3 Yr. Degree/4 Yr. Honours 3rd Semester Examination, 2024
(under CCFUP of NEP 2020)

Time: 1½ Hours **Subject : PHYSICS** **Full Marks: 40**

Course: Multi/Inter disciplinary **Course Code : PHYS3031 (MDC/IDC)** **Course Title : Electricity, Magnetism and Electronics**

Roll No.: ..... Registration No. ..... of 20

INSTRUCTIONS TO THE EXAMINEE

1. The Question-cum-Answer Booklet comprised of 40 Questions and each Question carrying 1 (one) mark.
2. Each Question possesses 4 (four) Answer Options (A), (B), (C) and (D) of which only one option bears Correct Answer.
3. Completely darken the respective circle for your response as shown below—

   Correct method ● Wrong method ⊘ ◐
4. Each Correct Answer will be credited with 1 (One) Mark.
5. If an Examinee attempts more than one Option for a Question, the attempt will be considered as WRONG Answer.
6. No Mark will be deducted for attempting Wrong Answer or Incorrect attempts.
7. Only Blue/Black Ink Pen is to be used for Answering Question.
8. No Electronic Gadget (Calculator, Mobile Phone, Laptop, I-Pad, Camera etc.), Papers (Other than Admit Card) will be allowed inside the Examination Hall.
9. No Loose sheet will be provided for scribbling and No Paper is to brought in this purpose. Any Examinee found with incriminating Documents in his/her possession– he/she will be Expelled.
10. All rough work must be done in the page provided in the Question-Answer-Booklet, and the said Page of the Booklet **must not be torn out.**
11. No Examinee will be allowed to leave the Examination Hall until an Hour has elapsed from the commencement of the Examination.
12. As per order of the Executive Council all Answer Scripts will be preserved for one year from the date of Publication of Results.

১. Question-cum-Answer Booklet-এ মোট ৪০টি প্রশ্ন আছে এবং প্রতিটি প্রশ্নের মান ১ (এক)।

২. প্রতিটি প্রশ্নের জন্য ৪ (চার)টি করে Option (A), (B), (C) এবং (D) থাকবে, এর মধ্যে একটি সঠিক উত্তর নির্দেশ করবে।

৩. সঠিক উত্তরের জন্য নির্দিষ্ট বৃত্তটিকে সম্পূর্ণ রূপে কালো করতে হবে তা নীচে দেখানো হল—

সঠিক পদ্ধতি ● ভুল পদ্ধতি ⊘ ◐

৪. প্রতিটি সঠিক উত্তরের মান ১ (এক)।

৫. যদি কোনো পরীক্ষার্থী একটি প্রশ্নের একাধিক উত্তর দেয় তাহলে সেটি ভুল উত্তর হিসেবে গণ্য হবে।

৬. ভুল উত্তরের জন্য কোনো নম্বর বাদ যাবে না।

৭. উত্তর লেখার জন্য কেবলমাত্র নীল অথবা কালো কালির কলম ব্যবহার করা যাবে।

৮. পরীক্ষাকেন্দ্রের মধ্যে কোনো ইলেকট্রনিক্স যন্ত্রাদি (ক্যালকুলেটর, মোবাইল ফোন, ল্যাপটপ, আই-প্যাড, ক্যামেরা ইত্যাদি), কাগজ (কেবলমাত্র অ্যাডমিট কার্ড ছাড়া) নিয়ে প্রবেশ নিষেধ।

৯. হিজিবিজি বা রাফ লেখার জন্য কোনো বাড়তি কাগজ দেওয়া যাবে না এবং এই উদ্দেশ্যে কোনো কাগজ আনা যাবে না। কোনো পরীক্ষার্থীর কাছে নকল-এর মতো অপরাধমূলক কাগজ থাকলে সেই ছাত্র/ছাত্রীকে বহিষ্কার করা হবে।

১০. সমস্ত 'রাফ ওয়ার্ক' প্রশ্ন-উত্তর-পুস্তিকার সঙ্গে থাকা নির্দিষ্ট পাতাতেই করতে হবে এবং **উত্তরপত্র জমা দেবার সময় পাতাটি ছিঁড়ে নেওয়া যাবে না।**

১১. পরীক্ষা শুরু থেকে এক ঘণ্টা সময় অতিবাহিত না হলে কোনো পরীক্ষার্থী পরীক্ষার হল থেকে বের হতে পারবে না।

১২. বিশ্ববিদ্যালয় কর্ম সমিতি কর্তৃক গৃহীত সিদ্ধান্ত অনুসারে পরীক্ষার ফল প্রকাশের দিন থেকে এক বছরের জন্য উত্তরপত্র সংরক্ষিত থাকবে।

1. Which of the following is a correct statement about electric charge?

(A) Electric charge does not exert a force.
(B) Electric charge is conserved.
(C) Only positive charges exist in nature.
(D) Only negative charges exist in nature.

2. If the electric field at a point is 200 N/C, the potential difference between two points separated by 0.5 m along the field direction is

(A) 50 V
(B) 100 V
(C) 200 V
(D) 400 V

3. A dielectric material is placed in an electric field. What happens to the field inside the material?

(A) Increases
(B) Decreases
(C) Remains constant
(D) Becomes zero

4. The energy stored in a capacitor is given by

(A) $CV^2/2$
(B) $CV/2$
(C) $C^2V/2$
(D) CV^2

5. The resistivity of a material depends on

(A) the voltage applied.
(B) the length of the conductor.
(C) the material and temperature.
(D) the cross-sectional area.

6. A wire has a resistance of 10Ω at 0°C. If its temperature coefficient of resistance is 0.004/°C, what is its resistance at 40°C?

(A) 10.4 Ω
(B) 12 Ω
(C) 11.6 Ω
(D) 10.8 Ω

7. The magnetic field at a point P due to a current-carrying wire is directly proportional to

(A) the distance from P to the wire.
(B) the square of the current through the wire.
(C) the current through the wire.
(D) the resistivity of the wire.

8. A point charge $q = 5$ μC is placed at the centre of a cube of side $a = 10$ cm. The electric flux through one face of the cube is

(A) $q/(6\varepsilon_0)$
(B) $q/(4\varepsilon_0)$
(C) $q/(\varepsilon_0)$
(D) zero

9. The induced EMF in a circuit is zero when

(A) the magnetic flux through the circuit is changing.
(B) the magnetic flux through the circuit is constant.
(C) the circuit is not stationary.
(D) the circuit is closed.

10. A transformer increases the voltage from 220 V to 440 V. If the primary coil has 100 turns, how many turns does the secondary coil have?

(A) 50
(B) 200
(C) 150
(D) 400

11. Which of the following is true for a Light Emitting Diode (LED)?

(A) It emits light when reverse biased.
(B) It emits light when forward biased.
(C) It does not emit light in any biasing.
(D) It operates only in AC circuits.

12. A fuse is used in an electrical circuit to

(A) stabilize voltage fluctuations.
(B) protect the circuit from overcurrent.
(C) reduce the resistance of the circuit.
(D) increase the power supplied to the circuit.

13. A spherical conductor of radius R has a charge Q. The electric potential at a point inside the sphere at a distance $r < R$ from the centre is

(A) $Q/(4\pi\varepsilon_0 r)$
(B) $Q/(4\pi\varepsilon_0 R)$
(C) $Q/[4\pi\varepsilon_0(R - r)]$
(D) zero

14. The SI unit of permittivity is

(A) $C^2/N{\cdot}m^2$
(B) $N{\cdot}m^2/C^2$
(C) V/m
(D) Farad

15. The capacitance of a capacitor increases when

(A) the plate area decreases.
(B) the distance between plates decreases.
(C) the plate area increases and separation decreases.
(D) both plates are made of conducting material.

16. A good electrical conductor should have

(A) high resistivity and low conductivity.
(B) high conductivity and low resistivity.
(C) high resistance and high resistivity.
(D) low resistance and high resistivity.

17. The inductance of a solenoid depends on which of the following?

(A) The diameter of the solenoid
(B) The number of turns of the solenoid
(C) The length of the solenoid
(D) All of the above

18. A 60W electric fan operates on 220 V. What is the current drawn by the fan?

(A) 0.27 A
(B) 0.36 A
(C) 0.42 A
(D) 0.50 A

19. In an NPN transistor operating in active mode, which of the following is true?

(A) The emitter is at a higher potential than the collector.
(B) The base-emitter junction is forward-biased, and the collector-base junction is reverse-biased.
(C) Both junctions are reverse-biased.
(D) The base is at a higher potential than the collector.

20. Which of the following is an advantage of using an integrated circuit (IC) compared to discrete components?

(A) High cost of production
(B) Reduced size and lower power consumption
(C) Inability to function at high frequencies
(D) Increased resistance to temperature fluctuations

21. Which of the following quantities determines the energy stored in an inductor?

(A) Current flowing through it
(B) Inductance of the inductor
(C) Both inductance and current
(D) Resistance of the circuit

22. A magnetic field of strength 0.2 T acts at right angles to a moving charge of 2 C with a velocity of 3 m/s. Calculate the force experienced by the charge.

(A) 0.6 N
(B) 1.2 N
(C) 2.4 N
(D) 3.0 N

23. If a conductor's cross-sectional area is halved, its conductivity

(A) remains the same
(B) doubles
(C) halves
(D) quadruples

24. The electric dipole moment is defined as

(A) product of charge and distance between charges.
(B) ratio of charge to the separation distance.
(C) the force experienced by charges in an electric field.
(D) the potential energy of a charged system.

25. A dielectric slab is inserted into a charged capacitor. The energy stored in the capacitor

(A) increases
(B) decreases
(C) remains constant
(D) becomes zero

26. A copper wire has a diameter of 0.5 mm and a length of 5m. If the resistivity of copper is 1.7×10^{-8} Ω-m, what is its resistance?

(A) 0.25 Ω
(B) 0.43 Ω
(C) 0.75 Ω
(D) 1.0 Ω

27. According to Lenz's Law, the direction of the induced current is such that it

(A) opposes the cause of the magnetic flux change.
(B) assists the cause of the magnetic flux change.
(C) remains constant irrespective of flux change.
(D) is always in the clockwise direction.

28. The unit of magnetic permeability (μ) in the SI system is

(A) T·m/A
(B) Wb/m^2
(C) A/m
(D) N/A^2

29. Electric potential is defined as:

(A) Work done per unit charge in moving a charge in an electric field.
(B) Force per unit charge in an electric field.
(C) The amount of charge stored in an electric field.
(D) The rate of change of electric field with distance.

30. A parallel plate capacitor with air as the dielectric has a capacitance of 10 μF. If a dielectric of relative permittivity 5 is inserted, the new capacitance will be

(A) 2 μF
(B) 50 μF
(C) 10 μF
(D) 5 μF

31. The breakdown voltage of a capacitor depends on

(A) the type of dielectric used.
(B) the area of the plates.
(C) the thickness of the plates.
(D) the resistance of the capacitor.

32. Two resistances $R_1 = 3\Omega$ and $R_2 = 7\Omega$ are in parallel. The equivalent resistance is

(A) 1·1 Ω
(B) 1·5 Ω
(C) 2·1 Ω
(D) 2·5 Ω

33. Ampere's circuital law relates magnetic field intensity around a closed loop to

(A) the current enclosed by the loop.
(B) the area of the loop.
(C) the resistivity of the wire.
(D) the distance from the source.

34. A coil is rotating in a uniform magnetic field at constant angular velocity. The induced EMF varies with time according to which function?

(A) Sin (ωt)
(B) Cos (ωt)
(C) ωt
(D) t^2

35. In an NPN transistor, which of the following statement is correct?

(A) Both electrons and holes are majority carriers.
(B) Electrons are the majority carriers.
(C) Holes are the majority carriers.
(D) Current flows only when the collector-base junction is reverse biased.

36. The primary advantage of using an LED over an incandescent bulb is:

(A) High power consumption
(B) Greater heat generation
(C) Higher efficiency and longer lifespan
(D) Emission of infrared radiation

37. The electric field inside a dielectric material is reduced by a factor of

(A) dielectric constant.
(B) relative permeability.
(C) permittivity of free space.
(D) electric potential difference.

38. If the length of a conductor is doubled, its resistivity

(A) remains the same
(B) is halved
(C) is doubled
(D) is quadrupled

39. In a rectifier circuit, the main role of a diode is to

(A) amplify the current.
(B) block alternating current (AC) in one direction.
(C) convert DC to AC.
(D) store electrical energy.

40. The relative permittivity of a dielectric material is also called

(A) Conductivity
(B) Permeability
(C) Dielectric constant
(D) Capacitance