

# NEW STANDARD ACADEMY

Test Type : Unit Test - 03

Do not open this Test Booklet until you are asked to do so.

14-08-2023

**JEE(MAIN): 11<sup>th</sup> Undergoing Students**

Read carefully the Instructions on the Back Cover of this Test Booklet.

## Important Instructions :

1. Immediately fill in the form number on this page of the Test Booklet with Blue/Black Ball Point Pen. Use of pencil is strictly prohibited.
2. The candidates should not write their Form Number anywhere else (except in the specified space) on the Test Booklet/Answer Sheet.
3. The Test Booklet consists of 90 questions.
4. There are three parts in the question paper 1,2,3 consisting of Physics, Chemistry and Mathematics having 30 questions in each subject and each subject having Two sections. (i) Section-I contains 20 multiple choice questions with only one correct option. Marking scheme : +4 for correct answer, 0 if not attempted and -1 in all other cases. (ii) Section-II contains 10 Numerical Value Type questions. Attempt any 5 questions. First 5 attempted questions will be considered for marking. Marking scheme : +4 for correct answer, 0 if not attempted and -1 in all other cases.
5. Use Blue/Black Ball Point Pen only for writing particulars/markings responses on Side -1 and Side-2 of the Answer Sheet. Use of pencil is strictly prohibited.
6. No candidate is allowed to carry any textual material, printed or written, bits of papers, mobile phone any electronic device etc, except the Identity Card inside the examination hall/room.
7. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
8. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator on duty in the Room/ Hall. However, the candidate are allowed to take away this Test Booklet with them.

Name of the Candidate(In Capitals) \_\_\_\_\_

Date of Examination \_\_\_\_\_

Candidate's Signature: \_\_\_\_\_ Invigilator's Signature: \_\_\_\_\_

## PART-1 : PHYSICS

### SECTION-I : (Maximum Marks: 80)

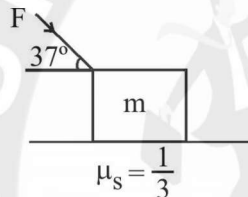
This section contains **20 questions**. Each question has 4 options for correct answer. Multiple-Choice Questions (MCQs) **Only one option is correct**. For each question, marks will be awarded as follows:

*Full Marks* : +4 If correct answer is selected.

*Zero Marks* : 0 If none of the option is selected.

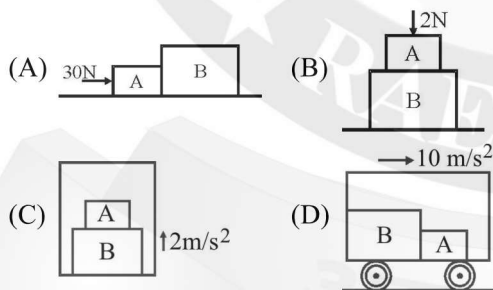
*Negative Marks* : -1 If wrong option is selected.

1. What will be the maximum value of  $F$  if the block does not slip. (coefficient of static friction is  $\mu_s = \frac{1}{3}$ )

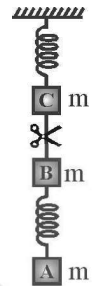


- (A)  $\frac{5}{9} mg$                       (B)  $\frac{2}{9} mg$   
 (C)  $\frac{1}{9} mg$                       (D) None

2. In which of the following cases is the contact force between A and B is maximum. If mass of each block is 1 kg :-

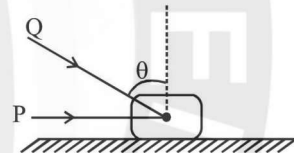


3. When string connecting B and C is cut, then acceleration of block A, B and C will be -



- (A)  $0, g\downarrow, 2g\uparrow$                       (B)  $0, 2g\downarrow, 2g\uparrow$   
 (C)  $g\downarrow, 2g\downarrow, 2g\uparrow$                       (D)  $g\downarrow, g\uparrow, 2g\downarrow$

4. A block of mass  $m$  lying on a rough horizontal plane is acted upon by a horizontal force  $P$  and another force  $Q$  inclined at an angle  $\theta$  to the vertical. The block will remain in equilibrium if the coefficient of friction between it and the surface is :-



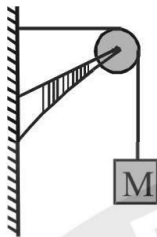
- (A)  $\frac{P + Q \sin \theta}{mg + Q \cos \theta}$   
 (B)  $\frac{P \cos \theta + Q}{mg - Q \sin \theta}$   
 (C)  $\frac{P + Q \cos \theta}{mg + Q \sin \theta}$   
 (D)  $\frac{P \sin \theta + Q}{mg - Q \cos \theta}$

5. A mass of 0.5 kg is just able to slide down the slope of an inclined rough surface when the angle of inclination is  $60^\circ$ . The minimum force necessary to pull the mass up the incline along the line of greatest slope is ( $g = 10 \text{ m/s}^2$ ) :-

- (A) 20.25N (B) 8.66 N (C) 100 N (D) 1 N

Space for Rough Work

6. A string of negligible mass going over a clamped pulley of mass  $m$  supports a block of mass  $M$  as shown in the figure. The force on the pulley by the clamp is given :-

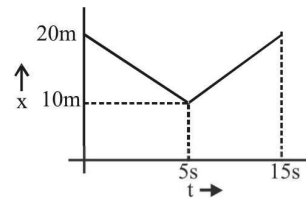


- (A)  $\sqrt{2} Mg$   
 (B)  $\sqrt{2} mg$   
 (C)  $\sqrt{(M+m)^2 + m^2} g$   
 (D)  $\sqrt{(M+m)^2 + M^2} g$
7. A smooth block is released at rest on a  $45^\circ$  incline and then slides a distance  $d$ . The time taken to slide is  $n$  times as much to slide on rough incline than on a smooth incline. The coefficient of friction is :
- (A)  $\mu_k = 1 - \frac{1}{n^2}$   
 (B)  $\mu_k = \sqrt{1 - \frac{1}{n^2}}$   
 (C)  $\mu_s = 1 - \frac{1}{n^2}$   
 (D)  $\mu_s = \sqrt{1 - \frac{1}{n^2}}$
8. Three identical blocks of masses  $m = 2\text{kg}$  are drawn by a force  $F = 10.2\text{ N}$  on a frictionless surface, then what is the tension (in N) in the string between the blocks B and C ?



- (A) 9.2    (B) 7.8    (C) 3.4    (D) 9.8

9. Position-time graph for a particle of mass  $100\text{g}$  is as shown in figure then impulse acting on the particle at  $t = 5$  second is :-



- (A)  $0.3\text{ N}\cdot\text{s}$                       (B)  $0.1\text{ N}\cdot\text{s}$   
 (C)  $0.2\text{ N}\cdot\text{s}$                       (D)  $0.4\text{ N}\cdot\text{s}$

10. What will be the acceleration of blocks and tension in the string connecting the blocks  $2\text{kg}$  and  $5\text{kg}$  for the given figure :-



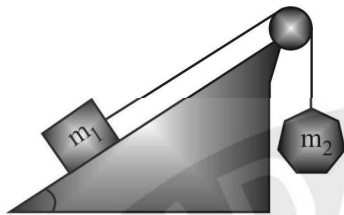
- (A)  $14\text{ m/s}^2, 120\text{ N}$   
 (B)  $4\text{ m/s}^2, 70\text{ N}$   
 (C)  $4\text{ m/s}^2, 30\text{ N}$   
 (D)  $14\text{ m/s}^2, 140\text{ N}$

11. A block of  $5\text{ newton}$  weight is kept at rest against a wall by applying  $12\text{ newton}$  force coefficient of friction between block & wall is  $0.6$ . Magnitude of force applied by wall on block is :-

- (A)  $12\text{ N}$                               (B)  $5\text{ N}$   
 (C)  $7.2\text{ N}$                             (D)  $13\text{ N}$

Space for Rough Work

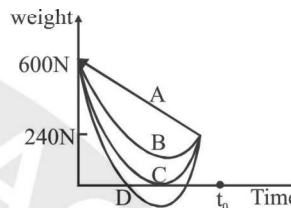
12. A block of mass  $m_1 = 2 \text{ kg}$  on a smooth inclined plane at angle  $30^\circ$  is connected to a second block of mass  $m_2 = 3 \text{ kg}$  by a cord passing over a frictionless pulley as shown in fig. The acceleration of each block is- (assume  $g = 10 \text{ m/sec}^2$ )



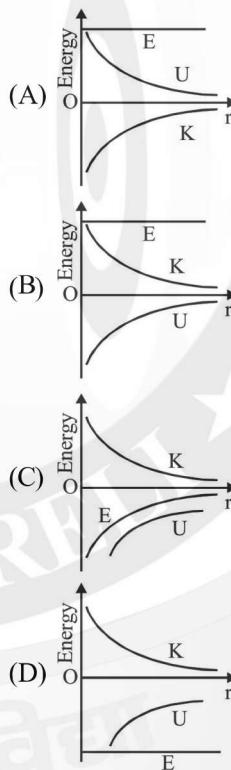
- (A)  $2 \text{ m/sec}^2$  (B)  $4 \text{ m/sec}^2$   
 (C)  $6 \text{ m/sec}^2$  (D)  $8 \text{ m/sec}^2$
13. A heavy uniform chain lies on a horizontal table top. If the coefficient of friction between the chain and the table surface is 0.25, then the maximum fraction of the length of the chain that can hang over one edge of the table is-
- (A) 20%  
 (B) 25%  
 (C) 35%  
 (D) 15%
14. The ratio of the radius of a planet 'A' to that of planet 'B' is 'r'. The ratio of acceleration due to gravity on the planets is 'x'. The ratio of the escape velocities from the two planets is :

- (A)  $xr$   
 (B)  $\sqrt{\frac{r}{x}}$   
 (C)  $\sqrt{rx}$   
 (D)  $\sqrt{\frac{x}{r}}$

15. Suppose, the acceleration due to gravity at the earth's surface is  $10 \text{ m/s}^2$  and at the surface of Mars it is  $4.0 \text{ m/s}^2$ . A 60 kg passenger goes from the earth to the mars in a spaceship moving with a constant velocity. Neglect all other objects in the sky. Which part of figure best represents the weight (net gravitational force) of the passenger as a function of time :



- (A) A (B) B (C) C (D) D
16. The correct graph representing the variation of total energy (E) kinetic energy (K) and potential energy (U) of a satellite with its distance from the centre of earth is :-



Space for Rough Work

17. A ball of mass  $m$  is fired vertically upwards from the surface of the earth with velocity  $nv_e$ , where  $v_e$  is the escape velocity and  $n < 1$ . Neglecting air resistance, to what height will the ball rise? (Take radius of the earth as  $R$ ) :-

- (A)  $\frac{R}{n^2}$   
 (B)  $\frac{R}{(1-n^2)}$   
 (C)  $\frac{Rn^2}{(1-n^2)}$   
 (D)  $Rn^2$

18. At what altitude will the acceleration due to gravity be 25% of that at the earth's surface (given radius of earth is  $R$ ) :-

- (A)  $R/4$                       (B)  $R$   
 (C)  $3R/8$                      (D)  $R/2$

19. A satellite of mass  $m$ , initially at rest on the earth, is launched into a circular orbit at a height equal to the radius of the earth. The minimum energy required is :-

- (A)  $\frac{\sqrt{3}}{4} mgR$                 (B)  $\frac{1}{2} mgR$   
 (C)  $\frac{1}{4} mgR$                  (D)  $\frac{3}{4} mgR$

20. Two satellites A and B go around a planet P in circular orbits having radius  $4R$  and  $R$  respectively. If the speed of satellite A is  $3v$ , then the speed of satellite B will be :-

- (A)  $5v$                         (B)  $9v$   
 (C)  $6v$                         (D) None of these

**SECTION-II : (Maximum Marks: 20)**

**This section contains 10 questions Candidates have to attempt any 5 questions out of 10. If more than 5 questions are attempted, then only first 5 attempted questions will be evaluated.**

The answer to each question is a **Numerical Value**. For each question, enter the correct integer value (In case of non-integer value, the answer should be rounded off to the nearest Integer).

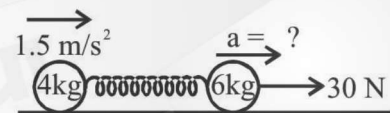
Answer to each question will be evaluated according to the following marking scheme:

- Full Marks* : +4 If correct answer is entered.  
*Zero Marks* : 0 If the question is unanswered.  
*Negative Marks* : -1 If wrong answer is entered.

1. If all surfaces are frictionless then what will be the value of mass ' $m$ ' (in kg) so that 1 kg block does not slip :

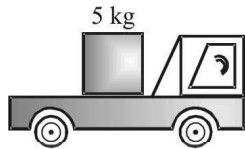


2. Two blocks of masses 4 kg and 6 kg are attached to the two ends of a spring and they are placed on a smooth horizontal surface and a force of 30 N is applied on 6 kg block as shown in figure. If acceleration of 4 kg mass is  $1.5 \text{ m/s}^2$  then acceleration of 6 kg block (in  $\text{m/s}^2$ ) will be :-



Space for Rough Work

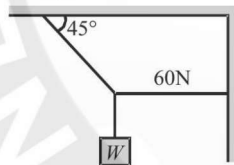
3. What will be the maximum acceleration of the truck (in  $m/s^2$ ) so that the block of mass 5 kg placed inside the truck does not slip ? If the coefficient of friction  $\mu = 0.3$  :-



4. A hammer of mass 1kg moving with a speed of 6m/s strikes a wall and comes to rest in 0.1s. Impulse of the force is (in N-s)

5. A particle moves in the x-y plane under the action of a force  $\vec{F}$  such that the value of its x and y component of linear momentum  $\vec{p}$  at any time t is  $p_x = 2\cos t$  and  $p_y = 2\sin t$ . The angle  $q$  between  $\vec{F}$  and  $\vec{p}$  at the time t is (in degree)

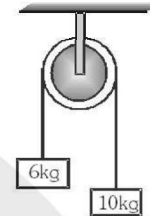
6. A weight W is suspended from the ceiling and the wall of a corner with the help of light strings. The tension in the horizontal string is measured to be 60 N, the weight W is closest to (in N)



7. A block of mass 2 kg is suspended from a string, is released from a height of 5m as shown in figure then what will be the impulse when string just becomes tight : (in N-s)



8. A light string passes over a frictionless pulley. To one of its ends a mass of 6 kg is attached and to its other end a mass of 10 kg is attached. The tension in the string will be- (in N)



9. Two planets A and B have the same material density. If the radius of A is twice that of B, then the ratio of the escape velocity  $\frac{v_A}{v_B}$  is :-

10. The mass of planet is  $1/9$  of the mass of the earth and its radius is half that of the earth. If a body weight 9 N on the earth. Its weight on the planet would be :- (in N)

Space for Rough Work

## PART-2 : CHEMISTRY

### SECTION-I : (Maximum Marks: 80)

This section contains **20 questions**. Each question has 4 options for correct answer. Multiple-Choice Questions (MCQs) **Only one option is correct**. For each question, marks will be awarded as follows:

*Full Marks* : +4 If correct answer is selected.

*Zero Marks* : 0 If none of the option is selected.

*Negative Marks* : -1 If wrong option is selected.

- Which is not correctly matched ?
  - $\text{XeO}_3 \rightarrow$  Trigonal Pyramidal
  - $\text{ClF}_3 \rightarrow$  Bent T-shape
  - $\text{XeOF}_4 \rightarrow$  Square pyramidal
  - $\text{XeF}_2 \rightarrow$  Linear
- Which of the following diagrams shows correct change in the polarity of bond ?
 

(A)

O-H	Decrease	Cl-H
S-H	Decrease	F-H

(B)

O-H	Decrease	Cl-H
S-H	Decrease	F-H

(C)

O-H	Increase	Cl-H
S-H	Decrease	F-H

(D)

O-H	Decrease	Cl-H
S-H	Decrease	F-H

- Incorrect order of bond angle is :-
  - $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3$
  - $\text{H}_2\text{O} > \text{H}_2\text{S} > \text{H}_2\text{Se}$
  - $\text{BCl}_3 > \text{AlCl}_3 > \text{GaCl}_3$
  - $\text{NO}_2^+ > \text{NO}_2 > \text{NO}_2^-$
- Out of  $\text{CHCl}_3$ ,  $\text{CH}_4$  and  $\text{SF}_4$ , the molecule are not having regular geometry are :-
  - $\text{CHCl}_3$  only
  - $\text{CHCl}_3$  &  $\text{SF}_4$
  - $\text{CH}_4$  only
  - $\text{CH}_4$  &  $\text{SF}_4$
- Select the correct statement :
  - The order of Xe-F bond length in various fluorides of Xenon is  $\text{XeF}_2 < \text{XeF}_4 < \text{XeF}_6$
  - $\text{PH}_5$  can undergo  $sp^3d$  hybridisation to have octahedral geometry
  - Dipole moment of  $\text{CH}_3\text{F}$  is greater than of  $\text{CH}_3\text{Cl}$
  - Increasing strength of hydrogen bonding is  $\text{Cl-H} \cdots \text{Cl} < \text{N-H} \cdots \text{N} < \text{O-H} \cdots \text{N} < \text{F-H} \cdots \text{F}$
- Which pair of molecules will have permanent dipole moment for both members ?
  - $\text{NO}_2$  &  $\text{O}_3$
  - $\text{SiF}_4$  &  $\text{CO}_2$
  - $\text{SiF}_4$  &  $\text{NO}_2$
  - $\text{NO}_2$  &  $\text{CO}_2$
- Between two atom maximum number of  $\sigma$  bond formed is :-
  - 2
  - 4
  - 3
  - 1

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8. Which one is linear :-  
 (A)  $\text{XeF}_2$  (B)  $\text{CO}_2$   
 (C)  $\text{CS}_2$  (D) All of these
9. Boron cannot form which one of the following anions ?  
 (A)  $\text{B}(\text{OH})_4^-$  (B)  $\text{BO}_2^-$   
 (C)  $\text{BF}_6^{3-}$  (D)  $\text{BH}_4^-$
10. The strength of bonds by  $2s - 2s$ ,  $2p - 2p$  and  $2p - 2s$  overlapping has the order :-  
 (A)  $s - s > p - p > s - p$   
 (B)  $s - s > p - s > p - p$   
 (C)  $p - p > s - p > s - s$   
 (D)  $p - p > s - s > p - s$
11. In which of the excitation state of chlorine  $\text{ClF}_3$  is formed:-  
 (A) In ground state  
 (B) In third excitation state  
 (C) In first excitation state  
 (D) In second excitation state
12. A sigma bond is formed by the overlapping of :-  
 (A) s-s orbital alone  
 (B) s and p orbitals alone  
 (C) s-s, s-p or p-p orbitals along internuclear axis  
 (D) p-p orbital along the sides
13. In which of the following compound all the bond angles are equal :-  
 (A)  $\text{SF}_4$  (B)  $\text{CCl}_4$   
 (C)  $\text{CHCl}_3$  (D)  $\text{XeF}_6$

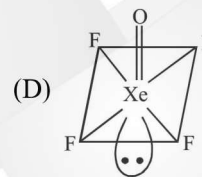
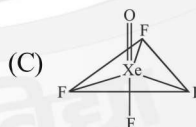
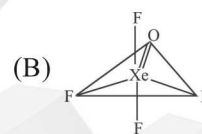
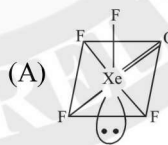
14. Which of the following is not correctly match between given species and type of overlapping ?  
 (A)  $\text{XeO}_3$  : Three ( $d\pi - p\pi$ ) bonds  
 (B)  $\text{H}_2\text{SO}_4$  : Two ( $d\pi - p\pi$ ) bonds  
 (C)  $\text{SO}_3$  : Three ( $d\pi - p\pi$ ) bonds  
 (D)  $\text{HClO}_4$  : Three ( $d\pi - p\pi$ ) bonds

15. Match the Column: (For molecular geometry)

	Column-I		Column-II
(a)	$\text{SF}_4$	(P)	Tetrahedral
(b)	$\text{BrF}_3$	(Q)	Pyramidal
(c)	$\text{BrO}_3^-$	(R)	See-saw
(d)	$\text{NH}_4^+$	(S)	T-shape(Bent T)

- (A) a-P, b-Q, c-R, d-S  
 (B) a-S, b-R, c-P, d-Q  
 (C) a-R, b-S, c-Q, d-P  
 (D) a-Q, b-S, c-R, d-P

16. Which one of the following is the correct structure of  $\text{XeOF}_4$  ?



Space for Rough Work



17. Consider the following statements :
- A sigma ( $\sigma$ ) bond is formed when two s-orbitals overlap
  - A pi ( $\pi$ ) bond is formed when two p-orbitals axially overlap
  - A  $\sigma$  - bond is weaker than  $\pi$  - bond
- Which of the above statements is/are correct ?
- (A) I and II                      (B) II and III  
(C) Only I                         (D) Only II
18. The correct order of bond angle for  $\text{CH}_4$ ,  $\text{NH}_3$  and  $\text{H}_2\text{O}$  is :-
- (A)  $\text{CH}_4 > \text{NH}_3 > \text{H}_2\text{O}$   
(B)  $\text{CH}_4 > \text{H}_2\text{O} > \text{NH}_3$   
(C)  $\text{NH}_3 > \text{CH}_4 > \text{H}_2\text{O}$   
(D)  $\text{H}_2\text{O} > \text{NH}_3 > \text{CH}_4$
19. Of the following sets which one does not contain isoelectronic species ?
- (A)  $\text{PO}_4^{3-}$ ,  $\text{SO}_4^{2-}$ ,  $\text{ClO}_4^-$   
(B)  $\text{CN}^-$ ,  $\text{N}_2$ ,  $\text{C}_2^{2-}$   
(C)  $\text{SO}_3^{2-}$ ,  $\text{CO}_3^{2-}$ ,  $\text{NO}_3^-$   
(D)  $\text{BO}_3^{3-}$ ,  $\text{CO}_3^{2-}$ ,  $\text{NO}_3^-$
20. Number of type of bonds between two carbon atoms in calcium carbide is
- (A)  $2\sigma$ ,  $2\pi$   
(B)  $1\sigma$ ,  $2\pi$   
(C)  $1\sigma$ ,  $1\pi$   
(D)  $2\sigma$ ,  $1\pi$

### SECTION-II : (Maximum Marks: 20)

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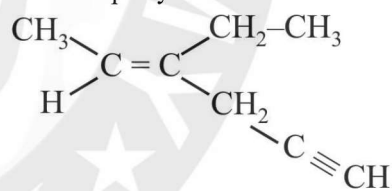
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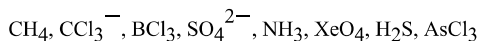
*Zero Marks* : 0 If the question is unanswered.

*Negative Marks* : -1 If wrong answer is entered.

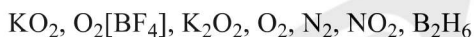
- Maximum number of hydrogen bond formed by one molecule of  $\text{H}_2\text{O}$  is :
- If compound  $\text{AX}_3$  is a hypervalent compound then the group no of element A is :-
- Find number of  $\text{sp}^3$  hybridised carbon in :-  

- The compound  $\text{MX}_4$  is tetrahedral. The number of  $\angle \text{XMX}$  formed in the compound is :-
- Sum of number of lone pair present at Xe in  $\text{XeF}_2$ ,  $\text{XeF}_4$ ,  $\text{XeF}_6$ .
- The number of  $\text{p}\pi\text{-p}\pi$  bonds in  $\text{XeO}_4$  molecule is/are -

Space for Rough Work

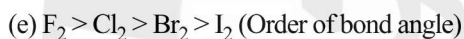
7. The number of species in the given species which are  $sp^3$  hybridised -



8. How many of the following compound have one unpaired electron ?



9. How many of the following are incorrect order ?



10. In how many of the following species axial d-orbitals participate in hybridization ?



## PART-3 : MATHEMATICS

### SECTION-I : (Maximum Marks: 80)

This section contains **20 questions**. Each question has 4 options for correct answer. Multiple-Choice Questions (MCQs) **Only one option is correct**. For each question, marks will be awarded as follows:

**Full Marks** : +4 If correct answer is selected.

**Zero Marks** : 0 If none of the option is selected.

**Negative Marks** : -1 If wrong option is selected.

1. Let  $x = \sin 1^\circ$ , then the value of the expression
- $$\frac{1}{\cos 0^\circ \cdot \cos 1^\circ} + \frac{1}{\cos 1^\circ \cdot \cos 2^\circ} + \frac{1}{\cos 2^\circ \cdot \cos 3^\circ} + \dots + \frac{1}{\cos 44^\circ \cdot \cos 45^\circ}$$
- is equal to
- (A) x (B)  $\frac{1}{x}$   
 (C)  $\frac{\sqrt{2}}{x}$  (D)  $\frac{x}{\sqrt{2}}$
2.  $\frac{\tan 10 + \tan 40 + \tan 130}{\tan 10 \tan 40 \tan 130}$  is equal to :-  
 (A) 0 (B) 1  
 (C) -1 (D) None
3.  $\sin^6 A + \cos^6 A + 3\sin^2 A \cdot \cos^2 A$  equal to :-  
 (A) 0 (B) 1  
 (C) 2 (D) 3
4.  $1 - \frac{\sin^2 y}{1 + \cos y} + \frac{1 + \cos y}{\sin y} - \frac{\sin y}{1 - \cos y}$  is equal  
 (A) 0 (B) 1  
 (C)  $\sin y$  (D)  $\cos y$

Space for Rough Work

5. If  $\tan \theta + \sin \theta = m$  &  $\tan \theta - \sin \theta = n$ , then :-

- (A)  $m^2 - n^2 = 4\sqrt{mn}$   
(B)  $m^2 + n^2 = 4mn$   
(C)  $m^2 - n^2 = m^2 + n^2$   
(D) None of these

6.  $\sin 10^\circ + \sin 20^\circ + \sin 30^\circ + \dots + \sin 360^\circ =$

- (A) 1 (B) 0  
(C) -1 (D) 2

7. If  $\sin \theta_1 + \sin \theta_2 + \sin \theta_3 = 3$  then  $\cos \theta_1 + \cos \theta_2 + \cos \theta_3$  is equal to :-

- (A) 3 (B) 2  
(C) 1 (D) 0

8.  $\cos 510^\circ \cos 330^\circ + \sin 390^\circ \cos 120^\circ =$

- (A) 1 (B) 0  
(C) -1 (D) 2

9.  $\sin^6 \theta + \cos^6 \theta + 3 \sin^2 \theta \cos^2 \theta$  equals :-

- (A) 1 (B) 0  
(C) -1 (D) 2

10. If  $5 \tan \theta = 4$ , then  $\frac{5 \sin \theta - 3 \cos \theta}{5 \sin \theta + 2 \cos \theta}$  equals :-

- (A) 0 (B) 1  
(C)  $\frac{1}{6}$  (D) 6

11.  $y = (1 + \tan A)(1 - \tan B)$  where  $A - B = \frac{\pi}{4}$

then  $(y + 1)^{y+1}$  equals :-

- (A) 9 (B) 4  
(C) 27 (D) 18

12. The value of  $\cos \frac{2\pi}{15} \cos \frac{4\pi}{15} \cos \frac{8\pi}{15} \cos \frac{16\pi}{15} :-$

- (A)  $\frac{1}{2}$  (B)  $\frac{1}{4}$   
(C)  $\frac{1}{8}$  (D)  $\frac{1}{16}$

13. Let  $a = \cos A + \cos B - \cos(A + B)$

$$b = 4 \sin \frac{A}{2} \sin \frac{B}{2} \cos \left( \frac{A+B}{2} \right).$$

Then  $a - b$  equal to :-

- (A) 1  
(B) 0  
(C) -1  
(D) None of these

14. The expression  $\frac{\tan A}{1 - \cot A} + \frac{\cot A}{1 - \tan A}$  can be written as

- (A)  $\sin A \cos A + 1$   
(B)  $\sec A \operatorname{cosec} A + 1$   
(C)  $\tan A + \cot A$   
(D)  $\sec A + \operatorname{cosec} A$

15. If  $x \in (\pi, 2\pi)$  &

$$\frac{\sqrt{1 + \cos x} + \sqrt{1 - \cos x}}{\sqrt{1 + \cos x} - \sqrt{1 - \cos x}} = \cot \left( a + \frac{x}{2} \right)$$
 then 'a' equals :-

- (A)  $\frac{\pi}{4}$  (B)  $\frac{\pi}{2}$   
(C)  $\frac{\pi}{3}$  (D) None of these

16. If  $\sin x + \sin^2 x = 1$ ; then

$$\cos^8 x + 2 \cos^6 x + \cos^4 x =$$

- (A) -1 (B) 0 (C) 1 (D) 2

Space for Rough Work

17.  $\frac{1 - \tan^2 7\frac{1}{2}^\circ}{1 + \tan^2 7\frac{1}{2}^\circ}$  is equal to :-
- (A)  $\frac{\sqrt{3} - 1}{2\sqrt{2}}$   
 (B)  $\frac{\sqrt{3} + 1}{2\sqrt{2}}$   
 (C)  $2 + \sqrt{3}$   
 (D) None
18. If  $\sum_{r=1^\circ}^{44^\circ} \frac{\sin(r^\circ)}{\sin(r+1^\circ)\sin(r)} = \tan A^\circ - \tan B^\circ$   
 where  $A^\circ$  &  $B^\circ \in (0, 90^\circ)$ , then value of  $\frac{1}{2B - A}$  is
- (A) 1 (B) 2  
 (C) 3 (D) 4
19. The value of  $(\cos 15^\circ - \sin 15^\circ)$  is :-
- (A)  $\frac{1}{\sqrt{2}}$  (B)  $\frac{-1}{\sqrt{2}}$   
 (C)  $\frac{1}{2\sqrt{2}}$  (D) 0
20. If  $0 < \theta < \frac{\pi}{8}$ , then  $\sqrt{2 + \sqrt{2 + \sqrt{2 + 2\cos 8\theta}}}$  equals :-
- (A)  $2\cos\theta$  (B)  $\cos\theta$   
 (C)  $2\sin\theta$  (D)  $-2\cos\theta$

### SECTION-II : (Maximum Marks: 20)

This section contains 10 questions Candidates have to attempt any 5 questions out of 10. If more than 5 questions are attempted, then only first 5 attempted questions will be evaluated.

The answer to each question is a **Numerical Value**. For each question, enter the correct integer value (In case of non-integer value, the answer should be rounded off to the nearest Integer).

Answer to each question will be evaluated according to the following marking scheme:

*Full Marks* : +4 If correct answer is entered.

*Zero Marks* : 0 If the question is unanswered.

*Negative Marks* : -1 If wrong answer is entered.

- Exact value of  $\sin^2 17^\circ + \sin^2 43^\circ + \sin^2 73^\circ - \cos^2 47^\circ$  is
- Maximum value of  $1 + 8 \sin^2 x^2 \cos^2 x^2$  is :-
- If  $\sin(\alpha + \beta) = 1$  and  $\sin(\alpha - \beta) = \frac{1}{2}$  then  $\tan(\alpha + 2\beta) \tan(2\alpha + \beta)$  is equal to :-
- $\log \sin 1^\circ \cdot \log \sin 2^\circ \cdot \log \sin 3^\circ \dots \dots \dots \log \sin 179^\circ$  is equal to :-
- The maximum value of  $3\sin^2 x + 2$  is :-
- $\frac{\sin(B - C)}{\cos B \cos C} + \frac{\sin(C - A)}{\cos C \cos A} + \frac{\sin(A - B)}{\sin A \sin B} =$

Space for Rough Work

7. If  $\sin(A - B) = \frac{1}{\sqrt{10}}$ ,  $\cos(A + B) = \frac{2}{\sqrt{29}}$ ,

then  $\tan 2A$  equals, if  $A$  &  $B$  lie between  $0$  &  $\frac{\pi}{4}$

8. If  $y = (1 + \tan A)(1 + \tan B)$ , where  $A + B = \frac{\pi}{4}$ ,  
then  $(y + 1)^y =$

9. If  $\sec \theta = \sqrt{2}$  and  $\theta \in \left(\frac{3\pi}{2}, 2\pi\right)$  then value of  
expression  $\frac{1 + \tan \theta + \operatorname{cosec} \theta}{1 + \cot \theta - \operatorname{cosec} \theta}$  is :

10. If  $\tan A + \cot A = 4$ ; then  $\tan^4 A + \cot^4 A$  equals :-

Space for Rough Work