Resonance®
Educating for better tomorrow

# JEE (Main)

PAPER-1 (B.E./B. TECH.)

# 2023

## COMPUTER BASED TEST (CBT)

## Memory Based Questions & Solutions

**Date: 30 January, 2023 (SHIFT-2) | TIME : (3.00 p.m. to 6.00 p.m)**

**Duration: 3 Hours | Max. Marks: 300**

**SUBJECT: PHYSICS**

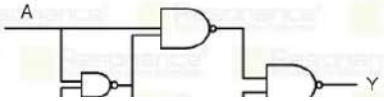
**Resonance Eduventures Ltd.**
Reg. Office & Corp. Office : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005
Ph. No.: +91-744-2777777, 2777700 | FAX No. : +91-022-39167222
To Know more : sms RESO at 56677 | Website : www.resonance.ac.in | E-mail : contact@resonance.ac.in | CIN : U80302RJ2007PLC024029
Toll Free : 1800 258 5555 7340010333 facebook.com/ResonanceEdu twitter.com/ResonanceEdu www.youtube.com/resowatch blog.resonance.ac.in

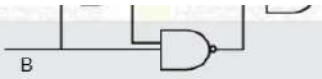




## PART : PHYSICS

**1.** Find output y.






(1)

| A | B | Y |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

(2)

| A | B | Y |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

(3)

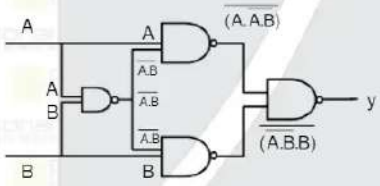
| A | B | Y |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

(4)

| A | B | Y |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

**Ans.** (1)

**Sol.** We can write this by using demorgn theorm




$y = \left(\overline{A.\overline{A.B}}\right) + \left(\overline{\overline{A.B}.B}\right)$ as $\bar{\bar{x}} = x$

$y = \left(A.\overline{A.B}\right) + \left(\overline{A.B}.B\right)$

$= A.\left(\bar{A}+\bar{B}\right) + \left(\bar{A}+\bar{B}\right).B$

$= A.\bar{A} + A.\bar{B} + \bar{A}.B + \bar{B}.B$

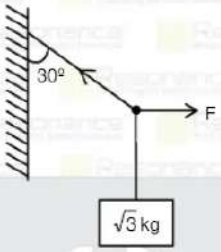
=

| A | B | $\bar{A}.B$ | $A.\bar{A}.B$ | $\bar{A}.B.B$ | y |
|---|---|---|---|---|---|
| 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 1 | 1 |
| 1 | 0 | 1 | 1 | 0 | 1 |
| 1 | 1 | 0 | 0 | 0 | 0 |





**2.** Find the tension in string




(1) 10 N (2) 20 N (3) 30 N (4) 40 N

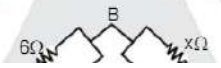
**Ans.** (2)

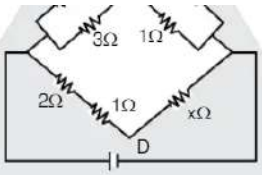
**Sol.** $T\cos 30^\circ = \sqrt{3}\,g$

$T \times \frac{\sqrt{3}}{2} = \sqrt{3}g$

$T = 20$ N

**3.** In given circuit potential of B & D is same and $x = \frac{1}{n}$ then find the value of n.






(1) 6 (2) 2 (3) 8 (4) 12

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

**Sol.** If $V_B = V_D$ then using wheat stone bridge

$$\frac{2}{3} = \frac{\frac{x}{x+1}}{x}$$

$2x^2 + 2x = 3x$

$2x^2 + 2x - 3x = 0$

$2x^2 - x = 0$

$x(2x - 1) = 0$

$x = \frac{1}{2}$

$x = \frac{1}{n} = \frac{1}{2}$

$n = 2$





**4.** A car is moving with velocity with 3 km/hr for 4 km and next 4 km is moving with 5 km/hr. then find average speed.

(1) $\frac{10}{2}$ (2) $\frac{15}{3}$ (3) $\frac{15}{4}$ (4) $\frac{20}{4}$

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

**Sol.** Average speed $= \frac{2V_1V_2}{V_1+V_2} = \frac{2\times3\times5}{3+5} = \frac{15}{4}$ km/hr

**5.** **Statement-1** : Efficiency of carnot cycle is maximum at –273°C

**Statement-2** : $\eta = 1 - \frac{T_2}{T_1}$

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True

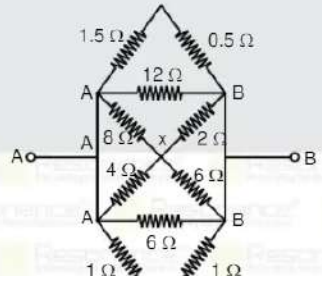
**Ans.** **(1)**

**Sol.** At $\Delta K$, $\eta = 1 - \frac{T_{sink}}{T_{source}}$

$\eta = 1 - \frac{0}{T}$ when $T_{sink} = 0$

$\eta = 1$

**6.** Find equivalent, resistance across A & B.



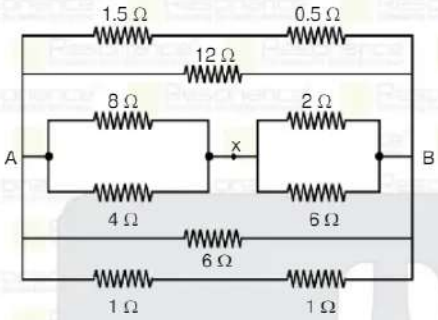
(1) $\frac{50}{149}\ \Omega$ (2) $\frac{200}{149}\ \Omega$ (3) $\frac{100}{149}\ \Omega$ (4) $\frac{300}{149}\ \Omega$

**Ans.** (3)





**Sol.**




$$\frac{1}{R_{eq}} = \frac{1}{2} + \frac{1}{12} + \frac{6}{25} + \frac{1}{6} + \frac{1}{2}$$

$$\frac{1}{R_{eq}} = \frac{150 + 25 + 72 + 50 + 150}{300}$$

$$R_{eq} = \frac{300}{447} = \Omega$$

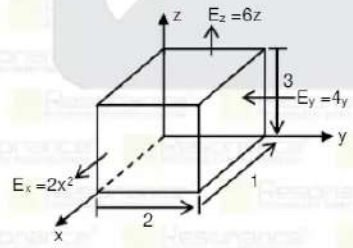
$$R_{eq} = \frac{100}{149}$$

**7.** If $\vec{E} = 2x^2\hat{i} - 4y\hat{j} + 6z\hat{k}$ find the charge in cuboid of side (1,2,3) with one vertex at origin.

(1) $14\varepsilon_0$ (2) $18\varepsilon_0$ (3) $24\varepsilon_0$ (4) $5\varepsilon_0$

**Ans.** (3)

**Sol.**




As $\phi = \vec{E}.\vec{A}$

then are 6 surface so will find it for every surface.

(i) face at x =0

$\phi_{ox} = E_{x=0}.A = 0$

(ii) face at x = 1

$\phi_{2x} = 2(1)^2 \times (3 \times 2) = 2 \times 6 = 12$

(iii) face at y = 0

$\phi_{0y} = 0$ [$\because E_{y=0} = 4 \times 0 = 0$]

(iv) face at y = 2

$\phi_{2y} = -4 \times 2 \times 3 \times 1 = -24$

(negative sign: area vector & $\vec{E}$ are opposite)

(v) face at z = 0, $\phi_{0z} = 0$

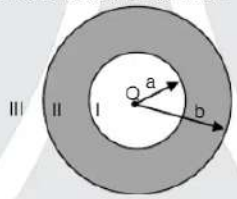
(vi) face at z = 3, $\phi_{3z} = (6 \times 3) \times 1 \times 2 = 36$

$\phi_{net} = \phi_{0x} + \phi_{1x} + \phi_{0y} + \phi_{2y} + \phi_{0z} + \phi_{3z} = 0 + 12 - 24 + 0 + 0 + 36$

$\phi_{net} = 24$

as $\phi_{net} = q/\varepsilon_0 \Rightarrow q = 24\varepsilon_0$

**8.** A Solid conducting sphere has a cavity there is a charge inside the cavity. Radius of inner surface & outer surface are 'a' & b respectively electric field at I, II & III are.




(1) $E_I \neq 0$, $E_{II} = 0$, $E_{III} \neq 0$ (2) $E_I = 0$, $E_{II} \neq 0$, $E_{III} = 0$

(3) $E_I = 0$, $E_{II} = 0$, $E_{III} = 0$ (4) $E_I \neq 0$, $E_{II} \neq 0$, $E_{III} = 0$

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

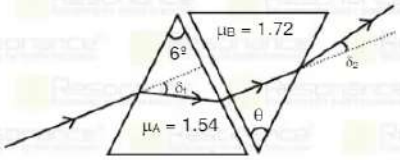
**9.** Two prism A & B are placed such a way that the mean deviation through prism is zero. The angle of prism A & B are 6° & θ°. Then find θ. ($\mu_A = 1.54$, $\mu_B = 1.72$)

(1) 2.5 (2) 1.5 (3) 4.5 (4) 9

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

**Sol.** As we know

$S_1 + S_2 = 0$




$A(\mu_A - 1) - B(\mu_B - 1) = 0$

$6(1.54 - 1) - \theta(1.72 - 1) = 0$

$6 \times 0.54 - \theta \times 0.72 = 0$

$\Rightarrow = \frac{6 \times 3}{4} = 4.5°$





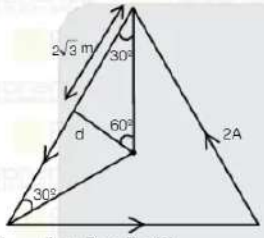
**10.** Current flowing through sides of equilateral triangular loop having side $4\sqrt{3}$ m is 2A. Find the magnetic field at centroid.

(1) $\sqrt{3} \times 10^{-7}$ T (2) $3\sqrt{5} \times 10^{-7}$ T (3) $3\sqrt{3} \times 10^{-7}$ T (4) $3\sqrt{2} \times 10^{-7}$ T

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

**Sol.** $\tan 30° = \frac{d}{2\sqrt{3}}$

$\frac{1}{\sqrt{3}} = \frac{d}{2\sqrt{3}}$ d = 2m




$B_{net} = B_1 + B_2 + B_2$ (•)

But $B_1 = B_2 = B_2 = B$

Between : $B = \frac{3 \times \mu_0 i}{4\pi d}$ [sin60° + sin60°]

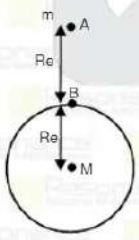
$3 \times 2 \times 10^{-7} \times \frac{2}{2} \times 2 \times \frac{\sqrt{3}}{2} = 3\sqrt{3} \times 10^{-7}$ T

**11.** A particle is released from a height equal to radius of earth, above the surface of earth. Its velocity when it hits the surface of earth is equal to

(1) $V = \sqrt{\frac{2GM}{Re}}$ (2) $V = \sqrt{\frac{GM}{2Re}}$ (3) $V = \sqrt{\frac{3GM}{Re}}$ (4) $V = \sqrt{\frac{GM}{Re}}$

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

**Sol.**




By energy conservation, $PE_A + KE_A = PE_B + KE_B$

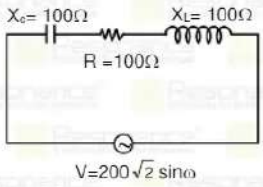
$\frac{-GMm}{2Re} + 0 = \frac{-GMm}{Re} + \frac{1}{2}mV^2 \Rightarrow \frac{GMm}{2Re} = \frac{1}{2}mV^2$

$V = \sqrt{\frac{GM}{Re}}$





**12.** In the AC circuit shown in the figure the Value of $I_{rms}$ is equal to




(1) 2 A (2) $2\sqrt{2}$ A (3) 4 A (4) $\sqrt{2}$ A

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

**Sol.** $I_{RMS} = \frac{V_{RMS}}{Z}$

$Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{100^2 + (100 - 100)^2} = 100$

$V_{RMS} = \frac{200\sqrt{2}}{\sqrt{2}} = 200$ ; $I_{RMS} = \frac{200}{100} = 2A$

**13.** A faulty scale reads 5°C at melting point and 95°C at steam point. Find original temperature if this faulty scale reads 41°C

(1) 213.15K (2) 375.15K (3) 113.15K (4) 313.15K

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

**Sol.** $\frac{X-LFP}{UFP-LFP} = \text{constant}$

$\frac{41-5}{95-5} = \frac{C-0}{100-0}$

$\frac{36}{90} = \frac{C}{100}$

$C = 40°C$

in k $C \rightarrow 40+273.15$

$C = 313.15\ K$

**14.** Ratio of De-Broglie wavelength when electron is accelerated by V & 2V

(1) $\frac{1}{\sqrt{2}}$ (2) $\sqrt{2}$ (3) 1 (4) $\frac{1}{2}$

**Ans.** (2)

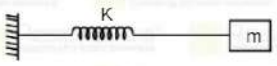
**Sol.** $\lambda = \frac{h}{mv} = \frac{h}{\sqrt{2meV}}$ .....(1)

$\lambda' = \frac{h}{\sqrt{2m(e2V)}} \Rightarrow \frac{\lambda}{\lambda'} = \frac{\sqrt{2}}{1}$





**15.** Ratio of angular frequency where $m_1 = 1$ & $m_2 = 2$.




(1) $\frac{1}{\sqrt{2}}$ (2) 2 (3) 1 (4) $\sqrt{2}$

**Ans.** (1)

**Sol.** $F = kx$

$ma = Kx$ $\omega^2 = K/m$

$a = \frac{K}{m}x$ $\omega = \sqrt{\frac{K}{m}}$

$\frac{\omega_2}{\omega_1} = \sqrt{\frac{1}{2}} = \frac{1}{\sqrt{2}}$

**16.** Two wave of same intensity from source in phase are made to superimpose at a point. If path difference between these two coherent wave is zero then resultant intensity is $I_0$. If the path difference is $\lambda/2$. Where $\lambda$ is wavelength of these waves then resultant intensity is $I_1$ & if the path difference is $\lambda/4$ then resultant intensity is $I_2$. Value of $\frac{I_0}{I_1+I_2}$ is equal to :

(1) 2 (2) 4 (3) 6 (4) 8

**Ans.** (1)

**Sol.** As, resultant intensity $I_{net} = 4I\cos^2(\phi/2)$
where I is the intensity of both source & $\phi$ is phase difference.

For $I_0$

$I_0 = 4I\cos^2(0°) = 4I$ .....(1)

For $I_1$

Phase difference = $\frac{2\pi}{\lambda}$ (Path difference)

$I_1 = 4I\cos^2(\pi/2) = 0$

So, $I_2 = 4I\cos^2\left(\frac{\pi}{4}\right) = 2I$

So, $\frac{I_0}{I_1+I_2} = \frac{4I}{0+2I} = 2$

**17.** Match the column

(A) Impulse (p) $ML^2T^{-2}$

(B) Energy density (q) $ML^{-1}T^{-2}$

(B) Energy density (q) $ML^{-1}T^{-}$
(C) Pressure Gradient (r) $MLT^{-1}$
(D) Torque (s) $ML^{-2}T^{-2}$

(1) A – p ; B – s ; C - q; D – r (2) A – r ; B – q ; C - s; D - p

(3) A – s ; B – p ; C - q; D – r (4) A – p ; B – r ; C - s; D - q

**Ans.** (2)





**18.** Match the columns & choose the correct option

| | | |
|---|---|---|
| (A) Attenuation | : | (i) Reverse process of modulation |
| (B) Repeater | : | (ii) a device/arrangement which converts one form of energy into another |
| (C) Demodulator | : | (iii) loss of signal strength during its propagation. |
| (D) Transducer | : | (iv) converts the message signal into a form suitable for transmission |
| (E) Transmitter | : | (v) An arrangement which help us to improve the range of signal |

(1) A-(ii), B-(iii), C-(i), D-(iv), E-(v) (2) A-(iii), B-(v), C-(i), D-(ii), E-(iv)

(3) A-(iii), B-(v), C-(ii), D-(i), E-(iv) (4) A-(ii), B-(iii), C-(iv), D-(v), E-(i)

**Ans.** (2)

**19.** A gun of mass 10 kg & bullet of 20 g & 180 bullets fired/min with velocity 100 m/s. What is recoil velocity after 1 sec.

(1) 0.4 m/s (2) 0.6 m/s (3) 0.8 m/s (4) 1.0 m/s

**Ans.** (2)

**Sol.** Momentum conservation


$n_0M_BV_B = M_GV_G$

$M_GV_G = -nM_BV_B$

$$V_G = \frac{-nM_BV_B}{M_G}$$

$V_G = 0.6$ m/s


Resonance®
Educating for better tomorrow
TO KNOW MORE
Call: 0744-2777777,
8441024095
TARGET: JEE (ADV.) 2023
Polish your subject knowledge with the guidance of
Top Notch Sr. Faculty of Resonance
SPARK
15 WEEKS COMPAC COURSE
OFFLINE / ONLINE
CLASS STARTS
6th FEBRUARY 2023
ACADEMIC FEATURES
Course Duration: 15 Weeks
Total No. of Lectures: 234 (P: 78 | C: 78 | M: 78)
Duration of One Lecture: 1.5 hrs. (90 Minutes)
Classroom Teaching Hours.: 351 Hrs.
Testing Duration: 60 Hrs.
Total Academic Hours.: 411 Hrs.
Course Features
Study Material
Doubt Classes
Back up support of recorded lectures
Part/ Full Syllabus Test Series
Facilities for Offline Students
In-house Computer Lab
Self Study Rooms for Boys & Girls
AIR 6
JEE (Adv.) 2022
TARGET: JEE (Main) 2023
Boost your Percentile with
PERCENTILE BOOSTER COURSE
8 WEEKS COMPAC COURSE
OFFLINE / ONLINE
CLASS STARTS
6th FEBRUARY 2023
COURSE FEATURES
Complete Course Coverage
25 Chapter wise Test
Regular Practice through 33 Daily Online Practice Test
5 Full Syllabus Test
3 Joint Preparatory Test
Approx 2500 practice Que.
113 Teaching hours
99 Testing Hours
Regular Test discussion classes for concept clearance
Back up support of recorded lectures
AIR 37
JEE (Main) 2022


Resonance®
Educating for better tomorrow
JEE (ADVANCED) 2022
RESULT
RESONites ने फिर लहराया सफलता का परचम