

# FIITJEE INTERNAL Phase Test

## PHYSICS, CHEMISTRY & MATHEMATICS

QP CODE: 101076

Paper-2

Time Allotted: 3 Hours

Maximum Marks: 180

- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.
- You are not allowed to leave the Examination Hall before the end of the test.

### INSTRUCTIONS

**Caution: Question Paper CODE as given above MUST be correctly marked in the answer OMR sheet before attempting the paper. Wrong CODE or no CODE will give wrong results.**

#### A. General Instructions

- Attempt ALL the questions. Answers have to be marked on the OMR sheets.
- This question paper contains **Three Sections**.
- Section-I** is Physics, **Section-II** is Chemistry and **Section-III** is Mathematics.
- All the section can be filled in **PART-A & B** of OMR.
- Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
- Blank Papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.

#### B. Filling of OMR Sheet

- Ensure matching of OMR sheet with the Question paper before you start marking your answers on OMR sheet.
- On the OMR sheet, darken the appropriate bubble with **Blue/Black Ball Point Pen** for each character of your Enrolment No. and write in ink your Name, Test Centre and other details at the designated places.
- OMR sheet contains alphabets, numerals & special characters for marking answers.

#### C. Marking Scheme For All Two Parts.

- Part-A (01-04)** – Contains Four (04) multiple choice questions which have ONLY ONE CORRECT answer. Each question carries **+3 marks** for correct answer and **-1 marks** for wrong answer.
- PART-A (05-08)** contains (4) Multiple Choice Questions which have **One or More Than One Correct** answer.  
*Full Marks: +4* If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.  
*Partial Marks: +1* For darkening a bubble corresponding to **each correct option**, provided NO incorrect option is darkened.  
*Zero Marks: 0* If none of the bubbles is darkened.  
**Negative Marks: -1 In all other cases.**  
For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will result in **+4 marks**; darkening only (A) and (D) will result in **+2 marks**; and darkening (A) and (B) will result in **-1 marks**, as a wrong option is also darkened.
- Part-B** – This section contains Eight (08) questions numerical based questions. The answer to each question is a **NUMERICAL VALUE**. If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places. Each question carries **+4 marks** for correct answer. **There is no negative marking.**

Name of the Candidate: \_\_\_\_\_

Batch: \_\_\_\_\_ Date of Examination: \_\_\_\_\_

Enrolment Number: \_\_\_\_\_

BATCHES – PANINI426-G1 & PANINI426XII-1\_PT-6

## **SECTION – I: PHYSICS**

### **(PART – A)**

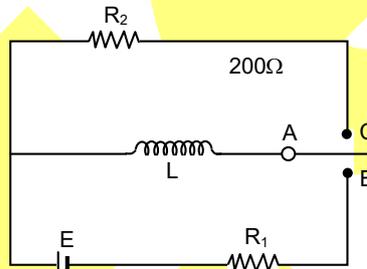
#### **(Single Correct Answer Type)**

This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

- A magnetic dipole  $\vec{M} = (A\hat{i} + B\hat{j})$  is placed in magnetic field.  $\vec{B} = (Cx^2\hat{i} + Dy^2\hat{j})$  in XY plane at  $\vec{r} = (E\hat{i} + F\hat{j})$ . Then force experienced by the small bar magnet is:
 

(A)  $2ACE\hat{i} + 2BDF\hat{j}$  (B)  $2ACE\hat{i}$   
 (C) 0 (D)  $ACE\hat{i} + BDF\hat{j}$
- The circuit shown in the figure consists of a battery of emf E, resistances  $R_1$  and  $R_2$ , inductance L and a two way switch ABC. First A is connected to B for a long time and then A is connected to C. The total heat produced in  $R_2$  is
 

(A)  $L \frac{E^2}{R_1^2}$  (B)  $\frac{LE^2}{2R_2^2}$   
 (C)  $\frac{LE^2}{2R_1^2}$  (D)  $\frac{LE^2}{2R_1R_2}$


- A short coil is placed in a time-varying magnetic field. Electrical power is dissipated due to the current induced in the coil. If the number of turns were to be quadrupled and the wire radius halved, the electrical power dissipated would be
 

(A) halved (B) same (C) doubled (D) quadrupled
- A uniform but time varying magnetic field  $B = C - Kt$ , where K and C are positive constants and t is time, is applied perpendicular to the plane of a circular loop of radius 'a' and resistance R. The total charge that will pass through any point of the loop by the time B becomes zero is:
 

(A)  $C \pi a^2/R$  (B)  $K \pi a^2/R$  (C)  $C \pi a^2/R$  (D) none of these

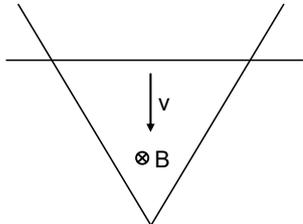
#### **(One or More Than One Options Correct Type)**

This section contains **4 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

- The magnetic flux  $\phi$  linked with a conducting coil depends on time as  $\phi = 4t^n + 6$ , where n is positive constant. The induced emf in the coil is e:
 

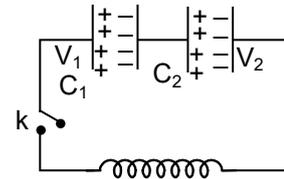
(A) If  $0 < n < 1$ ; e  $\neq 0$  and |e| decreases with time.  
 (B) If  $n = 1$ ; e is constant.  
 (C) If  $n > 1$ ; |e| increases with time.  
 (D) If  $n > 1$ ; |e| decreases with time.
- A wire is bent in form of a V shape and a uniform magnetic field B perpendicular to the plane of the wire. A uniform conducting rod starts sliding over the V shaped wire with a constant speed v as shown in the figure. If the wire has uniform resistance
 

(A) the emf in the circuit will remain constant.  
 (B) the emf in the circuit will change with time.  
 (C) the current in the rod will remain constant.  
 (D) the current in the rod will change with time.



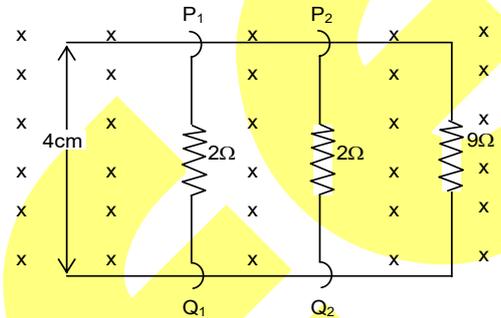
Space For Rough Work

7. Two capacitors of capacitance  $C_1$  and  $C_2$  are charged to a potential difference of  $V_1$  and  $V_2$  respectively and are connected to an inductor of inductance  $L$  as shown in the figure. Initially key  $k$  is open. Now key  $k$  is closed and current in the circuit starts increasing. When current in the circuit is maximum



- (A) charge on both the capacitors is same  
 (B) induced emf in the inductor is zero  
 (C) potential difference across both the capacitors is same  
 (D) electrostatic potential energy stored in both the capacitors is same

8. In the diagram shown, the identical wires  $P_1Q_1$  and  $P_2Q_2$  are made to slide on the rails with same speed of  $5 \text{ cm/s}$ . In this region a magnetic field of  $1 \text{ T}$  exists. The electric current in  $9 \Omega$  resistor is

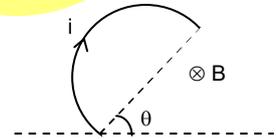


- (A) Zero if both wires slide towards left  
 (B) Zero if both wires slide in opposite direction  
 (C)  $0.2 \text{ mA}$  if both wires move towards right  
 (D)  $0.01 \text{ mA}$  if both wires move in opposite direction

### (PART - B)

This section contains **Eight (08)** numerical based questions. The answer to each question is a NUMERICAL VALUE. If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.

1. A semicircular ring of radius  $R$  carrying current  $i$  is placed in a magnetic field of intensity  $B$  so that plane of wire is perpendicular to magnetic field as shown. Net force acting on the ring is  $KBiR$ . Find the value of 'K'.

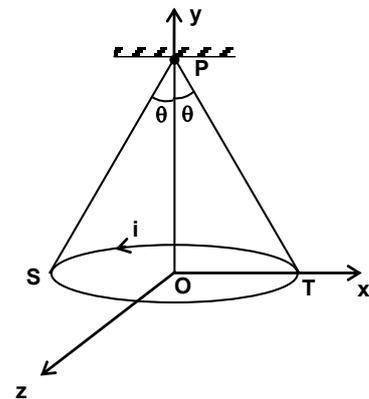


2. Flux  $\phi$  (in weber) in a closed-circuit of resistance  $1 \Omega$  varies with time  $t$  (in sec) according to the equation:

$$\phi = 6t^2 - 5t + 1$$

What is the magnitude of the induced current (in A)?

3. A ring of uniform mass density ( $m = 100 \text{ gm}$ ) and radius ( $R = 50 \text{ cm}$ ) is suspended by two strings  $PS$  and  $PT$  from the point  $P$  on  $y$ -axis in vertical plane. The ring is kept parallel to horizontal surface on  $x$ - $z$  plane. Ring carries a current  $\left(i = \frac{7}{22} \text{ amp}\right)$  as shown in the figure. There exist a magnetic field ( $B = 1 \text{ Tesla}$ ) along negative  $x$ -axis. The tension in the string  $PS$  is  $T_1$  and in the string  $PT$  is  $T_2$ . Find the ratio  $\frac{T_1}{T_2}$ . (It is given that  $\theta = 60^\circ$ )



Space For Rough Work

4. An inductor of inductance 100 mH is connected across a charged capacitor of capacitance  $0.5 \mu\text{F}$  and the resulting LC circuit is set oscillating at its natural frequency. Let  $Q$  denote the instantaneous charge on the capacitor and  $I$  the current in the circuit. It is found that the maximum value of charge is  $200 \mu\text{C}$ . When charge =  $30 \mu\text{C}$ , the value of  $\left| \frac{dI}{dt} \right|$  is  $10^n \text{As}^{-1}$ . Find the value of 'n'.
5. A coil, a capacitor and an AC source of rms voltage 24 V are connected in series. By varying the frequency of the source, a maximum rms current of 6A is observed. If coil is connected to a battery of emf 12 volt and internal resistance  $4\Omega$ , then current through it in steady state in Amperes is  $\frac{x}{2}$ . Find the value of 'x'.
6. A long solenoid has 1000 turns per metre. It has a small loop of area  $10^{-4} \text{m}^2$  placed inside it with the normal to the loop parallel to the axis of solenoid. The induced emf across the loop if the current in the solenoid is changing at the rate of  $10 \text{A/s}$  is  $n \times 10^{-6} \text{V}$ . Find the value of 'n'.
7. The current in the coil of self-inductance 3H is increasing according to  $I = 2\sin t^2$ . Find the amount of energy (in Joules) spent during the period when the current changes 0 to 5 ampere.
8. The r.m.s. value of the electric field of the light coming from the Sun is 720 N/C. the average total energy density of the electromagnetic waves is  $n \times 10^{-6} \text{J/m}^3$ . Find the value of 'n'.

## SECTION - II: CHEMISTRY

### (PART - A)

#### (Single Correct Answer Type)

This section contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

1. Which reaction produces  $\text{H}_3\text{PO}_4$ ?  
 (A)  $\text{P}_4 + \text{NaOH} \longrightarrow$  (B)  $\text{P}_4\text{O}_{10} + \text{H}_2\text{O} \longrightarrow$   
 (C)  $\text{H}_4\text{P}_2\text{O}_7 + \text{O}_2 \longrightarrow$  (D)  $\text{P}_4\text{O}_6 + \text{H}_2\text{O} \longrightarrow$
2. The reaction of  $\text{SO}_2$  with which substance produces a colloidal sol?  
 (A)  $\text{HNO}_3$  (B)  $\text{O}_2$  (C)  $\text{H}_2\text{S}$  (D)  $\text{NO}_2$
3. In which type of metallurgical process, nickel is converted to  $[\text{Ni}(\text{CO})_4]$ ?  
 (A) Concentration process (B) Smelting process  
 (C) Refining process (D) Roasting process
4. In the solution of a non-volatile solute which characteristic of the solution is expressed by  $\frac{p^\circ - p}{p^\circ}$ ?  
 (A) Mole fraction of solute (B) Mole fraction of solvent  
 (C) Boiling point of solution (D) Vapour pressure of solution

Space For Rough Work

**(One or More Than One Options Correct Type)**

This section contains **4 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. Which of the following substance(s) can react with benzene?  
 (A) ICl (B) NO<sub>2</sub>BF<sub>4</sub> (C) ClF (D) OF<sub>2</sub>
6. Which of the following properties change(s) in a crystal due to Schottky defect?  
 (A) Density decreases (B) Electrical neutrality is not maintained  
 (C) Partial conductivity will take place (D) Crystal contains more cation than anion
7. The correct statement(s) regarding ZnS unit cell is/are  
 (A) S<sup>2-</sup> ions are present at corners and face centres of the cubic unit cell  
 (B) Zn<sup>2+</sup> ions occupy half of the tetrahedral voids  
 (C) The coordination number of both ions is four  
 (D) Zn<sup>2+</sup> ions are present on the body diagonals
8. Which of the following substance(s) can decrease the freezing point of water?  
 (A)  $\begin{array}{c} \text{CH}_2\text{OH} \\ | \\ \text{CH}_2\text{OH} \end{array}$  (B) NaCl  
 (C) AlCl<sub>3</sub> (D)  $\begin{array}{c} \text{CH}_2\text{F} \\ | \\ \text{CH}_2\text{F} \end{array}$

**(PART – B)**

This section contains **Eight (08)** numerical based questions. The answer to each question is a NUMERICAL VALUE. If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.

1. 3 g of urea (NH<sub>2</sub>CONH<sub>2</sub>) is dissolved in 45 g of water. The relative lowering of vapour pressure in terms of 10<sup>-2</sup> is approximately.
2. How many compounds liberate NH<sub>3</sub> on heating from the following?  
 (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>, (NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub>, NH<sub>4</sub>Cl, NH<sub>4</sub>NO<sub>3</sub>, (NH<sub>4</sub>)<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>.
3. Hydrolysis of NCl<sub>3</sub> gives NH<sub>3</sub> and X. What is the basicity of X?
4. The number of S — O — S bonds in sulphur trioxide trimer S<sub>3</sub>O<sub>9</sub> is \_\_\_\_\_
5. A metal crystallized in b.c.c unit cell. What will be the diameter of the metal atoms in pm unit if the edge-length of the unit cell is  $\sqrt{3}$  pm?
6. Reaction of AuCl<sub>3</sub> with aqueous solution of HCHO forms a colloidal sol. What is the mass of one mole of the sol? [At. mass of Au = 197 g mol<sup>-1</sup>]
7. When  $8 \times 10^{-3}$  g of a protective colloid is added to 10 mL of standard gold sol, the colour of the sol did not change by adding one mL of 10% NaCl solution into it. What is the gold number of the protective colloid?
8. The edge-length of the unit cell of NaCl is  $2\sqrt{2} \overset{\circ}{\text{A}}$ . What is the radius of Cl<sup>-</sup> ions in  $\overset{\circ}{\text{A}}$  unit?

*Space For Rough Work*

## **SECTION – III: MATHEMATICS**

### **(PART – A)**

#### **(Single Correct Answer Type)**

This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1. If  $\int \frac{1+6x^3}{x+7 \cdot x^7} dx$ , then
- (A)  $\frac{1}{6} \ln\left(\frac{x^6}{7x^6+1}\right) - \frac{2}{\sqrt{7}} \tan^{-1}(\sqrt{7}x^3) + C$       (B)  $\frac{1}{6} \ln\left(\frac{x^6}{7x^6+1}\right) + 2 \tan^{-1}(\sqrt{7}x^3) + C$
- (C)  $\frac{1}{6} \ln\left(\frac{x^6}{7x^6+1}\right) + \frac{2}{\sqrt{7}} \tan^{-1}(\sqrt{7}x^3) + C$       (D)  $\frac{1}{6} \ln\left(\frac{x^6}{7x^6-1}\right) + \frac{2}{\sqrt{7}} \tan^{-1}(\sqrt{7}x^3) + C$
2. Let  $f(x) = \begin{cases} 2 - |x^2 + 5x + 6| & x \neq -2 \\ b^2 + 1 & x = -2 \end{cases}$   
Has relative maximum at  $x = -2$ , then complete set of values  $b$  can take is:
- (A)  $|b| \geq 1$       (B)  $|b| < 1$       (C)  $b > 1$       (D)  $b < 1$
3. If  $I = \int_1^2 \frac{dx}{\sqrt{2x^3 - 9x^2 + 12x + 4}}$ , then:
- (A)  $\frac{1}{9} < I^2 < \frac{1}{8}$       (B)  $\frac{1}{16} < I^2 < \frac{1}{9}$       (C)  $\frac{1}{6} < I^2 < \frac{1}{2}$       (D)  $\frac{1}{8} < I^2 < \frac{1}{4}$
4.  $\int \left( \int e^x \left( \ln x + \frac{2}{x} - \frac{1}{x^2} \right) dx \right) dx =$
- (A)  $e^x \ln x + C_1 x + C_2$       (B)  $e^x \ln x + \frac{1}{x} + C_1 x + C_2$
- (C)  $\frac{\ln x}{x} + C_1 x + C_2$       (D) None of these

#### **(One or More Than One Options Correct Type)**

This section contains **4 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. Consider the functions  $f(x)$  and  $g(x)$ , both defined from  $\mathbb{R} \rightarrow \mathbb{R}$  and are defined as  $f(x) = 2x - x^2$  and  $g(x) = x^n$  where  $n \in \mathbb{N}$ . If the area between  $f(x)$  and  $g(x)$  in first quadrant is  $\frac{1}{2}$  then  $n$  is a divisor of
- (A) 12      (B) 15      (C) 20      (D) 30

*Space For Rough Work*

6. Let  $F(x) = (f(x))^2 + (f'(x))^2$ ,  $F(0) = 6$ , where  $f(x)$  is a thrice differentiable function such that  $|f(x)| \leq 1 \forall x \in [-1, 1]$ , then
- (A) there is at least one point in each of the interval  $(-1, 0)$  and  $(0, 1)$  where  $|f'(x)| \leq 2$
- (B) there is atleast one point in each of the intervals  $(-1, 0)$  and  $(0, 1)$  where  $F(x) \leq 5$
- (C) there is no point of local maxima of  $F(x)$  in  $(-1, 1)$
- (D) for some  $e \in (-1, 1)$ ,  $F(e) \geq 6$ ,  $F'(e) = 0$  and  $F''(e) \leq 0$
7. Suppose  $f$  is defined from  $\mathbb{R} \rightarrow [-1, 1]$  as  $f(x) = \frac{x^2 - 1}{x^2 + 1}$  where  $\mathbb{R}$  is the set of real number. Then the statement which does not hold is :
- (A)  $f$  is many one onto
- (B)  $f$  increases for  $x > 0$  and decrease for  $x < 0$
- (C) minimum value is not attained even through  $f$  is bounded
- (D) the area included by the curve  $y = f(x)$  and the line  $y = 1$  is  $\pi$  sq. units.
8. Let  $f(x)$  be a differentiable function satisfying  $\int_0^{2x} x f(t) dt + 2 \int_x^0 t f(2t) dt = 2x^4 - 2x^3$ , for all  $x \in \mathbb{R}$  then which of the following is/are correct?
- (A) Minimum value of  $f(x)$  is equal to  $-\frac{3}{4}$
- (B)  $f(|x|)$  is non - derivable at exactly one value of  $x$
- (C) Area bounded by  $y = f(x)$  and  $x$  - axis is equal to 2
- (D)  $\lim_{x \rightarrow 1} \frac{f(x)}{x-1}$  exist and is equal to 3.

### (PART - B)

This section contains **Eight (08)** numerical based questions. The answer to each question is a NUMERICAL VALUE. If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.

1. The graph of  $f(x) = x^2$  and  $g(x) = cx^3$  intersects at two points. If the area of the region over the interval  $\left[0, \frac{1}{c}\right]$  is equal to  $\frac{2}{3}$ , then the value of  $\left(\frac{1}{c} + \frac{1}{c^2}\right)$ , is:
2. Let  $f(x) = x - x^2$  and  $g(x) = ax$ . If the area bounded by  $f(x)$  and  $g(x)$  is equal to the area bounded by the curves  $x = 3y - y^2$  and  $x + y = 3$ , then find the value of  $|[a]|$ .

Space For Rough Work

3. If  $f(x)$  is a quadratic expression in  $x$  and  $6\int_0^1 f(x)dx - \left(f(0) + 4f\left(\frac{1}{2}\right)\right) = kf(1)$  then  $k$  equals
4. If  $\int_0^{\pi/2} \sin\theta \log \sin\theta d\theta = \log\left(\frac{A}{e}\right)$  then  $A$  is equal to
5. The value of  $9999\int_0^\infty \frac{dx}{(x + \sqrt{1+x^2})^{100}} - 96$  is
6. If the  $x$  - axis divide the area of the region bounded by the parabolas  $y = 4x - x^2$  and  $y = x^2 - x$  in the ratio of  $a : b$  then  $\frac{ab}{121}$  is equal to
7. If  $\int \frac{\sec^2 x dx}{(\tan^{101} x + \tan x)} = g(x) + c$  where  $g\left(\frac{\pi}{4}\right) = -\frac{\ln 2}{100}$ , then  $\lim_{x \rightarrow \frac{\pi}{2}} g(x)$  is equal to
8. If  $\int (x^{24} + x^{16} + x^8)(2x^{16} + 3x^8 + 6)^{1/8} dx = \frac{1}{\alpha}(2x^{24} + 3x^{16} + 6x^8)^{\beta/\gamma} + C$  (where  $C$  is constant of integration and  $\beta, \gamma$  are coprime numbers) then the value of  $(\alpha + \beta + \gamma)$  is

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*Space For Rough Work*

# FIITJEE INTERNAL TEST

BATCHES – PANINI426-G1 & PANINI426XII-1

Phase Test – 6 (Paper-2)

Code: 101076

JEE ADVANCED

ANSWER KEY

ANSWER KEYS

## Physics

### PART – A

- |        |       |       |       |
|--------|-------|-------|-------|
| 1. A   | 2. C  | 3. C  | 4. C  |
| 5. ABC | 6. BC | 7. BC | 8. BC |

### PART – B

- |      |         |          |         |
|------|---------|----------|---------|
| 1. 2 | 2. 2    | 3. 3     | 4. 600  |
| 5. 3 | 6. 1.26 | 7. 37.50 | 8. 4.58 |

## Chemistry

### PART – A

- |        |       |         |         |
|--------|-------|---------|---------|
| 1. B   | 2. C  | 3. C    | 4. A    |
| 5. ABC | 6. AC | 7. ABCD | 8. ABCD |

### PART – B

- |                    |        |        |
|--------------------|--------|--------|
| 1. 2(range 1 to 3) | 2. 3   | 3. 1   |
| 4. 3               | 5. 1.5 | 6. 197 |
| 8. 1               | 7. 8   |        |

## Mathematics

### PART – A

- |        |        |        |        |
|--------|--------|--------|--------|
| 1. C   | 2. A   | 3. A   | 4. A   |
| 5. BCD | 6. ABD | 7. ACD | 8. ABD |

### PART – B

- |      |      |      |       |
|------|------|------|-------|
| 1. 6 | 2. 1 | 3. 1 | 4. 2  |
| 5. 4 | 6. 4 | 7. 0 | 8. 71 |