UNWAL PACIFIC
Foundation | IIT-JEE | Medical | Repeater

JEE Main – 2023

25th JAN 2023 (Morning Shift)

General Instructions

1. The test is of **3 hours** duration and the maximum marks is **300.**
2. The question paper consists of **3 Parts** (Part I: **Physics**, Part II: **Chemistry**, Part III: **Mathematics**). Each Part has **two** sections (Section 1 & Section 2).
3. **Section 1** contains **20 Multiple Choice Questions**. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE CHOICE** is correct.
4. **Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted. You will NOT be allowed to attempt the sixth question. If you wish to attempt any other question apart from the five already attempted, then you will have to delete any one response from the five previously answered and then proceed to answer the new one.**
   The answer to each question should be **rounded off to the nearest integer**.
5. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. inside the examination room/hall.

Marking Scheme

1. **Section – 1:** +4 for correct answer, –1 (negative marking) for incorrect answer, 0 for all other cases.
2. **Section – 2:** +4 for correct answer, –1 (negative marking) for incorrect answer, 0 for all other cases.

SUBJECT I: PHYSICS	MARKS: 100

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (1), (2), (3) and (4), out of which ONLY ONE CHOICE is correct.

1. Electron beam used in an electron microscope, when accelerated by a voltage of , has a de-Broglie wavelength of If the voltage is increased to then the de-Broglie wavelength associated with the electron beam would be:

(1) **(2)** **(3)** **(4)**

2. Given below are two stateemnts: one is labelled as Assertion A and the other is labelled as Reason R.
Assertion A: Photodiodes are used in forward bias usually for measuring the light intensity.
Reason R: For a junction diode, at applied voltage V the current in the forward bias is more than the current in the reverse bias for where is the threshold voltage and is the breakdown voltage.
In the light of the above statements, choose the correct answer from the options given below.

(1) Both A and R are true and R is correct explanation A
(2) Both A and R are true but R is NOT the correct explanation A
(3) A is false but R is true
(4) A is true but R is false

3. Assume that the earth is a solid sphere of uniform density and a tunnel is dug along its diameter throughout the earth. It is found that when a particle is released in this tunnel, it executes a simple harmonic motion. The mass of the particle is The time period of the motion of the particle will be (approximately):

(Take radius of earth = 640 km)

(1) 12 hours **(2)** 24 hours
(3) 1 hour 40 minutes **(4)** 1 hour 24 minutes

4. In Young's double slits experiment, the position of 5^{th} bright fringe from the central maximum is the distance between slits and screen is and wavelength of used monochromatic light is The separation between the slits is:

(1) **(2)**
(3) **(4)**

5. A bowl filled with very hot soup cools from 98°C to 86°C in 2 minutes when the room temperature is 22°C. How long it will take to cool from 75°C to 69°C?

(1) 0.5 minute **(2)** 2 minute
(3) 1.4 minute **(4)** 1 minute

6. A uniform metallic wire carries a current when battery is connected across it. The mass of uniform metallic wire is density is and resistivity is
The length of wire is:

(1) **(2)**
(3) **(4)**

7. A car is moving with a constant speed of in a circular horizontal track of radius a bon is suspended from the roof of the car by a massless string. The angle made by the string with the vertical will be: (Take)

(1) **(2)** **(3)** **(4)**

8. A car travels a distance of with speed and then same distance with speed in the same direction. The average speed of the car is:

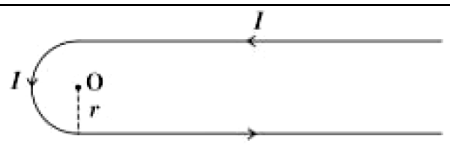
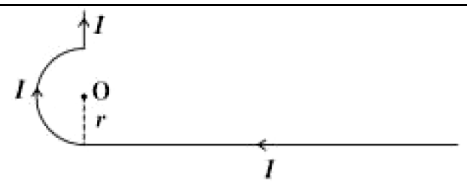
(1) **(2)** **(3)** **(4)**

9. A solenoid of 1200 turns is wound uniformly in a sample layer on a glass tube long and in diameter. The magnetic intensity at the center of the solenoid when a current of flows through it is:

(1) **(2)**

(3) **(4)**

10. Match List I with List II.

List I (Current configuration)		**List II (Magnitude of Magnetic Field at point O)**	
A.		**I.**	
B.		**II.**	
C.		**III.**	
D.		**IV.**	

Choose the correct answer from the options given below:

(1) A – I, B – III, C – IV, D – II **(2)** A – II, B – I, C – IV, D – III

(3) A – III, B – IV, C – I, D – II **(4)** A – III, B – I, C – IV, D – II

11. A message signal of frequency 5 kHz is used to modulate a carrier signal of frequency 2 MHz. The bandwidth for amplitude modulation is:

(1) 20 kHz **(2)** 10 kHz

(3) 5 kHz **(4)** 2.5 kHz

12. In an LC oscillator, if values of inductance and capacitance become twice and eight times, respectively, then the resonant frequency of oscillator becomes times its initial resonant frequency The value of is:

(1) 1/16 **(2)** 4 **(3)** 1/4 **(4)** 16

13. The root mean square velocity of molecules of gas is:

(1) Inversely proportional to square root of temperature

(2) Proportional to square root of temperature

(3) Proportional to temperature (T)

(4) Proportional to square of temperature

14. Match List I with List II.

List I		List II	
A.	Surface tension	**I.**	
B.	Pressure	**II.**	
C.	Viscosity	**III.**	
D.	Impulse	**IV.**	

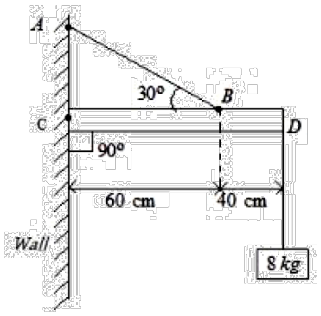
Choose the correct answer from the options given below:

(1) A – IV, B – III, C – II, D – I **(2)** A – II, B – I, C – III, D – IV

(3) A – IV, B – III, C – I, D – II **(4)** A – III, B – IV, C – I, D – II

(1) **(2)** **(3)** **(4)**

15. An object of mass is hanging from one end of a uniform rod CD of mass and length pivoted at its end C on a vertical wall as shown in figure. It is supported by a cable AB such that the system is in equilibrium. The tension in the cable is: (Take)



(1) 30 N **(2)** 90 N

(3) 300 N **(4)** 240 N

16. The ratio of the density of oxygen nucleus and helium nucleus is:

(1) 1 : 1 **(2)** 8 : 1 **(3)** 4 : 1 **(4)** 2 : 1

17. A Carnot engine with efficiency 50% takes heat from a source at 600 K. In order to increase the efficiency to 70%, keeping the temperature of sink same, the new temperature of the source will be:

(1) 300 K **(2)** 1000 K **(3)** 900 K **(4)** 360 K

18. An electromagnetic wave is transporting energy in the negative direction. At a certain point and certain time the direction of electric field of the wave is along positive direction. What will be the direction of the magnetic field of the wave at that point and instant?

(1) Positive direction of **(2)** Negative direction of

(3) Negative direction of **(4)** Positive direction of

19. A parallel plate capacitor has plate area and plates separation The space between the plates is filled with a dielectric medium of a thickness and dielectric constant 5. The capacitance of the system is:

(1) **(2)** **(3)** **(4)**

20. T is the time period of simple pendulum on the earth's surface. Its time period become T when taken to a height R (equal to earth's radius) above the earth's surface. Then, the value of will be:

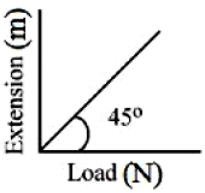
(1) **(2)** **(3)** **(4)**

SECTION-2

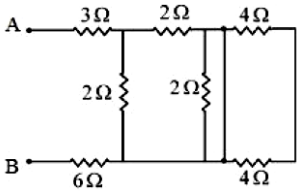
Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted.
The answer to each question should be **rounded off to the nearest integer**.

21. A ray of light is incident from air on a glass plate having thickness and refractive index The angle of incidence of a ray is equal to the critical angle for glass-air interface. The lateral displacement of the ray when it passes through the plate is
(Given sin 15° = 0.26)

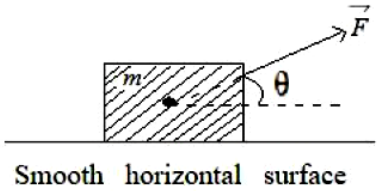
22. As shown in the figure, in an experiment to determine young's modulus of a wire, the extension-load curve is plotted. The curve is a straight line passing through the origin and makes an angle of 45° with the load axis. The length of wire is and its diameter is The Young's modulus is found to be . The value of is_____ .



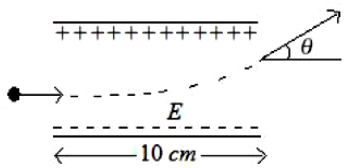
23. In the given circuit, the equivalent resistance between the terminal A and B is _____



24. An object of mass initially at rest on a smooth horizontal plane starts moving under the action of force In the process of its linear motion, the angle (as shown in figure) between the direction of force and horizontal varies as where is a constant and is the distance covered by the object from its initial position. The expression of kinetic energy of the object will be The value of is _____ .



25. A uniform electric field of 10 N/C is created between two parallel charged plates (as shown in figure). An electron enters the field symmetrically between the plates with a kinetic energy the length of each plate is The angle of deviation of the path of electron as it comes out of the field is _____ (in degree).



26. An LCR series circuit of capacitance and resistance of is connected to an A.C. source of frequency 2.0 kHz. For maximum value of amplitude of current in circuit, the value of inductance is _____ mH. (Take)

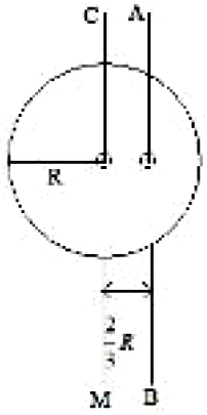
27. The distance between two consecutive points with phase difference of 60° in a wave of frequency 500 Hz is the velocity with which wave is traveling is _____

28. If then, The unit vector in the direction of is

. The value of is:

29. The wavelength of the radiation emitted is when an electron jumps from the second excited state to the first excited state of hydrogen atom. If the electron jumps from the third excited state to the second orbit of the hydrogen atom, the wavelength of the radiation emitted will be the value of is _____ .

30. is the moment of inertia of a circular disc about an axis (CM) passing through its center and perpendicular to the plane of disc. is it's moment of inertia about an axis Ab perpendicular to plane and parallel to axis CM at a distance from center. Where R is the radius of the disc. The ratio of and is The value of is _____ .

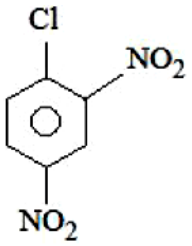


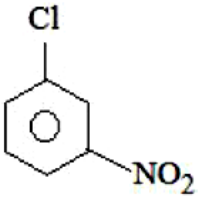
SUBJECT II: CHEMISTRY	MARKS: 100

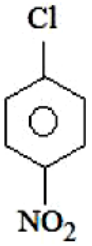
SECTION-1

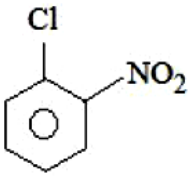
This section contains 20 Multiple Choice Questions. Each question has 4 choices (1), (2), (3) and (4), out of which ONLY ONE CHOICE is correct.

1. The compound which will have the lowest rate towards nucleophilic aromatic substitution on treatment with is:

(1) 

(2) 

(3) 

(4) 

2. The correct order in aqueous medium of basic strength in case of methyl substituted amines is:

(1)

(2)

(3)

(4)

3. Match List I with List II.

List I **Elements**		**List II** **Colour imparted to the flame**	
A.	K	**I.**	Brick Red
B.	Ca	**II.**	Violet
C.	Sr	**III.**	Apple Green
D.	Ba	**IV.**	Crimson Red

Choose the correct answer from the options given below:

(1) A – II, B – I, C – III, D – IV

(2) A – II, B – IV, C –I, D – III

(3) A – IV, B – III, C – II, D – I

(4) A – II, B – I, C – IV, D – III

4. Which one of the following reactions does not occur during extraction of copper?

(1)

(2)

(3)

(4)

5. '25 volume' hydrogen peroxide means

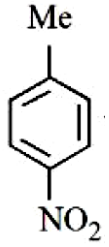
(1) 1 L marketed solution contains 75 g of

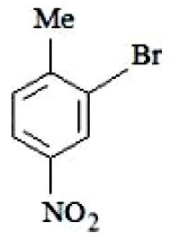
(2) 1 L marketed solution contains 25 g of

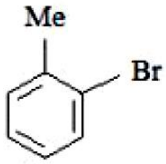
(3) 1 L marketed solution contains 250 g of

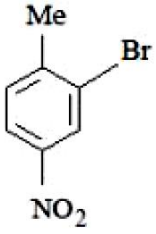
(4) 100 mL marketed solution contains 25 g of

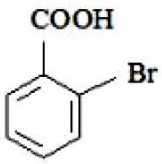
6. Identify the product formed (A and E):

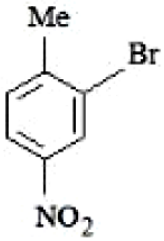


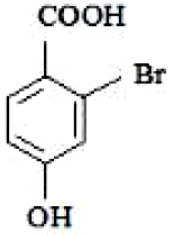
(1) A = 

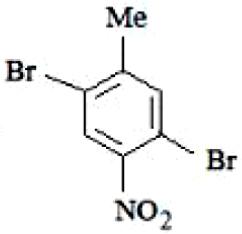
, E = 

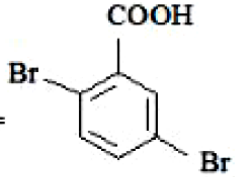
(2) A = 

, E = 

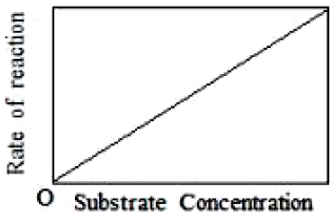
(3) A = 

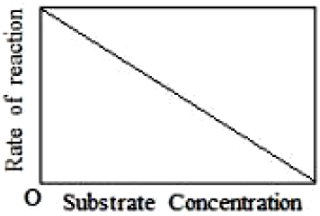
, E = 

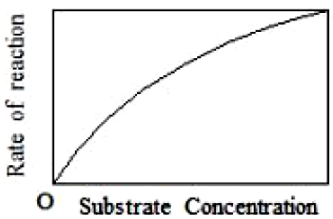
(4) A = 

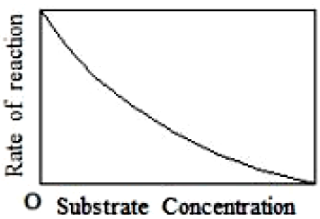
, E = 

7. The variation of the rate of an enzyme catalyzed reaction with substrate concentration is correctly represented by graph.

(a) 

(b) 

(c) 

(d) 

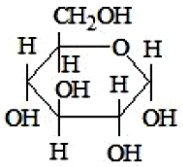
(1) (d) **(2)** (b) **(3)** (a) **(4)** (c)

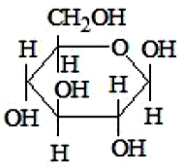
8. A cubic solid is made up of two elements X and Y. Atoms of X are present on every alternate corner and one at the center of cube. Y is at rd of the total faces. The empirical formula of the compound is:

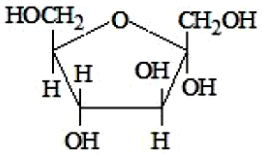
(1) **(2)** **(3)** **(4)**

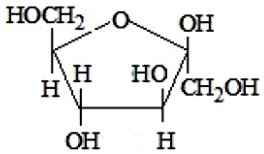
9. Match items of Row I with those of Row II.

Row I :


A


B


C


D

Row II :

(i) (ii)

(iii) (iv)

Correct match is:

(1) A – iv, B – iii, C – i, D – ii **(2)** A – iii, B – iv, C – i, D – ii

(3) A – iii, B – iv, C – ii, D – i **(4)** A – i, B – ii, C – iii, D – iv

10. Match the List-I with List-II.

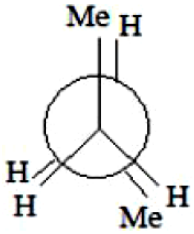
List I Cations		**List II Group reagents**	
A.		**i.**	gas is presence of dilute HCl
B.		**ii.**	in presence of
C.		**iii.**	in presence of
D.		**iv.**	in presence of

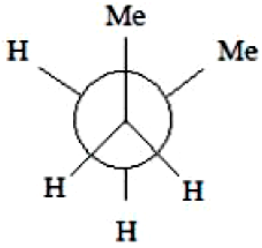
Choose the correct answer from the options given below:

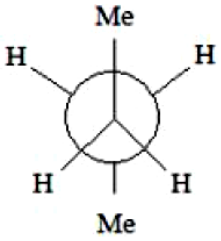
(1) A – iii, B – i, C – iv, D – ii **(2)** A – iv, B – ii, C – iii, D – ii

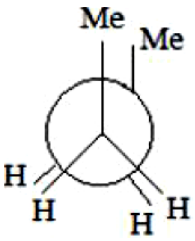
(3) A – i, B – iii, C – iv, D – ii **(4)** A – i, B – iii, C – ii, D – iv

11. Which of the following conformations will be the most stable?


(1)


(2)

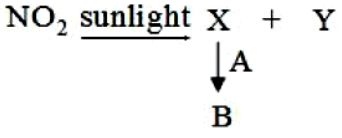

(3)


(4)

12. Some reactions of relevant to photochemical smog formation are:

Identify A, B, X and Y

(1)



(2)

(3)

(4)

13. The radius of the 2nd orbit of is . The expected radius of the 3rd orbit of is:

(1) **(2)** **(3)** **(4)**

14. Inert gases have positive electron gain enthalpy. Its correct order is:

(1) **(2)**

(3) **(4)**

15. Which of the following statements is incorrect for antibiotics?

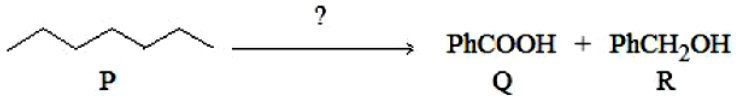
(1) An antibiotic is a synthetic substance produced as a structural analogue of naturally occurring

(2) An antibiotic should promote the growth or survival of microorganisms

(3) An antibiotic must be a product of metabolism

(4) An antibiotic should be effective in low concentrations

16.



The correct sequence of reagents for the preparation of Q and R is:

(1) (i) (ii) (iii) (iv)

(2) (i) (ii) (iii) (iv)

(3) (i) (ii) (iii) (iv)

(4) (i) (ii) (iii) (iv)

17. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: Acetal/Ketal is stable in basic medium.

Reason R: The high leaving tendency of alkoxide ion gives the stability to acetal/ketal in basic medium.

In the light of the above statements, choose the correct answer from the options given below:

(1) Both A and R are true and R is the correct explanation of A

(2) A is false but R is true

(3) Both A and R are true but R is NOT the correct explanation of A

(4) A is true but R is false

18. Compound A reacts with and forms a compound B. Compound B reacts with and excess of to form compound C which on passing through or reaction with saturated NaCl solution forms sodium hydrogen carbonate. Compound A, B and C, are respectively.

(1)

(2)

(3)

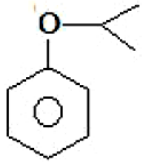
(4)

19. Reaction of thionyl chloride with white phosphorus forms a compound [A], which on hydrolysis gives [B], a dibasic acid. [A] and [B] are respectively.

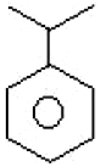
(1) **(2)**

(3) **(4)**

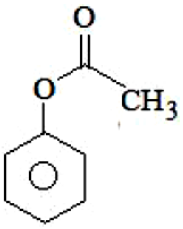
20. In the cumene to phenol preparation in presence of air, the intermediate is:



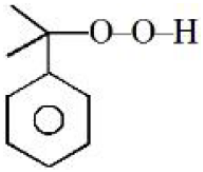
(1)



(2)



(3)



(4)

SECTION-2

Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted.
The answer to each question should be **rounded off to the nearest integer**.

21. In sulphur estimation, of an organic compound gave of barium sulphate. The percentage of sulphur in the compound is _____ . (Nearest Integer)
(Given: Atomic mass Ba: 137u, S:32u, O:16u)

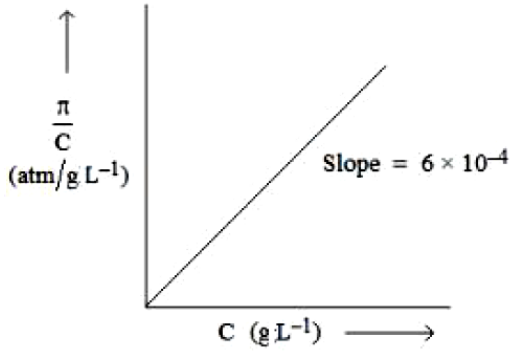
22. The number of paramagnetic species from the following is _____ .

23. The total number of lone pairs of electrons on oxygen atoms of ozone is _____ .

24. How many of the following metal ions have similar value of spin only magnetic moment in gaseous state _____ ? (Given: Atomic number: V, 23; Cr, 24; Fe, 26; Ni, 28)

25. A litre of buffer solution contains 0.1 mole of each of and . On the addition of 0.02 mole of HCl by dissolving gaseous HCl, the pH of the solution is found to be (Nearest integer) [Given: , log2 = 0.301, log3 = 0.477, T = 298 K]

26. The osmotic pressure of solutions of PVC in cyclohexanone at 300 K are plotted on the graph. The molar mass of PVC is _____ g (Nearest integer) [Given: R = 0.083 L atm]



27. Consider the cell

Given

If the potential of the cell is 0.712 V, the ratio of concentration of is _____ . (Nearest integer)

28. For the first order reaction the half life is 30 min. The time taken for 75% completion of the reaction is _____ min. (Nearest integer)
(Given: log2 = 0.3010, log3 = 0.4771, log5 = 0.6989)

29. An athlete is given of glucose for energy. This is equivalent to of energy. The 50% of this energy gained is utilized by the athlete for sports activities at the event. In order to avoid

storage of energy, the weight of extra water he would need to perspire is _____ g (Nearest integer)

Assume that there is not other way of consuming stored energy.

Given: The enthalpy of evaporation of water is 45 kJ

Molar mass of C, H & O are 12, 1 and 16 g .

30. The density of a monobasic strong acid (Molar mass 24.2 g/mol) is 1.21 kg/L. the volume of its solution required for the complete neutralization of 25 mL of 0.24 M NaOH is _____ mL (Nearest integer)

SUBJECT III: MATHEMATICS	MARKS: 100

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (1), (2), (3) and (4), out of which ONLY ONE CHOICE is correct.

1. Let and be respectively the sets of all for which the system of linear equations.

has unique solution and infinitely many solutions. Then:

(1) **(2)**

(3) is an infinite set and **(4)** is an infinite set

2. The value of is:

(1) **(2)** **(3)** **(4)**

3. The mean and variance of the marks obtained by the students in a test are 10 and 4 respectively. Later, the marks of one of the students is increased from 8 to 12. If the new mean of the marks is 10.2, then their new variance is equal to:

(1) 4.04 **(2)** 3.96 **(3)** 3.92 **(4)** 4.08

4. Let The set represents a:

(1) Straight line with the sum of its intercepts on the coordinate axes equals –18
(2) Hyperbola with eccentricity 2
(3) Hyperbola with the length of the transverse axis 7
(4) Straight line with the sum of its intercepts on the coordinate axes equals 14

5. Let be the solution curve of the differential equation

Then is equal to:

(1) **(2)**

(3) **(4)**

6. Let Then at is equal to:

(1) 944 **(2)** 464 **(3)** 496 **(4)** 976

7. The vector is rotated through a right angle, passing through the y-axis in its way and the resulting vector is Then the projection of on is:

(1) **(2)** **(3)** **(4)**

8. The points of intersection of the line and the circle are . The image of the circle with AB as a diameter in the line is:

(1) **(2)**

(3) **(4)**

9. Let be three non zero vectors such that If be a vector such that is equal to:

(1) **(2)** **(3)** **(4)**

10. Let be a function defined by and Consider two statements.
(I) g is an increasing function in (0, 1)
(II) g is one-one in (0, 1)
Then :

(1) Only (II) is true **(2)** Neither (I) nor (II) is true
(3) Only (I) is true **(4)** Both (I) and (II) are true

11. The statement is:

(1) A contradiction **(2)** Equivalent to
(3) A tautology **(4)** Equivalent to

12. The minimum value of the function is:

(1) 2 **(2)** **(3)** **(4)**

13. Consider the lines given by:

A line having direction ratios intersects and at the points P and Q respectively. Then the length of line segment PQ is:

(1) **(2)** **(3)** **(4)**

14. Let then is equal to:

(1) **(2)** **(3)** **(4)**

15. Let If then is equal to:

(1) **(2)**

(3) **(4)**

16. The distance of the point from the common tangent of the curves and is:

(1) 5 **(2)** **(3)** **(4)**

17. Let be a local minima of the function If M is local maximum value of the function in then M =

(1) **(2)** **(3)** **(4)**

18. The distance of the point from the line passing through the point and parallel to a line with direction ratios is equal to:

(1) **(2)** **(3)** **(4)**

19. If is the coefficient of in the Binomial expansion of then is equal to:

(1) 4895 **(2)** 5445 **(3)** 3025 **(4)** 1210

20. Let be the maximum value of the product of two positive integers when their sum is 66. Let the sample space and the event Then P(A) is equal to:

(1) **(2)** **(3)** **(4)**

SECTION-2

Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted.
The answer to each question should be **rounded off to the nearest integer**.

21. Let be the three A.P. with the same common difference and having their first terms as respectively. Let be the 7^{th} , 9^{th} , 17^{th} terms of respectively such that

If then the sum of first 20 terms of an AP whose first term is and common difference is is equal to _____ .

22. Let the equation of the plane passing through the line and parallel to the line be Then the distance of the point from the plane is _____ .

23. Let be distinct integers where and Then, the number of ways of choosing and such that is divisible by is _____ .

24. The constant term in the expansion of is _____ .

25. If the sum of all the solutions of is

then is equal to _____ .

26. If the area enclosed by the parabolas is equal to the area enclosed by and then is equal to _____ .

27. Let Then the maximum value of for which the

equation has real roots, is _____ .

28. Let The number of non-empty subsets of S that have the sum of all elements a multiple of 3, is _____ .

29. for some let and If then

is equal to _____ .

30. The vertices of a hyperbola H are and its eccentricity is Let N be the normal to H at a point in the first quadrant and parallel to the line If is the length of the line segment of N between H and the y-axis then is equal to _____ .