

# Sample Paper

# 5

Time : 90 Minutes

Max. Marks : 35

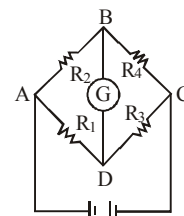
## General Instructions

1. The Question Paper contains three sections.
2. Section A has 25 questions. Attempt any 20 questions.
3. Section B has 24 questions. Attempt any 20 questions.
4. Section C has 6 questions. Attempt any 5 questions.
5. All questions carry equal marks.
6. There is no negative marking.

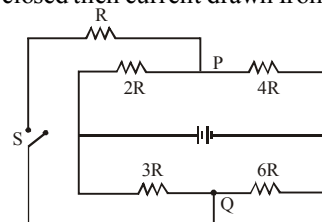
## SECTION-A

This section consists of 25 multiple choice questions with overall choice to attempt **any 20** questions. In case more than desirable number of questions are attempted, **ONLY first 20** will be considered for evaluation.

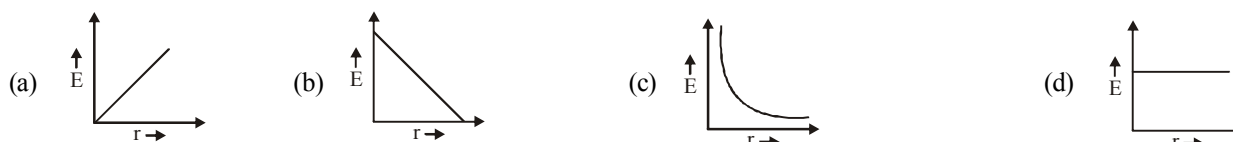
1. A current of 30A is registered when the terminals of a dry cell of emf 1.5V are connected through an ammeter. (Neglect the ammeter resistance). The amount of heat produced in the battery in 20s is  
(a) 450J (b) 900J (c) 1000J (d) 50J
2. The magnetic dipole moment of a current carrying coil does **not** depend upon  
(a) number of turns of the coil. (b) cross-sectional area of the coil.  
(c) current flowing in the coil. (d) material of the turns of the coil.
3. Sensitivity of potentiometer can be increased by  
(a) increasing the e.m.f of the cell (b) increasing the length of the potentiometer  
(c) decreasing the length of the potentiometer wire (d) None of these
4. When air in a capacitor is replaced by a medium of dielectric constant  $K$ , the capacity  
(a) decreases  $K$  times (b) increases  $K$  times (c) increases  $K^2$  times (d) remains constant
5. If the electric flux entering and leaving an enclosed surface respectively is  $\phi_1$  and  $\phi_2$ , the electric charge inside the surface will be  
(a)  $(\phi_2 + \phi_1) \times \epsilon_0$  (b)  $(\phi_2 - \phi_1) \times \epsilon_0$  (c)  $(\phi_1 + \phi_2) \times \epsilon_0$  (d)  $(\phi_2 - \phi_1) \times \epsilon_0$
6. If a dipole of dipole moment  $\vec{p}$  is placed in a uniform electric field  $\vec{E}$ , then torque acting on it is given by  
(a)  $\vec{\tau} = \vec{p} \cdot \vec{E}$  (b)  $\vec{\tau} = \vec{p} \times \vec{E}$  (c)  $\vec{\tau} = \vec{p} + \vec{E}$  (d)  $\vec{\tau} = \vec{p} - \vec{E}$
7. Three capacitors each of capacitance  $C$  and of breakdown voltage  $V$  are joined in series. The capacitance and breakdown voltage of the combination will be  
(a)  $3C, \frac{V}{3}$  (b)  $\frac{C}{3}, 3V$  (c)  $3C, 3V$  (d)  $\frac{C}{3}, \frac{V}{3}$
8. A charge  $q$  is projected into a uniform electric field  $E$ , work done when it moves a distance  $y$  is,  
(a)  $q E y$  (b)  $q y/E$  (c)  $q E/ y$  (d)  $y/q E$
9. In the figure in balanced condition of wheatstone bridge  
(a)  $B$  is at higher potential.  
(b)  $D$  is at higher potential.  
(c) Any of the two  $B$  or  $D$  can be at higher potential than other arbitrarily.  
(d)  $B$  and  $D$  are at same potential.
10. An energy source will supply a constant current into the load if its internal resistance is  
(a) very large as compared to the load resistance (b) equal to the resistance of the load  
(c) non-zero but less than the resistance of the load (d) zero



11. Why is the Wheatstone bridge better than the other methods of measuring resistances?  
 (a) It does not involve Ohm's law (b) It is based on Kirchoff's law  
 (c) It has four resistor arms (d) It is a null method
12. In the experiment of potentiometer, at balance point, there is no current in the  
 (a) main circuit (b) galvanometer circuit  
 (c) potentiometer circuit (d) both main and galvanometer circuits
13. The figure shows the circuit diagram of five resistors, a battery and a switch. If the switch S is closed then current drawn from the battery  
 (a) increases  
 (b) decreases  
 (c) remains same  
 (d) initially increases and when the resistance  $R$  gets heated then decreases.



14. The E-r curve for an infinite linear charge distribution will be



15. Two conducting spheres of radii  $R_1$  and  $R_2$  having charges  $Q_1$  and  $Q_2$  respectively are connected to each other. There is  
 (a) no change in the energy of the system  
 (b) an increase in the energy of the system  
 (c) always a decrease in the energy of the system  
 (d) a decrease in the energy of the system unless  $Q_1R_2 = Q_2R_1$
16. A rectangular coil of 100 turns and size  $0.1 \text{ m} \times 0.05 \text{ m}$  is placed perpendicular to a magnetic field of  $0.1 \text{ T}$ . The induced e.m.f. when the field drops to  $0.05 \text{ T}$  in  $0.05 \text{ s}$  is  
 (a)  $0.5 \text{ V}$  (b)  $1.0 \text{ V}$  (c)  $1.5 \text{ V}$  (d)  $2.0 \text{ V}$
17. A lamp consumes only 50% of peak power in an a.c. circuit. What is the phase difference between the applied voltage and the circuit current?  
 (a)  $\frac{\pi}{6}$  (b)  $\frac{\pi}{3}$  (c)  $\frac{\pi}{4}$  (d)  $\frac{\pi}{2}$
18. When an ac voltage of  $220 \text{ V}$  is applied to the capacitor  $C$ , then  
 (a) the maximum voltage between plates is  $220 \text{ V}$ .  
 (b) the current is in phase with the applied voltage.  
 (c) the charge on the plate is not in phase with the applied voltage.  
 (d) power delivered to the capacitor per cycle is zero.
19. If an electron and a proton having same momenta enter perpendicular to a magnetic field, then  
 (a) curved path of electron and proton will be same (ignoring the sense of revolution)  
 (b) they will move undeflected  
 (c) curved path of electron is more curved than that of the proton  
 (d) path of proton is more curved
20. Select the incorrect statement about Lorentz Force.  
 (a) In presence of electric field  $\vec{E}(r)$  and magnetic field  $\vec{B}(r)$  the force on a moving electric charge is  

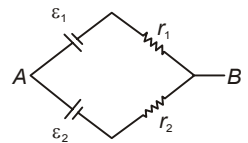
$$\vec{F} = q[\vec{E}(r) + v \times \vec{B}(r)]$$
  
 (b) The force, due to magnetic field on a negative charge is opposite to that on a positive charge.  
 (c) The force due to magnetic field become zero if velocity and magnetic field are parallel or antiparallel.  
 (d) For a static charge the magnetic force is maximum.
21. A solenoid has 2000 turns wound over a length of  $0.3 \text{ m}$ . Its cross-sectional area is  $1.2 \times 10^{-3} \text{ m}^2$ . Around its central section a coil of 300 turns is wound. If an initial current of  $2 \text{ A}$  flowing in the solenoid is reversed in  $0.25 \text{ s}$ , the emf induced in the coil will be  
 (a)  $2.4 \times 10^{-4} \text{ V}$  (b)  $2.4 \times 10^{-2} \text{ V}$  (c)  $4.8 \times 10^{-4} \text{ V}$  (d)  $4.8 \times 10^{-2} \text{ V}$
22. A direct current of  $5 \text{ A}$  is superimposed on an alternating current  $I = 10 \sin \omega t$  flowing through a wire. The effective value of the resulting current will be:  
 (a)  $15/2 \text{ amp}$  (b)  $5\sqrt{3} \text{ amp}$  (c)  $5\sqrt{5} \text{ amp}$  (d)  $15 \text{ amp}$

23. The transformation ratio in the step-up transformer is  
 (a) one (b) greater than one (c) less than one  
 (d) the ratio greater or less than one depends on the other factor
24. With increase in frequency of an A.C. supply, the inductive reactance  
 (a) decreases (b) increases directly with frequency  
 (c) increases as square of frequency (d) decreases inversely with frequency
25. Induction furnace is based on the heating effect of  
 (a) electric field (b) eddy current (c) magnetic field (d) gravitational field

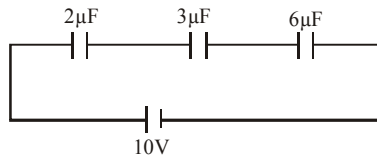
## SECTION-B

This section consists of 24 multiple choice questions with overall choice to attempt **any 20** questions. In case more than desirable number of questions are attempted, **ONLY** first 20 will be considered for evaluation.

26. The emf developed by a thermocouple is measured with the help of a potentiometer and not by a moving coil millivoltmeter because  
 (a) the potentiometer is more accurate than the voltmeter  
 (b) the potentiometer is more sensitive than voltmeter  
 (c) the potentiometer makes measurement without drawing any current from the thermocouple  
 (d) measurement using a potentiometer is simpler than with a voltmeter
27. Two batteries of emf  $\varepsilon_1$  and  $\varepsilon_2$  ( $\varepsilon_2 > \varepsilon_1$ ) and internal resistances  $r_1$  and  $r_2$  respectively are connected in parallel as shown in figure.



- (a) The equivalent emf  $\varepsilon_{eq}$  of the two cells is between  $\varepsilon_1$  and  $\varepsilon_2$ , i.e.,  $\varepsilon_1 < \varepsilon_{eq} < \varepsilon_2$   
 (b) The equivalent emf  $\varepsilon_{eq}$  is smaller than  $\varepsilon_1$   
 (c) The  $\varepsilon_{eq}$  is given by  $\varepsilon_{eq} = \varepsilon_1 + \varepsilon_2$  always  
 (d)  $\varepsilon_{eq}$  is independent of internal resistances  $r_1$  and  $r_2$
28. In the given figure, the charge on  $3 \mu\text{F}$  capacitor is



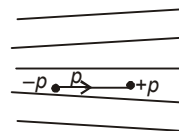
- (a)  $10 \mu\text{C}$   
 (b)  $15 \mu\text{C}$   
 (c)  $30 \mu\text{C}$   
 (d)  $5 \mu\text{C}$
29. A capacitor in an ideal LC circuit is fully charged by a DC source, then it is disconnected from DC source, the current in the circuit  
 (a) becomes zero instantaneously  
 (b) grows, monotonically  
 (c) decays monotonically  
 (d) oscillate infinitely
30. A resistance 'R' draws power 'P' when connected to an AC source. If an inductance is now placed in series with the resistance, such that the impedance of the circuit becomes 'Z', the power drawn will be

- (a)  $P \sqrt{\frac{R}{Z}}$  (b)  $P \left( \frac{R}{Z} \right)$  (c) P (d)  $P \left( \frac{R}{Z} \right)^2$

31. Consider the following statements and select the true/false.  
 I. Electric field lines are always perpendicular to equipotential surface.  
 II. No two equipotential surfaces can intersect each other.  
 III. Electric field lines are in the direction of tangent to an equipotential surface.  
 (a) T, F, F (b) F, T, F (c) T, T, F (d) T, T, T
32. Two equally charged spheres of radii a and b are connected together. What will be the ratio of electric field intensity on their surfaces?  
 (a)  $\frac{a}{b}$  (b)  $\frac{a^2}{b^2}$  (c)  $\frac{b}{a}$  (d)  $\frac{b^2}{a^2}$

33. Figure shows electric field lines in which an electric dipole P is placed as shown. Which of the following statements is correct?

- (a) The dipole will not experience any force  
 (b) The dipole will experience a force towards right  
 (c) The dipole will experience a force towards left  
 (d) The dipole will experience a force upwards



34. On decreasing the distance between the two charges of a dipole which is perpendicular to electric field and decreasing the angle between the dipole and electric field, the torque on the dipole

- (a) increases (b) decreases (c) remains same (d) cannot be predicted.

35. Among two discs A and B, first have radius 10 cm and charge  $10^{-6} \mu\text{C}$  and second have radius 30 cm and charge  $10^{-5} \text{C}$ . When they are touched, charge on both  $q_A$  and  $q_B$  respectively will, be

- (a)  $q_A = 2.75 \mu\text{C}$ ,  $q_B = 3.15 \mu\text{C}$  (b)  $q_A = 1.09 \mu\text{C}$ ,  $q_B = 1.53 \mu\text{C}$   
 (c)  $q_A = q_B = 5.5 \mu\text{C}$  (d) None of these

36. The resistance of an ammeter is  $13 \Omega$  and its scale is graduated for a current upto 100 amps. After an additional shunt has been connected to this ammeter it becomes possible to measure currents upto 750 amperes by this meter. The value of shunt-resistance is

- (a)  $2 \Omega$  (b)  $0.2 \Omega$  (c)  $2 \text{ k} \Omega$  (d)  $20 \Omega$

37. A charged particle is free to move in an electric field. It will travel

- (a) always along a line of force  
 (b) along a line of force, if its initial velocity is zero  
 (c) along a line of force, if it has some initial velocity in the direction of an acute angle with the line of force  
 (d) none of the above

38. A proton (mass =  $1.67 \times 10^{-27} \text{ kg}$  and charge =  $1.6 \times 10^{-19} \text{ C}$ ) enters perpendicular to a magnetic field of intensity 2 weber/ $\text{m}^2$  with a velocity  $3.4 \times 10^7 \text{ m/sec}$ . The acceleration of the proton should be

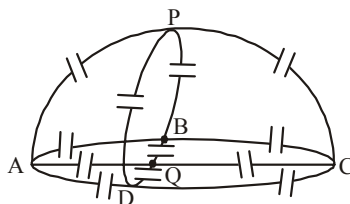
- (a)  $6.5 \times 10^{15} \text{ m/sec}^2$  (b)  $6.5 \times 10^{13} \text{ m/sec}^2$  (c)  $6.5 \times 10^{11} \text{ m/sec}^2$  (d)  $6.5 \times 10^9 \text{ m/sec}^2$

39. A.C. power is transmitted from a power house at a high voltage as

- (a) the rate of transmission is faster at high voltages (b) it is more economical due to less power loss  
 (c) power cannot be transmitted at low voltages (d) a precaution against theft of transmission lines

40. Find the capacitance between P and Q (Fig). Each Capacitor has capacitance C.

- (a)  $2C$   
 (b)  $3C$   
 (c)  $8C$   
 (d)  $6C$



41. A long solenoid has 200 turns per cm and carries a current  $i$ . The magnetic field at its centre is  $6.28 \times 10^{-2} \text{ Weber/m}^2$ . Another long solenoid has 100 turns per cm and it carries

a current  $\frac{i}{3}$ . The value of the magnetic field at its centre is

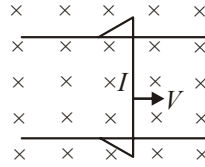
- (a)  $1.05 \times 10^{-2} \text{ Weber/m}^2$  (b)  $1.05 \times 10^{-5} \text{ Weber/m}^2$  (c)  $1.05 \times 10^{-3} \text{ Weber/m}^2$  (d)  $1.05 \times 10^{-4} \text{ Weber/m}^2$

42. The instantaneous voltage through a device of impedance  $20 \Omega$  is  $e = 80 \sin 100 \pi t$ . The effective value of the current is

- (a) 3 A (b) 2.828 A (c) 1.732 A (d) 4 A

43. The figure shows a wire sliding on two parallel conducting rails placed at a separation  $l$ . A magnetic field  $B$  exists in a direction perpendicular to the plane of the rails. The force required to keep the wire moving at a constant velocity  $v$  will be

- (a)  $evB$   
 (b)  $\frac{\mu_0 Bv}{4\pi l}$   
 (c)  $Blv$   
 (d) zero



44. A circular disc of radius 0.2 meter is placed in a uniform magnetic field of induction  $\frac{1}{\pi}$  (Wb/m<sup>2</sup>) in such a way that its axis makes an angle of 60° with  $\vec{B}$ . The magnetic flux linked with the disc is:

- (a) 0.02 Wb                      (b) 0.06 Wb                      (c) 0.08 Wb                      (d) 0.01 Wb

Given below are two statements labelled as Assertion (A) and Reason (R). Select the most appropriate answer from the options 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.

45. **Assertion :** When number of turns in a coil is doubled, coefficient of self-inductance of the coil becomes 2 times.

**Reason :** This is because  $L \propto 1/N$ .

46. **Assertion :** In series LCR resonance circuit, the impedance is equal to the ohmic resistance.

**Reason:** At resonance, the inductive reactance exceeds the capacitive reactance.

47. **Assertion :** The magnetic field at the end of a very long current carrying solenoid is half of that at the center.

**Reason :** If the solenoid is sufficiently long, the field within it is uniform.

48. **Assertion :** Magnetic field interacts with a moving charge and not with a stationary charge.

**Reason :** A moving charge produces a magnetic field.

49. **Assertion:** For a conductor resistivity increases with increase in temperature.

**Reason:** Since  $\rho = \frac{m}{ne^2\tau}$ , when temperature increases the random motion of free electrons increases and vibration of ions increases which decreases  $\tau$ .

### SECTION-C

This section consists of 6 multiple choice questions with an overall choice to attempt **any 5**. In case more than desirable number of questions are attempted, **ONLY first 5** will be considered for evaluation.

50. The electrostatic potential on the surface of a charged conducting sphere is 100V. Two statements are made in this regard  $S_1$  at any point inside the sphere, electric intensity is zero.  $S_2$  at any point inside the sphere, the electrostatic potential is 100V. Which of the following is a correct statement?

- (a)  $S_1$  is true but  $S_2$  is false  
 (b) Both  $S_1$  and  $S_2$  are false  
 (c)  $S_1$  is true,  $S_2$  is also true and  $S_1$  is the cause of  $S_2$   
 (d)  $S_1$  is true,  $S_2$  is also true but the statements are independent

51. Consider the following statements and select the correct statement(s).

- I. Current is the time rate of flow of charge through any cross-section  
 II. For a given conductor current does not change with change in cross-sectional area  
 III. The net charge in a current carrying conductor is infinite

- (a) I and II                      (b) II and III                      (c) I and III                      (d) I, II and III

**Case Study :** *Read the following paragraph and answers the questions.*

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52. The strength of the earth's magnetic field is  
(a) constant everywhere (b) zero everywhere  
(c) having very high value (d) vary from place to place on the earth's surface
53. The lines of force due to earth's horizontal magnetic field are  
(a) parallel and straight (b) concentric circles (c) elliptical (d) curved lines
54. The earth's magnetic field always has a vertical component except at the  
(a) magnetic equator (b) magnetic poles (c) geographic north pole (d) latitude  $45^\circ$
55. At the magnetic north pole of the earth, the value of the horizontal component of earth's magnetic field and angle of dip are respectively  
(a) zero, maximum (b) maximum, minimum (c) maximum, maximum (d) minimum, minimum

# OMR ANSWER SHEET

Sample Paper No -

- ★ Use Blue / Black Ball pen only.
- ★ Please do not make any stray marks on the answer sheet.
- ★ Rough work must not be done on the answer sheet.
- ★ Darken one circle deeply for each question in the OMR Answer sheet, as faintly darkened / half darkened circle might be rejected.

Start time : \_\_\_\_\_ End time \_\_\_\_\_ Time taken \_\_\_\_\_

1. Name (in Block Letters)

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2. Date of Exam

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3. Candidate's Signature

### Section-A

1. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	9. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	17. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d
2. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	10. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	18. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d
3. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	11. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	19. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d
4. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	12. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	20. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d
5. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	13. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	21. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d
6. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	14. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	22. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d
7. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	15. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	23. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d
8. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	16. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	24. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d
		25. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d

### Section-B

26. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	34. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	42. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d
27. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	35. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	43. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d
28. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	36. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	44. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d
29. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	37. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	45. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d
30. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	38. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	46. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d
31. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	39. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	47. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d
32. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	40. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	48. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d
33. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	41. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	49. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d

### Section-C

50. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	53. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d
51. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	54. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d
52. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	55. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d

No. of Qns. Attempted		Correct		Incorrect		Marks	
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