FIITJEE INTERNAL Phase Test

PHYSICS, CHEMISTRY & MATHEMATICS

QP CODE: 100911 **RIT – 10**

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.

BATCHES – C – XII

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

1. Attempt ALL the questions. Answers have to be marked on the OMR sheets.
2. This question paper contains **Three Sections.**
3. **Section-I** is Physics, **Section-II** is Chemistry and **Section-III** is Mathematics.
4. All the section can be filled in **PART-A & B** of OMR.
5. Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
6. 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

1. Ensure matching of OMR sheet with the Question paper before you start marking your answers on OMR sheet.
2. 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.
3. OMR sheet contains alphabets, numerals & special characters for marking answers.

C. Marking Scheme For All Two Parts.

(i) **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.

(ii) **PART–A** (**05–07)** contains **(3**) 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 options(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.

(iii) **Part-B (01-06)** This section contains **SIX (06)** questions. The answer to each question is a **NON-NEGATIVE INTEGER**. For each question, enter the correct integer corresponding to the answer. Each question carries **+4 marks** for correct answer. **There is no negative marking.**

(iv) **Part-B** (07-10) This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX**.** For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places. Each question carries **+3 marks** for the correct answer. **There is no negative marking.**

Name of the Candidate: _____

Batch: _____ **Date of Examination:** _____

Enrolment Number: _____

SECTION – I: PHYSICS

(PART – A)

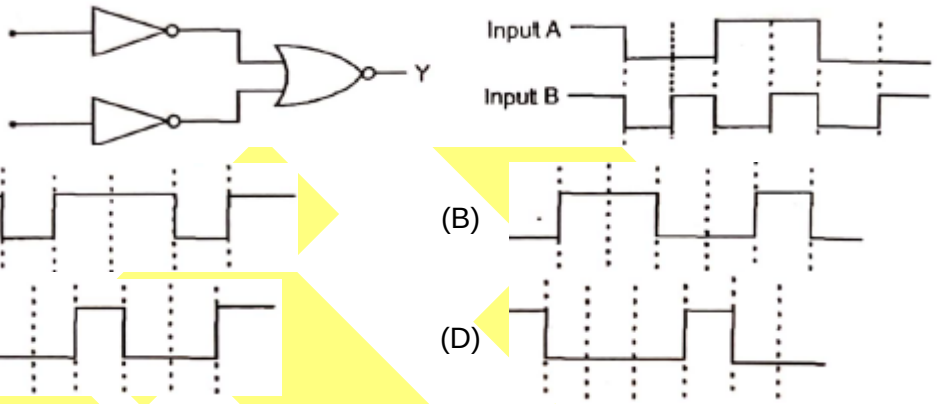
(Single Correct Answer Type)

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

1. All electrons ejected from a surface by incident light of wavelength 200 nm can be stopped before travelling 1 m in direction of uniform electric field of 4 N/C. The work function of surface is: (hc = 1240 eV nm)
   (A) 4 eV (B) 6.2 eV
   (C) 2 eV (D) 2.2 eV

2. The photon radiated from hydrogen corresponding to 2^{nd} line of Lyman series is absorbed by a hydrogen like atom 'X' in 2^{nd} excited state. As a result the hydrogen like atom 'X' makes a transition to nth orbit. Then,
   (A) $X = He^{+}$, n = 4 (B) $X = Li^{2+}$, n = 6
   (C) $X = He^{+}$, n = 6 (D) $X = Li^{2+}$, n = 9

3. The logic shown below has the input waveforms 'A' and 'B' as shown. Pick out the correct out put waveform.



4. The volume of a sphere is given by

$$V = \frac{4}{3}\pi R^3$$

where R is the radius of the sphere. Find the change in volume of the sphere as the radius is increased from 10.0 cm to 10.1 cm. Assume that the rate does not appreciable change between R = 10.0 cm to R = 10.1 cm.
   (A) 10π cm^3 (B) 20π cm^3
   (C) 30π cm^3 (D) 40π cm^3

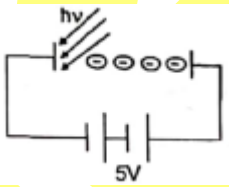
Space For Rough Work

(One or More Than One Options Correct Type)

This section contains **3 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONE** or **MORE THAN ONE is correct.**

5. When a hydrogen atom is excited from ground state to first excited state then
   (A) its kinetic energy is increases by 10.2 eV.
   (B) its kinetic energy decreases by 10.2 eV.
   (C) its potential energy increases by 20.4 eV.
   (D) its angular momentum increases by 1.05×10^{-34} J-s.

6. Photons of energy 5 eV are incident on cathode. Electrons reaching the anode have kinetic energies varying from 6 eV to 8 eV.
   (A) Work function of the metal is 2 eV.
   (B) Work function of the metal is 3 eV.
   (C) Current in the circuit is equal to saturation value.
   (D) Current in the circuit is less to saturation value.



7. The least count of a stop watch is $\frac{1}{5}$s. Two persons (A and B) use this watch to measure the time period of an oscillating pendulum. Person A takes the time period of 30 oscillations and person B takes the time period of 50 oscillations. Neglecting all other sources of error, we can say that
   (A) Absolute error in measurement of one time period by A is greater than the of B.
   (B) Absolute error in measurement of one time period by A is equal to that of B.
   (C) Accuracy in measurement of one time period by B is greater than that of A.
   (D) Accuracy in measurement of one time period by A is equal to that of B.

(PART – B)

(Non – Negative Integer)

1. In some observations, value of 'g' are coming as
   9.81, 9.80, 9.82, 9.79, 9.78, 9.84, 9.79, 9.78, 9.79 and 9.80 m/s^2. If mean error is $\frac{x}{1000}$, then value of 'x' is:

2. To find the distance d over which a signal can be seen clearly in foggy conditions, a railway. An engineer uses dimensional analysis and assumes that the distance depends on the mass density ρ of the fog, intensity (power/area) S of the light from the signal and its frequency f. An engineer find the d is proportional to $S^{1/n}$. The value of 'n' is

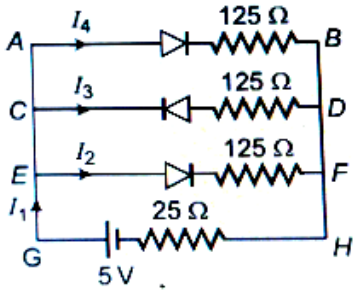
Space For Rough Work

3. Consider a nuclear reaction A + B $\rightarrow$ C. A nucleus 'A' moving with kinetic energy of 5 MeV collides with a nucleus 'B' moving with kinetic energy of 3 MeV and form a nucleus 'C' in excited state. The kinetic energy of nucleus 'C' just after its formation is $\frac{265}{N}$MeV, then value of 'N' is and it is formed in a state with excitation energy 10 MeV. Take masses of nuclei of A, B and C as 25.0, 10.0, 34.995 amu respectively. 1 amu = 930 MeV/c^2.

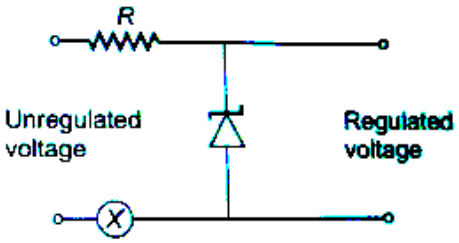
4. In a hydrogen like atom an electron is moving in an orbit having quantum number n. Its frequency of revolution is found to be 13.2×10^{15} Hz. Energy required to pull out this electron from given orbit is 54.4 eV. In a time of 7 nano second the electron jumps back to orbit having quantum number $\frac{n}{2}$.

τ be the average torque acted on the electron during the above process, then find $\frac{\tau}{5} \times 10^{27}$ Nm. (given: $\frac{h}{\pi}$ = 2.1×10^{-34} J-s, frequency of revolution of electron in the ground state of H-atom v_G = 6.6×10^{15} Hz and ionization energy of H atom, E_0 = 13.6 eV)

5. If each diode in figure has a forward bias resistance of 25 Ω and infinite resistance in reverse bias, what will be the values of the current I_2 (in milli ampere)?



6. A zener of power rating 1 W is to be used as a voltage regular. If Zener has a breakdown of 5 V and it has to regulate voltage which fluctuated between 3 V and 7 V, what should be the value of R for safe operation.



Space For Rough Work

(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Paragraph for Question no. 7 to 8

A beam of alpha particles is incident on a target of lead. A particular alpha particle comes in 'head-on' to a particular lead nucleus and stops 6.50×10^{-14} m away from the center of the nucleus. (This point is well outside the nucleus). Assume that the lead nucleus, which has 82 protons, remains at rest. The mass of alpha particle is 6.64×10^{-27} kg.

7. Calculate the electrostatic potential energy at the instant when the alpha particle stops? (in MeV)

8. What initial kinetic energy, (in Kilo-eV) did the alpha particle have, , when it is at very large distance from lead nucleus?

Paragraph for Question no. 9 to 10

A sample of hydrogen gas in its ground state is irradiated with photons of 10.2 eV energies. The radiation from the above sample is used to irradiate two other samples of excited ionized He^+ and excited ionized Li^{2+}, respectively. Both the ionized samples absorb the incident radiation.

9. How many spectral lines are obtained in the spectra of Li^{2+} ?

10. Which is the smallest wavelength that will be observed in spectra of He^+ ion (in nm)?

Space For Rough Work

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. The order of standard electrode potential for M^{3+}/M^{2+} couple is correctly represented for metal ions M^{3+} as
   (A) $Co^{3+} < Fe^{3+} < Cr^{3+}$ (B) $Fe^{3+} < Co^{3+} < Cr^{3+}$
   (C) $Cr^{3+} < Co^{3+} < Fe^{3+}$ (D) $Cr^{3+} < Fe^{3+} < Co^{3+}$

2. The wrong statement regarding an sulphate ore is that
   (A) It undergoes calcinations to remove sulhpur from it
   (B) it undergoes roasting to convert the metal into metal oxide
   (C) it's solution is subjected to hydrometallurgy if the metal associated with the ore is copper
   (D) the molten ore undergoes electrolysis if the metal to be extracted, is highly electropositive

3. Which of the following gives a strong yellowish green fluorescence in a very dilute alkaline solution?
   (A) phenolphthalein (B) fluorescein
   (C) alizarin (D) rosaniline

4. Sulfide ores are common for the metals
   (A) Ag, Cu and Pb (B) Ag, Cu and Sn
   (C) Ag, Mg and Pb (D) Al, Cu and Pb

(One or More Than One Options Correct Type)

This section contains **3 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONE** or **MORE THAN ONE is correct.**

5. Daniel cell: $\underset{(50\ mL\,1M)}{Zn|Zn^{2+}(aq)}||\underset{(50\ mL\,1M)}{Cu^{2+}(aq)|Cu}$ operates
   as electrolysis cell for 60 min and a current of 0.965 amp is passed. Which is/are correct?
   $\left(E^{o}_{Cu^{2+}/Cu} = 0.34V, E^{o}_{Zn^{2+}/Zn} = -0.76\,V\right)$
   (A) After electrolysis Zn^{2+}concentration is 1.36 M
   (B) After electrolysis Cu^{2+}concentration is 0.64 M
   (C) After electrolysis Zn^{2+}concentration is 0.82 M
   (D) After electrolysis Cu^{2+}concentration is 1.18 M

6. Which of the following is/are Transuranium element?
   (A) Th (B) Pa
   (C) Np (D) Bk

Space For Rough Work

7. Among the following the process that uses the formation of a complex is:
(A) vapour phase refining of Nickel
(B) separation of lead and zinc during concentration of their sulphide ores
(C) estimation of Cu^{2+} by gravimetric analysis
(D) oxidation of oxalic acid by $KMnO_4$

(PART – B)

(Non – Negative Integer)

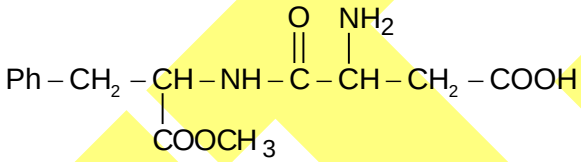
1. How many pairs of enantiomers are possible for [M(AA)(BC)de]?

2. If co-ordination number of $[M^{2+}]$ is four, how many moles of acetylacetonato anion per mole of metal ion is/are needed to form stable complex

3. What is the total number of correct statements in the following?
(A) Antiseptics are applied to living tissues.
(B) Aspirin is non-narcotic analgesic.
(C) Disinfectants are applied to inanimate.
(D) Aspartame is an artificial sweetener.
(E) Aspirin is acetyl salicylic acid.
(F) Insulin is a co-enzyme.
(G) Aluminium hydroxide is an antacid.
(H) D.D.T. is non-biodegradable pollutant.

4. The sum of total numbers of isomers possible for the complexes $\left[Co(ox)(PMe_3)_2(NH_3)(Cl)\right]$ and $K_4Fe(CN)_6$ is…….

5. The structure of aspartame is given below



If x = Number of dipolar ions formed by aspartame, considering stereoisomerism and
y = Number of non-bonding electron pairs present in the dipolar structure, what is the value of (x + y)?

6. During the discharge of a lead storage battery, the density of H_2SO_4 falls from 2.016 to 1.12 g mL^{-1}. Initially it was 25% H_2SO_4 by weight and that and finally it is 20%H_2SO_4 by weight. The battery holds 3.5L of acid and volume remains practically constant during the discharge. Calculate the number of ampere hours for which the battery must have been used. Given answer in nearest integer. [F = 96500]

Space For Rough Work

(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Paragraph for Question no. 7 to 8

Heavy metal compound (A) with a (+2) oxidation state on the central metal on heating produces a gas (B). The element of gas(B) forms a paramagnetic oxide (C). (A) on treatment with a chromate salt produces yellow crystalline p.p.t (D). (B) on reaction with water procures two acids (E), (F); (F) on heating gives (B) {Atomic weight of Pb = 207, Ba = 137}

7. Molecular weight of compound (A) is_____.

8. Molecular formula of (E) is HNO_x, the value of x is _____.

Paragraph for Question no. 9 to 10

An electrochemical cell is set up by combining the Zn electrode with hydrogen electrode. Zinc electrode behaves as anode and the hydrogen electrodes as cathode. The concentration of Zn^{2+} ions in the electrolyte is 0.01 M and that of H^+ ions in the electrolyte is 'C' M. The cell is represented as:

$Zn(s) \mid Zn^{2+}(0.01\ M) \parallel H^+(CM) \mid H_2(1\ bar), Pt(s)$

x = pH of hydrogen electrode when $E_{cell} = E^o_{cell}$

y = The potential of the hydrogen electrode in volt unit when $E_{cell} = E^o_{cell}$

9. The value of x is

10. The value of |y| upto two decimal point is

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 ABCD is a regular tetrahedron with length of any edge 'ℓ', then the minimum distance of any vertex from the opposite face is

(A) $\sqrt{\frac{2}{3}}\ell$ (B) $\sqrt{\frac{3}{2}}\ell$

(C) $\frac{2}{3}\ell^2$ (D) $\frac{1}{\sqrt{3}}\ell$

2. Let $\vec{a}=\hat{i}+\hat{j}, \vec{b}=\hat{j}+\hat{k}$ and $\vec{c}=\alpha\vec{a}+\beta\vec{b}$. If the vectors, $\hat{i}-2\hat{j}+\hat{k}, 3\hat{i}+2\hat{j}-\hat{k}$ and $\vec{c}$ are coplanar then $\frac{\alpha}{\beta}$ is

(A) 1 (B) 2

(C) 3 (D) –3

3. Two lines whose equations are $L_1: \frac{x-3}{2}=\frac{y-2}{3}=\frac{z-1}{\lambda}$ and $L_2: \frac{x-2}{3}=\frac{y-3}{2}=\frac{z-2}{3}$ lie in the same plane. If L_1 intersects a plane $x+y+z=15$ at P, then distance of P from (3, 4, 3) is

(A) 6 (B) 4

(C) 2 (D) 3

4. A biased die is such that probability of obtaining face numbered i is proportional to i. If die is rolled twice and face 'a' and 'b' turn up on first and second turn respectively, then probability that a is even and b is odd is –

(A) $\frac{12}{49}$ (B) $\frac{9}{49}$

(C) $\frac{17}{49}$ (D) $\frac{8}{49}$

(One or More Than One Options Correct Type)

This section contains **3 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONE** or **MORE THAN ONE is correct.**

5. A plane meets the coordinate axes in A, B, C such that centroid of the triangle ABC is the point $(1, r, r^2)$. The plane passes through the point (4, –8, 15) if r is equal to

(A) –3 (B) 3

(C) 5 (D) –5

Space For Rough Work

6. A line passes through two points A and B whose position vectors are $\hat{i}+\hat{j}-2\hat{k}$ and $\hat{i}-3\hat{j}+\hat{k}$ respectively. The position vector of a point on it at a unit distance from the point A is

(A) $\frac{1}{5}\left(5\hat{i}+\hat{j}-7\hat{k}\right)$ (B) $\frac{1}{5}\left(4\hat{i}+9\hat{j}-13\hat{k}\right)$

(C) $\frac{1}{5}\left(6\hat{i}+\hat{j}-7\hat{k}\right)$ (D) $\frac{1}{5}\left(5\hat{i}+9j-13\hat{k}\right)$

7. In an experiment A and B events are such that $P\left(\overline{A}\right)=\frac{6}{11}; P(B)=\frac{5}{22}, P(A\cap B)=\frac{1}{11}$, then

(A) $P(A\cup B)=\frac{15}{22}$ (B) $P\left(\overline{A}\cap\overline{B}\right)=\frac{9}{22}$

(C) $P\left(\overline{B}\cap A\right)=\frac{4}{11}$ (D) $P\left(\overline{A}\cup\overline{B}\right)=\frac{10}{11}$

(PART – B)

(Non – Negative Integer)

1. If two numbers are randomly chosen from the set of first 30 natural numbers, then probability that atleast one of them is prime is given by $\frac{a}{b}$, where a and b are coprime, then value of $\frac{b-a}{19}$ will be

2. Bag I contains 4 white and 3 black balls and another bag II contains 5 white and 2 black balls. Two balls are drawn randomly from the first bag and put in the second bag and then a ball is drawn from the bag II. The probability that the ball drawn from the second bag is white is expressed as $\left(\frac{p}{q}\right)$ where $p,q\in N$. Then the minimum value of $(p+q)$ is

3. Humpty plays three matches against Dumpty. In any match the probabilities of Humpty getting 0, 2 and 3 points are 0.2, 0.3 and 0.5 respectively. If probability that Humpty getting atmost 6 points is $\frac{p}{200}$, then sum of the digits of 'p' is

4. If $\vec{a},\vec{b}$ and $\vec{c}$ are mutually perpendicular vectors such that $|\vec{a}|=\sqrt{6}, |\vec{b}|=\sqrt{2}, |\vec{c}|=\sqrt{3}$ and vector $\vec{v}=\left(\vec{a}\times\left(\vec{a}\times\vec{b}\right)\right)\times\vec{c}+\left(\vec{b}\times\left(\vec{b}\times\vec{c}\right)\right)\times\vec{a}+\left(\vec{c}\times\left(\vec{c}\times\vec{a}\right)\right)\times\vec{b}$ where magnitude of $\vec{v}$ is M then M^2 is

Space For Rough Work

5. Consider a line passing through the point P (3, 4, 5) and having direction ratios (2, –2, 1). If image of point Q (1, –1, 8) w.r.t. given line in Q', then length of median of $\Delta PQQ'$ through vertex P is

6. Let $\hat{a}+2\hat{b}+\hat{c}=\hat{a}\times\hat{c}$ then $\left|\hat{a}\times\hat{b}+\hat{b}\times\hat{c}+\hat{a}+\hat{b}+\hat{c}\right|$ is equal to

(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Paragraph for Question no. 7 to 8

Let $\left|\vec{a}\right|=\left|\vec{b}\right|=2$ and $\left|\vec{c}\right|=1$. Also $\left(\vec{a}-\vec{c}\right).\left(\vec{b}-\vec{c}\right)=0$

7. $\left|\vec{a}-\vec{b}\right|^2+2\vec{c}.\left(\vec{a}+\vec{b}\right)$ has the value equal to

8. $\left|\vec{a}+\vec{b}-\vec{c}\right|^2$ equals

Paragraph for Question no. 9 to 10

Consider three vectors $\vec{p}=\hat{i}+\hat{j}+\hat{k}$, $\vec{q}=2\hat{i}+4\hat{j}-\hat{k}$ and $\vec{r}=\hat{i}+\hat{j}+3\hat{k}$ and let $\vec{s}$ be a unit vector, then

9. If $\left(\vec{p}\times\vec{q}\right)\times\vec{r}=u\vec{p}+v\vec{q}+w\vec{r}$, then $\left(u+v+w\right)$ equals to

10. The magnitude of the vector $\left(\vec{p}.\vec{s}\right)\left(\vec{q}\times\vec{r}\right)+\left(\vec{q}.\vec{s}\right)\left(\vec{r}\times\vec{p}\right)+\left(\vec{r}.\vec{s}\right)\left(\vec{p}\times\vec{q}\right)$ is

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES – C-XII

RIT – 10

Code : 100911

ANSWERS

Physics

PART – A

1.	D	2.	D	3.	D	4.	D
5.	BCD	6.	AD	7.	AC		

PART – B

1.	14	2.	3	3.	100	4.	3
5.	25	6.	10	7.	3.63	8.	3630
9.	15	10.	24.4 (range: 24.3 to 24.4)				

Chemistry

PART – A

1.	D	2.	B	3.	B	4.	A
5.	AB	6.	CD	7.	AB		

PART – B

1.	5	2.	2	3.	7	4.	16
5.	16	6.	268	7.	331.00	8.	2.00
9.	1.00	10.	0.06 (range 0.059 to 0.06)				

Mathematics

PART – A

1.	A	2.	D	3.	D	4.	A
5.	BC	6.	AD	7.	BCD		

PART – B

1.	2	2.	106	3.	4	4.	396
5.	3	6.	1	7.	10	8.	7
9.	2	10.	4				