VMC Vidyamandir Classes SINCE 1986

IIT JEE | MEDICAL | FOUNDATION

CODE A

JEE Advanced Booster Test - 2 | 2024

Date: 09/09/2022 **Maximum Marks: 177**

Timing: 04:00 PM - 07:00 PM **Duration: 3.0 Hrs**

General Instructions

1. The question paper consists of 3 Subjects (Subject I: **Physics**, Subject II: **Chemistry**, Subject III: **Mathematics**). Each Subject has **two** sections (Section 1 & Section 2).

2. **Section 1** contains **3 types** of questions **[Type A, Type B and Type C].**

   Type A contains **Five (05) Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.

   Type B contains **Five (05) Multiple Correct Answers Type Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

   Type C contains **ONE (01) paragraph**. Based on the paragraph, there are **TWO (02)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.

3. **Section 2** contains **6 Numerical Value Type Questions**. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, Θ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)

4. For answering a question, an ANSWER SHEET (OMR SHEET) is provided separately. Please fill your **Test Code, Roll No.** and **Group** properly in the space given in the ANSWER SHEET.

Name of the Candidate (In CAPITALS) : _____

Roll Number : _____

OMR Bar Code Number : _____

Candidate's Signature : _____ **Invigilator's Signature** _____

Syllabus

Physics: Vectors & forces (Including relative velocity), Kinematics of a particle

Chemistry: Stoichiometry-I, Atomic structure

Mathematics: Quadratic Equations, Trigonometry

MARKING SCHEME

SECTION-1 | Type A

- This section contains **Five (05)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the answer. For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme:

  Full Marks : +3 If ONLY the correct option is chosen;
  Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);
  Negative Marks : –1 In all other cases.

SECTION-1 | Type B

- This section contains **Five (05)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:

  Full Marks : +4 If only (all) the correct option(s) is(are) chosen;
  Partial Marks : +3 If all the four options are correct but ONLY three options are chosen;
  Partial Marks : +2 If three or more options are correct but ONLY two options are chosen, both of which are correct;
  Partial Marks : +1 If two or more options are correct but ONLY one option is chosen and it is a correct option;
  Zero Marks : 0 If unanswered;
  Negative Marks : –2 In all other cases.
- For example, in a question, if (A), (B) and (D) are the ONLY three options corresponding to correct answers, then
  choosing ONLY (A), (B) and (D) will get +4 marks; choosing ONLY (A) and (D) will get +2 marks;
  choosing ONLY (A) will get +1 mark;
  choosing no option(s) (i.e. the question is unanswered) will get 0 marks and
  choosing any other option(s) will get –2 marks.

SECTION-1 | Type C

- This section contains **ONE paragraphs**. Based on each paragraph, there are **TWO** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme;

  Full Marks : +3 If ONLY the correct option is chosen;
  Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);
  Negative Marks : −1 In all other cases.

SECTION - 2

- This section contains **6 Integer Type Questions**. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, Θ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)
- Answer to each question will be evaluated according to the following marking scheme:

  Full Marks: +3 If ONLY the correct Integer value is entered. There is **NO negative marking.**
  Zero Marks: 0 In all other cases.

SUBJECT I : PHYSICS 59 MARKS

SECTION-1 | Type A

This section consists of 5 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.

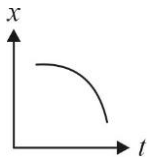
1. Man A sitting in a car moving with 54 km/hr observes another man B in front of car crossing perpendicularly the road of width 15*m* in 3*s*. The speed of man B is :

(A) $5\sqrt{10}m/s$ **(B)** 5 *m/s* **(C)** 10 *m/s* **(D)** 15 *m/s*

2. A horizontal force of 10N is necessary to just hold a block stationary against a wall. The coefficient of friction between the block and the wall is 0.4, the weight of the block is:

(A) 4N **(B)** 40N **(C)** 5N **(D)** 10N

3. The position-time graph of a particle moving along a straight line is shown below. Which statement is correct regarding the motion of particle ?



(A) Particle is accelerating **(B)** Particle is retarding

(C) Particle's speed is slowing down **(D)** Particle's speed is constant

4. A stick is thrown down with speed 0.5*u* from a high tower. An ant sitting at the lower end of the stick begins to crawl up at the instant the stick is thrown. Velocity of the ant relative to the stick remains constant and is equal to *u*. Assume that stick remains vertical during the fall and its length is sufficiently long. Find the maximum height attained by the ant (measured from its initial position)

(A) $9u^2/8g$ **(B)** $u^2/8g$ **(C)** $u^2/2g$ **(D)** $u^2/4g$

5. The position of a particle moving in a straight line in given by $x = 3t^3 - 18t^2 + 36t$. Here, *x* is in *m* and *t* is second. Then choose the INCORRECT option.

(A) Direction of velocity and acceleration both change at $t = 2s$

(B) The distance travelled by particle is equal to magnitude of displacement for $t = 0$ to $t = 5$s

(C) The speed of particle is decreasing in $t = 0$ to $t = 2s$ then it is increasing for $t > 2$

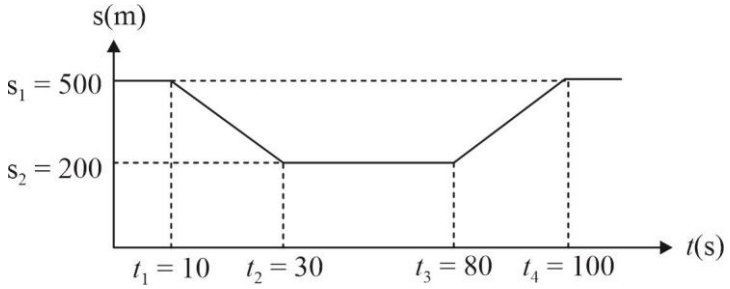
(D) The magnitudes of velocity and acceleration are equal at $t = 0$

SPACE FOR ROUGH WORK

SECTION-1 | Type B

This section consists of 5 Multiple Correct Answers Type Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

6. There is a narrow bridge somewhere on a road connecting two towns A and B. Two cars travel from A to B with a constant speed v_1 everywhere on the road, except on the bridge, where they travel with another constant speed v_2. How the separation s between the cars varies with time t is shown in the following graph. Which of the following statements is (are) correct ?



(A) The speed v_1 of the car on the road is 25m/s

(B) Length of the bridge is 700 m

(C) The speed v_2 of the car on the road is 25m/s

(D) The speed v_2 of the car on the road is 10m/s

7. A car travels 8 km towards north at an angle of 45° to the east and then travels a distance of 6 km towards north at an angle of 135° to east. Which of the following statements is (are) correct ?

(A) Minimum distance of the final point from the starting point is 10 km

(B) Minimum distance of the final point from the starting point is $10\sqrt{2}$ km

(C) The straight line joining its initial and final position makes an angle $\tan^{-1}(3)$ with east.

(D) The straight line joining its initial and final position makes an angle $\tan^{-1}(7)$ with east.

8. A boy takes 60 min to swim across a river, if his goal is to minimize time; and takes 180 min, if his goal is to minimize to zero the distance that he is carried downstream. In both these attempts, the boy swims with the same speed relative to the river current. Which of the following statements can be true?

(A) He can swim relative to water faster than the river current.

(B) He cannot swim relative to water faster than the river current.

(C) If width of the river is $3\sqrt{2}$ km, speed of river current is 4 km/h.

(D) If he crosses a $3\sqrt{2}$ km wide river in $60\sqrt{2}$ min, he will be carried $\sqrt{2}$ km downstream.

9. N particles moving in a straight line have initial velocities of 1, 2, 3,.... N m/s and accelerations of 1, 2, 3,... N m/s^2 respectively. If the initial spacing between any two consecutive particles is same then, select the correct alternative(s)

(A) The distance between any two particles remains constant throughout motion

(B) The distance between any two consecutive particles is same for all particles and increases with time.

(C) The distance between any two consecutive particles is different and increases with time

(D) The distance between any two consecutive particles increases periodically with time.

10. The instantaneous velocity v of a particle is related to its displacement x according to the relation $v = ax + b$, where $a > 0$ and $b \le a$.

Which of the following statement(s) is (are) true if $x = 0$ at $t = 0$:

(A) The displacement of the particle at time t is $x = \frac{b}{a}(e^{at} - 1)$

(B) The velocity of particle at time t is be^{at}

(C) The particle's velocity will be 'b' at time $t = 0$

(D) The acceleration of the particle is constant.

SECTION-1 | Type C

This section consists of ONE (01) paragraph. Based on each paragraph, there are **TWO (02)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.

PARAGRAPH FOR Q-11 & 12

A body is dropped from a balloon moving up with a velocity of 4 ms^{-1} when the balloon is at a height of 120.5 m from the ground.

11. The height of the body after 5s from the ground is $(g = 9.8\ m/s^{-1})$:

(A) 8 m **(B)** 12 m **(C)** 18 m **(D)** 24 m

12. The distance of separation between the body and the balloon after 5 s is:

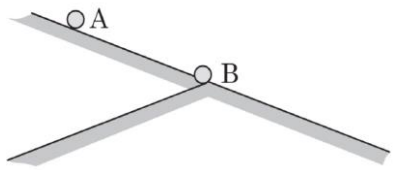
(A) 122.5 m **(B)** 100.5 m **(C)** 132.5 m **(D)** 112.5 m

SECTION-2

This section consists of 6 Numerical Value Type Questions. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, ⊖ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)

1. The speed of a motorboat in still water is four times the speed of river. Normally, the motorboat takes one minute to cross the river to the port straight across on the other bank. One time, due to a motor problem, it was not able to run at full power, and it took four minutes to cross the river along the same path. Find the ratio of speed of the boat in still water in this case to its original value. (Assume that the speed of the water is uniform throughout the whole width of the river). (take $\sqrt{31} = 5.6$)

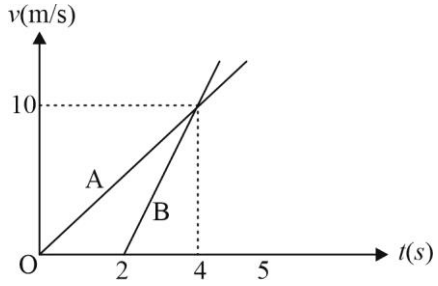
2. Two balls A and B are simultaneously released on two frictionless inclined planes from the positions shown. The inclined planes have equal inclinations. The balls pass through a particular horizontal level 12s and 4s after they were released. How long in sec after they were released will they be closest to each other?



3. The resultant of two vectors $\vec{A}$ and $\vec{B}$ is perpendicular to the vector $\vec{A}$ and its magnitude is equal to half of the magnitude of the vector $\vec{B}$. Find out the angle in degrees between $\vec{A}$ and $\vec{B}$.

4. A ball is dropped on a floor from a height 20*m*. Every time the ball rebounds, its speed after collision becomes 0.8 times of its speed before collision. Then, the average speed of the ball until it comes to rest is _____ *m*/*s*. [Take $g = 10 m/s^2$]

5. Two particles *A* and *B* start from same point and move along a straight line. Velocity-time graph for both of them is as shown in figure. The maximum separation between the particles in the interval $0 < t < 5$ sec is _____ m.



6. Wind is blowing at constant velocity *v* towards west. A man initially at rest starts moving with constant acceleration *a* towards north. Then the moment of time at which direction of wind appears south west to him is *nv*/*a*. The value of *n* is _____.

SPACE FOR ROUGH WORK

SUBJECT II : CHEMISTRY 59 MARKS

SECTION-1 | Type A

This section consists of 5 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.

1. In the reaction $2Al(s) + 6HCl(aq) \longrightarrow 2Al^{3+}(aq) + 6Cl^{-}(aq) + 3H_2(g)$.

(A) 11.2 litre H_2 at STP is produced for every mole of HCl(aq) used

(B) 6 litre HCl(aq) is consumed for every 3 litre $H_2(g)$ produced

(C) 33.6 litre $H_2(g)$ is produced regardless of temperature and pressure for every mole of Al that reacts

(D) 67.2 litre $H_2(g)$ at STP is produced for every mole of Al that reacts

2. Which of the following is/are the limitation(s) of Bohr's model?

(i) It could not explain the intensities or the fine spectrum of the spectral lines.

(ii) No justification was given for the principle of quantization of angular momentum

(iii) It could not explain why atoms should combine to form bond

(iv) It could not successfully applied to single electron species

(A) (i), (ii), (iv) **(B)** (ii), (iii) **(C)** (i), (iii), (iv) **(D)** (i), (ii), (iii)

3. The ratio of de Broglie wavelength of a proton and α - particles is 1 : 2 then:

(A) Their velocity are in the ratio 8 : 1

(B) Their kinetic energy are in the ratio 16 : 1

(C) Their masses are in the ratio 1 : 4

(D) All of the above

4. Sodium hydroxide can absorb CO_2 to form Na_2CO_3 and H_2O. 1 mole of a mixture containing CO and CO_2 requires exactly 20g of NaOH in aqueous solution for complete neutralization. How much more amount of NaOH will be needed to neutralize gaseous mixture if the mixture is completely oxidised to CO_2?

(A) 20 g **(B)** 60 g **(C)** 80 g **(D)** 100 g

5. Predict the type of orbitals using the following informations:

(i) The angular function of the orbital intersects the three axes at the origin only

(ii) The graph of radial probability vs r intersects the radial axes at three separate regions (points including origin)

(iii) xy plane acts as nodal plane

(A) $5P_z$ **(B)** $6d_{xy}$ **(C)** $5d_{zy}$ **(D)** $4d_{yz}$

SPACE FOR ROUGH WORK

SECTION-1 | Type B

This section consists of 5 Multiple Correct Answers Type Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

6. If mass of 1 mole of mixture containing NO_2 and N_2O_4 is 55.2 grams then which of following is/are correct?

(A) Mole % of NO_2 is 80

(B) Mole fraction of N_2O_4 is 0.2

(C) Mole % of N-atoms is 120

(D) Mass percentage of N_2O_4 is 33.3%

7. A mixture having 16% by mass inert impurity of SiO_2 containing equal number of moles of $MgCO_3(s)$ and $NaHCO_3(s)$. On heating, 896 litre gases (CO_2 and H_2O) produced at 1 atm pressure and 273°C temperature. Which of the following is/are correct statement(s)?

(A) Mass of sample initially taken is 2000 gm

(B) Mass of impurities present in sample is 340 g

(C) Average molar mass of gaseous mixture is 37.5 g/mole

(D) Total mass of residue is 1250 gm.

8. When photons of energy 4.25 eV strike the surface of a metal A, the ejected photoelectrons have maximum kinetic energy, $KE_A(\text{in eV})$ and de-Broglie wavelength λ_A. The maximum kinetic energy of photoelectrons emitted from another metal B by photons of energy 4.2 eV is $KE_B(\text{in eV})$ and de-Broglie wavelength is λ_B. If $\lambda_B = 2\lambda_A$ and $KE_B = KE_A - 1.5\,x(\text{in eV})$, then which is/are correct statement(s)

(A) The work function of A is 2.25eV

(B) The work function of B is 3.7 eV

(C) $KE_A = 2\,eV$

(D) $KE_B = 2.75\,eV$

9. Photon is emitted in 2nd line of Balmer series in He^+ is absorbed by an electron present in ground state of hydrogen atom. Find correct statement(s) for the electron present in excited state after absorbing energy of photon.

Given, $\lambda =$ de-Broglie wavelength associated with electron

$a_0 =$ Radius of 1st Bohr orbit in H-atom

(A) Electron will be present in 2nd energy state

(B) Ionization energy of electron is 3.4 eV

(C) λ associated with electron is $4a_0$

(D) Value of $\frac{\lambda}{\pi a_0}$ is 4

10. In a sample of hydrogen atom, electron present in 5th excited state. Find correct statement(s):

(A) Spectral lines belonging to UV region are 6

(B) Spectral lines belonging to visible region are 4

(C) Spectral lines belonging to infra-red region are 6

(D) Maximum number of lines will be 10

SECTION-1 | Type C

This section consists of ONE (01) paragraph. Based on each paragraph, there are **TWO (02)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.

PARAGRAPH FOR Q-11 & 12

A sample of H_2 gas contains infinite number of molecules. On passing electric discharge through H_2 gas, molecules dissociate into atoms. The electron of each H-atom is excited to higher energy level. The life period of excited state is 10^{-5} sec and therefore electron back to lower energy level by emission of photon. Electron present in ground state or any other excited state promoted to higher energy level or escape depend upon energy absorb by electron. Ionization energy of H-like system corresponding to second excited state is given by 13.6 eV.

11. The ionization energy (in eV) in ground state is:

(A) 13.6eV **(B)** 54.4eV **(C)** 122.4eV **(D)** 217.6eV

12. The wave length of emitted photon when electron falls from $n = \infty$ to n = 2 in terms of Rydberg constant R is:

(A) $\frac{9R}{4}$ **(B)** $\frac{4}{9R}$ **(C)** $\frac{4R}{9}$ **(D)** $\frac{13}{9R}$

SPACE FOR ROUGH WORK

SECTION-2

This section consists of 6 Numerical Value Type Questions. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, ⊖ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)

1. How many of the following statements is/are correct?

1. Principal quantum number identifies shell, determines size and energy of orbital.

2. Azimuthal quantum number identifies subshell, determines shape and orbital angular momentum.

3. The angular momentum of the electron is constant and cannot be changed.

4. For s-orbitals the maximum electron density is at the nucleus, all other orbitals have zero electron density at the nucleus.

5. For s-orbital, the angular part of orbital wave function is independent of angle and is of constant value.

6. All five 3d-orbitals are equivalent in energy and shape.

2. Find the total number of electrons in Cr which have $(n \times l) =$ zero?

3. What is degeneracy of the sixth excited state of He?

4. Hg reacts with Cl_2 to form Hg_2Cl_2 and $HgCl_2$. If 0.75 moles of Hg and 0.5 mole of Cl_2 are added such that none of reactants left. Total moles of product formed are $\frac{x}{10}$. Find x.

5. Number of revolutions made in 1 sec. by an electron in nth orbit of H-atom is $\frac{1}{4}$ times to the number of revolutions in 1 sec. by an electron in 4^{th} orbit of He^+, then find the value of n.

6. Preparation of Na_2SnO_2 involves the following set of reactions: [Mass number of Sn = 119]

(P) $Sn + 2HCl \longrightarrow SnCl_2 + H_2$

(Q) $SnCl_2 + 2NaOH \longrightarrow Sn(OH)_2 + 2NaCl$

(R) $Sn(OH)_2 + 2NaOH \longrightarrow Na_2SnO_2 + 2H_2O$

If % yield of reaction (P), (Q), (R) is 25%, 50%, 40% respectively. Calculate the mass of Sn (in kg) required to produce 19.7kg of Na_2SnO_2.

SPACE FOR ROUGH WORK

SUBJECT III : MATHEMATICS 59 MARKS

SECTION-1 | Type A

This section consists of 5 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.

1. If x_1 and x_2 are the two real roots of the equation $x^{\ln x^2} = e^{2018}, x > 0,$ then the product $(x_1 x_2)$ is not equals to.

(A) $\dfrac{(\cot^2 5^\circ).(\cos^2 5^\circ)}{(\cot^2 5^\circ)-(\cos^2 5^\circ)}$ **(B)** $\tan 5^\circ \tan 55^\circ \tan 65^\circ \tan 75^\circ$

(C) $\dfrac{4\cos^3 9^\circ - \cos 27^\circ}{6\cos 9^\circ} + \dfrac{4\sin^3 9^\circ + \sin 27^\circ}{6\sin 9^\circ}$ **(D)** $\dfrac{4\sin 40^\circ.\sin 50^\circ.\tan 10^\circ}{\cos 80^\circ}$

2. Let $A_k = \dfrac{k(k-1)}{2}\cos\left(\dfrac{k(k-1)\pi}{2}\right)$. The value of $\left|A_{19} + A_{20} + ... + A_{98}\right|$ is equal to:

(A) 36 **(B)** 20 **(C)** 40 **(D)** 80

3. The distance between the two parallel lines is 1 unit. A point 'A' is chosen to lie between the lines at a distance '*d*' from one of them. Triangle ABC is equilateral with B on one line and C on the other parallel line. The length of the side of the equilateral triangle is:

(A) $\dfrac{2}{3}\sqrt{d^2+d+1}$ **(B)** $2\sqrt{\dfrac{d^2-d+1}{3}}$ **(C)** $2\sqrt{d^2-d+1}$ **(D)** $\sqrt{d^2-d+1}$

4. The value of $\left[100(x-1)\right]$ is where [x] is the greatest integer less than or equal to *x* and $x = \dfrac{\sum_{n=1}^{44}\cos n^\circ}{\sum_{n=1}^{44}\sin n^\circ}$.

(A) 140 **(B)** 141 **(C)** 142 **(D)** 143

5. Number of solutions of the equation $2^{-x} = |\sin x|$ and $|\cos 2x| = |\sin x|$ in the interval $[0, 3\pi]$ is *m* and *n* respectively. The value of $n - m =$ ___.

(A) 6 **(B)** 5 **(C)** 4 **(D)** 3

SPACE FOR ROUGH WORK

SECTION-1 | Type B

This section consists of 5 Multiple Correct Answers Type Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

6. $\frac{\pi^e}{x-e}+\frac{e^\pi}{x-\pi}+\frac{\pi^\pi+e^e}{x-\pi-e}=0$ has

(A) One real root in (e,π) and other in $(\pi-e,e)$

(B) One real root in (e,π) and other in $(\pi,\pi+e)$

(C) Two real roots in $(\pi-e,\ \pi+e)$

(D) No real roots

7. Let $y=\frac{\cos x+\cos 2x+\cos 3x+\cos 4x+\cos 5x+\cos 6x+\cos 7x}{\sin x+\sin 2x+\sin 3x+\sin 4x+\sin 5x+\sin 6x+\sin 7x}$ then which of the following is/are true?

(A) The value of y when $x=\frac{2\pi}{7}$ is not defined **(B)** The value of y when $x=\frac{\pi}{16}$ is 1

(C) The value of y when $x=\frac{\pi}{32}$ is $\sqrt{2}-1$ **(D)** The value of y when $x=\frac{\pi}{48}$ is $2+\sqrt{3}$

8. If $\log_{\frac{1}{2^n}}\left(x^{\frac{1}{n}}\right)+\log_{\frac{1}{2^{n-1}}}\left(x^{\frac{1}{n-1}}\right)+....+\log_{\frac{1}{2^2}}\left(x^{\frac{1}{2}}\right)+\log_2 x=8$ then x can be equal to .....(where x and n are both positive integers):

(A) 2 **(B)** 4 **(C)** 16 **(D)** 256

9. Let $x=(2-\sec^2 181°)(2-\sec^2 182°)(2-\sec^2 183°)....(2-\sec^2 269°)$, then x is:

(A) Positive **(B)** Negative **(C)** Non positive **(D)** Non negative

10. Which of the following is/are correct?

(A) $\tan x-3\tan 3x=\frac{-8\tan x}{1-3\tan^2 x}$

(B) $\frac{3\tan 9°}{1-3\tan^2 9°}+\frac{9\tan 27°}{1-3\tan^2 27°}=12\tan 9°$

(C) $\tan x-2\tan 2x=\frac{-3\tan x}{1-\tan^2 x}$

(D) $\frac{3\tan 9°}{1-3\tan^2 9°}+\frac{9\tan 27°}{1-3\tan^2 27°}+\frac{27\tan 81°}{1-3\tan^2 81°}+\frac{81\tan 243°}{1-3\tan^2 243°}=30\tan 9°$

SPACE FOR ROUGH WORK

SECTION-1 | Type C

This section consists of ONE (01) paragraph. Based on each paragraph, there are **TWO (02)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.

PARAGRAPH FOR Q-11 & 12

Let $f_n(\theta) = \sec\theta.\sec 2\theta.\sec 3\theta.\sec 4\theta...\sec n\theta$ and

$g_n(\theta) = (2\cos\theta+1)(2\cos\theta-1)(2\cos 2\theta-1)(2\cos 4\theta-1)....(2\cos(2^{n-1}\theta)-1)$

11. The value of $f_7\left(\frac{\pi}{15}\right)$ is divisible by:

(A) 3 **(B)** 4 **(C)** 6 **(D)** 7

12. The value of $\log_{2^{g_3(\pi/24)}} 2f_7\left(\frac{\pi}{15}\right)$ is:

(A) Integer **(B)** Irrational **(C)** Not defined **(D)** Prime number

SPACE FOR ROUGH WORK

SECTION-2

This section consists of 6 Numerical Value Type Questions. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, Θ sign should be bubbled*. (Example: 6, 81, 1.50, 3.25, 0.08)

1. Number of values of '*x*' in the interval $\left(0, \frac{\pi}{2}\right)$ which satisfy $\left(\sqrt{3}-1\right)\text{cosec}\, x+\left(\sqrt{3}+1\right)\sec\, x = 4\sqrt{2}$ is:

2. The value of $-1+16\cos^2 70^\circ + 8\cot 70^\circ \cos 70^\circ + \frac{1}{\sin^2 70^\circ}$ is:

3. If the number of solutions satisfying the equation

$\sin\theta\cos\theta\left[(\sin\theta-1)(\cos\theta-1)(2\sin\theta-1)(2\cos\theta-1)...(n\sin\theta-1)(n\cos\theta-1)\right]=0$

where $n \in N$ in $[0, 2\pi]$ is 17, then *n* is equal to:

4. Let $P_k = \begin{cases} k, & \text{if k is odd} \\ \frac{1}{k-1}, & \text{if } k \text{ is even} \end{cases}$ and $\prod_{k=1}^{14}(P_k.\log_{(k+1)}(k+2) = N,$ then find the number of solutions of the equation $\tan^2 x + \cot^2 x + 2 = N\sin^2 2x,$ in $x \in [0,\ 2\pi].$

5. Given that $\sum_{k=1}^{35}\sin 5k^\circ = \tan\frac{m^\circ}{n^\circ},$ where *m* and *n* are relatively prime positive integers that satisfy $\frac{m}{n} < 90,$ then $m+n$ is equal to:

6. *ABC* is a right triangle in which $\angle B = 90^\circ$ and *BC* = 12 *cm*. If 10 points $L_1, L_2, L_3, ...L_{10}$ on *AB* are such that *AB* is divided in 11 equal parts and $L_1M_1, L_2M_2, ..., L_{10}M_{10}$ are line segments parallel to *BC* and $M_1, M_2, M_3, ..., M_{10}$ are on *AC*, then the sum of the lengths of the sides $L_1M_1, L_2M_2, ..., L_{10}M_{10}$ is:

SPACE FOR ROUGH WORK

End of Advanced Booster Test – 2 | JEE-2024