AVIRAL
JEE | NEET | FOUNDATIONS

FINAL TEST SERIES JEE -2020
TEST-03 ANSWER KEY

Test Date :22-12-2019

[PHYSICS]

1. $n' = \left(\dfrac{v+v_0}{v-v_s}\right)\times n$

$= \left(\dfrac{v+0.2v}{v-0}\right)\times n = \dfrac{1.2v}{v}\times n$

$= 1.2n = 1.2f$

since, the source is stationary, therefore apparent wavelength remains unchagned, i.e., λ.

2. 255 : 425 : 595

51 : 85 : 117

3 : 5 : 7 $\quad\therefore$ COP

where $3n_c = 255$ Hz

3. $\dfrac{\Delta n}{n} = \dfrac{1}{2}\dfrac{\Delta T}{T}$

$\dfrac{5}{n}\times 100 = \dfrac{1}{2}\times 2\%$

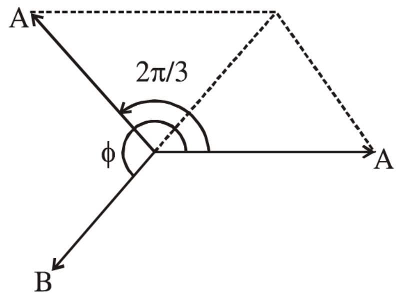
$n = 500$ Hz

4. $\dfrac{n_1}{n_2} = \dfrac{\ell_2}{\ell_1} \Rightarrow \dfrac{800}{1000} = \dfrac{\ell_2}{50} \Rightarrow \ell_2 = 40\text{cm}$

5. $\dfrac{T}{2} = 0.5 \quad \Rightarrow T = 1s \Rightarrow n = 1$

Wavelength $\lambda = \dfrac{v}{n} = 10$ m

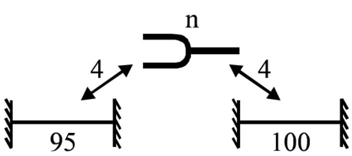
6.



$B = A$ and $\phi = 4\pi/3$

7. **B**

8.



$\dfrac{n+4}{n-4} = \dfrac{\ell_2}{\ell_1} = \dfrac{100}{95} \Rightarrow n = 156$ Hz

9. Frequency $= \dfrac{1}{\text{time}}$ [Velocity $= \dfrac{\text{mean free path}}{\text{time}}$]

$f = \dfrac{v_{rms}}{\lambda_m} = \dfrac{v_{\text{चाल}}}{2\ell} = \dfrac{200}{2+5} = 20s^{-1}$

10. **D**

11. KE of 1 g gas $= \dfrac{f}{2}\dfrac{RT}{M_w}$

For diatomic gas $f = 5$, and for O_2 $M_w = 32$g.

So KE of 8 g gas $= 8 \times \dfrac{5}{2}\times\dfrac{RT}{32} = \dfrac{5}{8}RT$

12. $\dfrac{\Delta\phi}{360^\circ} = \dfrac{\Delta\lambda}{\lambda}$

here $\Delta\lambda = 2\text{cm}$

$K = \dfrac{2\pi}{10}\text{cm} = \dfrac{2\pi}{\lambda} \Rightarrow \lambda = 10\text{cm}$

So $\dfrac{\Delta\phi}{360^\circ} = \dfrac{2}{10} \Rightarrow \Delta\phi = 72^\circ$

13. Wave speed does not depends on "freq."

14. **C**

15. ℓ effectively increases. Due to shifting of centre of mass.

$\therefore T \propto \sqrt{\ell}$

16. **A**

17. $K = \omega^2 M = \left(\dfrac{2\pi}{\pi/5}\right)^2 \times 10 \times 10^{-3} = 1 \text{ N/m}$

$F_{max} = -KA = -1 \times 0.5 = 0.5\text{N}$

18. **D**

19. **B**

20. **A**

[CHEMISTRY]

26. **B**

27. **A**

28. **C**

29. Metal Nitrate $\xrightarrow{\Delta}$ Metal Oxide + $\underbrace{NO_2 + O_2}_{\text{(Paramagnetic gas)}}$

(Except Na, K, Rb, S)

30. **C**

31. $\left[\text{Ionic mobility} \propto \dfrac{1}{\text{Hydration effect}}\right]$

32. d-block element in higher oxidation state shows acidic nature.

33. **D**

34. **D**

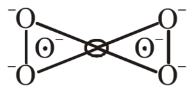
35. B

36. D

37. **B**

38. **B**

39.



O $\rightarrow$ Oxygen $(Si_2O_7)^{-6}$

. $\rightarrow$ Silicon

(Pyrosilicates)

40. **A**

41. **B**

42. $XeF_4 \xrightarrow{H_2O} XeO_3$

on complete hydrolysis

43. **C**

44. **A**

45. **A**

46. **1**

47. **5**

48. **1**

49. **4**

50. **1**

[MATHEMATICS]

51. **Ans. (3)**

We have, z = 0 for the point where the line intersects the curve

$\therefore \dfrac{x-2}{3} = \dfrac{y+1}{2} = \dfrac{0-1}{-1}$

$\Rightarrow x = 5$ and $y = 1$

Putting these values in $xy = c^2$

$\Rightarrow 5 = c^2 \Rightarrow c = \pm\sqrt{5}$

52. **Ans. (3)**

D.R's of normal to plane $x + y + z - 1 = 0$ and $x + ky + 3z - 1 = 0$ is (1, 1, 1) and (1, k, 3) respectively

$\Rightarrow$ D.R. of normal to a plane perpendicular to given planes

$$= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 1 & 1 \\ 1 & k & 3 \end{vmatrix} = \hat{i}(3-k) - \hat{j}(2) + \hat{k}(k-1)$$

$$\Rightarrow \frac{1+2\lambda}{3-k}=\frac{2+\lambda}{-2}=\frac{1+3\lambda}{k-1}$$
$$\Rightarrow -2-4\lambda=6+3\lambda-2k-\lambda k$$
$$-4-10\lambda=4+2\lambda \Rightarrow 12\lambda=-8 \Rightarrow \lambda=-\frac{2}{3}$$
$$\Rightarrow -2+\frac{8}{3}=6-2-2k+2-k=3$$
$$\Rightarrow \frac{2}{3}-4=-\frac{4}{3}k \Rightarrow -\frac{10}{3}=-\frac{4}{3}k \Rightarrow k=\frac{5}{2}$$

53. Ans. (3)

g(x) = x |x|^3 has 4 repeated roots

$\therefore$ g''(x) is cont. and diff. at x = 0

$\therefore$ consider $f(x)=\begin{cases} x^p \sin\frac{1}{x} & x\neq 0 \\ 0 & x=0 \end{cases}$

$$f'\left(0^+\right)=\lim_{h\to 0}\frac{h^p \sin\frac{1}{h}}{h}=0 \quad \text{if } p>1$$

$\therefore f'(0)=0$ for p > 1

$$\therefore f'(x)=\begin{cases} p\,x^{p-1}\sin\frac{1}{x}-x^{p-2}\cos\frac{1}{x} & x\neq 0 \\ 0 & x=0 \end{cases}$$

$$f''\left(0^+\right)=\lim_{h\to 0}\frac{p\,h^{p-1}\sin\frac{1}{h}-h^{p-2}\cos\frac{1}{h}}{h}=0$$

if p > 3

$$\therefore f''(x)=\left(p(p-1)x^{p-2}-x^{p-4}\right)\sin\frac{1}{x}+\left(2x^{p-3}\right)\cos\frac{1}{x} \quad \text{for } x\neq 0$$
$$=0 \quad \text{for } x=0$$

$\therefore$ f''(x) to be continuous $p\in(4,\infty)$

54. Ans. (4)

$$\frac{2x^3+3x^2+x-3}{x^2+x-2}=(2x+1)+\frac{1}{x-1}+\frac{3}{x+2}$$

$$\frac{d}{dx}\left[\frac{2x^3+3x^2+x-3}{x^2-x-2}\right]=2-\frac{1}{(x-1)^2}-\frac{3}{(x+2)^2}$$

$\therefore$ A = 2, B = –1, C = –3

$\therefore$ A + B + C = 0

55. Ans. (2)

PA × PB = (PT)^2

where PT = length of tangent

(PT)^2 = (–1)^2 + 3^2 – 2(–1) + 4(3) – 8 = 16

P(A) P(B) = 16

$\therefore$ AM $\geq GM$

$PA+PB\geq 8$

56. Ans. (1)

The normal at the extremities of focal chord meet at right angle. So orthocentre is the point of intersection of normals.

If $P\left(at_1^2,2at_1\right),Q\left(at_2^2,2at_2\right)$ then $t_1t_2=-1$,.

Point of intersection of normals

$$h=a\left(t_1^2+t_2^2+t_1t_2+2\right)$$
$$k=-at_1t_2\left(t_1+t_2\right)$$

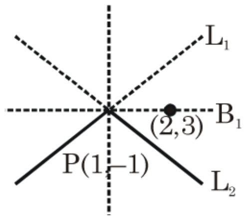
57. Ans. (1)

Fixed point of family is (1,–1)

$\Rightarrow$ other bisector is

$$y+1=-\frac{1}{4}(x-1)$$

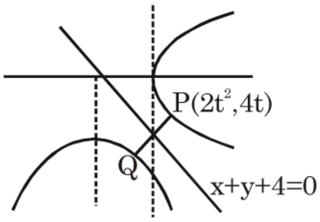
x + 4y + 3 = 0



58. **Ans. (4)**

Let point be $\left(8\lambda+\frac{1}{3}, 3\lambda, -6\lambda\right)$ which also satisfies both the plane $P_1 = 0 = P_2$

59. **Ans. (1)**



for minimum distance $\left.\frac{dy}{dx}\right|_P = -1$

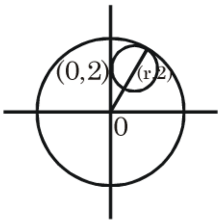
$\Rightarrow t = -1$

$\Rightarrow$ min distance = PQ = $2\sqrt{2}$

60. **Ans. (2)**

$4 = \sqrt{r^2+4} + r$

$\Rightarrow r = \frac{3}{2}$



61. **Ans. (1)**

P_1 and P_2 are $x + 2y - 2z = 0$

and $2x - 3y + 6z = 0$

$$\cos\alpha = \left|\frac{2-6-12}{3.7}\right| = \frac{16}{21}$$

62. **Ans. (3)**

Differentiate both sides wrt 'x',

$$(e-1)e^{xy}\left(\frac{xdy}{dx}+y\right)+2x = e^{x^2+y^2}\left(2x+2y\frac{dy}{dx}\right)$$

$$(e-1)\left.\left(\frac{dy}{dx}\right)\right|_{(1,0)} + 2 = e(2)$$

$$\left.\frac{dy}{dx}\right|_{(1,0)} = 2$$

63. **Ans. (3)**

$h(x) = f(g(f(x))$

$h'(x) = f'(g(f(x)).g'(f(x)).f'(x)$

$h'(2) = 64.$

64. **B**

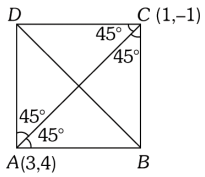
65. **D** Point lies on director circle of ellipse $\frac{\pi}{2}$

66. (b) Let $y = x^x \Rightarrow \log y = x\log x$

$\therefore \lim_{y\to 0}\log y = \lim_{x\to 0} x\log x = 0 = \log 1 \Rightarrow \lim_{x\to 0} x^x = 1$

67. (c) Obviously, slope of $AC = 5/2$.

Let m be the slope of a line inclined at an angle of 45^o to AC, then $\tan 45^o = \pm\frac{m-\frac{5}{2}}{1+m.\frac{5}{2}} \Rightarrow m = -\frac{7}{3}, \frac{3}{7}$.



Thus, let the slope of AB or DC be 3/7and that of AD or BC be $-\frac{7}{3}$. Then equation of AB is $3x-7y+19=0$.

Also the equation of BC is $7x+3y-4=0$.

On solving these equations, we get, $B\left(-\frac{1}{2},\frac{5}{2}\right)$.

Now let the coordinates of the vertex D be (h, k). Since the middle points of AC and BD are same, therefore $\frac{1}{2}\left(h-\frac{1}{2}\right)=\frac{1}{2}(3+1)\Rightarrow h=\frac{9}{2}$, $\frac{1}{2}\left(k+\frac{5}{2}\right)=\frac{1}{2}(4-1)$

$\Rightarrow k=\frac{1}{2}$. Hence, $D=\left(\frac{9}{2},\frac{1}{2}\right)$.

68. (d) Let the centre be (h, k), then radius $= h$

Also $CC_1 = R_1 + R_2$

or $\sqrt{(h-3)^2+(k-3)^2}=h+\sqrt{9+9-14}$

$\Rightarrow (h-3)^2+(k-3)^2=h^2+4+4h$

$\Rightarrow k^2-10h-6k+14=0$ or $y^2-10x-6y+14=0$.

69. (d) Equation of line PQ (*i.e.*, common chord) is $5ax+(c-d)y+a+1=0$ .....(i)

Also given equation of line PQ is

$5x+by-a=0$ .....(ii)

Therefore $\frac{5a}{5}=\frac{c-d}{b}=\frac{a+1}{-a}$; As $\frac{a+1}{-a}=a$

$\Rightarrow a^2+a+1=0$

Therefore no real value of a exists, (as $D<0$).

70. (c Suppose the axes are rotated in the anticlockwise direction through an angle 45^o. To find the equation of L $w.r.t$ the new axis, we replace x by $x\cos\alpha - y\sin\alpha$ and by $x\sin\alpha+y\cos\alpha$, so that equation of line $w.r.t.$ new axes is

$\Rightarrow 1/1(x\cos 45^o - y\sin 45^o)+\frac{1}{2}(x\sin 45^o+y\cos 45^o)=1$

Since, p, q are the intercept made by the line on the coordinate axes. we have on putting $(p, 0)$ and then $(0, q)$

$\Rightarrow \frac{1}{p}=\frac{1}{a}\cos\alpha+\frac{1}{b}\sin\alpha \Rightarrow \frac{1}{q}=-\frac{1}{a}\sin\alpha+\frac{1}{b}\cos\alpha$

$\Rightarrow \frac{1}{p}=\frac{1}{1}\cos 45^o+\frac{1}{2}\sin 45^o$

$\Rightarrow \frac{1}{p}=\frac{1}{\sqrt{2}}+\frac{1}{2}.\frac{1}{\sqrt{2}}=\frac{3}{2\sqrt{2}}$

$\therefore\ p=\frac{2\sqrt{2}}{3}$; $\therefore \frac{1}{q}=-\frac{1}{1}\sin 45^o+\frac{1}{2}\cos 45^o$

$\frac{1}{q}=\frac{-1}{\sqrt{2}}+\frac{1}{2\sqrt{2}}=-\frac{1}{2\sqrt{2}}$, $\therefore q=2\sqrt{2}$

So intercept made by is assume on the new axis $\left(2\sqrt{2}/3,\ 2\sqrt{2}\right)$. If the rotation is assume in clockwise direction, so intercept made by the line on the new axes would be $\left(2\sqrt{2},2\sqrt{2}/3\right)$.

71. **Ans. (4)**

$$\lim_{x\to\frac{1}{2}}\frac{ax^2+bx+c}{(2x-1)^2}=\frac{1}{2}$$

$$\Rightarrow ax^2+bx+c=\frac{1}{2}(2x-1)^2$$

$$\Rightarrow ax^2+bx+c=2x^2-2x+\frac{1}{2}$$

$$\therefore a=2, b=-2, c=\frac{1}{2}$$

$$\therefore \lim_{x\to 2}\frac{(x-2)(x+2)\left(x-\frac{1}{2}\right)}{x-2}=4\times\frac{3}{2}=6$$

72. Its centre is of type (c, c) and radius is

$\left|\frac{4c+3c-12}{5}\right|=\sqrt{c^2}\Rightarrow c=6$.

73. Hyperbola is $\frac{x^2}{144}-\frac{y^2}{81}=\frac{1}{25}$

$a=\sqrt{\frac{144}{25}},\ b=\sqrt{\frac{81}{25}},\ e_1=\sqrt{1+\frac{81}{144}}=\sqrt{\frac{225}{144}}=\frac{15}{12}=\frac{5}{4}$

Therefore, foci $=(ae_1,0)=\left(\frac{12}{5}.\frac{5}{4},0\right)=(3,0)$

Therefore, focus of ellipse $=(4e,0)$ *i.e.* $(3,0)$

$\Rightarrow e=\frac{3}{4}$. Hence $b^2=16\left(1-\frac{9}{16}\right)=7$.

74. The hyperbola is $\frac{x^2}{16}-\frac{y^2}{9}=1$. We have difference of focal distance $=2a=8$.

75. Any normal is $y+tx=6t+3t^3$. It is identical with $x+y=k$ if $\frac{t}{1}=\frac{1}{1}=\frac{6t+3t^3}{k}$

$\therefore t=1$ and $1=\frac{6+3}{k} \Rightarrow k=9$.