4ℓ is rotated about a point O in a uniform magnetic field directed into the paper. AO = ℓ and OC = 3ℓ. Then which is incorrect :-



(1) $|V_A - V_O| = \frac{B\omega\ell^2}{2}$

(2) $|V_O - V_C| = \frac{7}{2}B\omega\ell^2$

(3) $|V_A - V_C| = 4B\omega\ell^2$

(4) $|V_C - V_O| = \frac{9}{2}B\omega\ell^2$

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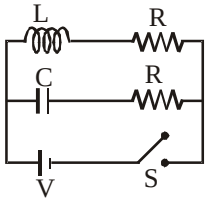
Q.33 In the circuit shown in figure, $R = \sqrt{L/C}$. Switch S is closed at time t = 0. The current through C & L would be equal after a time 't' equal to :-



(1) CR (2) CR ln 2

(3) $\frac{L}{R \ln 2}$ (4) LR

Q.34 In L-C-R, A.C. series circuit, L = 9 H, R = 10Ω & C = 100μF. Hence Q-factor of the circuit is –

(1) 25 (2) 45

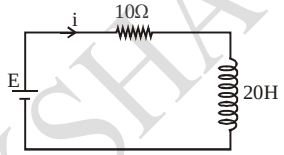
(3) 35 (4) 30

Q.35 The total number of turns and cross-section area in a solenoid is fixed. However, its length L is varied by adjusting the separation between windings. The inductance of solenoid will be proportional to :

(1) $1/L^2$ (2) $1 / L$

(3) L (4) L^2

Q.36 A 20 Henry inductor coil is connected to a 10 ohm resistance in series as shown in figure. The time at which rate of dissipation of energy (joule's heat) across resistance is equal to the rate at which magnetic energy is stored in the inductor is :



(1) $\frac{2}{\ln 2}$ (2) ln 2

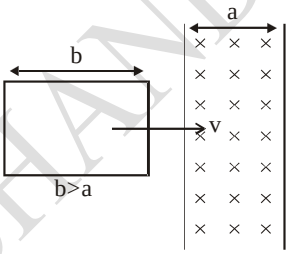
(3) 2 ln 2 (4) $\frac{1}{2}\ln 2$

Q.37 An electromagnetic wave is represented by the electric field $\vec{E} = E_0\hat{n} \sin [\omega t + (6y - 8z)]$. Taking unit vectors in x, y and z directions to be $\hat{i}, \hat{j}, \hat{k}$, the direction of propagation is :

(1) $\hat{s} = \frac{4\hat{j} - 3\hat{k}}{5}$ (2) $\hat{s} = \frac{3\hat{i} - 4\hat{j}}{5}$

(3) $\hat{s} = \frac{-3\hat{j} + 4\hat{k}}{5}$ (4) $\hat{s} = \frac{-4\hat{k} + 3\hat{j}}{5}$

Q.38 In the given arrangement, the loop is moved with constant velocity v in a uniform magnetic field B in a restricted region of width a. The time for which the emf is induced in the circuit is :-



(1) $\frac{2b}{v}$ (2) $\frac{2a}{v}$

(3) $\frac{a+b}{v}$ (4) $\frac{2(a-b)}{v}$

Q.39 A coil of surface area 200 cm^2 having 25 turns is held perpendicular to the magnetic field of intensity 0.02 Wb/m^2. The resistance of the coil is 1Ω. If it is removed from the magnetic field in 1s, the induced charge in the coil is –

(1) 1 C (2) 0.01 C

(3) 0.1 C (4) 0.001 C

Q.40 A plane electromagnetic wave travels in free space along the x-direction. The electric field component of the wave at a particular point of space and time is E = 6 V m^{-1} along y-direction. Its corresponding magnetic field component, B would be :

(1) 6×10^{-8} T along z-direction

(2) 6×10^{-8} T along x-direction

(3) 2×10^{-8} T along z-direction

(4) 2×10^{-8} T along y-direction

Q.41 When a 60 mH inductor and resistor are connected in series with an AC voltage source, the voltage leads the current by 60°. If the inductor is replaced by a 0.5 mF capacitor, the

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voltage lags behind the current by 30°. What is the frequency of the AC supply?

(1) $\frac{1}{2\pi}\times10^4$ Hz (2) $\frac{1}{\pi}\times10^4$ Hz

(3) $\frac{3}{2\pi}\times10^4$ Hz (4) $\frac{1}{2\pi}\times10^8$ Hz

Q.42 The magnetic field of a plane electromagnetic wave is given by :

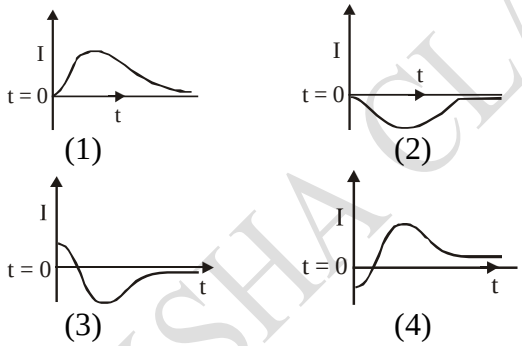
$\vec{B} = B_0\hat{i}\,[\cos(kz-\omega t)] + B_1\hat{j}\cos(kz+\omega t)$

where $B_0 = 3\times10^{-5}$ T and $B_1 = 2\times10^{-6}$ T. The rms value of the force experienced by a stationary charge $Q = 10^{-4}$ C at z = 0 is closest to :

(1) 0.9 N (2) 0.1 N

(3) 3×10^{-2} N (4) 0.6 N

Q.43 A very long solenoid of radius R is carrying current $I(t) = kte^{-\alpha t}$ (k > 0), as a function of time ($t \geq 0$), counter clockwise current is taken to be positive. A circular conducting coil of radius 2R is placed in the equatorial plane of the solenoid and concentric with the solenoid. The current induced in the outer coil is correctly depicted, as a function of time, by



Q.44 An electromagnetic wave of intensity 50 Wm^{-2} enters in a medium of refractive index 'n' without any loss. The ratio of the magnitudes of electric fields, and the ratio of the magnitudes of magnetic fields of the wave before and after entering into the medium are respectively, given by :

(1) $\left(\frac{1}{\sqrt{n}}, \frac{1}{\sqrt{n}}\right)$ (2) $\left(\sqrt{n}, \frac{1}{\sqrt{n}}\right)$

(3) $\left(\sqrt{n}, \sqrt{n}\right)$ (4) $\left(\frac{1}{\sqrt{n}}, \sqrt{n}\right)$

Q.45 A 10 m long horizontal wire extends from North East to South West. It is falling with a speed of 5.0ms^{-1}, at right angles to the horizontal component of the earth's magnetic field, of 0.3×10^{-4} Wb/m^2. The value of the induced emf in wire is :

(1) 2.5×10^{-3} V (2) 1.1×10^{-3} V

(3) 0.3×10^{-3} V (4) 1.5×10^{-3} V

Q.46 A square conducting loop is placed near an infinitely long current carrying wire with one edge parallel to the wire as shown in the figure. If the current in the straight wire is suddenly halved, which of the following statements will be true?

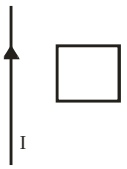
"The loop will ....."

(1) stay stationary

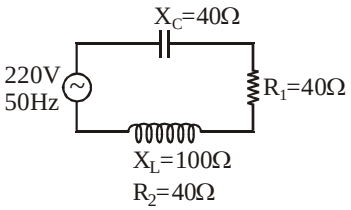
(2) move towards the wire

(3) move away from the wire

(4) move parallel to the wire



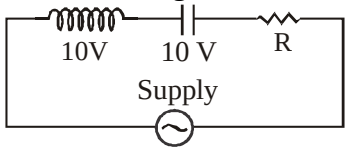
Q.47 The power factor of the circuit as shown in figure is



(1) 0.2 (2) 0.4

(3) 0.8 (4) 0.6

Q.48 If value of R is changed then :



(1) voltage across L remains same.

(2) voltage across C remains same.

(3) voltage across L-C combination remains same.

(4) voltage across L-C combination changes.

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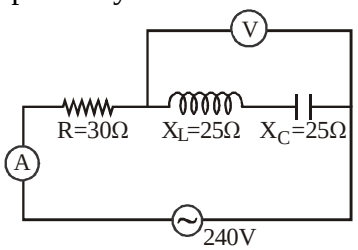
Q.49 The primary winding of a transformer has 100 turns and its secondary winding has 200 turns. The primary is connected to an ac supply of 120 V and the current flowing in it is 10 A. The voltage and the current in the secondary are :

(1) 240 V, 5 A (2) 240 V, 10 A

(3) 60 V, 20 A (4) 120 V, 20 A

Q.50 In the circuit shown in figure neglecting source resistance the voltmeter and ammeter reading will respectively be :



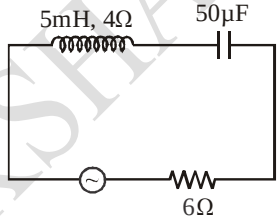
(1) 0V, 3A (2) 150V, 3A

(3) 150V, 6A (4) 0V, 8A

SECTION - 2 (Q.51 - Q.60)

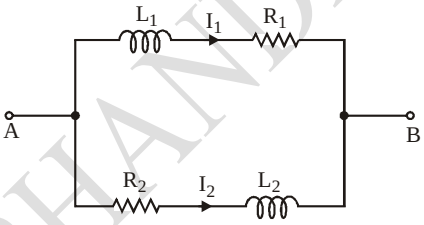
This section contains TEN (10) questions. ATTEMPT ANY FIVE (05) QUESTIONS. The answer to each question is NUMERICAL VALUE. If the numerical value has more than two decimal places truncate/round-off the value upto TWO decimal places.

Q.51 In the circuit shown below, the ac source has voltage V = 20 cos (ωt) with ω = 2000 rad/sec. The amplitude of the current will be nearest to:



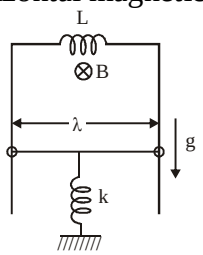
Q.52 A very long straight conducting wire, lying along the z-axis, carries a current of 2A. The integral $\int \vec{B}\cdot d\vec{\ell}$ is computed along the straight line PQ, where P has the coordinates (2cm, 0, 0) and Q has the coordinates (2cm, 2cm, 0). The integral can be expressed as $N\pi\times10^{-7}$ in SI units. Find N

Q.53 Branched chain AB (fig.) has the following parameters : L_1 = 0.1 H, L_2 = 0.4 H, R_1 = 10ohms. At some point of time, the current I_1 = 0.2 A begins to increase at a rate of 5 A/s, and the current I_2 = 0.5 A decreases at a rate 1.25 A/s, find the resistance R_2.



Q.54 Protons moving in a straight, cylindrically symmetrical beam have a charge density ρ = A /r, where r is the distance from the beam's axis and A is a constant equal to $4/\mu_0$. Find the magnetic field (in tesla) at r = (3/4) m generated by the beam if the protons are moving at a speed v = 2m/sec.

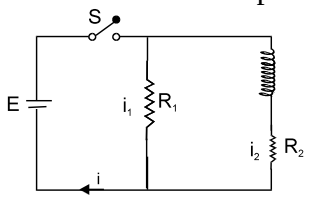
Q.55 Figure shows a circuit in vertical plane kept in uniform horizontal magnetic field B.



The slider is movable while remaining part is fixed. The slider has mass m = 1 kg. Electrical resistance of circuit is equal to zero. Take B = 10 T, l = 1m, L = 1 H, g = 10 m/s^2. In the absence of spring maximum distance travelled by slide is X_1 and in the presence of spring maximum distance travelled by slider is X_2. For k = 10^2 N/m it is found that $\frac{X_1}{X_2} = n$ then find the value of n.

SPACE FOR ROUGH WORK

Q.56 In the circuit, E = 10 volt, R_1 = 5.0 ohm, R_2 = 10 ohm and L = 5.0 henry. Calculate the current i just when the switch S is pressed.



Q.57 A current increases uniformly from zero to one ampere in 0.01 second, in a coil of inductance 10mH. The induced e.m.f. (in V) will be-

Q.58 The ratio of contributions made by the electric field and magnetic field components to the intensity of an electromagnetic wave is :: X : Y .Find the minimum sum of X and Y.

Q.59 A 40 μF capacitor is connected to a 200 V, 50 Hz ac supply. The rms value of the current in the circuit is, nearly (y/2) amp. Find the value of y.

Q.60 In LC circuit the inductance L = 40 mH and capacitance C = 100 μF. If a voltage V(t) = 10sin (314 t) is applied to the circuit,if the maximum value of current in the circuit is : $\frac{X}{19.28}$. Find the value of X.

PART C – MATHEMATICS

SECTION - 1 (Q.61 - Q.80)

Each question has FOUR options (1), (2), (3) and (4). ONLY ONE of these four options is correct.

Q.61 Let f : [0, 2] → R be a twice differentiable function such that f "(x) > 0, for all x ∈ (0, 2). If f (x) = f (x) + f (2 – x), then f is :
(1) decreasing on (0, 2)
(2) decreasing on (0, 1) and increasing on (1, 2)
(3) increasing on (0, 2)
(4) increasing on (0, 1) and decreasing on (1, 2)

Q.62 If $f(x) = \begin{cases} \frac{\sin(p+1)+\sin x}{x}, & x<0 \\ q, & x=0 \\ \frac{\sqrt{x+x^2}-\sqrt{x}}{x^{3/2}}, & x>0 \end{cases}$ is continuous at x = 0, then the ordered pair (p,q) is equal to :
(1) (5/2, 1/2) (2) (–3/2, –1/2)
(3) (–1/2, 3/2) (4) (–3/2, 1/2)

Q.63 If m is the minimum value of k for which the function $f(x) = x\sqrt{kx - x^2}$ is increasing in the interval [0, 3] and M is the maximum value of f in [0, 3] when k = m, then the ordered pair (m, M) is equal to :
(1) $(4, 3\sqrt{2})$ (2) $(4, 3\sqrt{3})$
(3) $(3, 3\sqrt{3})$ (4) $(5, 3\sqrt{6})$

Q.64 A water tank has the shape of an inverted right circular cone, whose semi-vertical angle is $\tan^{-1}(1/2)$. Water is poured into it at a constant rage of 5 cubic meter per minute. The rate (in m/min.), at which the level of water is rising at the instant when the depth of water in the tank is 10m; is :-
(1) 2/π (2) 1/5π
(3) 1/10π (4) 1/15π

Q.65 The height of a right circular cylinder of maximum volume inscribed in a sphere of radius 3 is
(1) $2\sqrt{3}$ (2) $\sqrt{3}$
(3) $\sqrt{6}$ (4) $\frac{2}{3}\sqrt{3}$

Q.66 If f (1) = 1, f ' (1) = 3, then the derivative of $f(f(f(x))) + (f(x))^2$ at x = 1 is :
(1) 12 (2) 33
(3) 9 (4) 15

Q.67 Applying mean value theorem on f (x) = logx ; x ∈ [1, e] the value of c = ……
(1) log (e – 1) (2) e – 1
(3) 1 – e (4) 2

SPACE FOR ROUGH WORK

Q.68 If the point (1,3) serves as the point of inflection of the curve $y = ax^3 + bx^2$ then the value of 'a' and 'b' are -
(1) a = 3/2 & b = – 9/2 (2) a = 3/2 & b = 9/2
(3) a = –3/2 & b = – 9/2 (4) a = – 3/2 & b = 9/2

Q.69 Let $f(x) = \begin{cases} \frac{4-x}{2-\sqrt{x}} & \text{for } 0 < x < 4 \\ 4 & \text{for } x = 4 \\ 16-3x & \text{for } 4 < x < 6 \end{cases}$
Which of the following properties does f have on the interval (0, 6) ?
I. ℓn f(x) exists ; **II.** f is continuous
III. f is monotonic
(1) I only (2) II only
(3) III only (4) none

Q.70 The approximate value of $5^{2.01}$ is ……., where, ($\log_e 5 = 1.6095$).
(1) 25.4125 (2) 25.2525
(3) 25.5025 (4) 25.4024

Q.71 If $f(x) = \begin{cases} \frac{1-\cos 4x}{x^2} & , \ x < 0 \\ a & , \ x = 0 \\ \frac{\sqrt{x}}{\sqrt{16+\sqrt{x}}-4} & , \ x > 0 \end{cases}$,
then correct statement is -
(1) f (x) is discontinuous at x = 0 for any value of a
(2) f (x) is continuous at x = 0 when a = 8
(3) f (x) is continuous at x = 0 when a = 0
(4) none of these

Q.72 If a variable tangent to the curve $x^2y = c^3$ makes intercepts a, b on x and y axis respectively, then the value of a^2b is -
(1) $27c^3$ (2) $\frac{4}{27}c^3$
(3) $\frac{27}{4}c^3$ (4) $\frac{4}{9}c^3$

Q.73 The difference between the greatest and the least value of $f(x) = \cos^2\frac{x}{2}\sin x, \ x \in [0, \pi]$ is
(1) $\frac{3\sqrt{3}}{8}$ (2) $\frac{\sqrt{3}}{8}$
(3) $\frac{3}{8}$ (4) $\frac{1}{2\sqrt{2}}$

Q.74 If $x\sqrt{(1+y)} + y\sqrt{(1+x)} = 0$, then $\frac{dy}{dx}$ equals
(1) $\frac{1}{(1+x)^2}$ (2) $-\frac{1}{(1+x)^2}$
(3) $-\frac{1}{(1+x)} + \frac{1}{(1+x)^2}$ (4) none of these

Q.75 The length of the subnormal of the curve $y^2 = 8ax$ (a > 0) is -
(1) 2a (2) 4a
(3) 6a (4) 8a

Q.76 Let $f(x) = \int e^x (x-1)(x-2)\,dx$.
Then f increases in the interval -
(a) $(-\infty, -2)$ (b) $(-2, -1)$
(c) (1, 2) (d) $(2, \infty)$
Choose the correct option –
(1) a ,b , d (2) a, b, c
(3) a, b, c, d (4) a, c

Q.77 If $f'(x) = \begin{cases} \frac{x-1}{2x^2-7x+5}, x \neq 1 \\ \frac{-1}{3}, x = 1 \end{cases}$,
then f '(1) equals -
(1) 2/9 (2) –2/9
(3) 0 (4) does not exist

Q.78 Let $f(x) = \begin{cases} 4x^2 + 2[x]x & \text{if } -\frac{1}{2} \le x < 0 \\ ax^2 - bx & \text{if } 0 \le x < \frac{1}{2} \end{cases}$
where [x] denotes the greatest integer function. Then

SPACE FOR ROUGH WORK

(1) f (x) is continuous and differentiable in $\left(-\frac{1}{2},\frac{1}{2}\right)$ for all a, provided b = 2.

(2) f (x) is continuous and differentiable in $\left(-\frac{1}{2},\frac{1}{2}\right)$ if f(a) = 4, b = 2.

(3) f (x) is continuous and differentiable in $\left(-\frac{1}{2},\frac{1}{2}\right)$ if a = 4 and b = 0.

(4) for no choice of a and b, f(x) is differentiable in $\left(-\frac{1}{2},\frac{1}{2}\right)$.

Q.79 If f (4) = g (4) = 2 ; f ' (4) = 9 ; g' (4) = 6 then $\lim\limits_{x\to4}\frac{\sqrt{f(x)}-\sqrt{g(x)}}{\sqrt{x}-2}$ is equal to

(1) $3\sqrt{2}$ (2) $3/\sqrt{2}$

(3) 0 (4) none of these

Q.80 A helicopter is flying along the curve given by $y - x^{3/2} = 7$, $(x \geq 0)$. A soldier positioned at the point (1/2, 7) wants to shoot down the helicopter when it is nearest to him. Then this nearest distance is :

(1) $\frac{1}{2}$ (2) $\frac{1}{3}\sqrt{\frac{7}{3}}$

(3) $\frac{1}{6}\sqrt{\frac{7}{3}}$ (4) $\frac{\sqrt{5}}{6}$

SECTION - 2 (Q.81 - Q.90)

This section contains TEN (10) questions. ATTEMPT ANY FIVE (05) QUESTIONS. The answer to each question is NUMERICAL VALUE. If the numerical value has more than two decimal places truncate/round-off the value upto TWO decimal places.

Q.81 $\lim\limits_{x\to0}\frac{x+2\sin x}{\sqrt{x^2-2\sin x+1}-\sqrt{\sin^2 x-x+1}}$ is

Q.82 f '(x) = g (x) and g'(x) = – f (x) for all real x and f (5) = 2 = f ' (5) then $f^2(10) + g^2(10)$ is -

Q.83 Let f : R $\to$ R be a function such that $f(x) = x^3 + x^2 f'(1) + x f''(2) + f'''(3)$, $x \in R$. Then f (2) = (–A). Find the value of A.

Q.84 The tangent to the curve, $y = xe^{x^2}$ passing through the point (1, e) also passes through the point (A/3, 2e). Find the value of A.

Q.85 The maximum value of the function $f(x) = 3x^3 - 18x^2 + 27x - 40$ on the set $S = \{x \in R : x^2 + 30 \leq 11x\}$ is (120 + A). Find the value of A.

Q.86 Let f (x) = $\frac{x^3-3x^2-9x+27}{(x-3)^2} = \lambda$ if $x \neq 3$, when x = 3 such that f (x) is continuous for all $x \in R$ then the value of λ is

Q.87 Let the equation $(a - 1)x^2 = x(2b + 3)$ be satisfied by three distinct values of x, where a, $b \in R$.
If $f(x) = (a - 1)x^3 + (2b + 3)x^2 + 2x + 1$, and f (g (x)) = 6x – 7 where g (x) is a linear function then find the value of g' (2012).

Q.88 Let f : R $\to$ R be defined as f (x) = x + cos x + 2 and g (x) be the inverse function of f (x). Find (g'(3) + g"(3)).

Q.89 Let f : R $\to R^+$ be a differentiable function satisfying f ' (x) = 2f (x) $x \in R$. Also f (0) = 1 and g (x) = f (x) . $\cos^2 x$. If n_1 represent number of points of local maxima of g (x) in $[-\pi, \pi]$ and n_2 is the number of points of local minima of g (x) in $[-\pi, \pi]$ and n_3 is the number of points in $[-\pi, \pi]$ where g (x) attains its global minimum value, then find the value of $(n_1 + n_2 + n_3)$.

Q.90 A polynomial y = f (x) of degree 4 increases in the interval $(-\infty, 1) \cup (2, 3)$ and decreases in the interval $(1, 2) \cup (3, \infty)$ and satisfies f(0) = 1 and f ' (0) = 6. Find the value of f (2).

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK