KEAM 2026 Engineering April 21

Question Paper with Solutions (Memory-Based)

Conducted by CEE Kerala

General Instructions

- **Duration:** The total duration of the examination is 1.5 hours (90 minutes).
- **Total Marks:** The complete paper carries a maximum of 300 marks.
- **Structure:** The paper has 2 Sections:
  - **Section A:** 30 Multiple Choice Questions (Physics).
  - **Section B:** 45 Multiple Choice Questions (Chemistry).
- **Compulsory Questions:** All 75 questions are compulsory.
- Each question has four options. Only **one** option is correct.
- Correct Answer: +4 marks.
- **Incorrect Answer:** −1 (Negative marking).
- **Unanswered/Marked for Review:** 0 marks.

PHYSICS

1. The semi-major axis of the orbit of Saturn is approximately nine times that of Earth. The time period of revolution of Saturn is approximately equal to

(A) 81 years
(B) 27 years
(C) 729 years
(D) $\sqrt[3]{81}$ years

(E) 9 years

Correct Answer: (B) 27 years

Solution:

Step 1: Understanding the Concept:

The problem relates the time period of revolution of a planet to its orbital radius (semi-major axis). This relationship is governed by Kepler's Third Law of Planetary Motion.

Step 2: Key Formula or Approach:

Kepler's Third Law states that the square of the time period (T) of a planet is directly proportional to the cube of the semi-major axis (R) of its orbit:

$$T^2 \propto R^3$$

For two planets, say Earth (E) and Saturn (S), we can set up a ratio:

$$\left(\frac{T_S}{T_E}\right)^2 = \left(\frac{R_S}{R_E}\right)^3$$

Step 3: Detailed Explanation:

Let's denote the parameters for Earth with subscript 'E' and for Saturn with subscript 'S'.

We know the time period of Earth, $T_E = 1$ year.

The problem states that the semi-major axis of Saturn is nine times that of Earth:

$R_S = 9R_E$

Now, substitute these values into Kepler's Third Law equation:

$$\left(\frac{T_S}{1 \text{ year}}\right)^2 = \left(\frac{9R_E}{R_E}\right)^3$$

$$T_S^2 = (9)^3$$

To find T_S, we take the square root of both sides:

$$T_S = \sqrt{9^3}$$

We can simplify this by rewriting 9 as 3^2:

$$T_S = \sqrt{(3^2)^3} = \sqrt{3^6} = 3^3$$

$$T_S = 27$$

So, the time period of Saturn is approximately 27 Earth years.

Step 4: Final Answer:

The time period of revolution of Saturn is 27 years.

Quick Tip: To simplify calculations like $\sqrt{n^3}$, you can compute it as $(\sqrt{n})^3$. In this case, $\sqrt{9^3} = (\sqrt{9})^3 = 3^3 = 27$. This avoids dealing with large intermediate numbers like 729.

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2. Two strings of the same material and same length are given equal tension. If they are vibrating with fundamental frequencies 1600 Hz and 900 Hz, then the ratio of their respective diameters is

(A) 16 : 9

(B) 4 : 3

(C) 81 : 256

(D) 3 : 4

(E) 9 : 16

Correct Answer: (E) 9 : 16

Solution:

Step 1: Understanding the Concept:

The fundamental frequency of a stretched string vibrating transversely depends on three factors: its length, the tension applied, and its linear mass density (mass per unit length).
The linear mass density itself is determined by the material's density and the string's cross-sectional area, which directly relates to its diameter.

Step 2: Key Formula or Approach:

The fundamental frequency f is given by Mersenne's law:

$$f = \frac{1}{2L}\sqrt{\frac{T}{\mu}}$$

where L is length, T is tension, and μ is linear mass density.
Express μ in terms of diameter d and material density ρ:

$$\mu = \text{Volume density} \times \text{Cross-sectional area} = \rho \cdot \pi\left(\frac{d}{2}\right)^2 = \frac{\pi\rho d^2}{4}$$

Step 3: Detailed Explanation:

Substitute the expression for μ into the frequency formula:

$$f = \frac{1}{2L}\sqrt{\frac{T}{\frac{\pi\rho d^2}{4}}}$$

$$f = \frac{1}{2L}\sqrt{\frac{4T}{\pi\rho d^2}}$$

$$f = \frac{1}{2L}\cdot\frac{2}{d}\sqrt{\frac{T}{\pi\rho}}$$

$$f = \frac{1}{L \cdot d}\sqrt{\frac{T}{\pi\rho}}$$

The problem states that both strings have the same material (same density ρ), same length (L), and are under equal tension (T).
Therefore, all terms except f and d are constant.
This establishes an inverse proportionality between frequency and diameter:

$$f \propto \frac{1}{d} \implies d \propto \frac{1}{f}$$

We can write this as a ratio for the two strings:

$$\frac{d_1}{d_2} = \frac{f_2}{f_1}$$

Given the fundamental frequencies are $f_1 = 1600$ Hz and $f_2 = 900$ Hz, we plug these in to find the ratio of their respective diameters:

$$\frac{d_1}{d_2} = \frac{900}{1600}$$

$$\frac{d_1}{d_2} = \frac{9}{16}$$

Thus, the ratio $d_1 : d_2$ is $9 : 16$.

Step 4: Final Answer:

The correct ratio matches option (E).

Quick Tip: Remember the general proportionality $f \propto \frac{1}{L \cdot d}\sqrt{\frac{T}{\rho}}$ for vibrating strings. Recognizing what parameters remain constant allows you to quickly set up ratios without doing full calculations.

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3. On an average, the number of neutrons and the energy of a neutron released per fission of a uranium atom are respectively

(A) 2.5 and 2 keV

(B) 3 and 1 keV

(C) 2.5 and 2 MeV

(D) 2 and 2 keV

(E) 1 and 2 MeV

Correct Answer: (C) 2.5 and 2 MeV

Solution:

Step 1: Understanding the Concept:

This is a theoretical knowledge question based on the principles of nuclear physics, specifically regarding the induced nuclear fission of Uranium-235 (^{235}U).

Step 2: Detailed Explanation:

When a slow (thermal) neutron strikes a ^{235}U nucleus, it makes the nucleus highly unstable ($^{236}U^*$), causing it to undergo fission.

The nucleus splits into two lighter, intermediate-mass fission fragments.

To conserve nucleons, this process also emits several secondary neutrons.

Depending on the specific fission fragment pair created, 2, 3, or sometimes more neutrons are ejected. Experimental data shows that the average number of neutrons released per fission is approximately 2.47, which is conventionally rounded to 2.5 in general physics problems.

These newly born secondary neutrons are emitted with high kinetic energy. They are termed "fast neutrons".

The average kinetic energy of these fast neutrons emitted during fission is known to be approximately 2 MeV (Mega-electron Volts).

Therefore, on average, 2.5 neutrons are released, each possessing an energy of roughly 2 MeV.

Step 3: Final Answer:

The correct pair of values is 2.5 and 2 MeV, corresponding to option (C).

Quick Tip: Memorizing key constants in nuclear physics is crucial. For Uranium fission, remember: 200 MeV of total energy is released per fission, 2.5 average neutrons are produced, and these are "fast" neutrons with 2 MeV energy each.

CHEMISTRY

4. An example of electrophilic substitution reaction is :

(A) Chlorination of methane

(B) Conversion of methyl chloride to methyl alcohol

(C) Nitration of benzene

(D) Formation of ethylene from ethyl alcohol.

Correct Answer: (C) Nitration of benzene

Solution:

Step 1: Understanding the Concept:

Electrophilic substitution reactions are characteristic of aromatic compounds, such as benzene. In these reactions, an electrophile (an electron-seeking species) substitutes one of the hydrogen atoms on the aromatic ring, preserving the stable aromatic system.

Step 2: Detailed Explanation:

Let's analyze each of the given options:

(A) **Chlorination of methane**: This reaction proceeds via a free-radical mechanism under the presence of sunlight or heat. It is a free-radical substitution reaction, not electrophilic.

(B) **Conversion of methyl chloride to methyl alcohol**: This involves the reaction of methyl chloride with an aqueous alkali (like NaOH). The hydroxide ion (OH^-) acts as a nucleophile, replacing the chloride ion. This is a nucleophilic substitution reaction (specifically S_N2).

(C) **Nitration of benzene**: Benzene reacts with a mixture of concentrated nitric acid (HNO_3) and concentrated sulfuric acid (H_2SO_4). The sulfuric acid acts as a catalyst to generate the nitronium ion (NO_2^+), which is a strong electrophile. This nitronium ion then attacks the electron-rich benzene ring, substituting a hydrogen atom. This is a classic example of an electrophilic aromatic substitution.

(D) **Formation of ethylene from ethyl alcohol**: This reaction involves heating ethyl alcohol with concentrated sulfuric acid, which acts as a dehydrating agent to remove a molecule of water, forming a double bond. This is an elimination reaction.

Step 4: Final Answer:

Therefore, the nitration of benzene is the correct example of an electrophilic substitution reaction.

Quick Tip: Remember that benzene rings are highly electron-dense and generally repel nucleophiles, making them prime targets for electrophilic attack. Common electrophilic aromatic substitution reactions include nitration, halogenation, sulfonation, and Friedel-Crafts alkylation/acylation.

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5. Which has minimum bond angle?

(A) NH_3

(B) H_2O

(C) PH_3

(D) H_2S

(E) SO_2

Correct Answer: (D) H_2S

Solution:

Step 1: Use VSEPR Theory

Bond angle depends on:

- Number of lone pairs
- Hybridization
- Repulsion: lp-lp > lp-bp > bp-bp

Step 2: Analyze Each Molecule

(A) NH_3

$$sp^3 \text{ with 1 lone pair} \Rightarrow 107^\circ$$

(B) H_2O

$$sp^3 \text{ with 2 lone pairs} \Rightarrow 104.5^\circ$$

(E) SO_2

$$sp^2 \text{ with 1 lone pair} \Rightarrow \approx 119^\circ$$

(C) PH_3

Due to weak hybridization (Drago's rule):

$$\text{Bond angle} \approx 93.5^\circ$$

(D) H_2S

$$\text{Less hybridization} + 2 \text{ lone pairs} \Rightarrow \approx 92^\circ$$

Step 3: Compare Values

$$SO_2 > NH_3 > H_2O > PH_3 > H_2S$$

Step 4: Final Answer

$$\boxed{H_2S}$$

Quick Tip: Drago's rule is a powerful shortcut. When the central atom is from the 3rd period or lower (like P, S, As, Se) and is bonded to a less electronegative atom like Hydrogen, assume no hybridization. The bond angles will be very close to 90°, making them smaller than any comparable sp^3 hybridized molecule from the 2nd period.

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6. One mole of an alkene on ozonolysis gives a mixture of one mole pentan-3-one and one mole methanal. The alkene is

(A) 3-ethylbut-1-ene
(B) 2-methylpent-1-ene
(C) 2-ethylbut-1-ene
(D) 4-methylpent-2-ene
(E) 4-methylpent-1-ene

Correct Answer: (C) 2-ethylbut-1-ene

Solution:

Step 1: Concept of Ozonolysis

Ozonolysis cleaves the double bond of an alkene to give carbonyl compounds.

To find the alkene, we reverse the process (join carbonyl carbons).

Step 2: Write Given Products

Pentan-3-one:

$$CH_3 - CH_2 - CO - CH_2 - CH_3$$

Methanal:

$$HCHO$$

Step 3: Reverse Ozonolysis

Remove oxygen and join carbonyl carbons:

$$CH_3 - CH_2 - C(= CH_2) - CH_2 - CH_3$$

Step 4: Identify Longest Chain

$$CH_2 = C(CH_2CH_3) - CH_2 - CH_3$$

Parent chain = But-1-ene

Step 5: Identify Substituent

Ethyl group at C-2

$$\Rightarrow \text{2-ethylbut-1-ene}$$

Step 6: Final Answer

$$\boxed{\text{2-ethylbut-1-ene}}$$

Quick Tip: Reverse ozonolysis is like solving a puzzle piece connection. Just erase the '=O' from both product molecules and connect the 'sticky ends' (the carbons) with a double bond. Always be careful to select the correct longest chain containing the double bond when naming the resulting structure.

Maths

7. Consider the following statements :

(i) For every positive real number x, $x-10$ is positive.

(ii) Let n be a natural number. If n^2 is even, then n is even.

(iii) If a natural number is odd, then its square is also odd.

Then

(A) (i) False, (ii) True and (iii) True

(B) (i) False, (ii) False and (iii) True

(C) (i) True, (ii) False and (iii) True

(D) (i) True, (ii) True and (iii) True

(E) (i) False, (ii) True and (iii) False

Correct Answer: (A) (i) False, (ii) True and (iii) True

Solution:

Step 1: Understanding the Concept:

We need to evaluate the truth value of three separate mathematical statements using basic logic, properties of numbers, and counterexamples.

Step 2: Detailed Explanation:

Let's analyze each statement one by one:

Statement (i): "For every positive real number x, $x-10$ is positive."

To prove a "for every" statement false, we only need to find a single counterexample.

Let's pick a positive real number, for instance, $x = 5$.

Substitute $x = 5$ into the expression: $5 - 10 = -5$.

Since -5 is not a positive number, the statement does not hold for all positive real numbers.

Therefore, Statement (i) is **False**.

Statement (ii): "Let n be a natural number. If n^2 is even, then n is even."

We can prove this by proving its contrapositive: "If n is not even (i.e., odd), then n^2 is not even (i.e., odd)."

Let n be an odd natural number. By definition, an odd number can be written as $n = 2k+1$, where k is a non-negative integer.

Now let's square n:

$$n^2 = (2k+1)^2$$

$$n^2 = 4k^2 + 4k + 1$$

We can factor out a 2 from the first two terms:

$$n^2 = 2(2k^2 + 2k) + 1$$

Let $m = 2k^2 + 2k$, which is also an integer. Then:

$$n^2 = 2m + 1$$

This is the standard form of an odd number. Thus, if n is odd, n^2 is odd. The contrapositive is true, which implies the original statement is also true.
Therefore, Statement (ii) is **True**.

Statement (iii): "If a natural number is odd, then its square is also odd."
This is precisely the contrapositive we just proved while analyzing statement (ii).
Let $n = 2k + 1$ (an odd number).
$n^2 = (2k+1)^2 = 4k^2 + 4k + 1 = 2(2k^2 + 2k) + 1$, which is odd.
Therefore, Statement (iii) is **True**.

Summarizing our findings: (i) is False, (ii) is True, and (iii) is True. This matches option (A).

Step 4: Final Answer:
The correct option is (i) False, (ii) True and (iii) True.

Quick Tip: To disprove a universally quantified statement ("for every", "for all"), providing just one counterexample is sufficient. To prove an implication "If P then Q", it is often easier to prove its contrapositive "If not Q then not P".

8. The principal argument of the complex number $z = \frac{8+4i}{1+3i}$ is equal to

(A) $\frac{\pi}{4}$

(B) $\frac{-\pi}{4}$

(C) $\frac{3\pi}{4}$

(D) $\frac{-3\pi}{4}$

(E) $\frac{\pi}{6}$

Correct Answer: (B) $\frac{-\pi}{4}$

Solution:

Step 1: Rationalize the Denominator

$$z = \frac{8+4i}{1+3i} \times \frac{1-3i}{1-3i}$$

Step 2: Simplify

$$z = \frac{(8+4i)(1-3i)}{(1+3i)(1-3i)}$$

Denominator:

$$= 1-(3i)^2 = 1+9 = 10$$

Numerator:

$$= 8-24i+4i-12i^2$$

$$= 8-20i+12 = 20-20i$$

$$z = \frac{20-20i}{10} = 2-2i$$

Step 3: Find Argument

$$\tan\theta = \frac{-2}{2} = -1$$

$$\theta = \tan^{-1}(1) = \frac{\pi}{4}$$

Since z lies in 4th quadrant:

$$\theta = -\frac{\pi}{4}$$

Step 4: Final Answer

$$\boxed{-\frac{\pi}{4}}$$

Quick Tip: Always convert a complex number to its standard $a + ib$ form before trying to find its argument. Pay close attention to the signs of the real and imaginary parts to correctly identify the quadrant, as this determines whether the argument is positive or negative.

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9. The number of arrangements containing all the seven letter of the word ALRIGHT that begins with LG is

(A) 720

(B) 120

(C) 600

(D) 540

(E) 760

Correct Answer: (B) 120

Solution:

Step 1: Total Letters

The word ALRIGHT has 7 distinct letters:

$$A, L, R, I, G, H, T$$

Step 2: Apply Given Condition

The arrangement must begin with LG:

$$\text{L} \quad \text{G} \quad \_ \quad \_ \quad \_ \quad \_ \quad \_$$

So, first 2 positions are fixed.

Step 3: Remaining Letters

Remaining letters:

$$A, R, I, H, T \quad \text{(5 letters)}$$

Step 4: Arrange Remaining Letters

Number of ways:

$$5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$$

Step 5: Final Answer

$$\boxed{120}$$

Quick Tip: When a problem specifies that certain elements must occupy fixed positions, you can simply "remove" them from the pool of items to be arranged and calculate the permutations for the remaining items in the remaining slots.

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10. Evaluate the integral: $\int \frac{1}{x^3}\sqrt{1-\frac{1}{x^2}}\mathbf{dx} =$

(A) $\frac{-1}{6}\left(1-\frac{1}{x^2}\right)^{\frac{3}{2}} + C$
(B) $\frac{1}{3}\left(1-\frac{1}{x^2}\right)^{\frac{3}{2}} + C$
(C) $\frac{-1}{3}\left(1-\frac{1}{x^2}\right)^{\frac{3}{2}} + C$
(D) $\frac{4}{3}\left(1-\frac{1}{x^2}\right)^{\frac{3}{2}} + C$
(E) $\frac{-4}{3}\left(1-\frac{1}{x^2}\right)^{\frac{3}{2}} + C$

Correct Answer: (B) $\frac{1}{3}\left(1-\frac{1}{x^2}\right)^{\frac{3}{2}} + C$

Solution:

Step 1: Understanding the Concept:

We are given an indefinite integral that involves a composite function under a square root and an algebraic fraction.

The presence of $1/x^2$ inside the root and $1/x^3$ outside strongly suggests the method of substitution, as the derivative of x^{-2} yields a term proportional to x^{-3}.

Step 2: Key Formula or Approach:

Use the integration by substitution method: Let $u = g(x)$, then $du = g'(x)dx$.

Step 3: Detailed Explanation:

Let $u = 1 - \frac{1}{x^2} = 1 - x^{-2}$.

Differentiating both sides with respect to x, we get:

$$\frac{du}{dx} = 0 - (-2)x^{-3} = \frac{2}{x^3}$$

This implies that $du = \frac{2}{x^3}dx$.

We can rearrange this to match the term in our integral:

$$\frac{1}{x^3}dx = \frac{1}{2}du$$

Now, substitute u and du back into the original integral:

$$I = \int \sqrt{1 - \frac{1}{x^2}} \cdot \left(\frac{1}{x^3}dx\right)$$

$$I = \int \sqrt{u} \cdot \left(\frac{1}{2}du\right)$$

$$I = \frac{1}{2}\int u^{\frac{1}{2}}du$$

Integrate using the power rule $\int u^n du = \frac{u^{n+1}}{n+1}$:

$$I = \frac{1}{2}\left[\frac{u^{\frac{1}{2}+1}}{\frac{1}{2}+1}\right] + C$$

$$I = \frac{1}{2}\left[\frac{u^{\frac{3}{2}}}{\frac{3}{2}}\right] + C$$

$$I = \frac{1}{2} \cdot \frac{2}{3}u^{\frac{3}{2}} + C$$

$$I = \frac{1}{3}u^{\frac{3}{2}} + C$$

Finally, substitute back the original expression for u:

$$I = \frac{1}{3}\left(1 - \frac{1}{x^2}\right)^{\frac{3}{2}} + C$$

Step 4: Final Answer:

The calculated integral matches option (B).

Quick Tip: Always look for a function and its derivative when dealing with complex integrals. Factoring out terms or rewriting fractions with negative exponents (like $1/x^2$ as x^{-2}) often reveals a clear substitution path.

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11. If $-1+7i$, $-1+xi$ and $3+3i$ are the three vertices of an isosceles triangle which is right angled at $-1+xi$, then the value of x is equal to

(A) -1

(B) 3

(C) -3

(D) 7

(E) -7

Correct Answer: (B) 3

Solution:

Step 1: Understanding the Concept:

Vertices of a triangle given as complex numbers can be mapped directly to coordinates (a, b) on the Cartesian (Argand) plane.

The problem involves finding an unknown coordinate based on the properties of a right-angled isosceles triangle.

Step 2: Key Formula or Approach:

Convert the complex numbers to coordinate points: $A(-1, 7)$, $B(-1, x)$, and $C(3, 3)$.

Use geometric properties: The angle at B is $90°$, meaning line segments AB and BC are perpendicular.

Also, since it is isosceles, the lengths of the legs adjacent to the right angle must be equal (i.e., $AB = BC$).

Step 3: Detailed Explanation:

Let the vertices in the coordinate plane be:

$A = (-1, 7)$

$B = (-1, x)$

$C = (3, 3)$

The triangle is right-angled at $B(-1, x)$.

Notice that the x-coordinates of points A and B are both -1.

This implies that the line passing through A and B is a vertical line parallel to the y-axis.

For angle B to be $90°$, the line passing through B and C must be perpendicular to AB.

Since AB is a vertical line, BC must be a completely horizontal line parallel to the x-axis.

A horizontal line has a constant y-coordinate for all its points.

Therefore, the y-coordinate of B must equal the y-coordinate of C.

This gives us: $x = 3$.

Let us verify if the triangle is isosceles with $x = 3$:

The length of segment AB is the distance between $(-1, 7)$ and $(-1, 3)$:

$AB = |7 - 3| = 4$ units.

The length of segment BC is the distance between $(-1, 3)$ and $(3, 3)$:

$BC = |3 - (-1)| = 4$ units.

Since $AB = BC = 4$, the triangle is indeed an isosceles right-angled triangle.

Step 4: Final Answer:

The value of x is 3.

Quick Tip: A quick sketch of the points in the complex plane can often reveal geometric properties like vertical or horizontal lines, saving you from lengthy distance or slope formula calculations.

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12. The three vertices of a triangle are $(0, 0)$, $(3, 1)$ and $(1, 3)$. If this triangle is inscribed in a circle, then the equation of the circle is

(A) $2x^2 + 2y^2 - 2x - 6y = 0$

(B) $x^2 + y^2 - 3x - y = 0$

(C) $x^2 + y^2 - x - 3y = 0$

(D) $2x^2+2y^2-6x-2y=0$

(E) $2x^2+2y^2-5x-5y=0$

Correct Answer: (E) $2x^2+2y^2-5x-5y=0$

Solution:

Step 1: Understanding the Concept:

A circle circumscribing a triangle passes through all three of its vertices.

We need to find the general equation of a circle that satisfies the coordinates of the given three points.

Step 2: Key Formula or Approach:

The general equation of a circle is given by:

$$x^2+y^2+2gx+2fy+c=0$$

Substitute each vertex (x, y) into the equation to form a system of linear equations in terms of g, f, and c.

Step 3: Detailed Explanation:

Let the equation of the required circle be:

$$x^2+y^2+2gx+2fy+c=0 \quad \ldots\text{(Equation 1)}$$

The circle passes through the origin $(0,0)$. Substitute $x=0, y=0$ into Equation 1:

$$0^2+0^2+2g(0)+2f(0)+c=0 \implies c=0$$

Since $c=0$, the simplified general equation is:

$$x^2+y^2+2gx+2fy=0$$

The circle passes through the point $(3,1)$. Substitute $x=3, y=1$:

$$3^2+1^2+2g(3)+2f(1)=0$$

$$9+1+6g+2f=0$$

$$6g + 2f = -10$$

Dividing the entire equation by 2 gives:

$$3g + f = -5 \quad \ldots \text{(Equation 2)}$$

The circle also passes through the point $(1, 3)$. Substitute $x = 1, y = 3$:

$$1^2 + 3^2 + 2g(1) + 2f(3) = 0$$

$$1 + 9 + 2g + 6f = 0$$

$$2g + 6f = -10$$

Dividing the entire equation by 2 gives:

$$g + 3f = -5 \quad \ldots \text{(Equation 3)}$$

Now, we solve Equation 2 and Equation 3 simultaneously.

From Equation 3, isolate g:

$$g = -5 - 3f$$

Substitute this expression for g into Equation 2:

$$3(-5 - 3f) + f = -5$$

$$-15 - 9f + f = -5$$

$$-8f = 10$$

$$f = -\frac{10}{8} = -\frac{5}{4}$$

Substitute $f = -\frac{5}{4}$ back into the isolated equation for g:

$$g = -5 - 3\left(-\frac{5}{4}\right)$$

$$g = -5 + \frac{15}{4}$$

$$g = \frac{-20 + 15}{4} = -\frac{5}{4}$$

Now, substitute the values $g = -5/4$, $f = -5/4$, and $c = 0$ into the general equation:

$$x^2 + y^2 + 2\left(-\frac{5}{4}\right)x + 2\left(-\frac{5}{4}\right)y = 0$$

$$x^2 + y^2 - \frac{5}{2}x - \frac{5}{2}y = 0$$

Multiply the entire equation by 2 to clear the fractions:

$$2x^2 + 2y^2 - 5x - 5y = 0$$

Step 4: Final Answer:

The correct equation is found in option (E).

Quick Tip: For a circle passing through the origin, the constant term c in the general equation $x^2 + y^2 + 2gx + 2fy + c = 0$ is always zero. This instantly simplifies your system of equations, saving valuable time.

