Version No.			

ROLL NUMBER						

Answer Sheet No._____

Sign. of Candidate _____

Sign. of Invigilator _____

PHYSICS SSC–II

SECTION – A (Marks 12)

Time allowed: 15 Minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. **Do not use lead pencil.**

Q.1 Fill the relevant bubble for each part. All parts carry one mark.

(1) In vacuum, all electromagnetic waves have the same:

A. Speed ◯ B. Amplitude ◯
C. Frequency ◯ D. Wavelength ◯

(2) The relationship between speed, frequency and wavelength of a wave is known as:

A. Wave equation ◯ B. Frequency equation ◯
C. SHM equation ◯ D. Wavelength equation ◯

(3) Which of the following forms of wave is "sound"?

A. Electrical ◯ B. Longitudinal ◯
C. Transverse ◯ D. Magnetic ◯

(4) If a ray of light in a glass is incident on an air surface at an angle greater than the critical angle, the ray will:

A. Refract only ◯ B. Reflect only ◯
C. Partially reflect & refract ◯ D. Diffract only ◯

(5) According to Coulomb's law, if distance between charges increases, the force of attraction:

A. Will be increased ◯ B. Will be decreased ◯
C. Will be unchanged ◯ D. Will become repulsion ◯

(6) When we apply more voltage to an ohmic conductor, we get:

A. More resistance ◯ B. More flow of current ◯
C. Decrease in power ◯ D Less flow of current ◯

(7) Electromagnetism is the study of:

A. Magnetic effect of current ◯ B. Flow of protons ◯
C. Flow of electrons ◯ D. Flow of neutrons ◯

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(8) Logic gates are used in:

A.	LDRs	◯	B.	DC circuits	◯
C.	Analogue circuits	◯	D.	House safety	◯

(9) Which one of the following is the most suitable means of reliable continuous communication between an orbiting satellite and Earth?

A.	Microwaves	◯	B.	Radio waves	◯
C.	Sound waves	◯	D.	Any light wave	◯

(10) Which one of the following particles has the greatest penetrating power?

A.	α- Particle	◯	B.	β- Particle	◯
C.	γ- Particle	◯	D.	Proton	◯

(11) What is the voltage across a 6 Ω resistor when 3A of current passes through it?

A.	2 V	◯	B.	9 V	◯
C.	18 V	◯	D.	36 V	◯

(12) If the turn ratio of a step-up transformer is 10. It means:

A.	$I_s = 10\ I_p$	◯	B.	$N_s = \frac{N_P}{10}$	◯
C.	$N_s = 10\ N_p$	◯	D.	$V_p = 10V_s$	◯

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Federal Board SSC-II Examination
Physics Model Question Paper
(Curriculum 2006)

Time allowed: 2.45 hours Total Marks: 53

Note: Answer any eleven parts from Section 'B' and attempt any two questions from Section 'C' on the separately provided answer book. Write your answers neatly and legibly.

SECTION – B (Marks 33)

Q.2 Attempt any **ELEVEN** parts from the following. All parts carry equal marks. **(11×3=33)**

i. A pendulum of length 1m and period 2.01s is placed at the top of Mount Everest having an altitude of 8849m. Calculate the value of 'g' at that point.

Answer: l = 1m
T= 2.01s
g =?
$T = 2\pi \sqrt{l/g}$

$2.01 = 2\pi \sqrt{1/g}$
Squaring and re-arranging gives value of g = 9.76 m/s^2

ii. If the concave mirror produces a real image of an object, will the image be necessarily inverted?

Answer: Concave mirror always produces real and inverted images of those objects, which are placed beyond principal focus. But if an object lies within principal focus of mirror, its image will be virtual and erect. So real image will necessarily be inverted.

iii. Is the restoring force on a mass attached to spring in SHM ever zero? If so, where?

Answer: A restoring force always pushes or pulls the object performing oscillatory motion towards the mean position.
Suppose the mass attached to spring is pulled up to extreme position A and then released. The maximum restoring force exerted by the spring on the mass will pull it towards the mean position O. The mass moves back, towards the mean position O. The magnitude of the restoring force decreases with the distance from the mean position and becomes zero at O. So, at the mean position of SHM, the restoring force will be zero.

iv. How can a body be negatively charged by electrostatic induction?

Answer: Fix the object to be charged on insulated stand. Bring a positively charged rod near the insulated object. Rod will attract negative charge towards it and repel positive charge away from it. Now earth the object by a conducting wire, while the rod is still near it. Now if we first break the earth connection and then remove the rod, negative charges are uniformly distributed over the surfaces of the object. By using this process of electrostatic induction, we get a negatively charged object.

v. Does increasing the frequency of wave also increases its wavelength? If not, how are these quantities related?

Answer: No, wavelength does not increase with increase of frequency of waves because

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frequency depends upon the source which produces waves per second. But the wavelength of the wave depends on the magnitude of vibrating particles. Frequency (f) and wavelength (λ) are inversely related to each other by following equation:

$$\lambda = \frac{V}{f}$$

Hence from this equation we conclude that when frequency (f) of waves increases then their wavelength (λ) decreases.

vi. Will two wires carrying current in the same direction repel or attract each other? Give reason.

Answer: Two wires carrying current in same direction attract each other. The current in each wire generates magnetic field around each wire. In the center, the magnetic fields tend to cancel each other as they are oppositely oriented, therefore creating a weak field region. On the other sides of the wire the field is strong. So, force is exerted towards the weaker region, hence they attract each other.

vii. Write down differences between conductors and insulators.

Answer: **CONDUCTORS**

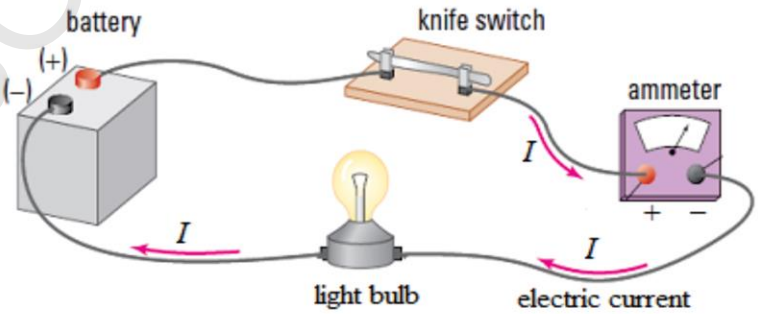
1. They are good conductors of electricity and offer less resistance to the flow of current.
2. They have large number of free electrons moving randomly in all directions.
3. Metals like silver and copper are good conductors.

INSULATORS

1. Current cannot flow through an insulator because they have very large value of resistance.
2. There are no free electrons for the flow of current and the induced charge remains static on their surface.
3. Examples of insulators are glass, wood, plastic, fur, silk, etc.

viii. How is an ammeter connected with a device to measure current? Support your answer with reason.

Answer: A large current of the range such as 1 A or 10 A can be measured by means of ammeter. Ammeter is connected in series, so the current flowing in the circuit also passes through the Ammeter.



ix. What do you understand by digital and analogue quantities?

Answer: **Analogue quantities**

The quantities whose values vary continuously or remain constant are known as analogue quantities. For example, the temperature of air varies in a continuous fashion during 24 hours of a day. If we plot a graph between time and temperature recorded at different times, we find that temperature varies continuously with time. Therefore, we say that temperature is an analogue quantity. Similarly, time, pressure, distance, etc. are analogue quantities.

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Digital quantities

The quantities whose values vary in non-continuous manner are called digital quantities. Digital quantities are expressed in the form of digits or numbers. The branch of electronics which deals with digital quantities is called digital electronics. Digital electronics uses only two digits 0 and 1.

x. Why are some elements radioactive but some are not?

Answer: Nuclei which do not emit radiations naturally are called stable nuclei. In general, most of the nuclei with atomic number 1 to 82 are stable nuclei, while the elements whose atomic number is greater than 82 are naturally unstable. They emit different types of radiations, all the time, and hence continuously change from one type of element to another.

xi. How electronic mail is preferred over traditional communication?

Answer*:* Electronic mail (or e-mail) provides very fast delivery of messages to any enabled site on the Internet. Some advantages of e-mail are as follows:
Fast Communication– We can send messages anywhere in the world instantly.
Cost Free Service– If we have an internet access, then we can avail the e-mail service free of cost.
Simple to Use- After initial set up of e-mail account, it is easy to use.
More Efficient– We can send our message to many friends or people only in one action.

xii. Explain whether the atomic number can increase during nuclear decay. Support your answer with an example.

Answer: In beta β-decay, the parent nuclide has its proton number *Z* increased by 1 but its mass number or nucleon number *A* remains unchanged.

$$^{A}_{Z}X_{Z} \longrightarrow {}^{A}_{Z+1}Y + {}^{0}_{-1}e + \text{Energy}$$

Example

$$^{14}_{6}C \longrightarrow {}^{14}_{7}Y + {}^{0}_{-1}e + \text{Energy}$$

xiii. Why is an electron beam deflected when passes through a magnetic field?

Answer: When we apply magnetic field at right angle to the beam of electrons. We will notice that the electrons beam is getting deflected from its original direction. Now if we change the direction of the magnetic field. We will see that electrons are getting deflected in the opposite direction. It is due to magnetic force, which magnetic field is applying on moving electrons. The magnetic force is increased if:

a) The number of electrons is increased.
b) Strength of magnetic field is increased.
c) The velocity of electrons is increased.

xiv. How can we find the direction of magnetic field of a current carrying conductor?

Answer: **Direction of magnetic field**

The direction of the magnetic field is governed by the direction of the current flowing through the conductor. A simple method of finding the direction of magnetic field around the conductor is the Right-Hand Grip Rule.

Grasp a wire with your right hand such that your thumb is pointed in the direction of current. Then curling fingers of your hand will point in the direction of the magnetic field.

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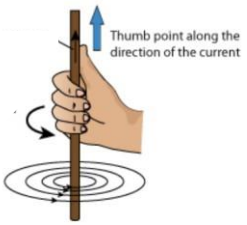


Thumb points along the direction of the current

xv. Describe electrostatic painting of cars.

Answer: **Electrostatic Powder Painting**

Automobile manufacturers use static electricity to paint new cars. The body of a car is charged and then the paint is given the opposite charge by charging the nozzle of the spray. Due to mutual repulsion, charge particles coming out of the nozzle form a fine mist and are evenly distributed on the surface of the object. The charged paint particles are attracted to the car and stick to the body, just like a charged balloon sticks to a wall. Once the paint dries, it sticks much better to the car and is smoother, because it is uniformly distributed. This is a very effective, efficient and economical

SECTION – C (Marks 20)

Note: Attempt any **TWO** questions. All questions carry equal marks. ($2 \times 10 = 20$)

Q.3 a. With the help of electroscope, how can you achieve the following: **(3x2=6)**

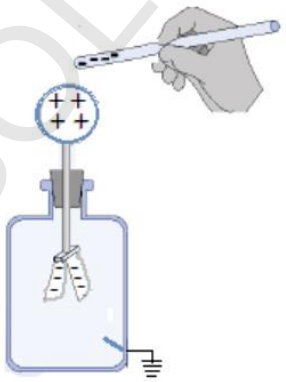
i. The detection of charge on a body.

ii. Determining the nature of charge.

Answer*:* **Detecting the Presence of Charge**

In order to detect the presence of charge on anybody, bring the body near the disk of an uncharged electroscope. If the body is neutral there will be no deflection of the leaves

But if the body is positively or negatively charged, the leaves of the electroscope diverge. For example, if the body is negatively charged then due to electrostatic induction, positive charge will appear on the disk while negative charge will appear on the leaves. The leaves of electroscope repel each other and diverge because each leave gets similar charge (fig). The divergence of leaves will depend on the amount of charge.



Detecting the Type of Charge

For the detection of type of charge on a body, electroscope is first charged either positively or negatively. Suppose the electroscope is positively charged. Now in order to detect the type of charge on a body, bring the charged body near the disk of the positively charged electroscope. If the divergence of the leaves increases, the body carries positive charge (Fig. b). On the other hand, if the divergence decreases, the body has negative charge.

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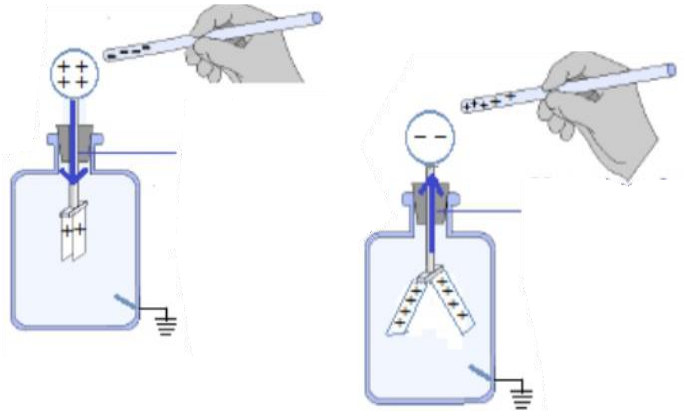


iii. Investigating whether the body under test is conductor or insulator.

Answer: **Identifying Conductors and Insulators**

Electroscope can also be used to distinguish between insulators and conductors. Touch the disk of a charged electroscope with material under test. If the leaves collapse from their diverged position, the body would be a good conductor. If there is no change in the divergence of the leaves, it will show that the body under test is an insulator.

b. An object is placed at a distance of 20cm in front of a convex mirror forms an image 10cm behind the mirror. What is its focal length? **(4)**

Answer: Given that, p = 20 cm and q = -10 cm (virtual)

Using the mirror formula,

$1/f = 1/p + 1/q$

$1/f = 1/20 - 1/10$

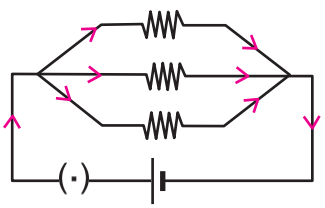
$f = -20$ cm

The negative sign indicates that the mirror used is convex.

Q.4 a. Discuss the main features of parallel combination of resistors. **(6)**

Answer: **Parallel Combination**

In parallel combination one end of each resistor is connected with positive terminal of the battery while the other end of each resistor is connected with the negative terminal of the battery (Fig.). Therefore, the voltage is same across each resistor which is equal to the voltage of the battery i.e. $V_1 = V_2 = V_3 = V$



Equivalent Resistance of Parallel Circuit **(3)**

In parallel circuit, the total current is equal the sum of the currents in various resistances i.e., $I = I_1 + I_2 + I_3$.Since the voltage across each resistance is V, so by Ohm's law

$I = V/R_1 + V/R_2 + V/R_3$

$I/V = 1/R_1 + 1/R_2 + 1/R_3$

$1/R = 1/R_1 + 1/R_2 + 1/R_3$

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Thus, we can replace the combination of resistors with a single resistor called the equivalent resistance R such that the same current passes through the circuit. Thus, the reciprocal of equivalent resistance of a parallel combination is sum of the reciprocals of the individual resistances, which is less than the smallest resistance of the combination. If resistances R_1 , R_2 , R_3 ……., R_n are connected in parallel, then the equivalent resistance of the combination will be given by

$$1/R = 1/R_1 + 1/R_2 + 1/R_3 + \ldots\ldots\ldots\ldots 1/R_n$$

b. What are the basic Logic Gates? Give symbols and truth tables of any two. **(4)**

Answer: Simple logic gates are the circuits which perform simple mathematical as well as intricate logical operations. These are digital circuits which have one or more inputs but only one output.

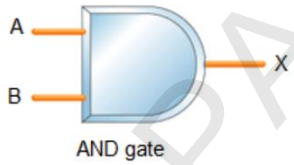
There are three basics logic gates: AND gate, OR gate and NOT gate.

AND Gate **(1.5)**

Symbol for AND operation is dot (.). Its Boolean expression is:

$$X = A \cdot B$$

The circuit which implements the AND operation is known as AND gate. Its symbol is shown in Fig. AND gate has two or more inputs and only one output. The value of output of AND gate is always in accordance with the truth table of AND gate.

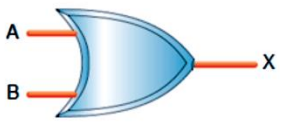


AND gate

A	B	X = A.B
0	0	0
0	1	0
1	0	0
1	1	1

OR Gate **(1.5)**

OR operation is represented by the symbol of plus (+). Boolean expression for OR operation is: X = A + B .Truth table of OR operation is shown in Table. The electronic circuit which implements the OR operation is known as OR gate. Symbolically, OR gate is shown in Fig.It has two or more inputs and has only one output. The values of output of OR gate are always in accordance with the truth table



A	B	X = A+B
0	0	0
0	1	1
1	0	1
1	1	1

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Q.5 a. Explain the working of transformer in connection with mutual induction. Describe types of transformer. **(6)**

Answer: **Transformer** **(4)**

The transformer is a practical application of mutual induction. Transformers are used to increase or decrease AC.

Working of a transformer

A transformer has two coils, electrically insulated from each other, but wound around the same iron core. One coil is called the primary coil. The other coil is called the secondary coil. Number of turns on the primary and the secondary coils are represented by N_p and N_s respectively.

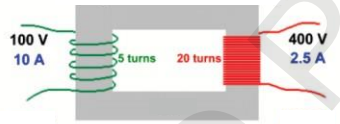
When the primary coil is connected to a source of AC voltage, the changing current creates a changing magnetic field, which is carried through the core to the secondary coil. In the secondary coil, the changing field induces an alternating e.m.f.

The e.m.f. induced in the secondary coil, called the secondary voltage V_s, is proportional to the primary voltage V_p. The secondary voltage also depends on the ratio of the number of turns on the secondary coil to the number of turns on the primary coil, as shown by the following expression:

$$V_s / V_p = N_s / N_p$$

Types of transformer **(2)**

If the secondary voltage is larger than the primary voltage, the transformer is called a step-up transformer. If the secondary voltage is smaller than the primary voltage, the transformer is called a step-down transformer.



b. Lead-210 has half-life of 22.3 years. How much of the 80 mg of lead will be left after 66.9 years? **(4)**

Answer:

Half-life of Lead $T_{1/2}$ = 22.3 years
Total time = 66.9 years
Original mass = 80mg
Remaining mass =?

No. of Half-life = 66.9/22.3 = 3
Mass left after 1st half life = 80/2 = 40mg
Mass left after 2nd half-life = 40/2 = 20mg
Mass left after 3rd half-life = 20/2 = 10mg

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