COURSE NAME: 12TH **Marks : 100** **Topic : FULL SYLLABUS** **DATE :**

PART – A

Instructions:

*(1) There are 50 objective type **(M.C.Q)** questions in **part-A** and all questions are compulsory.*

(2) The questions are serially numbered from 1 to 50 and each carries 1 mark.

(3) Read each question carefully, select proper alternative and answer in the O.M.R. sheet.

(4) The OMR sheet is given for answering the questions. The answer of each question is represented by (1) O, (2) O, (3) O, (4)O. Darken the circle of the correct answer with ball-pen.

(5) Rough work is to be done in the space provided for this purpose in the test booklet only.

(6) 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.

(7) Students may use a calculator and log-table, if necessary.

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1. A proton is 1836 times heavier than an electron. If the repulsive force between two protons is F for given distance, then the electric force between two electrons at same distance will be _____ N

(1) F (2) – F (3) $\frac{F}{(1836)^2}$ (4) $(1836)^2$ F

2. The liquid drop of mass 'm' has a charge 'q'. What should be the magnitude of electric field E to balance this drop?

(1) mgq (2) $\frac{E}{m}$ (3) $\frac{mg}{q}$ (4) $\frac{mq}{g}$

3. An electron performs circular motion of radius r, perpendicular to a uniform magnetic filed B. The kinetic energy gained by this electron in half the revolution is.....

(1) $\frac{1}{2}mv^2$ (2) $\frac{1}{4}mv^2$ (3) Zero (4) $\pi rBev$

4. Electric field produced due to an infinitely long straight uniformly charged wire at perpendicular distance of 2 cm is 3×10^8 NC^{-1}. Then linear charge density on the wire is.

(1) $333\frac{\mu C}{m}$ (2) $666\frac{\mu C}{m}$ (3) $3.33\frac{\mu C}{m}$ (4) $6.66\frac{\mu C}{m}$

5. A hemisphere is uniformly charged positively. The electric field at a point on a diameter away from the centre is directed

(1) Perpendicular to the diameter
(2) Parallel to the diameter
(3) At an angle tilted towards the diameter
(4) At an angle tilted away from the diameter

6. A parallel plate capacitor has a capacitance of C. If the distance between the plates of capacitors becomes half and if a dielectric medium is introduced between the plate, its new capacitance will be 3C. what is dielectric constant of a medium?

(1) 1 (2) 1.5 (3) 2 (4) 3

7. When 4μF, 6μF and 12μF, capacitors are joined in series, their equivalent capacitance is C_s and when they are joined in parallel, their equivalent capacitance is C_p. Then, $\frac{C_s}{C_p} = ...$

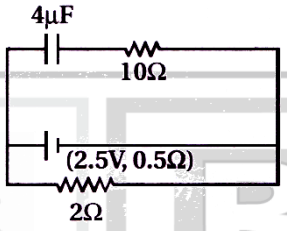
(1)2 : 11 (2) 1 : 11 (3) 3 : 11 (4) 4 : 11

8. A parallel plate capacitor is to be designed using a dielectric of dielectric constant 5, so as to have a dielectric strength of 10^9 Vm^{-1}. If the voltage rating of the capacitor is 12 kV, the minimum area of each plate required to have a capacitance of 80 pF is

(1) 10.5×10^{-6} m^2 (2) 21.7×10^{-6} m^2

(3) 25.0×10^{-5} m^2 (4) 12.5×10^{-5} m^2

9. A capacitor of 4μF is connected as shown in the circuit as per figure. The internal resistance of the battery is 0.5 Ω. The amount of charge on the capacitor plates will be



(1) 0 μC (2) 4 μC (3) 16 μC (4) 8 μC

10. Masses of three conductors of same material are in the proportion of 1 : 2 : 3. Their lengths area at in the proportion of 3 : 2 : 1. Then their resistance will be in the proportion of

(1) 1 : 1 : 1 (2) 1 : 2 : 3 (3) 9 : 4 : 1 (4) 27 : 6 : 1

11. Equivalent resistance of n resistors having same resistance r is R. Then equivalent resistance when connected in series = _____

(1) nR (2) $\frac{R}{n}$ (3) $\frac{R}{n^2}$ (4) n^2R

12. A metal rod of length 10 cm and a rectangular cross-section of 1 cm × $\frac{1}{2}$ cm is connected to a battery across opposite faces. The resistance will be

(1) Maximum when the battery is connected across 1 cm × $\frac{1}{2}$ cm faces

(2) Maximum when the battery is connected across 10 cm × 1 cm faces

(3) Maximum when the battery is connected across 10 cm × $\frac{1}{2}$ cm faces

(4) Same irrespective of the three faces

13. To turn galvanometer into ammeter, _____

(1) Greater resistance should be joined in series

(2) Greater resistance should be joined in parallel

(3) Smaller resistance should be joined in series

(4) Smaller resistance should be joined in parallel

14. The resistance of galvanometer is G and its current capacity is I_g. To increase the current capacity by 'n' times, the required value of shunt is_____

(1) $\frac{G}{n-1}$ (2) $\frac{I_g \cdot G}{n-1}$ (3) $\frac{nG}{n-1}$ (4) $\frac{I_g \cdot G}{I - n \cdot I_g}$

15. Biot-Savart law indicates that the moving electrons (velocity v) produce a magnetic field $\vec{B}$ such that

(1) B is perpendicular to v

(2) B is parallel to v

(3) It obeys inverse cube law

(4) It is along the line joining the electron and point of observation

16. What is the value of gyromagnetic ratio?

(1) $8.8\times10^{11}\ \frac{\text{C}}{\text{kg}}$ (2) $8.8\times10^{10}\ \frac{\text{C}}{\text{kg}}$

(3) $8.8\times10^{12}\ \frac{\text{C}}{\text{kg}}$ (4) $8.8\times10^{9}\ \frac{\text{C}}{\text{kg}}$

17. A magnetic needle is kept in a non-uniform magnetic field. It experiences _____

(1) A force and a torque (2) A torque but not a force

(3) A force but not a torque (4) Neither a force nor a torque

18. A magnet of magnetic moment *M* is situated with its axis along the direction of a magnetic field of strength B. The work done in rotating it by an angle of 180° will be

(1) $-MB$ (2) $+MB$ (3) 0 (4) $+2MB$

19. Consider the two idealized systems: (i) a parallel plate capacitor with large plates and small separation and (ii) a long solenoid of length L >> R, radius of cross-section. In

(i) $\vec{\text{E}}$ is ideally treated as a constant between plates and zero outside. In

(ii) Magnetic field is constant inside the solenoid and zero outside.

These idealised assumptions, however, contradict fundamental laws as below:

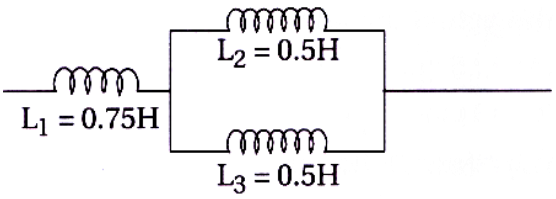
(1) Case (i) contradicts Gauss's law for electrostatic fields

(2) Case (ii) contradicts Gauss's law for magnetic fields

(3) Case (i) agrees with $\oint \vec{E} \cdot \vec{dl} = 0$

(4) case (ii) contradicts $\oint \vec{H} \cdot \vec{dl} = I_{en}$

20. The equivalent inductance of the following circuit is _____

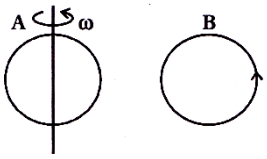


(1) 1.0 H (2) 1.75 H (3) 0.75 H (4) 0.25 H

21. When the solenoid is wound over a soft iron core of relative permeability μ, then the self-inductance of solenoid is L = _____

(1) $\mu_r\mu_o n^2 A$ (2) $\mu_o n^2 A$ (3) $\mu_r\mu_o n^2 lA$ (4) $\mu_o n^2 lA$

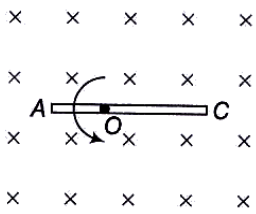
22. Same as problem 4 except the coil A is made to rotate about a vertical axis figure. No current flows in B if A is at rest. The current in coil A, when the current in B (at t = 0) is counter clockwise and the coil A is as shown at this instant, t = 0, is



(1) Constant current clockwise (2) Varying current clockwise

(3) Varying current counter clockwise (4) Constant current counter clockwise

23. A conducting rod AC of length 4 *l* is rotated about a point *O* in a uniform magnetic field **B** directed into the plane of the paper AO = *l* and OC = 3 *l*. Then,



(1) $V_A - V_O = \frac{B\omega l^2}{2}$ (2) $V_O - V_C = \frac{7}{2}B\omega l^2$ (3) $V_A - V_C = 4B\omega l^2$ (4) $V_C - V_O = \frac{9}{2}B\omega l^2$

24. In series L-C-R circuit, resistance, inductance and capacitance are connected in series. The value of potential difference across three are 70 V, 90 V and 65 V respectively. The value of potential difference of A.C. source is……

(1) 225 V (2) 95 V (3) 85 V (4) 74.3 V

25. To reduce the resonant frequency in an LCR series circuit with a generator

(1) The generator frequency should be reduced

(2) Another capacitor should be added in parallel to the first

(3) The iron core of the inductor should be removed

(4) Dielectric in the capacitor should be removed

26. Out of the following options which one can be used to produce a propagating electromagnetic wave?

(1) A stationary charge

(2) A chargeless particle

(3) An accelerating charge

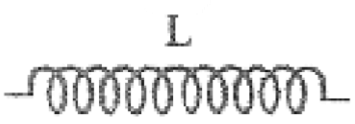
(4) A charge moving at constant velocity

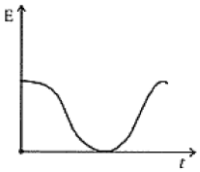
27. Average intensity of sunlight on the Earth surface is 1400 Wm^{-2}. How much pressure it exerts on the Earth surface?

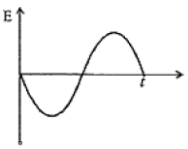
(1) 4.67×10^{-10} Nm^{-2} (2) 4.67×10^{-6} Nm^{-2}

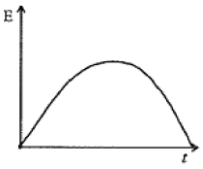
(3) 4.67 Nm^{-2} (4) 4.67×10^{6} Nm^{-2}

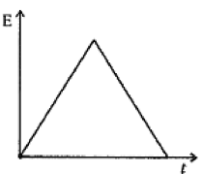
28. The variation of induced emf E with time t in a coil when a short bar magnet is moved along its axis constant velocity as shown in below fig. which fig. is best represented as?



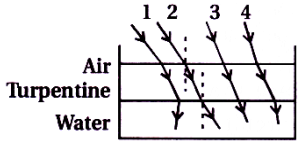
(1) 

(2) 

(3) 

(4) 

29. The optical density of turpentine is higher than that of water while its mass density is lower. Figure shows a layer of turpentine floating over water in a container. For which one of the four rays incident on turpentine in as figure, the path shown is correct?



(1) 1 (2) 2 (3) 3 (4) 4

30. A glass slab having refractive index n and thickness d is placed on the paper on table. A dot (drop) of d ink is made on paper below glass slab. At how much height will the dot be found if it is observed from the upper side of slab?

(1) $(n-1)\frac{d}{n}$ (2) $(n+1)\frac{d}{n}$ (3) $\left(\frac{n}{n-1}\right)d$ (4) $\left(\frac{n}{n+1}\right)d$

31. If this telescope is used to view the moon, what is the diameter of the image of the moon formed by the objective lens? The diameter of the moon is 3.48×10^6m, and the radius of lunar orbit is 3.8×10^8 m.

(1) 0.1374 cm (2) 13.74 cm (3) 1.374 cm (4) 137.4 cm

32. A wavelength of a monochromatic light in vacuum is λ. It travels from vacuum to a medium of absolute refractive index μ. The ratio of wavelength of the incident and refracted wave is

(1) 1 :μ (2) μ : 1 (3) 1 : 1 (4) μ^2 : 1

33. In a Young's double slit experiment, the source is white light. One of the holes is covered by a red filter and another by a blue filter. In this case

(1) There shall be alternate interference patterns of red and blue

(2) There shall be an interference pattern for red distinct from that for blue

(3) There shall be no interference fringes

(4) There shall be an interference pattern for red mixing with one for blue

34. The maximum intensity obtained due to the superposition of waves of 'n' coherent sources having same intensity I_0 is……

(1) nI (2) $\frac{I}{n}$ (3) n^2I (4) $\frac{I}{n^2}$

35. The focal length of objective and eye lens of a astronomical telescope are respectively 2 m and 5 cm. Final image is formed at (i) least distance of distinct vision (ii) infinity. The magnifying power in both cases will be

(1) – 48, – 40 (2) – 40, – 48 (3) – 40, 48 (4) – 48, 40

36. If yellow light emitted by sodium lamp in Young's double slit experiment is replaced by monochromatic blue value of light of the same intensity then……

(1) Fringe width will decrease

(2) Fringe width will increase

(3) Fringe width will remain unchanged

(4) Fringes will becomes less intense

37. A proton, a neutron, an electron and an α-particle have same energy. Then their de-Broglie wavelengths compare as

(1) $\lambda_p = \lambda_n > \lambda_e > \lambda_\alpha$ (2) $\lambda_\alpha < \lambda_p = \lambda_n < \lambda_e$ (3) $\lambda_e < \lambda_p = \lambda_n > \lambda_\alpha$ (4) $\lambda_e = \lambda_p = \lambda_n = \lambda_\alpha$

38. A photon will have less energy, if its……

(1) Amplitude is higher

(2) Frequency is higher

(3) Wavelength is longer

(4) Wavelength is shorter

39. The work function of caesium is 2.14 eV. Find (1) the threshold frequency for caesium, and (2) the wavelength of the incident light if the photocurrent is brought to zero by a stopping potential of 0.60 V.

(1) $v_0 = 4.54 \times 10^{14}$ Hz, $\lambda = 454$ nm

(2) $v_0 = 5.16 \times 10^{14}$ Hz, $\lambda = 516$ nm

(3) $v_0 = 5.16 \times 10^{14}$ Hz, $\lambda = 454$ nm

(4) $v_0 = 5.16 \times 10^{14}$ Hz, $\lambda = 414$ nm

40. For photoelectric emission from certain metal the cut-off frequency is v. If radiation of frequency 2v impinges on the metal plate, the maximum possible velocity of the emitted electron will be (m is the electrons mass):

(1) $\sqrt{\frac{hv}{(2m)}}$ (2) $\sqrt{\frac{hv}{m}}$ (3) $\sqrt{\frac{2hv}{m}}$ (4) $\sqrt[2]{\frac{hv}{m}}$

41. The frequency of an alternating voltage is 50 cycles/s and its amplitude is 120 V. Then what is the rms value of voltage?

(1) 101.3 V (2) 84.9 V (3) 70.7 V (4) 56.5 V

42. de-Broglie wavelength of electron in ground state is 2.116 Å, then its velocity will be _____ ms^{-1}.

(1) 0.034×10^8 (2) 3.4×10^8 (3) 34×10^{-8} (4) 0.034×10^{-8}

43. In Young's double slit experiment, phase difference between light waves reaching 3rd bright fringe from the central fringe when X = 5000Å is..... rad.

(1) 6π (2) 3π (3) 2π (4) Zero

44. What is the main reason for the energy emitted by the atomic bomb?

(1) Nuclear fusion (2) Nuclear fission

(3) Chemical reaction (4) Radioactive disintegration

45. Which are isotope, isotone and Isobar nuclei respectively of ${}_6C^{12}$ from among ${}_6C^{13}$, ${}^{12}_5B$, ${}^{13}_7N$?

(1) ${}^{13}_6C$, ${}^{13}_7N$, ${}^{12}_5B$ (2) ${}^{12}_5B$, ${}^{13}_6C$, ${}^{13}_7N$ (3) ${}^{13}_7N$, ${}^{12}_5B$, ${}^{13}_6C$ (4) ${}^{13}_6C$, ${}^{12}_5B$, ${}^{13}_7N$

46. The three stable isotope of neon : ${}^{20}_{10}Ne$, ${}^{21}_{10}Ne$ and ${}^{22}_{10}Ne$ have respective abundance of 90.51%, 0.27% and 9.22%. The atomic masses of the three isotopes are 19.99 u, 20.99 u and 21.99 u respectively. Obtain the average atomic mass of neon.

(1) 20.99 u (2) 33.33 u (3) 20.18 u (4) 21.00 u

47. If a small amount of antimony is added in the crystal of silicon ..... in formed.

(1) Good conductor (2) P–type semiconductor

(3) N–type semiconductor (4) co–insulator

48. Which of the statements is true for p-type semiconductors.

(1) Electrons are majority carriers and trivalent atoms are the dopants

(2) Electrons are minority carriers and pentavalent atoms are the dopants

(3) Holes are minority carriers and pentavalent atoms are the dopants

(4) Holes are majority carriers and trivalent atoms are the dopants

49. In an unbiased p-n junction, holes diffuse from the p-region to n-region because

(1) Free electrons in the n-region attract them

(2) They move across the junction by the potential difference

(3) Hole concentration in p-region is more as compared to n-region

(4) All the above

50. There are 6×10^{19} electrons per unit cubic metre of pure semiconductor. What will be the number of holes for this semiconductor of dimension 1 cm × 1 cm × 2 cm?

(1) 6×10^{19} (2) 1.2×10^{14} (3) 12×10^{14} (4) 2×10^6

PART- B

Instructions:

(1) Write in a clear legible handwriting.

(2) There are three sections in part- B of the question paper and total 1 to 27 questions are there.

(3) All the questions are compulsory. Internal options are given.

(4) The numbers at right side represent the marks of the question.

(5) Start new section on new page.

(6) Maintain sequence.

(7) Students may use a calculator and log-table, if necessary.

PART – B

SECTION – A (Attempt any eight out of twelve)

- **Answer question No. 1 to 12 as directed. Each question carry 2 marks. (Attempt any 8 out of 12)** **[16]**

1. How does the mutual inductance of a pair of coil change when,

(i) Distance between the coils is increased and

(ii) Number of turns in the coils is increased?

2. Draw the energy band diagrams of conductors, semiconductors and insulators.

3. A neutron is absorbed by a $^{6}_{3}$Li nucleus with subsequent emission of an alpha particle. Write the corresponding nuclear reaction. Calculate the energy releases in this reaction.

Given, m($^{6}_{3}$Li) = 6.015126 amu

m($^{4}_{2}$He) = = 4.0026044 amu

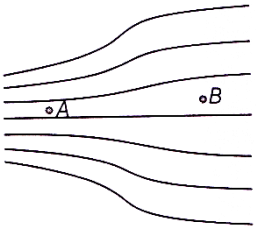
m($^{1}_{0}$n) = 1.0086654 amu

m($^{3}_{1}$H) = 3.016049 amu

4. A ray of light falls on a triangular glass prism in such a way that the deviation of the emergent ray is minimum for the prism.

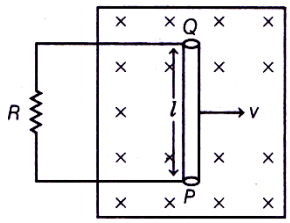
Draw the ray diagram for this case and write the relation between the angle of incidence and angle of emergence.

5. In the electric field shown in figure, the electric field lines on the left have half separation as that between those on the right. If the magnitude of the field at point A is 60 NC^{-1}, calculate the force experienced by a proton placed at point B. Also, find the magnitude of electric field at point B.



6. A point charge Q is placed at point O as shown in figure. Is the potential difference V_A — V_B positive, negative or zero if Q is (i) positive (ii) negative?

7. A conducting rod PQ of length l, connected to a resistor R, is moved at a uniform speed v, normal to a uniform magnetic field B as shown in the figure.



Deduce the expression for the emf induced in the conductor.

8. In a series L-C-R circuit, obtain conditions under which

(i) impedance of the circuit is minimum.

(ii) current flowing in circuit is wattles.

9. (i) Draw V-I characteristics of solar cell.

(ii) Mention two important criteria for selection of a material for solar cell fabrication.

10. An α-particle and a proton are moving in the plane of paper in a region where there is a uniform magnetic field $\vec{B}$ directed normal to the plane of the paper. If the particles have equal linear momenta, what would be the ratio of the radii of their trajectories in the field?

11. The force between two point charges kept at a distance r apart in air is F. If the same charges are kept in water at the same distance, how does the force between them change?

12. The radius of inner most orbit of hydrogen atom is 5.1×10^{-11}m. What is the radius of orbit in second excited state?

SECTION – B (Attempt any six out of nine)

▪ **Answer question No.13 to 21 as directed. Each question carry 3 marks.(Attempt any 6 out of 9) [18]**

13. (i) With reference to photoelectric effect, define threshold wavelength.

(ii) What are matter waves?

(iii) State any one phenomenon in which moving particles exhibit wave nature.

14. How does the energy stored in a capacitor change if after disconnecting the battery, the plates of a charged capacitor is moved farther?

15. Locus of point (wavelets) having same phase of oscillations is a wavefront. Huygens' in his principle stated that each point on the given wavefront is the source of a secondary disturbance and the wavelets emanating from these points spread out in all directions with the speed of wave.

However, when this wavefront transverses through a medium, then velocity gets reduced, which can be represented as, $v_{medium} = \frac{v_{air}}{n}$, where n is the refractive index of the medium.

Now, using the above knowledge, specify the behaviour of a plane wavefront when it is incident on a prism and a spherical mirror and justify your answer.

16. An electric field is uniform in the positive X-direction for positive x and uniform with the same magnitude in the negative X-direction for negative x. It is given that

$E = 200\ \hat{i}\ NC^{-1}$ for $x > 0$

$E = -200\ \hat{i}\ NC^{-1}$ for $x < 0$

A right circular cylinder of length 20 cm and radius 5 cm has its centre at the origin and its axis along the X-axis, so that one face is at x = +10 cm while other is at x = −10 cm.

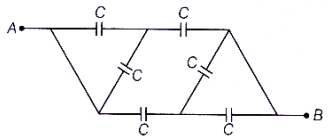
(i) What is the net outward flux through each flat face?

(ii) What is the net outward flux through the cylinder?

(iii) What is the net charge inside the cylinder?

17. A network of six identical capacitors, each of capacitance C is shown in figure.

Find the equivalent capacitance between the points A and B.



18. Draw ray diagram to show how a right angled isosceles prism can be used

(i) to deviate a ray by 90°?

(ii) to deviate a ray by 180°?

(iii) to produce an inverted image without any deviation?

19. Monochromatic light of wavelength 632.8 nm is produced by a helium- neon laser. The power emitted is 9.42 mW.

(1) Find the energy and momentum of each photon in the light beam,

(2) How many photons per second, on the average, arrive at a target irradiated by this beam? (Assume the beam to have a uniform cross-section which is less than the target area), and

(3) How fast does a hydrogenatom have to travel in order to have the same momentum as that of the photon?

20. Acircular coil of 16 turns and radius 10 cm carrying a current of 0.75 A rests with its plane normal to an external field of magnitude 5.0×10^{-2} T. The coil is free to turn about an axis in its plane perpendicular to the field direction. When the coil is turned slightly and released, it oscillated about its stable equilibrium with a frequency of 2.0 s^{-1}.

What is the moment of inertia of the coil about its axis of rotation?

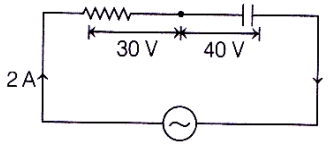
21. Using the Bohr's model calculate the speed of the electron in a hydrogen atom in the n = 1, 2, and 3 levels.

SECTION – C (Attempt any four out of six)

▪ **Answer question No. 22 to 27 as directed. Each question carry 4 marks. (Attempt any 4 out of 6) [16]**

22. (i) State the condition for resonance to occur in a series L-C-R AC circuit and derive an expression for the resonant frequency. Draw the plot showing the variation of the peak current (I_m)with frequency of the AC source used. Also, define the quality factor Q of the circuit.

(ii) Calculate the (1) impedance (2) wattles current of the given AC circuit.



23. (i) Mention the reasons for energy losses in an actual transformer.

(ii) The power transmission lines need input power at 2300 V to a step down transformer with its primary windings having 4000 turns. What should be the number of turns in the secondary windings in order to get output power at 230 V?

24. (i) Deduce the expression for the energy density stored in a charged capacitor.

(ii) Show that the effective capacitance C, of a series combination, of three capacitors C_1, C_2 and C_3 is given by

$$C = \frac{C_1 C_2 C_3}{(C_1 C_2 + C_2 C_3 + C_3 C_1)}$$

25. Derive an expression for the potential energy of an electric dipole placed in a uniform electric field. Hence, discuss the conditions of stable and unstable equilibrium.

26. With the help of a ray diagram, show the formation of image of a point object due to refraction of light at a spherical surface separation two media of refractive indices n_1 and n_2 ($n_2 > n_1$) respectively. Using this diagram, derive the relation

$$\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_1 - n_2}{R}$$

Write the sign conventions used. What happens to the focal length of convex lens when it is immersed in water?

27. (i) What is interference of light? Write the condition for sustained interference pattern on screen. What is the effect on the interference fringes to a Young's double slit experiment when

(1) The separation between the two slits is increased?

(2) The width of the source-slit is decreased?

(ii) In a Young's double slit experiment using monochromatic light of wavelength λ, the intensity of light at a point on the screen where path difference is λ in K units.

What is the intensity of light at a point where path difference is $\frac{\lambda}{3}$?