Sl.No. 1000304

# 054(E)

Oct/Nov - 2015

(SEMESTER - III)

Set No. of Question Paper:

**10**

*Time : 2½ Hours]* *[Maximum Marks : 100*

Instructions :

1) There are 64 questions in this question paper. All questions are compulsory
2) Figures to the right indicate full marks to the question.
3) Select proper option to make the statement correct.
4) The OMR sheet is given for answering the questions. The answer of each question is represented by (A) O, (B) O, (C) O, (D) O. Darken the circle ● of the correct answer with ball-pen.
5) Rough work is to be done on the space provided for this purpose in the Test Booklet only.
6) Read the questions carefully before your answer.
7) Set No. of Question Paper printed on the upper-most right side of the Question Paper is to be written in the Column provided in the OMR sheet.

1) The force acting on one plate due to the other in a parallel plate capacitor is [2

(A) $\frac{CV^2}{d}$

(B) $\frac{1}{2}\frac{CV^2}{d}$

(C) $\frac{CV}{d^2}$

(D) $\frac{1}{2}\frac{C^2V^2}{d}$

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2) When $R_1$ and $R_2$ resistances are connected in parallel, equivalent resistance detained is $\frac{6}{5}\Omega$. If $R_1 = 2\Omega$ and $R_2 =$ ____ ____ $\Omega$. [2]

(A) $\frac{3}{5}$ (B) $\frac{1}{3}$

(C) $\frac{4}{5}$ (D) 3

3) A cylindrical wire is stretched to increase its length by 20%. Calculate the percentage increase in resistance. [2]

(A) 21% (B) 42%

(C) 22% (D) 44%

4) Two parallel very long straight wires carrying currents of 10A and 20A respectively are at a separation of 2m between them. If the currents are in the same direction, find the attractive force between them per unit length.

$[\mu_0 = 4\pi \times 10^{-7}$ SI] [2]

(A) $4 \times 10^{-5}$ Nm$^{-1}$ (B) $4 \times 10^{-4}$ Nm$^{-1}$

(C) $2 \times 10^{-5}$ Nm$^{-1}$ (D) $2 \times 10^{-4}$ Nm$^{-1}$

5) What is the magnetic field intensity at the centre of coil of 50 turns, radius 0.5m and carrying a current of 2A? [2]

(A) $0.5 \times 10^{-5}$ T (B) $3 \times 10^{-5}$ T

(C) $1.25 \times 10^{-4}$ T (D) $4 \times 10^{-5}$ T

6) A short barmagnet is placed in an external magneticfield of 600G. When its axis makes an angle of 30° with the external field, it experiences a torque of 0.012 Nm. What is the magnetic moment of the magnet. [2]

(A) 4 Am²

(B) 0.4 Am²

(C) $0.4 \times 10^{-4}$ Am²

(D) $4 \times 10^{-4}$ Am²

$B = 600G$

$\tau = mB \sin 30°$

$\frac{0.012 \times 2}{600 \times \sqrt{3}} =$ 0.00004

7) Force acting on a magnetic pole of $7 \times 10^{-5}$ Am is 31.5N. Magnetic field at that point is [2]

(A) $4 \times 10^{-2}$ T

(B) $3.5 \times 10^{2}$ T

(C) $4.5 \times 10^{+2}$ T

(D) $3 \times 10^{2}$ T

$B =$

$F = PB$

$F = PB$

$F/P = B$

$\frac{31.5}{7 \times 10} \cdot 2$

8) The radii of curvature of a convex lens are 10 cm and 15 cm. If its focal length is 12 cm, find the refractive index of the material of the lens. [2]

(A) 1.5

(B) 0.5

(C) 1.0

(D) 2

$\frac{1}{12} = (n-1)\left(\frac{1}{10} + \frac{1}{15}\right)$

$\frac{1}{f} = \frac{1}{12} = (n-1)\frac{15+10}{150}$

$\frac{25}{150}$

$12n - 12 =$

Space for Rough Work

9) Two converging lenses of power 5D and 4D are placed 10 cm apart. Find the focal length of this combination. [2]

(A) 13.5 cm

(B) 12.5 cm

(C) 14.3 cm

(D) 12 cm

10) Output power of He-Ne LASER of low energy is 1.00 mW. Wavelength of the light is 632.8nm. What will be the number of photons emitted per second from this LASER? ($h = 6.625 \times 10^{-34}$ Js) [2]

(A) $31.8 \times 10^{15}\ s^{-1}$

(B) $3.81 \times 10^{15}\ s^{-1}$

(C) $0.381 \times 10^{15}\ s^{-1}$

(D) $3.18 \times 10^{15}\ s^{-1}$

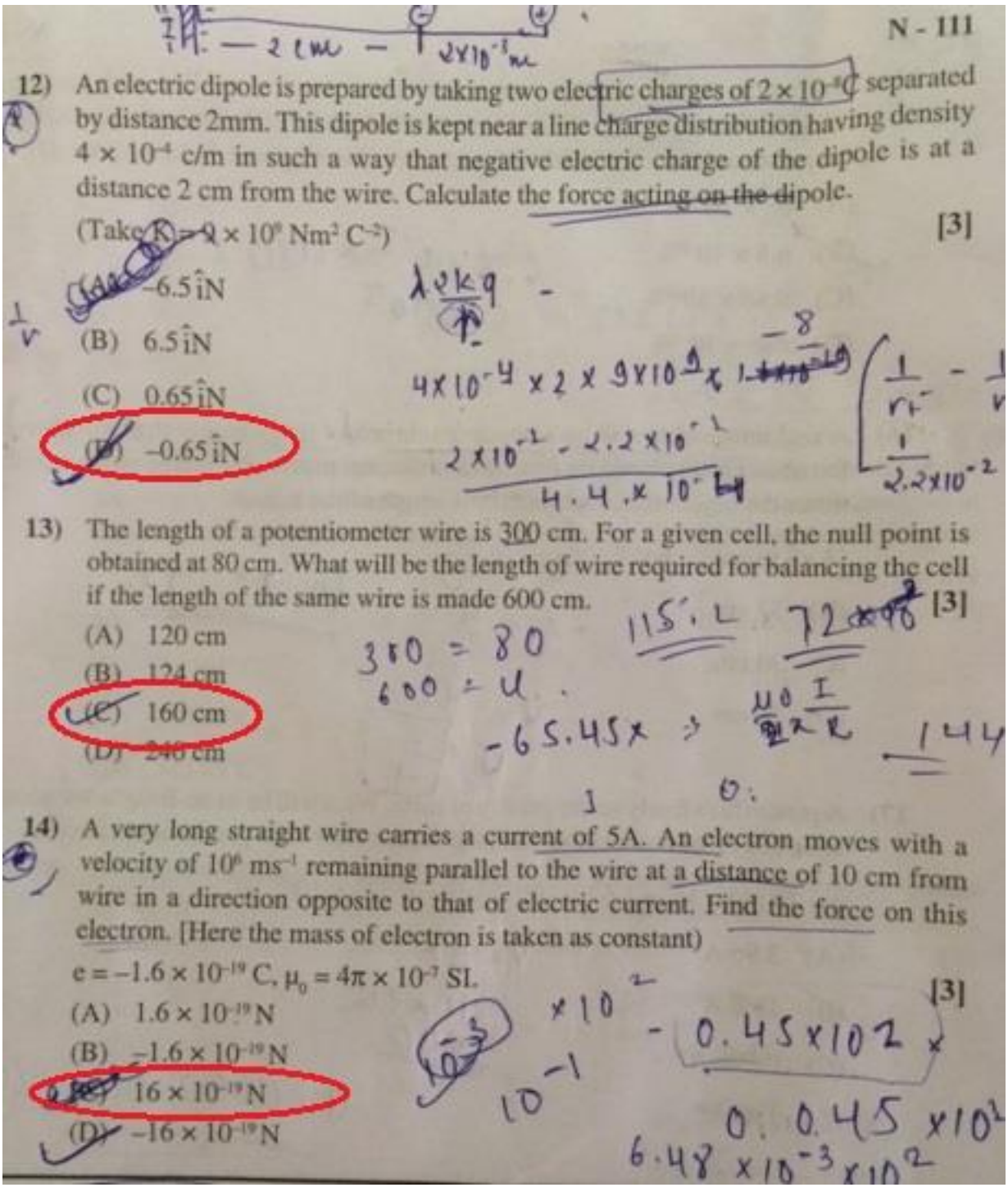
11) Wavelength of light incident on photo sensitive surface reduced from 3500A° to 290 nm. Find the change in stopping potential ($h = 6.625 \times 10^{-34}$ Js). [2]

(A) $73.42 \times 10^{-2}$ V

(B) $7.342 \times 10^{-2}$ V

(C) 0.7342 V

(D) $0.7342 \times 10^{-1}$ V



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12) An electric dipole is prepared by taking two electric charges of $2 \times 10^{-8}$ C separated by distance 2mm. This dipole is kept near a line charge distribution having density $4 \times 10^{-4}$ c/m in such a way that negative electric charge of the dipole is at a distance 2 cm from the wire. Calculate the force acting on the dipole.
(Take K = $9 \times 10^9$ $Nm^2 C^{-2}$) [3]

(A) $-6.5\hat{i}$N
(B) $6.5\hat{i}$N
(C) $0.65\hat{i}$N
(D) $-0.65\hat{i}$N

13) The length of a potentiometer wire is 300 cm. For a given cell, the null point is obtained at 80 cm. What will be the length of wire required for balancing the cell if the length of the same wire is made 600 cm. [3]

(A) 120 cm
(B) 124 cm
(C) 160 cm
(D) 240 cm

14) A very long straight wire carries a current of 5A. An electron moves with a velocity of $10^6$ $ms^{-1}$ remaining parallel to the wire at a distance of 10 cm from wire in a direction opposite to that of electric current. Find the force on this electron. [Here the mass of electron is taken as constant)
$e = -1.6 \times 10^{-19}$ C, $\mu_0 = 4\pi \times 10^{-7}$ SI. [3]

(A) $1.6 \times 10^{-19}$ N
(B) $-1.6 \times 10^{-19}$ N
(C) $16 \times 10^{-19}$ N
(D) $-16 \times 10^{-19}$ N

15) The region inside a current carrying toroidal winding is filled with tungsten of susceptibility $6.8 \times 10^{-5}$. What is the percentage increase in the magnetic field in the presence of the material with respect to the magnetic field without it? [3]

(A) $68 \times 10^{-3}\%$

(B) $6.8 \times 10^{-3}\%$

(C) $0.68 \times 10^{-3}\%$

(D) $680 \times 10^{-3}\%$

$6.8 \times 10^{-5} \times 100$

$6.8 \times 10^{-3}$

16) A real image obtained by a concave mirror is 4 times bigger than the object. If the object is displaced by 3 cm away from the mirror, the image size becomes 3 times the object size. Find the focal length of the mirror. [3]

(A) 36 cm

(B) 32 cm

(C) 34 cm

(D) 30 cm

$m = -\frac{v}{u} \quad \frac{4}{u}$

$-\frac{v}{u} = \frac{4}{1}$

$v = -4u$

$u = \frac{v}{4}$

17) A proton falls freely under gravity of earth. What will be its de-Broglie wavelength after 20s of its motion? Neglect the forces other than gravitational force.

$g = 10\ m/s^2$ $M_p = 1.67 \times 10^{-27}\ kg$, $h = 6.625 \times 10^{-34}\ Js$ [3]

(A) 3.96 A°

(B) 19.6 A°

(C) 0.396 A°

(D) 196 A°

$v = gt$

$= 10 \times 20$

$= 200$

$0.019 \times 10^{-10}$

18) An electric field is represented by $\vec{E} = A\ x\ \hat{i}$, where $A = 100\ v/m^2$. Find the potential of the origin with respect to the point (10, 20)m [4]

(A) 500 V

(B) 5000 V

(C) 50 V

(D) 0.5 V

$= \phi - \int_{10}^{0} E\,dx$

$-100 \left[\frac{x^2}{2}\right]_{10}^{0}$

$\frac{0-10}{2} = -5 \times$

$= 50$

19) The resistance of the platinum wire of a platinum resistance thermometer at the ice point is 5Ω and at steampoint is 5.23Ω. When the thermometer is inserted in a hot bath, the resistance of the platinum wire is 5.795Ω. Calculate the temperature of the bath. [4]

(A) 34.565°C

(B) 3.4565°C

(C) 3456.5°C

(D) 345.65°C

$\frac{5.795 - 5.0}{5.23 - 5.0}$

20) An equilateral prism is kept in air and for a particular ray, angle of minimum deviation is 38°. Calculate the angle of minimum deviation if the prism is immersed in water. Refractive index of water is 1.33 [4]

(A) 9°12'

(B) 10°12'

(C) 8°24'

(D) 12°09'

$n_g \sin\left(\frac{A+\delta}{2}\right) / \sin A/2$

$\frac{\sin 49'}{\sin 30}$

$\frac{0.7547}{0.5}$

21) When $10^{19}$ electrons are kept on a neutral metal plate, what is the electric charge (in coulomb) on it? [1]

(A) −1.6 (B) $10^{-19}$

(C) 1.6 (D) $10^{19}$

22) Force acting between two point charges is F. Now each of the two point charges are doubled and the distance is kept as it is. So force between them is _____.[1]

(A) $\frac{F}{4}$ (B) $\frac{F}{2}$

(C) 4F (D) 2F

23) When the electric flux linked with the surface will be positive. [1]

(A) $\theta < 90°$ (B) $\theta = 90°$

(C) $\theta > 90°$ (D) $\theta \geq 90°$

24) There exist an electric field of 100 N/C along X-direction. The flux passing through a square of 10 cm sides placed on YZ plane inside the electric field is _____.[1]

(A) 2.0 Vm (B) $4.0\frac{Nm^2}{C}$

(C) 10 Vm (D) $1.0\frac{Nm^2}{C}$

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25) The electric dipole moment of a HCl atom is $3.4 \times 10^{-30}$ cm. The charges on both atoms are unlike and of same magnitude. Magnitude of this charge is _____. The distance between the charges is 2 A°. [1]

(A) $1.7 \times 10^{-20}$ C
(B) $6.8 \times 10^{-20}$ C
(C) $3.4 \times 10^{-20}$ C
(D) $3.4 \times 10^{-10}$ C

26) Force acting on $6.4 \times 10^{-3}$C placed at a point in a uniform electric field is 0.128N. The intensity of electric field is _____ N/C. [1]

(A) 0.2
(B) 20
(C) 2
(D) 200

27) Electric field intensity at mid point in between two parallel sheets with unlike charges if same surface charge densities ($\sigma$) is. [1]

(A) Zero
(B) $\frac{2\sigma}{\varepsilon_0}$
(C) $\frac{\sigma}{2\varepsilon_0}$
(D) $\frac{\sigma}{\varepsilon_0}$

28) For a uniform electric field $\vec{E} = -E_0(\hat{i})$, if the electric potential at x = 0 is zero, then the value of electric potential at $x = -x$ will be _____. [1]

(A) $xE_0$
(B) $x^2E_0$
(C) $-xE_0$
(D) $-x^2E_0$

29) A moving electron moves away from another electron. What would be the change in the potential energy of the system? [1]

(A) Remains constant (B) Decreases

(C) Increases (D) May increase or decrease

30) The capacitance of an isolated conducting sphere is directly proportional to _____. [1]

(A) R (B) $1/R$

(C) $R^2$ (D) $1/R^2$

31) The capacitance of a variable capacitor joined with a battery of 100 V is varied from 2 μF to 10 μF. What is the change in the energy stored in it? [1]

(A) $2 \times 10^{-2}$J (B) $6.5 \times 10^{-2}$J

(C) $2.5 \times 10^{-2}$J (D) $4 \times 10^{-2}$J

32) If the capacitance of a capacitor is 'C', by keeping a medium of dielectric constant 'K' between the plates of the capacitor, its capacitance becomes _____. [1]

(A) KC (B) $K^2C$

(C) $\frac{C}{K}$ (D) C

33) Dimensional formula of an electric potential is _____. [1]

(A) $M^1L^2T^3A^1$ (B) $M^1L^2T^{-3}A^1$

(C) $M^1L^2T^{-3}A^{-1}$ (D) $M^1L^2T^3A^{-1}$

34) Frequency of an electron performing circular motion is f, so current obtained is _____. [1]

(A) fet (B) $\frac{f}{et}$

(C) fe (D) $\frac{1}{fet}$

35) Internal resistance of a battery of 2V terminal voltage is 0.2Ω and current flowing through is 0.5A. So e.m.f of battery will be _____. [1]

(A) 1.9V (B) 2.1V

(C) 1.0V (D) 3V

36) The ratio of length of two wires of same mass and made up of same material is 1:2 There fore ratio of their resistance is _____. [1]

(A) 1:1 (B) 2:1

(C) 1:2 (D) 1:4

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37) Relation between electric field E, current density J and resistivity ρ is [1]

(A) $E = \rho^2 J$

(B) $E = \rho / J$

(C) $E = \rho J$

(D) $E = J / \rho$

38) Length of a wire is halved keeping its cross section constant. What will be its new conductance? [1]

(A) halved

(B) doubled

(C) does not change

(D) four times

39) On a carbon resistor there are bands of colours of our national flag from up to down. What is the resistance of the carbon resistor. [1]

(A) $39 \times 10^5 \pm 20\%\ \Omega$

(B) $39 \times 10^5 \pm 10\%\ \Omega$

(C) $59 \times 10^5 \pm 20\%\ \Omega$

(D) $39 \times 10^5 \pm 5\%\ \Omega$

40) 20Ω resistor wire is bent in the form of circle. Equivalent resistance between dimetrically opposite points will be [1]

(A) 5 Ω

(B) 20 Ω

(C) 10 Ω

(D) 40 Ω

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41) The strength of the magnetic field at a point 'r' near a long straight current carrying wire is B. What will be the field at a distance $r/2$? [1]

(A) $B/2$ (B) 2B

(C) $B/4$ (D) 4B

42) Magnetic field at the centre of a circular coil of radius r, through which a current I flow is _____. [1]

(A) Directly proportional to r

(B) Directly proportional to I

(C) Inversely proportional to I

(D) Directly proportional to $I^2$

43) Dimensional formula of the magnetic field intensity B is. [1]

(A) $M^1L^{-2}A^{-1}$ (B) $M^2T^1A^{-2}$

(C) $M^1T^{-2}A^{-1}$ (D) $M^2L^1T^{-2}A^{-1}$

44) A long solenoid carrying a current produces a magnetic field B along its axis. If the current is doubled and the number of turns per cm is halved, the new value of the magnetic field is _____. [1]

(A) B (B) 4B

(C) 2B (D) B/2

45) If the speed of a charged particle moving through a magnetic field is decreased, then the radius of curvature of its trajectory will be [1]

(A) decrease (B) not change

(C) increase (D) become half

46) A conducting wire of 1m length is used to form a circular loop. If it carries a current of 1 ampere its magnetic moment will be _____ $Am^2$. [1]

(A) $2\pi$ (B) $\pi/4$

(C) $\pi/2$ (D) $1/4\pi$

47) An electron moves with a constant speed v along a circle of radius 'r'. Its magnetic moment will be _____. (e is electron's charge) [1]

(A) evr (B) $\pi r^2 ev$

(C) $\frac{1}{2}$ evr (D) $2\pi rev$

48) A magnet has coercivity of $3 \times 10^3$ $Am^{-1}$. It is kept in a 10 cm long solenoid with total of 50 turns. How much current has to be passed through the solenoid to demagnetize it? [1]

(A) 0.6A (B) 6A

(C) 3A (D) 12A

49) In a graph of B→H at point B = 0 the value of H is called _____. [1]

(A) Retentivity

(B) Saturation magnetization

(C) Soft ferromagnetic

(D) Coercivity

50) At a place on earth, the Horizontal component of Earth's magnetic field is $1/\sqrt{3}$ times its vertical component. The angle of dip at this place is _____. [1]

(A) 0

(B) $\frac{\pi}{3}$ rad

(C) $\frac{\pi}{2}$ rad

(D) $\frac{\pi}{6}$ rad

$\frac{V}{H} = \frac{\sqrt{3}}{\sin 48.} \quad 1.73$

51) Relative permeability of a substance is 0.025. Its magnetic susceptibility is [1]

(A) –0.975

(B) 1.025

(C) +0.975

(D) –1.025

$\mu_r = \mu_r - 1 = 0.025$

52) An object is placed at a distance of 25 cm on the axis of a concave mirror, having focal length 20cm. Find the lateral magnification of an image. [1]

(A) 2

(B) –4

(C) 4

(D) –2

$-\frac{V}{U} =$

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53) Depth of a well is 5.5m and refractive index of water is 1.33. If viewed from the bottom, by how much height would the bottom of the well appear to be shifted up? [1]

(A) 1.37m (B) 2.75m

(C) 4.13m (D) 5.5m

54) If the tube length of astronomical telescope is 105 cm and magnifying power is 20 for normal setting, turn the focal length of the objective is _____cm. [1]

(A) 25 (B) 20

(C) 100 (D) 10

55) A defect of vision in which lines in one plane of an object appear in focus while those in another plane are out of focus is called _____. [1]

(A) astigmatism (B) myopia

(C) distortion (D) hyper metropia

56) If the power of the lens is + 5D, then the focal length is _____cm. [1]

(A) 20 (B) 60

(C) –20 (D) –60

57) An electron requires $5 \times 10^{-19}$J energy to Just escape from the irradiated metal. If photo electron is emitted after $10^{-9}$s of the incident light, calculate the rate of absorption of energy. [1]

(A) $0.5 \times 10^{-10}$ J/s (B) $5 \times 10^{-10}$ J/s

(C) $5 \times 10^{-28}$ J/s (D) $0.5 \times 10^{-28}$ J/s

58) Suppose you are late in reaching the school, and you are going at the speed of 3.0 m/s. If your mass is 60 kg. assuming that you are a particle find your de-Broglie wavelength $h = 6.625 \times 10^{-34}$ Js [1]

(A) $0.368 \times 10^{-36}$m (B) $36.8 \times 10^{-36}$m

(C) $3.68 \times 10^{-36}$m (D) $368 \times 10^{-36}$m

$\lambda = \frac{h}{mv}$ $0.0368 \times 10^{-34}$

59) Mass of photon in motion is _____. [1]

$mc^2 = hf$

$m = \frac{hf}{c^2}$

(A) $\frac{c}{hf}$ (B) hf

(C) $\frac{h}{\lambda}$ $\frac{h c}{\lambda c^2}$ (D) $\frac{hf}{c^2}$

60) Which of the following physical quantity has the dimension of planck constant (h)? [1]

(A) Force (B) Energy

(C) Angular momentum (D) Power

61) Calculate the magnitude of the torque on an electricdipole having dipole moment of $5 \times 10^{-9}$ cm placed in a uniform electric field of intensity of $4 \times 10^{5}$ $NC^{-1}$ making an angle 30° with the field. [2]

(A) $10^{-5}$ Nm (B) $10^{-5}$ Nm

(C) $10^{-4}$ Nm (D) $10^{-4}$ Nm

62) Two electric charges having magnitude 8.0 μc and –2 μc are separated by 10cm. Where should a third charge be placed so that the resultant force acting on it is zero? [2]

(A) 10 cm
(B) 0.1 cm
(C) 20 m
(D) 10 m

63) Electrical force between two point charges is 200N. If we increase 10% charge on one of the charges and decrease 10% charge on the other, then electrical force between them for the same distance is _____N. [2]

(A) 200
(B) 198
(C) 99
(D) 100

64) A point P is 40 m away from a point 2 μc charge and 20m away from a point 4μc charge. Find the electric potential at P. [2]

(A) 2250 V
(B) 1800 V
(C) 2200 V
(D) 2000 V

$\frac{kq}{r_1} - \frac{kq}{r_2}$

$9\times10^9 \left[\frac{2\times10}{40} + \frac{4}{20}\right]$

$2.25\times10^3$