INDIAN SCHOOL AL WADI AL KABIR
REHEARSAL EXAMINATION-I

10.12.2020	**PHYSICS (042) – SET I**	**Maximum Marks: 70**
Class: XII		**Time: 3 Hours**

General Instructions:

(1) All questions are compulsory. There are 33 questions in all.

(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.

(3) Section A contains ten very short answer questions and four assertion reasoning MCQs of 1 mark each, Section B has two case-based questions of 4 marks each, Section C contains nine short answer questions of 2 marks each, Section D contains five short answer questions of 3 marks each and Section E contains three long answer questions of 5 marks each.

(4) There is no overall choice. However internal choice is provided. You have to attempt only one of the choices in such questions.

(i) Use of calculators is not permitted.
(ii) You may use the following values of physical constants wherever necessary:
(iii) $c = 3 \times 10^{8}\ ms^{-1}$, $h = 6.626 \times 10^{-34} Js$, $e = 1.602 \times 10^{-19}$ C ,

$\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1} , $\frac{1}{4\pi\epsilon 0} = 9 \times 10^{9}$ N m^2 C^{-2},

$\epsilon o = 8.854 \times 10^{-12}\ C^2N^{-1}m^{-2}$, $m_e = 9.1 \times 10^{-31}$kg, $m_n = 1.675 \times 10^{-27}$kg,

$m_p = 1.673 \times 10^{-27}$ kg, Boltzmann Constant $= 1.38 \times 10^{-23}$ J/K

Avogadro's number $N_A = 6.023 \times 10^{23}$ /mol^{-1}

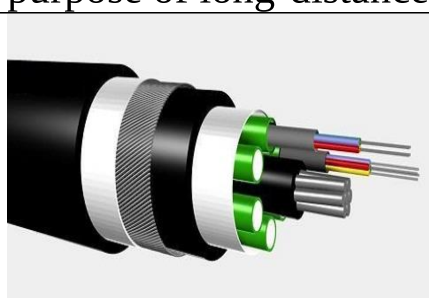
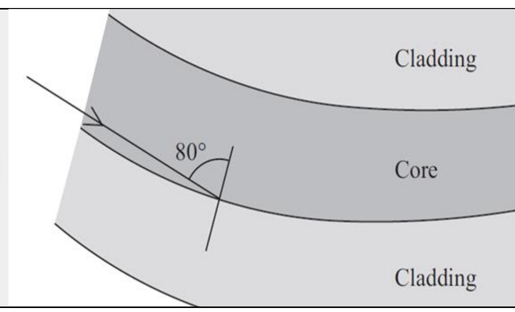
Sr. No.		Marks
	Section – A **All questions are compulsory. In case of internal choices, attempt any one of them.**	
[1]	Name the physical quantity having unit Weber	1
[2]	Name the electromagnetic wave which is suitable for radar system used in aircraft navigation. **<u>OR</u>** Write the expression for speed of electromagnetic waves in a medium of electrical permittivity $'\epsilon 0'$ and magnetic permeability ‘μ0’.	1
[3]	Write the condition [or the equation] under which the charged particles moving with different speeds in the presence of electric field ‘E’ and magnetic field ‘B’ vectors can be used to select charged particles of a particular speed ‘V’.	1
[4]	A p.d. ‘V’ is applied to a conductor of length L . How is the drift velocity affected when V is doubled and L is halved ? **<u>OR</u>** Two wires one of copper and other of manganin have same resistance and equal length. Which wire is thicker?	1
[5]	The ground state energy of hydrogen atom is – 13.6 eV. What are the kinetic and potential energies of the electron in this state?	1

<table>
<tr><td>[6]</td><td>Which of the following will experience max. force, when projected with the same velocity V :
an α particle moving perpendicular to the M.F or
an electron moving parallel to the magnetic field.</td><td>1</td></tr>
<tr><td>[7]</td><td>An electron is accelerated through a potential difference of 100Volts.What is the de-Broglie wavelength associated with it in ?</td><td>1</td></tr>
<tr><td>[8]</td><td>A light bulb and a solenoid are connected in series across an ac source of voltage. How the glow of the light bulb will be affected when an iron rod is inserted in the solenoid?

<u>OR</u>
In a series LCR circuit, the voltage across an inductor, a capacitor and a resistor are 30V, 30 V and 60V respectively. What is the phase difference between the applied voltage and the current in the circuit ?</td><td>1</td></tr>
<tr><td>[9]</td><td>For which of the following colour, the magnifying power of a compound microscope will be maximum?
Red or violet colour</td><td>1</td></tr>
<tr><td>[10]</td><td>You are given the following three lenses. Which two lenses will you prefer as an objective and as an eyepiece to construct an astronomical telescope?

<table><tr><td>LENSES</td><td>POWER [D]</td><td>APERTURE[cm]</td></tr><tr><td>L1</td><td>3</td><td>8</td></tr><tr><td>L2</td><td>6</td><td>1</td></tr><tr><td>L3</td><td>10</td><td>1</td></tr></table>
<u>OR</u></td><td>1</td></tr>
</table>

	The intensity at the central maxima in Young's double slit experiment is Io. Find out the intensity at a point where the path difference is $\frac{\lambda}{3}$	
	For question numbers 11, 12, 13 and 14, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. a) Both A and R are true and R is the correct explanation of A b) Both A and R are true but R is NOT the correct explanation of A c) A is true but R is false d) A is false and R is also false	
[11]	Assertion[A]: Electrons move away from a region of lower potential to a region of higher potential. Reason[R]: Since an electron has negative charge.	1
[12]	Assertion[A]: Work done in moving a charge between any two points in an electric field is independent of the path followed by the charge, between these points. Reason[R]: Electrostatic forces are non-conservative.	1
[13]	Assertion[A]: A capacitor blocks dc Reason[R]: This is because capacitive reactance of a capacitor is $X_c = \frac{1}{2\pi f C}$ and for dc, f = 0	1
[14]	Assertion[A]: In series combination of electrical bulbs of lower power emits more light than that of higher power bulb. Reason[R]: The lower power bulb in series gets more current than the higher power bulb.	1

	Section – B **Questions 15 and 16 are Case Study based questions and are compulsory. Attempt any 4 sub parts from each question. Each question carries 1 mark.**	
15	Optical fiber communication is a communication method in which light is used as an information carrier and optical fiber is used as a transmission medium. First, an electrical signal is converted into an optical signal, and then an optical signal is transmitted through the optical fiber, which is a type of wired communication. Optical communication utilizes the principle of total internal reflection. When the injection angle of light satisfies certain conditions, light can form total internal reflection in the optical fiber, thereby achieving the purpose of long-distance transmission.	4
	 	
	[1] The condition at which total internal reflection takes place in an optical fibre is [a] angle of incidence is lesser than critical angle [b] angle of incidence is greater than critical angle [c] the light ray should enter from rarer to denser medium [d] the frequency of light should be more than threshold frequency	

[2] The refractive index of core should be
[a] equal to the refractive index of cladding
[b] more than the refractive index of cladding
[c] less than the refractive index of cladding
[d] equal to zero

[3] Why is the total internal reflecting prism preferred over plane mirror in periscopes ?
[a] There is no loss of intensity of light in reflecting prism
[b] to reduce the size of the periscope
[c] The size of the image of the enemy ship seems to be bigger in total internal reflecting prism
[d] both [b] & [c]
[4] The possible value of refractive index of core with respect to cladding is
[a] 1.05 [b]0.95 [c] 0.5 [d] zero
[5] If the angle of incidence is 80^0,then the possible value of critical angle for the core-cladding boundary is
[a] 28^0 [b] 80^0 [c] 89^0 [d] zero

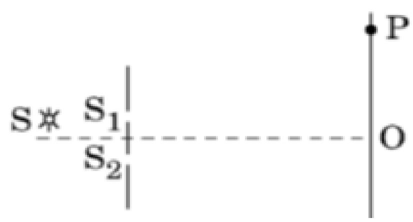
<table>
<tr><td>[16]</td><td>
Magical Cage</td><td>4</td></tr>
<tr><td></td><td>A ‘magical cage’ is an enclosure used to block electromagnetic fields . This cage may be formed by a continuous covering of conductive material. The fields within a conductor cancel out with any external fields, so the electric field within the enclosure is zero. Any electrical shocks the cage receives, pass harmlessly around the outside of the cage. This cage is also called as ‘Faraday cage’

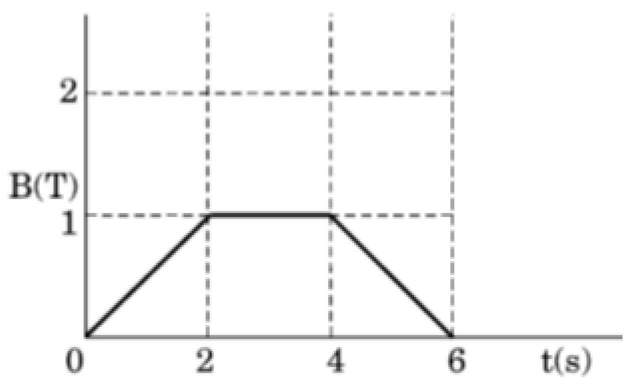
[1] Which of the following can be act as a Faraday cage?

[a] An intrinsic semiconductor
[b] A solid metal sheet
[c] A hollow metal box
[d] An insulator</td><td></td></tr>
</table>

	[2] Name the basic phenomenon involved in a Faraday Cage [a] dielectric polarization [b] electrostatic shielding [c] Superposition principle [d] Frictional electricity [3] Inside a Faraday Cage, which of the following are correct: [a] electric field, E = 0, Potential V = 0 [b]electric field, E = E, Potential V = 0 [c]electric field, E = E, Potential V = variable [d] electric field, E = 0, Potential V = constant [4] A charge 'Q' is residing on the outer surface of a Faraday Cage of inner radius 'r1' and outer radius 'r2'. A charge 'q' is placed at the centre of the Cage, then its surface charge density on the inner surface is [a] $\frac{+q}{4\pi r_1^2}$ [b] $\frac{-q}{4\pi r_1^2}$ [c] $\frac{Q-q}{4\pi r_1^2}$ [[d] Zero [5] A charge 'Q' is residing on the outer surface of a Faraday Cage of inner radius 'r1' and outer radius 'r2'. A charge 'q' is placed at the centre of the Cage, then its surface charge density on the outer surface is [a] $\frac{+q}{4\pi r_2^2}$ [b] $\frac{-q}{4\pi r_2^2}$	

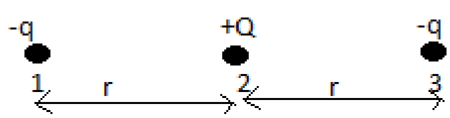
	[c] $\frac{Q+q}{4\pi r_2^2}$ [[d] Zero	
	Section – C **All questions are compulsory. In case of internal choices, attempt any one.**	
[17]	A charged particle having a charge of 2nC moving in a magnetic field B with a velocity $\vec{v}$ = $10^5\hat{\imath}$ m/s experiences a magnetic force $\vec{F}$ = $2\ x\ 10^5\ [-\hat{\jmath}]$ N. Find the direction and magnitude of the magnetic field.	2
[18]	[a]How does the angular separation between fringes in single – slit diffraction experiment change when the distance of separation between the slit and screen is doubled? [b] When light travels from a rarer to a denser medium, the speed decreases. Does this decrease in speed imply a reduction in the energy carried by the wave? **OR** [a] Define a wavefront. [b] A plane wavefront is incident on a convex lens. Draw a ray diagram showing the incident wavefront and the refracted wavefront formed.	2
[19]	Derive an expression for energy stored in a capacitor **OR** [a] Define an equipotential surface. [b] Why the equipotential surfaces about a single charge are not equidistant	2

[20]	A circular coil of radius 10 cm, 500 turns is placed with its plane perpendicular to the horizontal component of the Earth's magnetic field . It is rotated about its vertical diameter through 180^0 in 0.25s. Estimate the magnitude of the emf induced in the coil.{Given: $B_H = 3 \times 10^{-5}T$}	2
[21]	The figure shows a modified Young's double slit experimental set – up. Here $SS_2 - SS_1 = \frac{\lambda}{4}$  [a] Write the condition for constructive interference at 'P' [b] Obtain an expression for the band width	2
[22]	A magnetic needle free to rotate in a vertical plane to the magnetic meridian has its north tip down at 60^0 with the horizontal. The horizontal component of the Earth's magnetic field at the place is known to be 0.4G. Determine the magnitude of the Earth's magnetic field B_E at the place .[Take $1G = 10^{-4}T$] **OR** [a] Define the term angle of dip [I]. [b] Derive the relation between the angle of dip, horizontal component of earth's magnetic field B_H and vertical component of earth's magnetic field B_V	2

[23]	Draw a labeled ray diagram of a reflecting type telescope. Write it's any one advantage over refracting type telescope.	2
[24]	[a]Draw the labelled diagram of moving coil galvanometer. [b] What is the significance of radial magnetic field ?	2
[25]	[i] State the principle on which a potentiometer works. [ii] Draw the circuit diagram to compare the emfs of two primary cells	2
	Section -D **All questions are compulsory. In case of internal choices, attempt any one.**	
[26]	The magnetic field through a circular loop of wire 12cm in radius changes with time as shown in the figure. The magnetic field is perpendicular to the plane of the loop. Calculate the induced emf in the loop: [i] during the time interval 0 -2s [ii] 2 – 4s [iii] 4- 6s 	3
[27]	Two cells of emfs 1.5V and 2V having internal resistances 0.2 ohm and 0.3 ohm respectively are	3

	connected in parallel. Calculate the emf and internal resistance of the equivalent cell. **<u>OR</u>** [i] On the basis of electron drift, derive an expression for resistivity of a conductor in terms of number density of free electrons and relaxation time. [ii] Why alloys like constantan and manganin are used for making standard resistors?	
[28]	[a]Write Einstein's photoelectric equation in terms of the stopping potential and the frequency of the incident radiation for a given photosensitive surface. [b] Draw a suitable graph to show how one can get the information about: [i] the work function of the material [ii] value of Planck's constant from this graph **<u>OR</u>** [a] Define the term 'threshold frequency' in photo electric emission. [b] The threshold frequency of a metal is fo. When the light of frequency 2fo is incident on the metal plate, the maximum velocity of photo electrons is v1. When the frequency of the incident radiation is increased to 5fo, the maximum velocity of photo electrons is v2. Find the ratio v1: v2	3
[29]	Using Bohr's postulates, derive the expression for the total energy of the electron revolving in n^{th} orbit of hydrogen atom in terms of principal quantum number 'n' and Planks constant 'h' .	3

[30]	[a] Explain with the help of a labelled diagram the underlying principle and working of a step- up transformer. [b]Derive the expression for transformation ratio 'K'	3
	Section – E **All questions are compulsory. In case of internal choices, attempt any one.**	
[31]	Draw a ray diagram to show the formation of the image of a point object placed in a medium of refractive index μ1 on the principal axis of a convex spherical surface of radius of curvature R and refractive index μ2. Using the ray diagram, derive the relation $\frac{\mu2-\mu1}{R} = \frac{\mu2}{v} - \frac{\mu1}{u}$ **<u>OR</u>** [a] Show, with the help of a diagram, how Huygen's principle is used to obtain the diffraction pattern by a single slit. Obtain the conditions for secondary minima and secondary maxima. [b] Draw a plot of intensity distribution and explain why the secondary maxima become weaker with increasing order [n] of the secondary maxima.	5
[32]	[a] What is the basic principle of ac generator? [b] Derive the equation for instantaneous emf as E = E0 sinωt [c] With the help of a labelled diagram explain the working of ac generator. **<u>OR</u>** [a]What is impedance in LCR circuit?	5

	[b]With the help of phasor diagram, derive an expression for impedance in LCR circuit and show that , there is a phase difference of ‘Φ’ between the current and voltage . [c]Using phasor diagram, obtain the expression for phase angle ‘Φ’	
[33]	[a] Use Gauss’s theorem to find the intensity of electric field due to a thin straight infinitely long conducting wire of linear charge density ‘λ’ [b]An electric dipole of 2 charges 2 x 10^{-8} C each, separated by a distance of 2mm.It is placed near a long line charge of linear charge density 4 x10^{-4} C/m, such that the negative charge is at a distance of 2cm from the line charge. Calculate the Net force acting on the dipole. **OR** [a] Deduce the expression for the potential energy of a system of two charges q1and q2 located at r1 and r2 respectively in an external electric field. [b] 3 charges -q, +Q and –q are placed at equal distances on a straight line. If the potential energy of the system of 3 charges is zero, then what is the ratio Q:q ? 	5