AVIRAL JEE | NEET | FOUNDATIONS

# FINAL TEST SERIES JEE -2020
# TEST-05 ANSWER KEY

Test Date :28-12-2019

## [PHYSICS]

1. B
2. C
3. A
4. D
5. B
6. A

7. $$V_{eq} = \sqrt{V_0^2 + \left(\frac{V_0}{2}\right)^2} = \frac{\sqrt{5}V_0}{2}$$

$$Z = \sqrt{(\omega L)^2 + R^2}$$

Current amplitude

$$I_{max} = \frac{V_{max}}{Z} = \sqrt{\frac{5V_0^2}{4(\omega^2 L^2 + R^2)}}$$

8. positive charge flow outside so, charge decreases.

thus voltage = $\frac{Q}{C}$ also decreases and

$V = \frac{-Ldi}{dt}$ so $\frac{di}{dt}$ increases

Hence i increases

**Or**

Energy of capacitor ↓ so energy of inductor ↑. Therefore i increase.

9. at time constant voltage of capacitor

Reduces to = 0.37% of $V_0$

= 0.37 × 25 = 9.25 volt

which lies in the range from 100 and 150 sec.

10. With sinusoidal wave $P = i_{rms}^2 R$

$$= \frac{i_0^2 R}{2} = W \quad ..(1)$$

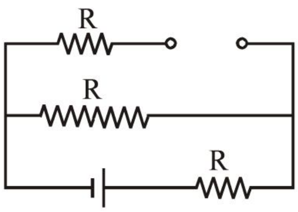
with square wave

$$P = i_{rms}^2 R = i_0^2 R = 2W$$

11. As f ↑, $X_C$ ↓ ⇒ Brightness of $B_1$ ↑

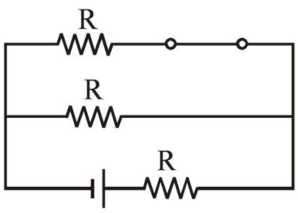
As f ↑, $X_L$ ↑ ⇒ Brightness of $B_2$ ↓

12. At t = 0




$$I_i = \frac{E}{2R}$$

at t = ∞




$$I_f = \frac{E}{3R/2} = \frac{2E}{3R}$$

$$\frac{I_i}{I_f} = \frac{3}{4}$$

Hence option (4) is correct.

**13.** For dip angle $\tan\phi = \frac{B_v}{B_H} = \frac{1}{1}$ so $\phi = 45°$ & declination = 10°W Hence option (3)

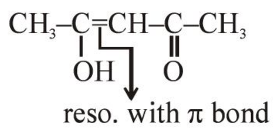
**14.** For positive charge $F_e = F_m$ & there direction are opposite therefore particle will move in straight line.
For negative charge direction of $F_e$ & $F_m$ are same.

**15.** The electron will start moving along the electric field in the plane containing the electric field and direction of propagation.

**16.** C
**17.** B
**18.** C
**19.** B
**20.** B
**21.** 1
**22.** 0
**23.** 1
**24.** 0 On equitorial position field due to magnet pair cancel each other
**25.** 3

## [CHEMISTRY]

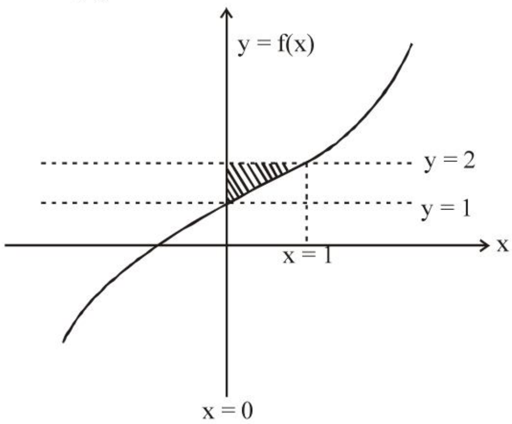
**26.** A
**27.** D
**28.** D
**29.** C
**30.** C
**31.** D
**32.** B
**33.** B
**34.** B
**35.** A
**36.** D
**37.** D
**38.** D
**39.** D
**40.** A

**41.**



**42.** C
**43.** A
**44.** C
**45.** D
**46.** 5
**47.** 4
**48.** 4
**49.** 4
**50.** 7

## [MATHEMATICS]

**51.** **Ans. (2)**




$$A = \int_0^1 2-\left(x^3-3x^2+3x+1\right)$$

$$A = \int_0^1 \left(-x^3+3x^2-3x+1\right)dx$$

$$A = -\frac{x^4}{4}+x^3-\frac{3x^2}{2}+x\Big|_0^1 = \frac{1}{4}$$

**52.** **Ans. (2)**

$0 < x < \frac{\pi}{6}$

$\cos x > x \Rightarrow \frac{\cos x}{x} > 1$

$\int_0^{\pi/6} \frac{\cos x}{x} dx > \int_0^{\pi/6} 1.dx$

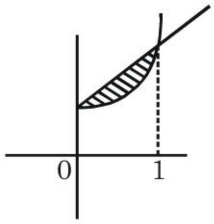
$I > \frac{\pi}{6}$ ; $\frac{\pi}{3} < x < \frac{\pi}{2}$

$\cos x < x$

$\frac{\cos x}{x} < 1 \Rightarrow \int_{\pi/3}^{\pi/2} \frac{\cos x}{x} dx < \int_{\pi/3}^{\pi/2} dx \Rightarrow J < \frac{\pi}{6}$

**53.**

**Ans. (3)**




$x = \sqrt{y-1}$

$y = x + 1$

$\int_0^1 \left(x + 1 - x^2 - 1\right) dx$

$= \frac{1}{6}$

**54.** **Ans. (2)**

$\frac{dy}{dx} + x\sin^2 y = \sin y \cos y$

$\text{cosec}^2 y \frac{dy}{dx} + x = \cot y$

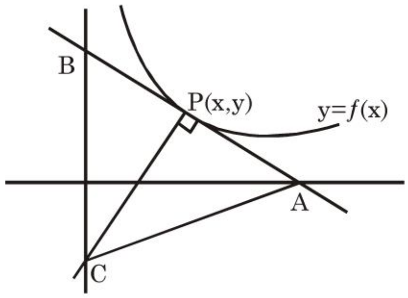
Let $-\cot y = v$

$\frac{dv}{dx} + v = x$

$\therefore \quad -\cot y . e^x = \int x e^x dx$

$\Rightarrow \quad \cot y = (x - 1) + Ce^{-x}$

**55.** **Ans. (1)**




$\because \quad AC = BC$

$\therefore \quad$ P is mid point of AB

$\Rightarrow \quad A(2x.0)$ & $B(0, 2y)$

$\Rightarrow \quad \frac{dy}{dx} = -\frac{y}{x}$

$\Rightarrow \quad xy = c \quad \Rightarrow \quad xy = 6$

**56.** **Ans. (1)**

$\int_0^2 f(x)dx = \int_0^1 \sqrt{1-x}\, dx + \int_1^2 (7x-6)^{-1/3} dx$

$= \frac{55}{42}$

**57.** **Ans. (2)**

Put $e^x = t$

$I = \int_1^e e^t \left(\frac{1 + t\ell nt}{t}\right) dt = \int_1^e e^t \left(\ell nt + \frac{1}{t}\right) dt = e^e$

**58.** **Ans. (2)**

$\int_0^1 \left(4x^6 + \left(4x^3 - f(x)\right) f(x) - 4x^6\right) dx = \frac{4}{7}$

$\int_0^1 \left(f(x) - 2x^3\right)^2 dx = 0 \Rightarrow f(x) = 2x^3$

**59.** **Ans. (2)**

$$\frac{d\left(\int_x^y dt\right)}{dy} = x \Rightarrow \frac{d(y-x)}{dy} = x$$

$$\int \frac{dx}{1-x} = \int dy \Rightarrow y = -\ell n|1-x| + C$$

**60.** **Ans. (4)**

$f(x) = x^3 + bx^2 + cx + d,\ 0 < b^2 < c$

$f'(x) = 3x^2 + 2bx + c.$

$D = 4b^2 - 12c = 4(b^2 - 3c) = 4((b^2 - c) - 3c) < 0$

$\Rightarrow f'(x) > 0\ \forall\ x \in R.$

Hence, $f(x)$ is strictly increasing.

**61.** **Ans. (4)**

$\frac{x^2}{18} - \frac{y^2}{9} = 1$ $\qquad y = -x + k$

$\therefore m = -1.$

for tangent : $k^2 = 18(-1)^2 - 9 \Rightarrow k^2 = 9$

$\Rightarrow$ sum of squares of possible values = 18.

**62.** **Ans. (1)**

$h'(x) = 2f(x).f'(x) + 2f'(x).f''(x)$

put $f''(x) = -f(x) - x.g(x).f'(x)$

$\therefore h'(x) = -2x.g(x).(f'(x))^2$

**63.** **Ans. (1)**

Given equation can be simplified as

$$\frac{ydx - xdy}{x^2} + \left(\frac{1+x^2}{x^2}\right)dx + \sin y\,dy = 0$$

$$\Rightarrow \frac{y}{x} + \frac{1}{x} - x + \cos y = c$$

$\because x = 1;\ y = 0 \Rightarrow c = 1$

$\Rightarrow y + 1 - x^2 + x\cos y = x.$

**64.** **Ans. (4)**

$$I = \int_{-\pi/2}^{\pi/2} \frac{e^x.\cos^2 x}{(1+e^x)}dx \qquad ...(i)$$

king

$$I = \int_{-\pi/2}^{\pi/2} \frac{\cos^2 x}{1+e^x}dx \qquad ...(ii)$$

(i) + (ii)

$$2I = \int_{-\pi/2}^{\pi/2} \cos^2 x\,dx \Rightarrow I = \frac{\pi}{4}$$

**65.** **Ans. (3)**

$x^4 = x^2 + 12 \Rightarrow x^2 = 4 \Rightarrow x = 2, -2$

$$A = \int_{-2}^{2} x^2 + 12 - x^4 dx = 2\int_0^2 x^2 + 12 - x^4 dx$$

$$= 2\left(\frac{x^3}{3} + 12x - \frac{x^5}{5}\right)\Bigg|_0^2 = \frac{608}{15}$$

**66.** **Ans. (1)**

$f(x) = x^a(1-x)^b$

$f'(x) = ax^{a-1}(1-x)^b + x^a(-b(1-x)^{b-1})$

$= (a(1-x) - bx)x^{a-1}(1-x)^{b-1}$

in the interval [0, 1]

$a(1-x) - bx = 0 \Rightarrow x = \frac{a}{a+b}$

$f_{max}$ at $x = \frac{a}{a+b}$ then p = 1, q = 1

Then p + q = 2

**67.** **Ans. (3)**

$$f(a) = \int_0^a \frac{du}{(1+u^2)^{3/2}}$$

Let $u = \tan\theta$

$du = \sec^2\theta d\theta$

$$f(a) = \int_0^{\tan^{-1}a} \frac{\sec^2\theta}{\sec^3\theta}d\theta$$

**68.** **Ans. (3)**

$$y'+\frac{1}{x}y=y^{\frac{1}{2}}$$

$$\Rightarrow y^{-\frac{1}{2}}y'+\frac{1}{x}y^{\frac{1}{2}}=1$$

Put $y^{\frac{1}{2}}=v\Rightarrow v'=\frac{1}{2}y^{-\frac{1}{2}}y'$

$$2v'+\frac{1}{x}v=1\Rightarrow v'+\frac{1}{2x}v=\frac{1}{2}$$

Here $P=\frac{1}{2x}, Q=\frac{1}{2}$

$$IF=e^{\int Pdx}=e^{\int\frac{1}{2x}dx}=e^{\frac{1}{2}\ln|x|}=|x|^{\frac{1}{2}}$$

So, $v\times IF=\int IF\times Q$

$$v\times|x|^{\frac{1}{2}}=\int|x|^{\frac{1}{2}}\times\frac{1}{2}\Rightarrow y^{\frac{1}{2}}|x|^{\frac{1}{2}}=\frac{2|x|^{\frac{3}{2}}}{3}\times\frac{1}{2}+c$$

$$y^{\frac{1}{2}}=\frac{1}{3}x+cx^{-\frac{1}{2}}$$

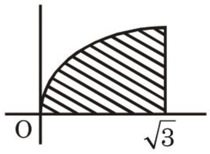
Now, $y(1)=0\Rightarrow 0=\frac{1}{3}+c\Rightarrow c=-\frac{1}{3}$

$$\therefore y=\left(\frac{1}{3}x-\frac{1}{3}x^{-\frac{1}{2}}\right)^2\Rightarrow y=\frac{x^3-2x^{\frac{3}{2}}+1}{9x}$$

$$\Rightarrow y=\frac{1}{9}\left(x^2-2x^{\frac{1}{2}}+\frac{1}{x}\right)$$

$\therefore$ [9f(9)] = 75

**69.** **Ans. (4)**




$$y=\sqrt{3}\sin\left(\frac{\pi x}{2\sqrt{3}}\right)$$

$$\Rightarrow \theta=\int_0^{\sqrt{3}}\sqrt{3}\sin\left(\frac{\pi x}{2\sqrt{3}}\right)dx$$

$$\theta=\frac{-6}{\pi}\left(\cos\left(\frac{\pi x}{2\sqrt{3}}\right)\right)_0^{\sqrt{3}}=\frac{6}{\pi}$$

$$\Rightarrow \tan\left(\frac{1}{\theta}\right)=\tan\left(\frac{\pi}{6}\right)=\frac{1}{\sqrt{3}}$$

**70.** **Ans. (3)**

$y=e^x-e^{-x}$

$$\Rightarrow \frac{dy}{dx}=e^x+e^{-x}, g'(y)=\frac{1}{dy/dx}=\frac{1}{e^x+e^{-x}}$$

when y = 2

$e^x-e^{-x}=2\Rightarrow e^x=1\pm\sqrt{2}$

$x=\ln(1+\sqrt{2})$

$$g'(2)=\frac{1}{e^{\ln(\sqrt{2}+1)}+e^{-\ln(\sqrt{2}+1)}}=\frac{1}{2\sqrt{2}}$$

**71. 1**

Put $x=y-\frac{1}{y}$

$$\Rightarrow 1\Rightarrow\int_{-\infty}^{\infty}f\left(y-\frac{1}{y}\right)\left(1+\frac{1}{y^2}\right)dy$$

$$=\int_{-\infty}^{0}f\left(y-\frac{1}{y}\right)dy+\int_{-\infty}^{0}f\left(y-\frac{1}{y}\right)\frac{dy}{y^2}$$

Putting $z=-\frac{1}{y}=\int_{-\infty}^{0}f\left(y-\frac{1}{y}\right)dy+\int_{0}^{\infty}f\left(z-\frac{1}{z}\right)dz=1$

**72** 4

$$\left|\ell nt\left(\frac{t^3}{3}-t\right)\right|_0^{|x|}-\int_0^{|x|}\frac{1}{t}\left(\frac{t^3}{3}-t\right)dt=\frac{5|x|}{6}$$

$$\ell n|x|\left(\frac{|x|^3}{3}-|x|\right)-\frac{|x|^2}{3}+|x|=\frac{5|x|}{6}$$

$$\ell n|x|\left(\frac{|x|^2}{3}-1\right)-\frac{|x|}{3}+1=\frac{5}{6}$$

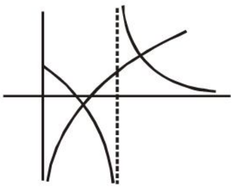
$$\ell n|x|\left(\frac{|x|^2}{3}-1\right)=\frac{|x|}{3}-\frac{1}{6}$$

$$\ell n|x|(|x|^2-3)=\frac{2|x|-1}{2}$$

$\Rightarrow \quad \ell n|x|=\dfrac{2|x|-1}{2(|x|^2-1)}$

$|x| = t = t > 0$

$\ell nt=\dfrac{2t-1}{2(t^2-1)}$



$\Rightarrow$ 2 solutions for $|x|$

$\Rightarrow$ 4 solutions.

**73. 2**

$$f\left(\frac{8}{\pi x}\right)=\frac{8}{x}\Rightarrow\left(f\left(\frac{8}{\pi x}\right)\right)''=\frac{16}{x^3}$$

**74. 9**

a = 2; b = 1; c = –5

a + 2b – c = 9

**75. 3**

$$\frac{dx}{dy}-\frac{x}{y}=-y$$

$$\frac{x}{y}=-y+c\Rightarrow x=2y-y^2$$

y = 3 when x = – 3