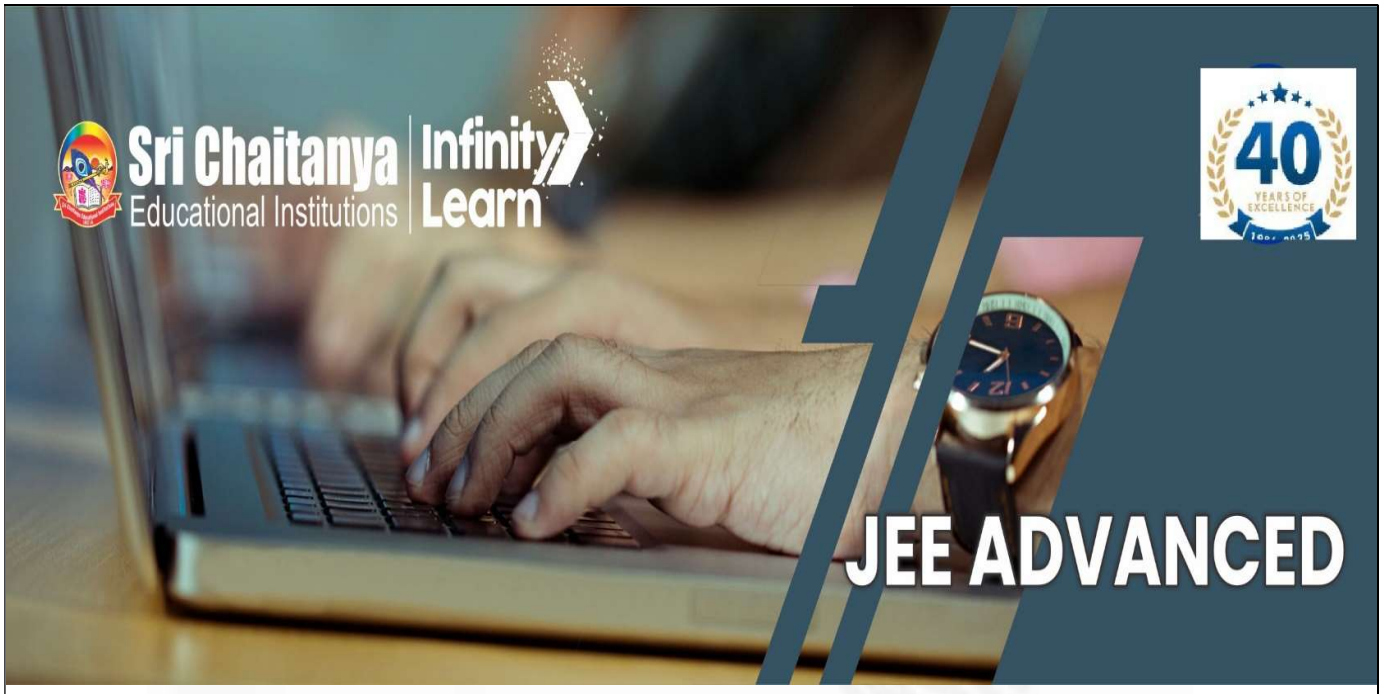


Sri Chaitanya IIT Academy.,India.

A.P T.S KARNATAKA TAMILNADU MAHARASTRA DELHI RANCHI

A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

SEC: Sr.Super60_STERLING BT	**RPTA-05**	**Date: 07-09-2025**
Time: 09:00AM to 12:00PM	**JEE-ADV(2021-P1)**	**Max. Marks: 180**

07-09-2025_Sr.Super60_STERLING BT_Jee-Adv(2021-P1)_RPTA-05_Syllabus

PHYSICS : Gravitation: Law of gravitation, Gravitational potential and field, Acceleration due to gravity, Kepler's law, Motion of planets and satellites in circular orbits, Escape velocity, Geostationary orbits (Important for ADVANCED)
Electrostatics: Coulomb's law, Electric field and potential, Electrical potential energy of a system of point charges and of electrical dipoles in a uniform electrostatic field, Electric field lines.

CHEMISTRY : Aldehydes & Ketones: Preparation of aldehydes and ketones from acid chlorides and nitriles, aldehydes from esters, benzaldehyde from toluene and benzene, conversion of alcohols into aldehydes and ketones Reactions: oxidation, reduction, oxime and hydrazone formation, Aldol condensation and Family aldol reactions, . Cannizzaroreaction, haloform reaction and nucleophilic addition reactions with RMgX, NaHSO3, HCN, water, alcohol, RSH, amine and derivatives

MATHEMATICS : Definite Integration

Name of the Student: _____ **H.T. NO:** | | | | | | | |

JEE-ADVANCE-2021-P1-Model

Time:3Hr's **IMPORTANT INSTRUCTIONS** **Max Marks: 180**

PHYSICS:

Section	Question Type	+Ve Mark	- Ve Mark	No.of Qs	Total marks
Sec – I(Q.N : 1 – 4)	Questions with Single Correct Choice!	+3	-1	4	12
Sec – II(Q.N : 5 – 10)	Paragraph Questions with Numerical Value Answer Type	+2	0	6	12
Sec – III(Q.N : 11 – 16)	Questions with Multiple Correct Choice with partial mark	+4	-2	6	24
Sec – IV(Q.N : 17 – 19)	Questions with Non-negative Integer Value Type	+4	0	3	12
Total				**19**	**60**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 20 – 23)	Questions with Single Correct Choice	+3	-1	4	12
Sec – II(Q.N : 24 – 29)	Paragraph Questions with Numerical Value Answer Type	+2	0	6	12
Sec – III(Q.N : 30 – 35)	Questions with Multiple Correct Choice with partial mark	+4	-2	6	24
Sec – IV(Q.N : 36– 38)	Questions with Non-negative Integer Value Type	+4	0	3	12
Total				**19**	**60**

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 39 – 42)	Questions with Single Correct Choice	+3	-1	4	12
Sec – II(Q.N : 43 – 48)	Paragraph Questions with Numerical Value Answer Type	+2	0	6	12
Sec – III(Q.N : 49 – 54)	Questions with Multiple Correct Choice with partial mark	+4	-2	6	24
Sec – IV(Q.N : 55 – 57)	Questions with Non-negative Integer Value Type	+4	0	3	12
Total				**19**	**60**

PHYSICS

Max Marks: 60

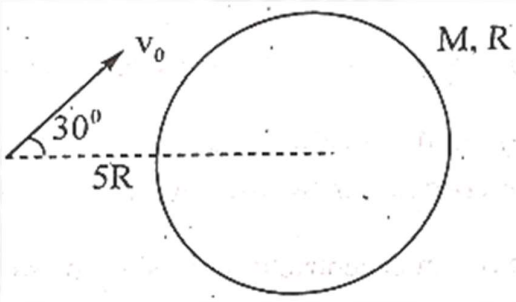
SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 4 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +3 for correct answer, 0 if not attempted and –1 in all other cases. Section 1 (Max Marks: 12)

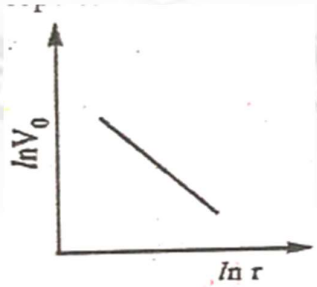
- Section 1 contains Four questions
- Each Question has Four Options and Only One of these four will be the correct answer.
- For each question, choose the option corresponding to the correct answer
- The Marking scheme to evaluate Answer to each question will be :
- Full Marks: **+3** (If the answer is correct)
- Zero Marks: **0** (If the question is unanswered)
- Negative Marks: -1 (In all other cases)

1. An asteroid of mass m (<<M) was fast approaching the earth of mass 'M', Scientists fires a racket which hit the asteroid at a distance 5R from the centre of the earth, where R is radius of earth. Immediately after the hit the asteroids velocity V_0 was making a angle of $\theta=30^0$ with the line joining the center of the earth the asteroid. The asteroid just grazed past the surface of the earth. Find its speed when it grazes the earth.



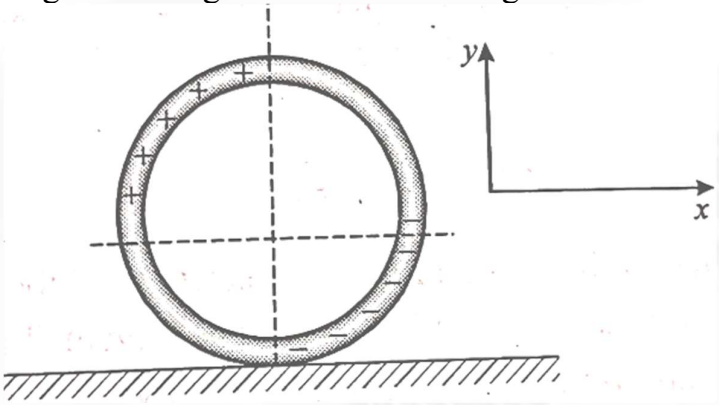
A) $\sqrt{\frac{32GM}{105R}}$ B) $\sqrt{\frac{16GM}{21R}}$ C) $\sqrt{\frac{64GM}{105\,R}}$ D) $\sqrt{\frac{40GM}{21\,R}}$

2. If the law of gravitation be such that the force of attraction between two particles vary inversely as the (5/2)th power of their separation , then the graph of orbital velocity V_0 plotted against the distance r of a satellite from the earth's centre on a $\log_e$-$\log_e$ scale is as shown. The modulus of slope of the line will be



A) $\frac{3}{4}$ B) $\frac{4}{3}$ C) $\frac{5}{2}$ D) $\frac{2}{5}$

3. A non- conducting ring of mass m and radius R is charged as shown in figure and placed on a rough horizontal non conducting plane. The charge per unit length on the charged quadrants of ring is λ. At time t=0 , a uniform ,electric field $\vec{E}=E\hat{i}$ is switched on and the ring starts rolling without sliding. Determine the magnitude and direction of friction force acting on the ring when it starts rolling



A) λRE_0 along negative x-axis B) λRE_0 along positive x-axis

C) $2\lambda RE_0$ along negative x-axis D) $2\lambda RE_0$ along positive x-axis

4. Four point charges, each of charge +q, are rigidly fixed at the four corners of a square planner soap film of side 'a'. The surface tension of the soap film is σ. If the system of charges and planar film are in equilibrium, then side of square is given as

$a=k\left[\frac{q^2}{\sigma}\right]^{1/N}$, Find the values of k and N.

A) $\left[\frac{1}{8\pi\in_0}\left(1+\frac{1}{2\sqrt{2}}\right)\right]^{1/3},3$ B) $\left[\frac{1}{4\pi\in_0}\left(1+\frac{1}{2\sqrt{2}}\right)\right]^{1/3},3$

C) $\left[\frac{1}{4\pi\in_0}\left(1+\frac{1}{\sqrt{2}}\right)\right]^{1/3},3$ D) $\left[\frac{1}{4\pi\in_0}\left(1+\frac{1}{2\sqrt{2}}\right)\right]^{1/3},\frac{1}{3}$

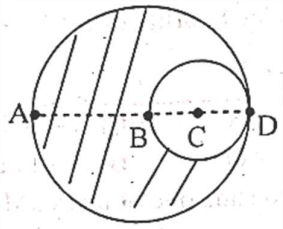
SECTION-II
(PARAGRAPH WITH NUMERICAL VALUE TYPE)

- This section contains **THREE (03)** questions stems.
- There are **TWO (02)** questions corresponding to each question stem.
- The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct numerical value corresponding to the answer in the designated place using the mouse and the on-screen virtual numeric keypad.
- If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.
- Answer to each question will be evaluated according to the following marking scheme:
- ***Full Marks:* +2** If ONLY the correct numerical value is entered at the designated place;
- **Zero Marks:0** in all other cases

Question Stem for Question Nos. 5 and 6

Question Stem

From a uniform sphere of radius 'R' a spherical cavity of radius $\frac{R}{2}$ is removed from the edge as shown. The mass of the sphere after removing cavity is M_0. Consider points A,B,C,D. Assume potential at infinity is zero. 'C' is the centre of the cavity and AB = R



5. The gravitational field at A is $\frac{x}{y}\frac{GM_0}{R^2}$ then $x-y=$ _____

6. The gravitational potential at B is $-\frac{x}{y}\frac{GM_0}{R}$ then $x+y=$_____

Question Stem for Question Nos. 7 and 8

Question Stem

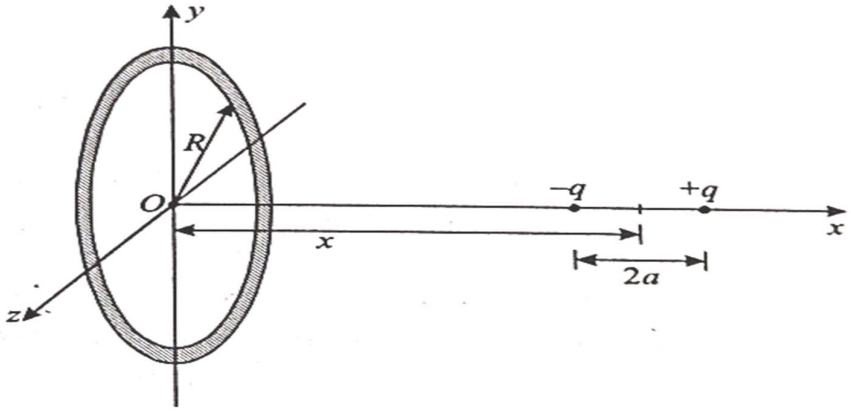
An artificial satellite is moving in a circular orbit around the earth with a speed equal to half the magnitude of escape velocity from the earth. $\left(g=10m/s^2, \text{Re}=6400km\right)$

7. The height of the satellite above the earth's surface is _____$\times 10^5 m$
8. If the satellite is stopped suddenly in its orbit and allowed to fall freely onto the earth, the speed with which it hits the surface of the earth is _____ km/sec

Question Stem for Question Nos. 9 and 10

Question Stem

An electric dipole is placed at a distance x form center O on the axis of a charged ring of radius R and charge Q uniformly distribution over it.



9. The net force acting on the dipole is $\frac{aqQ}{2\pi \in_0}\left[\frac{R^2-2x^2}{\left(R^2+x^2\right)^{\alpha}}\right]$ then $\alpha =$_____

10. The work done in rotating the dipole through 180^0 is $\frac{aqQx}{\pi \in_0 \left(R^2+x^2\right)^{\beta}}$. Then $\beta =$____

SECTION-III
(ONE OR MORE CORRECT ANSWER TYPE)

- This section contains **SIX (06)** 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 the correct answer, then

Choosing ONLY (A), (B) and (D) will get +4 marks;
Choosing ONLY (A), will get +1 mark;
Choosing ONLY (B), will get +1 mark;
Choosing ONLY (D), 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.

11. A pair of stars rotate about its common centre of mass. One of the stars has a mass M and the other has mass m such M=2m. The distance between the centres of the stars is d (d being large compared to the size of either star)

A) The period of rotation of the stars about their common centre of mass is $\sqrt{\frac{4\pi^2}{3Gm}d^3}$

B) The period of rotation of the stars about their common centre of mass is $\sqrt{\frac{2\pi^2}{Gm}d^3}$

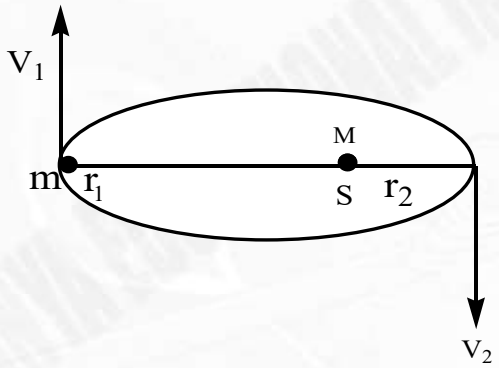
C) The ratio of the angular momentum of the two stars about their common centre of mass $\left(L_m/L_M\right)$ is 2

D) The ratio of the angular momentum of the two stars about their common centre of mass $\left(L_m/L_M\right)$ is 1

12. A planet of mass M, has two natural satellites with masses m_1 and m_2. The radii of their circular orbits are R_1 and R_2 respectively. Ignore the gravitational force between the satellites. Define v_1, L_1, K_1 and T_1 to be respectively, the orbital speed, angular momentum, kinetic energy and time period of revolution of satellite 1: and v_2,L_2, K_2 and T_2 to be the corresponding quantities of satellite 2. Given $m_1/m_2=2$ and $R_1/R_2=1/4$,

A) $\frac{v_1}{v_2}=2$ B) $\frac{L_1}{L_2}=1$ C) $\frac{K_1}{K_2}=8$ D) $\frac{T_1}{T_2}=\frac{1}{8}$

13. A planet of mass M moves along an ellipse around the sun, so that its maximum and minimum distances from the sun are r_1 and r_2 respectively. Then



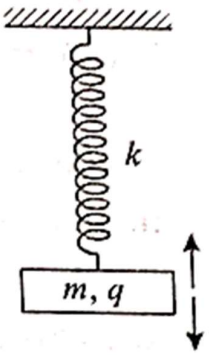
A) $V_1r_1=V_2r_2$

B) Total energy of plant is always a constant

C) Angular momentum of plant is $m\sqrt{\frac{2GM(r_1r_2)}{(r_1+r_2)}}$

D) $V_2r_1=V_1r_2$

14. The following figure shown a block of mass m suspended from a fixed point means of a vertical spring. The block is oscillating simple harmonically and carries a charge q. There also exists a uniform electric field in the space. Consider four different cases. The electric field is zero, in case -1, E=mg/q downward in case-2, E=mg/q upward in case-3 and E=2mg/q downward in case-4. The speed at mean position of block is same in all cases. Select which of the following statements is/are correct:



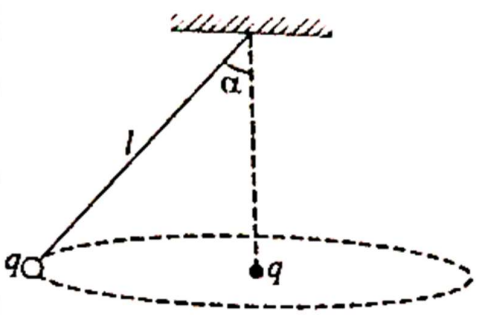
A) Time periods of oscillation are equal in case-1, and case-3

B) Amplitudes of displacement are same in case-2 and case-3

C) The maximum elongation (increment in length from natural length) is maximum in case-4

D) Time periods of oscillation are equal in case-2 and case-4

15. A Charge q is revolving around another charge q as shown in a conical pendulum. The motion is in a horizontal plane. Which of the following statements is/are correct about this situation.



A) Tension in the string is greater than the weight of the ball

B) The tension in the string is greater than the electrostatic repulsive force.

C) If the charge is removed, the speed of the ball has to be increased to maintain the angle.

D) If the charge is removed, the speed of ball has to be decreased to maintain the angle.

16. Eight-point charges each of magnitude q are located on the corners of a cube of edge a.

Then. $\left(K=\frac{1}{4\pi\in_0}\right)$

A) Force on each corner charge is $\frac{kq^2}{a^2}\left(\frac{2}{2\sqrt{2}}+\frac{1}{3\sqrt{3}}\right)N$

B) Force on a charge placed at centre of cube is $\frac{8kq^2}{\left(\frac{\sqrt{3}}{2}a\right)^2}N$

C) Electric field at centre of top face is $\frac{2^{7/2}}{3^{3/2}}\left(\frac{kq}{a^2}\right)$

D) Electric field at centre of top face is directed along area vector of the face.

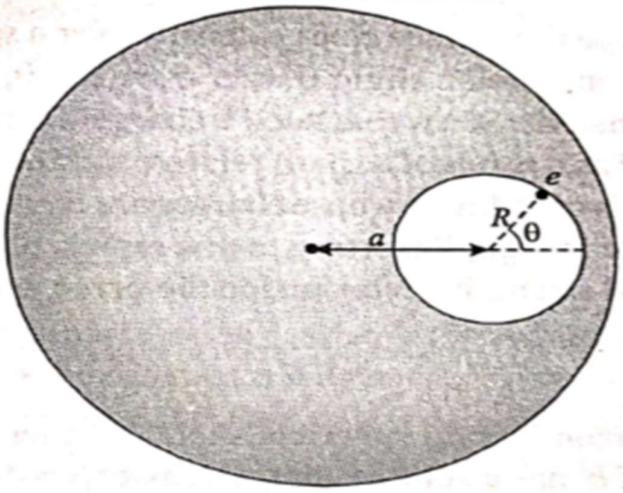
SECTION-IV
(INTEGER ANSWER TYPE)

- This section contains **THREE (03)** question.
- The answer to each question is a **NON-NEGATIVE INTEGER.**
- For each question, enter the correct integer corresponding to the answer the using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:
- ***Full Marks*** **: +4** If ONLY the correct integer is entered;
- ***Zero Marks*** **: 0** In all other cases.

17. For a certain hypothetical planet revolving around a star, the total energy is given as $E=-\frac{GMm}{40l}$, where M is the mass of the star, 'm' is the mass of the planet, l is a certain distance and it is given that M>>m. The distance between the planet and the centre of the star at the perigee position is 4 l. The velocity of the planet at perigee is V_p and that at the apogee is V_a and the ratio $\frac{V_p}{V_a}=$____

18. A uniform sphere has a mass 'M' and radius 'R'. The pressure caused by gravitational compression at a depth $\frac{R}{2}$ from surface is $\frac{9GM^2}{32\pi R^x}$ then x=____

19. A solid non-conducting sphere of radius R is charged with a uniform volume charge density ρ. Inside the sphere a cavity of radius r is made as shown in figure. The distance between the centre of the sphere and the cavity is a. An electron e is kept inside the cavity and angle $\theta=45^0$ as shown. If at t=0 this electron is released from point P. The time it will take to touch the sphere on inner wall of cavity again is $\sqrt{\frac{s\sqrt{2}mr\in_0}{e\rho a}}$. Then s is ____

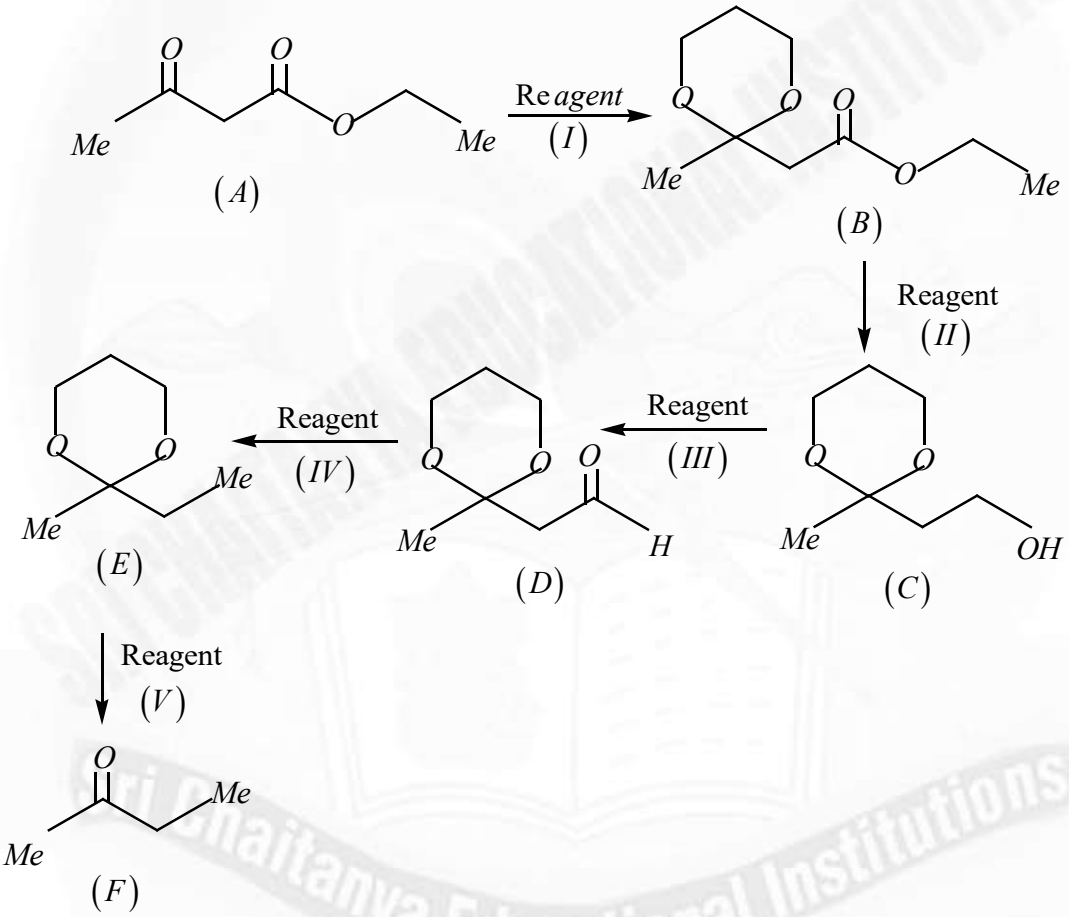


CHEMISTRY **Max. Marks: 60**

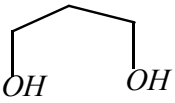
SECTION-I
(SINGLE CORRECT ANSWER TYPE)

- This section contains **Four (04)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four 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 the none of the options is chosen (i.e. the question is unanswered);
- *Negative Marks* : -1 In all other cases.

20.



The different reagents are given as

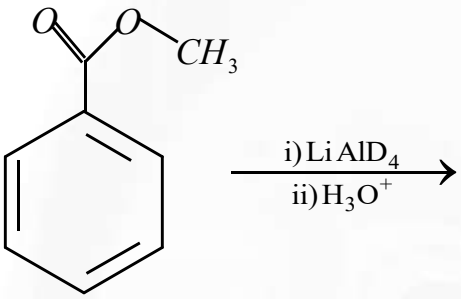
$U = NH_2 - NH_2$ $V = H_3O^{(+)}$ $W = PCC,$ $X =$ 

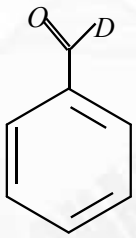
y =NaOH $Z = LAH / H_3O^+$, ether

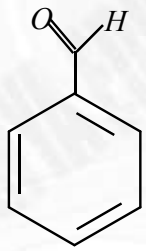
Select the correct order in sequence in order to get the final product (F)

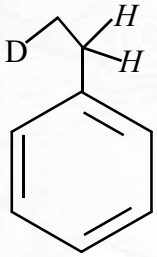
Reagenty	I	II	III	IV	V
A)	X	U	Z	W	U,Y
B)	X	U	Z	V	U,Y
C)	X	Z	W	U,Y	V
D)	X	Z	W	U	V

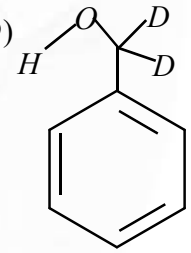
21. Choose the major product of the following reaction



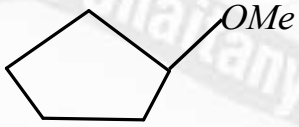
A) 

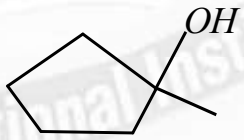
B) 

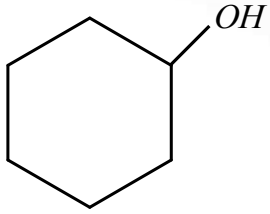
C) 

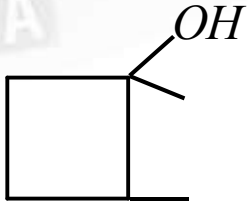
D) 

22. An organic compound A ($C_6H_{12}O$) neither decolourise bromine water nor changes the colour of acidic dichromate solution A on heating with H_2SO_4 produces an alkene which on oxidative ozonolysis gives B($C_6H_{10}O_3$) which gives an yellow precipitate with $NaOH/I_2$ the most probable structure of A is

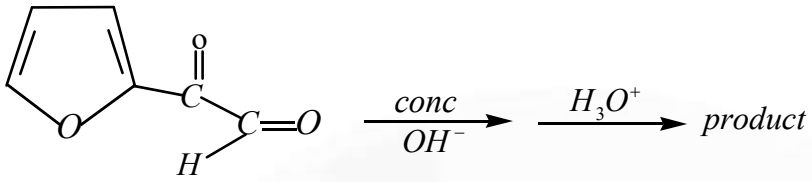
A) 

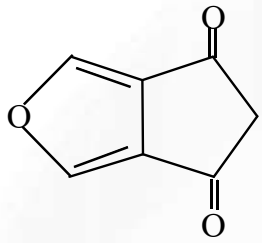
B) 

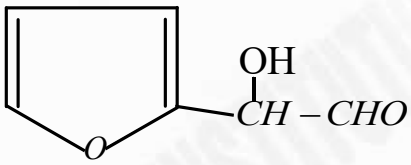
C) 

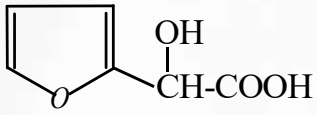
D) 

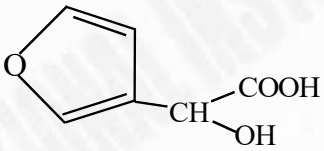
23. The product of the below reaction is



A) 

B) 

C) 

D) 

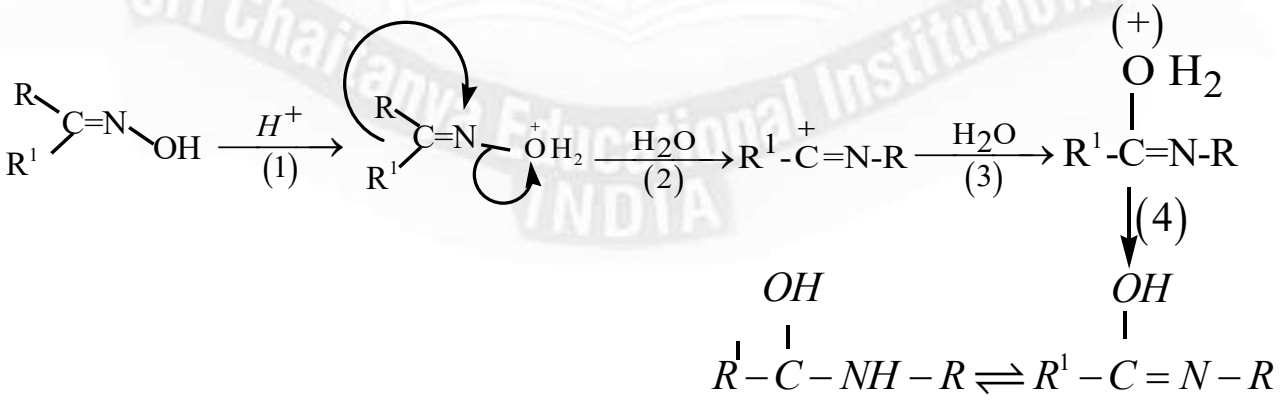
SECTION-II
(PARAGRAPH WITH NUMERICAL VALUE TYPE)

- This section contains **THREE (03)** questions stems.
- There are **TWO (02)** questions corresponding to each question stem.
- The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct numerical value corresponding to the answer in the designated place using the mouse and the on-screen virtual numeric keypad.
- If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.
- Answer to each question will be evaluated according to the following marking scheme:
- ***Full Marks*** : **+2** If ONLY the correct numerical value is entered at the designated place;
- ***Zero Marks*** : **0** In all other cases.

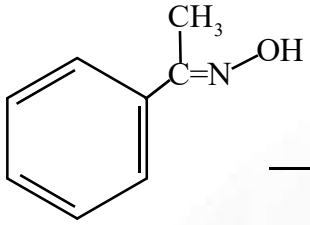
Question Stem for Question Nos. 24 and 25

Question Stem

One of the well known rearrangement is the formation of N-Substituted amides by rearrangement of aldoximes or ketoximes this is known as Beckmann rearrangement It is catalyzed by various acidic reagents the mechanism of this reaction is given as



24. Rate – determing step in Beckmann rearrangement is

25. 

$\xrightarrow{H^+}$ product (p); the molecular weight of product (p) is x. Then $\frac{x}{2}$

Question Stem for Question Nos. 26 and 27

Question Stem

An organic compound 'p' with molecular formula C_8H_8O forms an organic red ppt with 2,4-DNP, gives yellow ppt on heating with I_2 in presence of NaOH It neither reduce Tollen's or Fehling reagent nor does it decolonize Br_2 water or Bayer's regent on drastic oxidation with chromic acid (H_2CrO_4) it gives an acid (Q) having molecular formula $C_7H_6O_2$

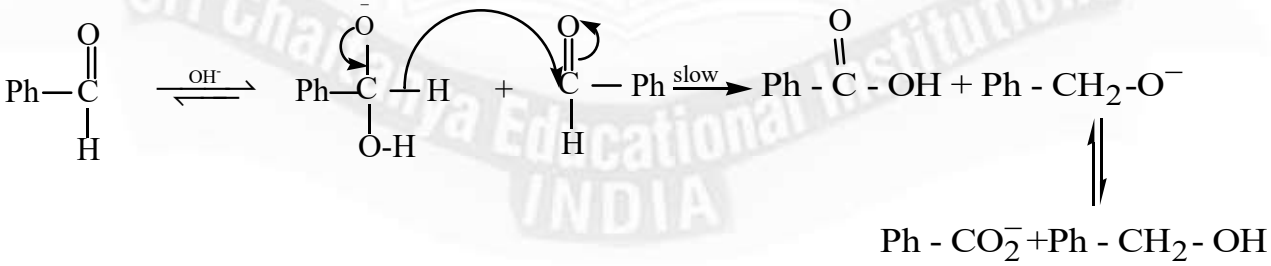
26. Total number of π bonds in compound 'P' is

27. $P \xrightarrow[\Delta]{dil.OH} S \xrightarrow[H_3O^{(+)}]{CH_3MgBr(1\,mole)} T$ No. of stereo isomers in the final product T is

Question Stem for Question Nos. 28 and 29

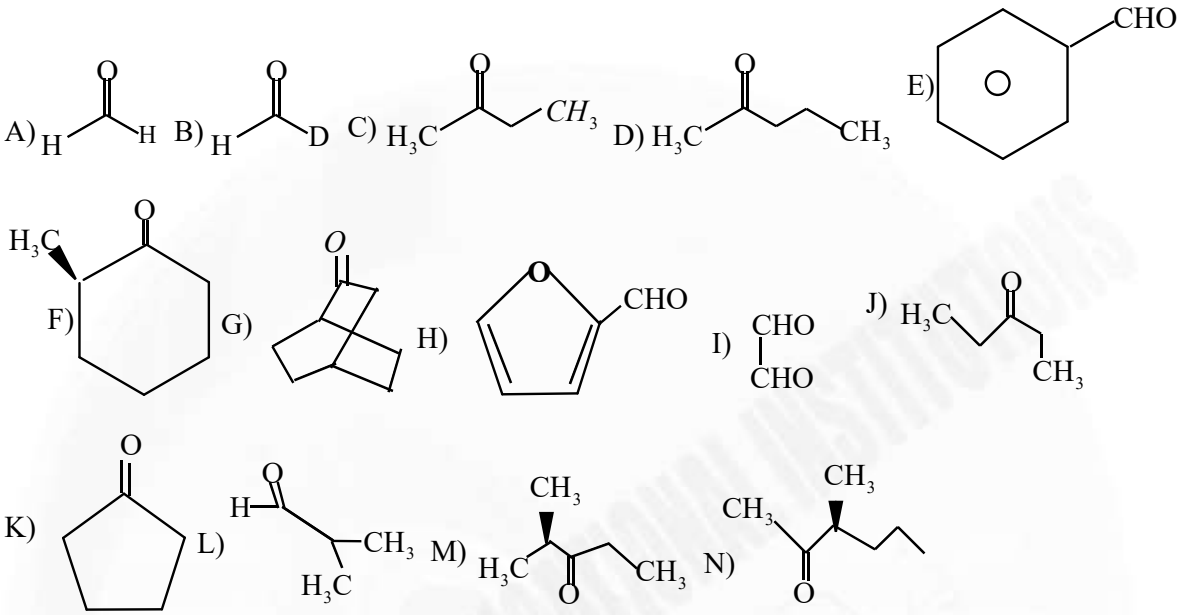
Question Stem

Mechanism of Cannizzaro's reaction of Benzaldehyde is



28. Order of the above reaction is

29. Identify compounds that give Cannizaro reaction

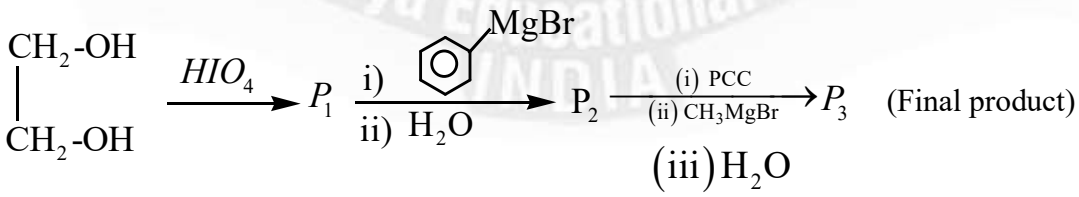


SECTION-III
(ONE OR MORE CORRECT ANSWER TYPE)

- This section contains **SIX (06)** 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 the correct answer, then

Choosing ONLY (A), (B) and (D) will get +4 marks;
Choosing ONLY (A), will get +1 mark;
Choosing ONLY (B), will get +1 mark;
Choosing ONLY (D), 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.

30. Which of the following is correct for the final product of the given sequence of reaction

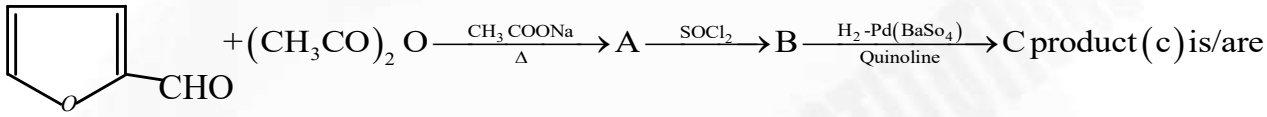


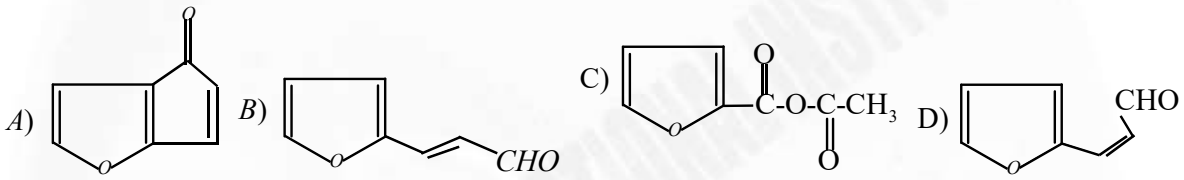
A) Compound P_3 on oxidation with (CrO_3+H_2SO_4) gives a compound which gives 2,4-DNP test

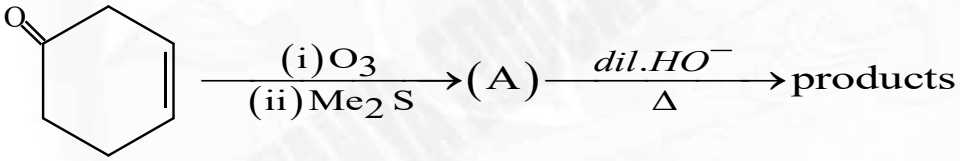
B) Compound P_3 on reaction with I_2+NaOH gives yellow ppt

C) Compound P_3 on reaction with ceric ammonium nitrate gives red colorations

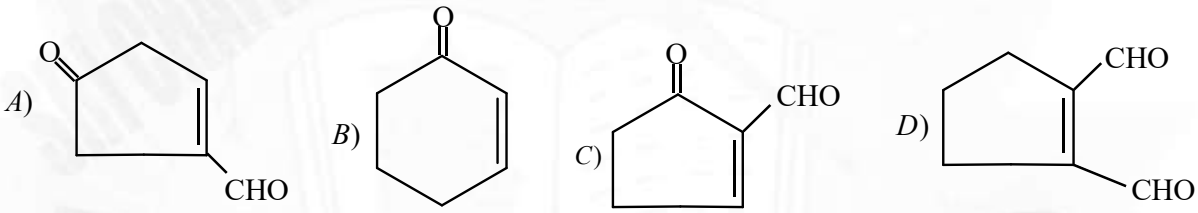
D) Compound P_3 on reaction with MnO_2 gives carboxylic acid

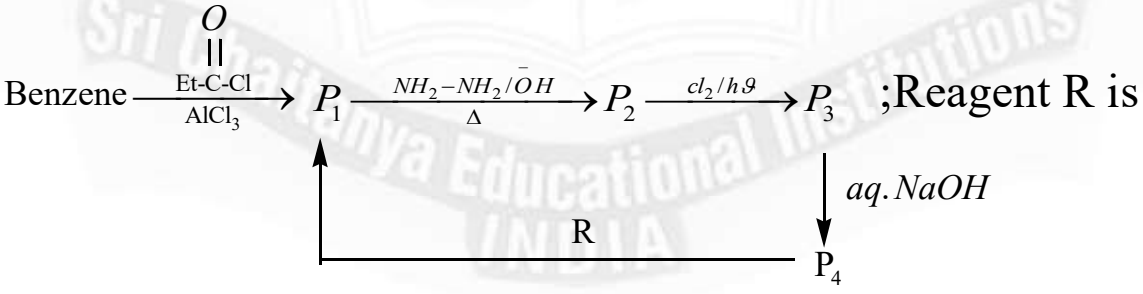
31. 



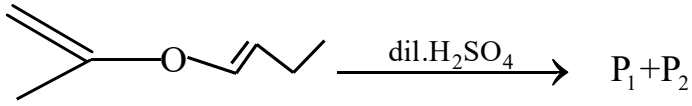
32 

In the above sequence the final products of the reaction is / are



33 

A) MnO_2/ Δ B) P.C.C C) $Br_2 + H_2O$ D) LAH

34. 

P_1 & P_2 Products are distinguished by

A) Tollen's reagent B) Iodoform test C) $2,4-DNP$ test D) 1% alkaline $KMnO_4$

35. When 1-phenyl propyne reacts with $H_2O/Hg\ SO_4/\ H_2SO_4$. The major product is propiophenone this is because

A) Alkyl groups are weak electron donors due to inductive effect

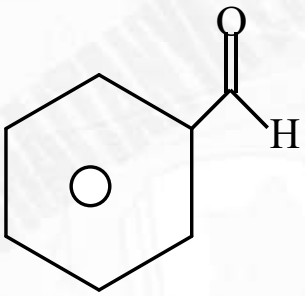
B) Carbonyl groups are electron with drawing groups due to resonance

C) Phenyl groups can stabilize positive charge by resonance

D) The reaction is controlled by steric factors

SECTION-IV
(INTEGER ANSWER TYPE)

- This section contains **THREE (03)** question.
- The answer to each question is a **NON-NEGATIVE INTEGER.**
- For each question, enter the correct integer corresponding to the answer the using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:
- ***Full Marks*** **: +4** If ONLY the correct integer is entered;
- ***Zero Marks*** **: 0** In all other cases.

Reaction -1 

$\xrightarrow[2)\,H_3o^+,\Delta]{1)\,AC_2O,\,Aco\,Na,\Delta}(A)$

36

Reaction-2 $Ph\text{-}CH{=}CH\text{-}\underset{\displaystyle OH}{\underset{|}{C}}H\text{-}CH_3 \xrightarrow[2)\ H^+]{1)\,NaOI} (B)$

Degree of unsaturation present in compound $(A+B)$ is

37. What is the molecular weight of a compound that undergoes an aldol self condensation reaction and whose dehydrated product has a molecular weight of 70

38. How many products are possible when ethanal and phenyl ethanal mixture is treated with dil. NaOH about 0^0 C. (including stereo isomers)

MATHEMATICS **Max. Marks: 60**

SECTION-I
(SINGLE CORRECT ANSWER TYPE)

- This section contains **Four (04)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four 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 the none of the options is chosen (i.e. the question is unanswered);
- *Negative Marks* : -1 In all other cases.

39. $\int_0^{102}(x-1)(x-2).....(x-100)\times\left(\frac{1}{(x-1)}+\frac{1}{(x-2)}+...+\frac{1}{x-100}\right)dx=$_____

A) 101!-100! B) 100!-99! C) 102!-101! D)101!+100!

40. If $y=\int_{\frac{1}{8}}^{\sin^2 x}\sin^{-1}\sqrt{t}\,dt+\int_{\frac{1}{8}}^{\cos^2 x}\cos^{-1}\sqrt{t}\,dt$, where $0\le x\le \pi/2$, is the equation of a straight line parallel to the x-axis , its equation is

A) $y=\frac{\pi}{16}$ B) $y=\frac{-3\pi}{16}$ C) $y=\frac{3\pi}{16}$ D) $y=\frac{\pi}{4}$

41. $\int_1^3\frac{dx}{x^2+[x]^2+1-2x[x]}=$_____$([.]\ is\ G.I.F)$

A) $\frac{\pi}{4}$ B) $\frac{\pi}{2}$ C) $\frac{3\pi}{4}$ D) $\frac{5\pi}{4}$

42. Let f(x) be a non-negative continuous function defined on R such that $f(x)+f\left(x+\frac{1}{2}\right)=3$ and the value of $\int_0^{1500}f(x)dx=\frac{9000}{\lambda}$ then $\lambda=$

A) 2 B) 1 C) 3 4) 4

SECTION-II
(PARAGRAPH WITH NUMERICAL VALUE TYPE)

- This section contains **THREE (03)** questions stems.
- There are **TWO (02)** questions corresponding to each question stem.
- The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct numerical value corresponding to the answer in the designated place using the mouse and the on-screen virtual numeric keypad.
- If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.
- Answer to each question will be evaluated according to the following marking scheme:
- ***Full Marks: +2*** If ONLY the correct numerical value is entered at the designated place;
- ***Zero Marks: 0*** In all other cases.

Question Stem for Question Nos. 43 and 44

Question Stem

Let $f(a)=\int_{a^{-1}}^{a}\frac{1}{x}\cot^{-1}\left(\frac{x^2-x+1}{2x-3x^2}+\frac{x^2-x+1}{3-2x}\right)dx$ **and**

$$g(a)=\int_{\ln\frac{1}{a}}^{\ln a}\left(\frac{\left|x^2-3x+2\right|-\left|(x+1)(x+2)\right|+\left|x+1\right|+\left|x-1\right|}{\left|x+1\right|+\left|x-1\right|}\right)dx$$

Where $a\in(0,\infty)-\left\{\frac{2}{3},\frac{3}{2}\right\}$**. If** $f(200)-\frac{\pi}{2}g(50)=\alpha\frac{\pi}{3}\ln\beta\ \ (\alpha,\beta\in I)$

43. α = _____ (*if* β *is prime*)

44. β = _____ (*if* α *is odd prime*)

Question Stem for Question Nos. 45 and 46

Question Stem

If $\int_0^{100\pi}\left(\left[\cot^{-1}x\right]+\left[\tan^{-1}x\right]\right)dx\left([.]is\,G.I.F\right)=p\pi+q.\cot q$ **then**

45. P = _____

46. $\frac{q^5}{10}$ = _____

Question Stem for Question Nos. 47 and 48

Question Stem

Let $g_i:\left[\frac{\pi}{8},\frac{3\pi}{8}\right]\to R, i=1,2$ **and** $f:\left[\frac{\pi}{8},\frac{3\pi}{8}\right]\to R$ **be functions such that**

$g_1(x)=1$, $g_2(x)=|4x-\pi|$, $f(x)=\sin^2 x$

$\forall x\in\left[\frac{\pi}{8},\frac{3\pi}{8}\right]$ **and** $S_i=\int_{\frac{\pi}{8}}^{\frac{3\pi}{8}}f(x)g_i(x)dx$ **(i=1,2)**

47. The value of $\frac{48S_1}{\pi}$ = ____

48. The value of $\frac{32S_2}{\pi^2}$ = ____

SECTION-III
(ONE OR MORE CORRECT ANSWER TYPE)

- This section contains **SIX (06)** 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 the correct answer, then

Choosing ONLY (A), (B) and (D) will get +4 marks;
Choosing ONLY (A), will get +1 mark;
Choosing ONLY (B), will get +1 mark;
Choosing ONLY (D), 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.

49. Let e be the eccentricity of a hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$, and $f(e)$ be the eccentricity of conjugate hyperbola $\frac{-x^2}{a^2}+\frac{y^2}{b^2}=1$, then $\int_1^3 \frac{\text{fff.....f(e)}}{\text{n times}}$ de is equal to

A) 2, if n is even B) 4, if n is even C) $2\sqrt{2}$ if n is odd D) $4\sqrt{2}$, if n is odd

50. Let $f(x)=7\tan^8 x+7\tan^6 x-3\tan^4 x-3\tan^2 x$ for all $x\in\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$ then the correct expression (s) is (are)

A) $\int_o^{\pi/4} xf(x)dx=\frac{1}{12}$ B) $\int_o^{\pi/4} f(x)dx=0$

C) $\int_o^{\pi/4} xf(x)dx=\frac{1}{6}$ D) $\int_o^{\pi/4} f(x)dx=1$

51. If $f(2-x)=f(2+x)$ and $f(4-x)=f(4+x)$ and $f(x)$ is a function of which $\int_0^2 f(x)dx=5$, then $\int_0^{50} f(x)dx$ is equal to

A) 125 B) $\int_{-4}^{46} f(x)dx$ C) $\int_1^{51} f(x)dx$ D) $\int_2^{52} f(x)dx$

52. If $u_n = \int_0^{\frac{\pi}{2}} \frac{\sin^2 nx}{\sin^2 x} dx$ then which of the following is (are) true

A) $u_1 = \frac{\pi}{2}$ B) $u_n = \frac{n\pi}{2}$ C) $u_n - u_{n-1} = \frac{\pi}{2}$ D) $u_1, u_2, u_3 \ldots\ldots$ are in A.P

53. Let $I_1 = \int_0^{10^4} \frac{\{\sqrt{x}\}}{\sqrt{x}} dx, I_2 = \int_0^{10} \left(x\{x^2\}\right) dx$ where $\{x\}$ is fractional part of x , then which of the following is/are correct.

A) $I_1 = I_2$ B) $I_1 < I_2$ C) $I_1 = 4I_2$ D) $I_1 = 100$

54 If $I_n = \int_{-\pi}^{\pi} \frac{\sin nx}{\left(1+\pi^x\right).\sin x} dx, n = 0,1,2,\ldots\ldots,$ then which of the following is/are true?

A) $I_n = I_{n+2}$ B) $\sum_{m=1}^{10} I_{2m+1} = 10\pi$ C) $\sum_{m=1}^{10} I_{2m} = 0$ D) $I_n = I_{n+1}$

SECTION-IV
(INTEGER ANSWER TYPE)

- This section contains **THREE (03)** question.
- The answer to each question is a **NON-NEGATIVE INTEGER.**
- For each question, enter the correct integer corresponding to the answer the using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:
- ***Full Marks*** **: +4** If ONLY the correct integer is entered;
- ***Zero Marks*** **: 0** In all other cases.

55. If $f(x) = x^3 - \frac{3x^2}{2} + x + \frac{1}{4}$ then the value of $\left(\int_{\frac{1}{4}}^{\frac{3}{4}} f(x)dx\right)^{-1}$ is

56. If $f(x) = \begin{cases} 1-|x|, & |x| \le 1 \\ 0, & |x| > 1 \end{cases}$, and $g(x) = f(x-1) + f(x+1)$

then the value of $\int_{-3}^{5} g(x)dx$ is

57. The value of $\int_0^2 \left(\sqrt{1+x^3} + \sqrt[3]{x^2+2x}\right) dx$ equal to

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29	113	205	745	4,212

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