TEST SERIES CSIR-NET/JRF JUNE 2019

BOOKLET SERIES A

Paper Code 05 **Test Type: TEST SERIES**

[QUANTUM MECHANICS + EMT + ELECTRONICS]

PHYSICAL SCIENCES

Duration: 02:30 Hours **Date: 22-05-2019**

Maximum Marks: 160

Read the following instructions carefully:

* Single Paper Test is divided into **THREE** Parts.

Part - A: This part shall carry **10** questions. Each question shall be of **2 marks.**

Part - B: This part shall contain **20** questions. Each question shall be of **2 marks**.

Part - C: This part shall contain **25** questions. Each question shall be of **4 marks**.

* Darken the appropriate bubbles with HB pencil/Ball Pen to write your answer.

* There will be negative marking @25% for each wrong answer.

* The candidates shall be allowed to carry the Question Paper Booklet after completion of the exam.

* For rough work, blank sheet is attached at the end of test booklet.

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PART – A

1. A can do a piece of work in 10 days; B in 15 days. They work for 5 days. The rest of the work was finished by C in 2 days. If they get Rs. 1500 for whole work, then the daily wages of B and C together is :
(a) Rs. 150 (b) Rs. 225 (c) Rs. 250 (d) Rs. 300

2. It takes eight hours for a 600 km journey, if 120 km is done by train and the rest by car. It takes 20 minutes more, if 200 km is done by train and the rest by car. The ratio of the speed of the train to that of the car is
(a) 2 : 3 (b) 3 : 2 (c) 3 : 4 (d) 4 : 3

3. In a certain code language, if 'COW' is coded as '365' and 'GIVE' is coded as 7945, then what will be the code of 'EMPTY' in the same language?
(a) 513727 (b) 54727 (c) 541627 (d) 540772

4. Seven people A, B, C, D, E, F, G is sitting in a line facing the north.
D is second to the left of F.
A is third to the left of D, and G is third to the right of D.
B sits between A and C.
Who is second to the right of C ?
(a) E (b) A (c) F (d) B

5. A conical vessel, whose internal diameter is 24 cm and height 50 cm, is full of liquid.The contents are emptied into a cylindrical vessel with internal diameter 20 cm. Find the height in cm to which the liquid rises, in the cylindrical vessel ?
(a) 20 (b) 18 (c) 30 (d) 24

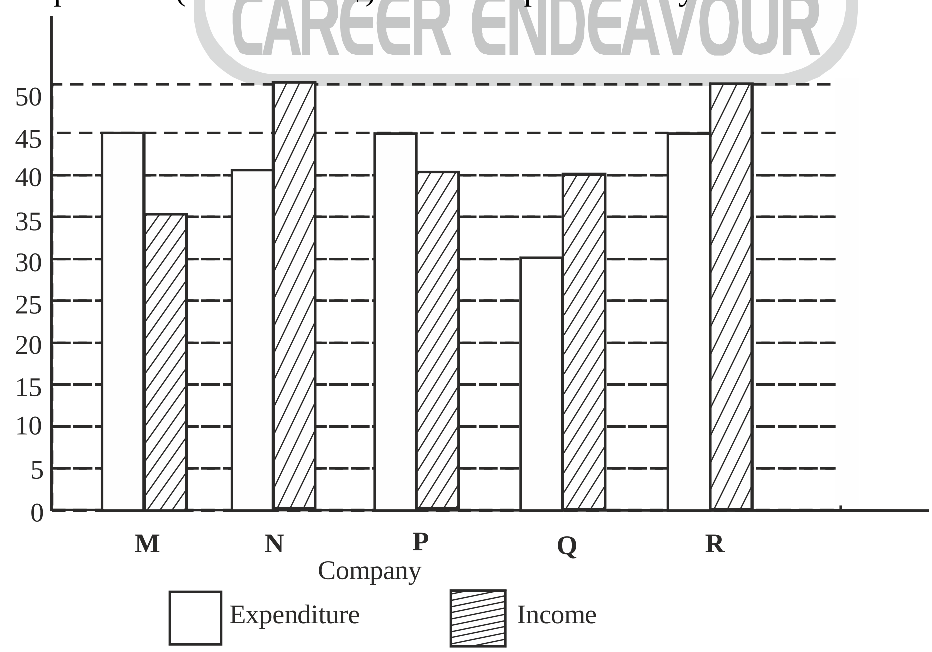
6. Pointing towards a photograph of a man, Hari says, "He is the father of my wife's only daughter's son". How is Hari related to the man's son ?
(a) Maternal uncle (b) Brother (c) Grandfather (d) Cousin

7. How many digits are there in 4^{32} ? [Provided, log 2 = 0.30103, and log 3 = 0.477]
(a) 20 (b) 22 (c) 19 (d) 16

8. The following bar-graph shows the Income and Expenditures (in million US $) of five Companies in the year 2011. The percent profit or loss of a Company is given by

$$(\text{Profit/Loss})\% = \frac{\text{Income} - \text{Expenditure}}{\text{Expenditure}} \times 100$$

Study the graph and answer the question that is based on it.
Income and Expenditure (in million US $) of five Companies in the year 2011



Which Company earned the maximum percentage profit in the year 20011?

(a) M (b) N (c) P (d) Q

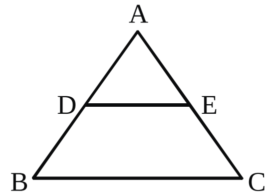
9. **Direction:** In the question below are few statements followed by the conclusions numbered accordingly. You have to take the given statements to be true even if they seem to be at variance from commonly known facts and then decide which of the given conclusions logically follows from the statements disregarding commonly known facts.

Statements:
1. All A are B
2. All B are C
3. Some C are D

Conclusions:
I. Some A are D
II. Some B are D
III. All C are B

(a) Only I follows (b) Only II follows (c) Only III follows (d) None follows

10. In the figure given below. Area of ΔADE is equal to area of $\square$DECB and DE || BC. What is the ratio of AD and BD ?



(a) $\sqrt{2}:\left(1-\sqrt{2}\right)$ (b) $1:\left(\sqrt{2}-1\right)$

(c) $\sqrt{2}:\left(\sqrt{2}+1\right)$ (d) $1:\left(\sqrt{2}+1\right)$

PART – B

11. Which of the following vector potential(s) satisfy the Coulomb Gauge condition for a uniform magnetic field?

(I) $x\hat{i}+y\hat{j}+2z\hat{k}$ (II) $y\hat{i}-x\hat{j}-2z\hat{k}$ (III) $y\hat{i}-x\hat{j}+\hat{k}$

(a) Only option (I) (b) Only option (I) and (II)

(c) Only option (III) (d) All (I), (II) and (III)

12. A thin conducting ring of radius *a* having a charge *q* is placed with its plane parallel to an infinite grounded conducting plane at a distance *a* from it. The magnitude of electric field at the centre of the ring is

(a) $\dfrac{q}{10\sqrt{5}\,\pi\varepsilon_0 a^2}$ (b) $\dfrac{q}{\sqrt{2}\,\pi\varepsilon_0 a^2}$ (c) $\dfrac{q}{8\,\pi\varepsilon_0 a^2}$ (d) zero

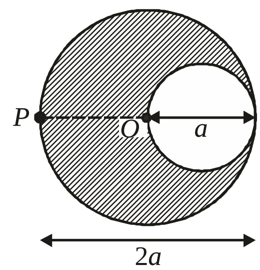
13. The electric field of an EM wave travelling through non-magnetic, linear dielectric medium is

$$\vec{E}=\left(4\hat{x}+\hat{y}-\alpha\hat{z}\right)E_0\exp\left[i\left(\omega t-2x+\alpha y-3z\right)\right]$$

The frequency of wave is $\omega=3\times10^8$ rad/sec. The dielectric constant $\left(\varepsilon_r\right)$ of the medium is

(a) $\dfrac{\sqrt{17}}{2}$ (b) $\dfrac{17}{4}$ (c) 17 (d) $3\sqrt{17}$

14. A cylindrical cavity of diameter *a* exists inside a cylinder of diameter 2*a* as shown in the figure. Both the cylinder and the cavity are infinitely long. A uniform current density *J* flows along the length of the cylinder. The magnitude of the magnetic field at the point *P* is given by



(a) $\dfrac{1}{12}\mu_0 Ja$ (b) $\dfrac{3}{4}\mu_0 Ja$

(c) $\dfrac{5}{12}\mu_0 Ja$ (d) $\dfrac{1}{3}\mu_0 Ja$

15. The region at space $z<0$ and $z>0$ are filled with materials having permeability $2\mu_0$ and $4\mu_0$ respectively. The magnetic field in the region $z<0$ is $\vec{B}=\mu_0\left(15\hat{x}+30\hat{y}+45\hat{z}\right)$. The magnetic field in the region $z>0$ is

(a) $\mu_0\left(70\hat{x}+60\hat{y}+45\hat{z}\right)$
(b) $\mu_0\left(30\hat{x}+60\hat{y}+45\hat{z}\right)$
(c) $\mu_0\left(70\hat{x}-60\hat{y}+45\hat{z}\right)$
(d) $\mu_0\left(30\hat{x}-60\hat{y}+45\hat{z}\right)$

16. A long solenoid of radius *r* and the number of turns per unit length *n* is driven by an AC current $i=I_0\sin\omega t$. Now, a small circular loop at radius *a* and resistance *R* is placed co-axially inside the solenoid. The induced current in the loop is given by

(a) $-\dfrac{\pi r^2\omega\mu_0 nI_0}{R}\sin(\omega t)$
(b) $-\dfrac{\pi a^2\omega\mu_0 nI_0}{R}\cos(\omega t)$
(c) $-\dfrac{\pi r^2\omega\mu_0 nI_0}{R}\cos(\omega t)$
(d) $-\dfrac{\pi a^2\omega\mu_0 nI_0}{R}\sin(\omega t)$

17. Given the scalar and vector potentials in free space

$$\phi(r,t)=0$$
$$\vec{A}(r,t)=\hat{j}A_0\sin(kx-\omega t)$$

where A_0, k and ω are constant. The time average Poynting vector corresponding to the above potentials is given by

(a) $\dfrac{\hat{k}\omega kA_0^2}{\mu_0}$
(b) $-\dfrac{\hat{j}\omega kA_0^2}{4\mu_0}$
(c) $\dfrac{\hat{i}\omega kA_0^2}{2\mu_0}$
(d) $\hat{i}\omega kA_0^2$

18. The wavefunction of a Hydrogen atom is spherically symmetric and its radial part has two nodes. Which of the following denotes the state?

(a) $\dfrac{1}{4\sqrt{2\pi}}\dfrac{1}{a_0^{3/2}}\left(2-\dfrac{r}{a_0}\right)e^{-\frac{r}{2a_0}}$
(b) $-\dfrac{1}{8\sqrt{\pi a_0^3}}\dfrac{r}{a_0}e^{-\frac{r}{2a_0}}\sin\theta e^{i\phi}$
(c) $\dfrac{1}{81\sqrt{3\pi a_0^3}}\left(27-18\dfrac{r}{a_0}+2\dfrac{r^2}{a_0^2}\right)e^{-\frac{r}{3a_0}}$
(d) $\dfrac{1}{\sqrt{\pi a_0^3}}e^{-\frac{r}{a_0}}$

19. A particle is moving in two dimensional harmonic oscillator potential, $V(x,y)=m\omega^2\left(2x^2+8y^2\right)$, where *m* is mass of the particle and ω is angular frequency. If the particle has energy $13\hbar\omega$, the degree of degeneracy of the state of the particle is

(a) 3
(b) 4
(c) 6
(d) 7

20. Consider a particle of mass *m* moving in the three-dimensional attractive potential,

$$V(\vec{r})=-\frac{\hbar^2\lambda}{2m}\left(\delta(x)+\delta(y)+\delta(z)\right)$$

where λ is a positive constant of appropriate dimension. The energy of the system for its bound state is

(a) $-\dfrac{\hbar^2\lambda^2}{2m}$
(b) $-\dfrac{3\hbar^2\lambda^2}{2m}$
(c) $-\dfrac{\hbar^2\lambda^2}{8m}$
(d) $-\dfrac{3\hbar^2\lambda^2}{8m}$

21. Consider four operators $\hat{A}, \hat{B}, \hat{C}$ and $\hat{D}$ such that, $\left[\hat{A},\hat{C}\right]=\left[\hat{A},\hat{D}\right]=\left[\hat{B},\hat{C}\right]=\left[\hat{B},\hat{D}\right]=I$, where I is the identity operator. The value of the commutator bracket $\left[\hat{A}\hat{B},\hat{C}\hat{D}\right]$ will be

(a) $\left(\hat{A}+\hat{B}\right)\left(\hat{D}+\hat{C}\right)+2I$
(b) $\left(\hat{A}+\hat{B}\right)\left(\hat{D}+\hat{C}\right)-2I$
(c) $\left(\hat{A}-\hat{B}\right)\left(\hat{D}+\hat{C}\right)+2I$
(d) $\left(\hat{A}+\hat{B}\right)\left(\hat{D}-\hat{C}\right)-2I$

22. A system is in the normalized state given by, $\psi(\theta,\phi)=aY_1^1+bY_2^{-1}$ (a, b are constants and Y_ℓ^m are spherical harmonics). If $\langle L_z\rangle$ for this state is $\frac{\hbar}{3}$, $\langle L^2\rangle$ will be equal to

(a) $\frac{5}{3}\hbar^2$
(b) $\frac{10}{3}\hbar^2$
(c) $4\hbar^2$
(d) $6\hbar^2$

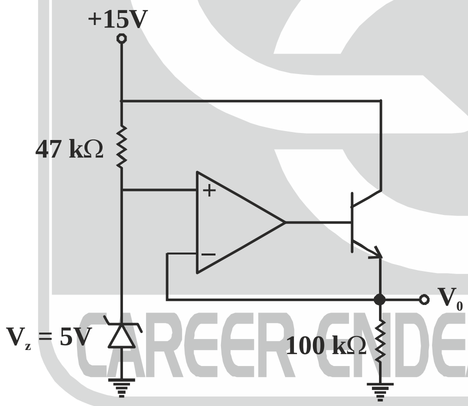
23. Consider two normalized wavefunctions of the following form:

$$\psi_0(-x)=\psi_0(x)=\psi_0^*(x) \text{ and } \psi_1(x)=N_0 a\frac{d\psi_0}{dx}$$

where, N_0 and a are constants. The value of $\langle \hat{x}^2\hat{p}\rangle$ for $\psi_0(x)$ will be

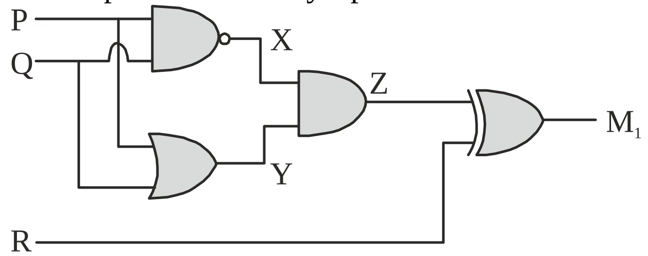
(a) $\hbar a$
(b) $\frac{\hbar a}{2}$
(c) $2\hbar a$
(d) zero

24. In the following circuit, the op-amp is ideal. If $\beta_F=60$, then the total current supplied by the 15 V source is



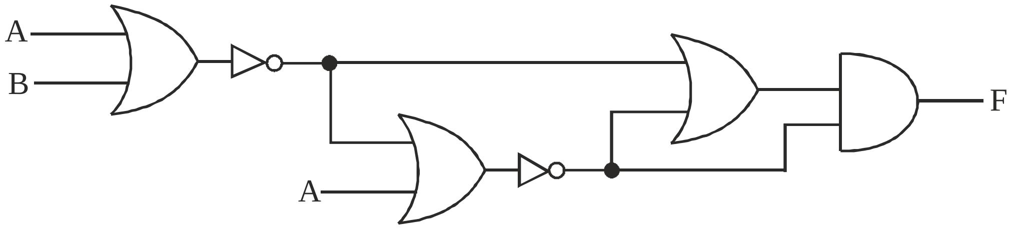
(a) 0.123 mA
(b) 0.983 mA
(c) 0.262 mA
(d) 0.168 mA

25. Which of the following Boolean Expression correctly represents the relation between P, Q, R and M_1.



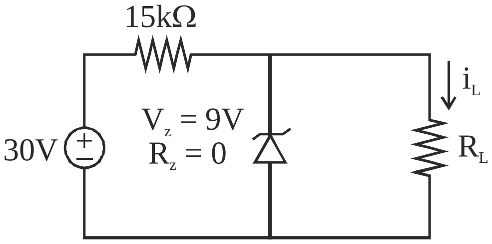
(a) $M_1=(P \text{ OR } Q) \text{ XOR } R$
(b) $M_1=(P \text{ AND } Q) \text{ XOR } R$
(c) $M_1=(P \text{ NOR } Q) \text{ XOR } R$
(d) $M_1=(P \text{ XOR } Q) \text{ XOR } R$

26. In the following circuit for which of the following input combination output will be ‘1’ ?



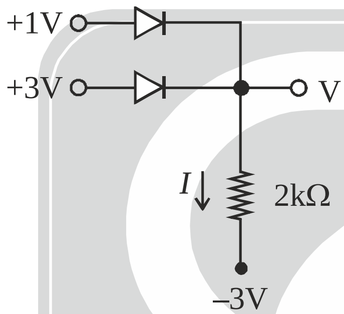
(a) $A=0, B=0$ (b) $A=1, B=0$ (c) $A=0, B=1$ (d) Either A = 1 or B = 1

27. In the voltage regulator circuit shown below the maximum load current i_L that can be drawn is



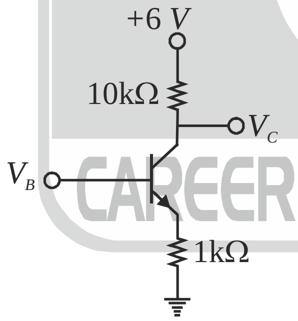
(a) 1.4 mA (b) 2.3 mA (c) 1.8 mA (d) 2.5 mA

28. For the circuit shown below cutin voltage of diode is $V_\gamma = 0.7$. What is the value of V and I ?



(a) 2.3 V, 2.65 mA (b) 2.65 V, 2.3 mA (c) 2 V, 0 mA (d) 0 V, 2.3 mA

29. For the circuit shown below $V_B = V_C$ and $\beta = 50.$ The value of V_B is



(a) 0.9 V (b) 1.19 V (c) 2.14 V (d) 1.84 V

30. A 3-input majority gate is defined by the ligic function $M(a,b,c) = ab + bc + ca$. Which one of the following gate is represented by the function $M\left(\overline{M(a,b,c)}, M(a,b,\bar{c}), c\right)$?

(a) 3-input NAND gate (b) 3-input XOR gate

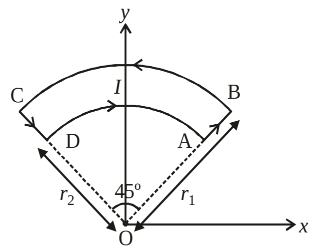
(c) 3-input NOR gate (d) 3-input XNOR gate

PART – C

31. Two semi infinite earthed conducting planes meet at right-angles. In the region between them there is a point charge q, which is at a distance d from each plane. At large distance ($r >> d$) the potential will vary with r as

(a) $V \propto \frac{1}{r^2}$ (b) $V \propto \frac{1}{r^3}$ (c) $V \propto \frac{1}{r^4}$ (d) $V \propto \frac{1}{r^5}$

32. A current loop ABCD is held fixed in plane of the paper as shown in figure. The arcs BC (radius = r_1) and DA (radius $= r_2$) of the loop are joined by two straight wires AB and CD. A steady state current I is flowing in the loop. Angle made by AB and CD at the origin O is 45°. The magnitude of magnetic field (B) due to the loop ABCD at the origin (O) is



(a) $\frac{\mu_0 I}{16}\left[\frac{r_2 - r_1}{r_1 r_2}\right]\hat{z}$ (b) $\frac{\mu_0 I}{16}\left[\frac{r_2 - r_1}{r_1 r_2}\right](-\hat{z})$

(c) $\frac{\mu_0 I}{8}\left[\frac{r_2 - r_1}{r_1 r_2}\right]\hat{z}$ (d) $\frac{\mu_0 I}{8}\left[\frac{r_2 - r_1}{r_1 r_2}\right](-\hat{z})$

33. Suppose the $\vec{E}$ field associated with a spherical electromagnetic wave, radiated from a point like source is given by

$$\vec{E}(r,\theta,\phi) = A\frac{\sin\theta}{r}\cos(kr - \omega t)\hat{\phi}$$

The magnetic field associated this electromagnetic wave is

(a) $\frac{2A\cos\theta}{r^2 c}\sin(kr - \omega t)\hat{r}$

(b) $\frac{2A}{c}\frac{\cos\theta}{r^2}\sin(kr - \omega t)\hat{r} - \frac{A\sin\theta}{rc}\cos(kr - \omega t)\hat{\theta}$

(c) $-\frac{A\sin\theta}{rc}\cos(kr - \omega t)\hat{\theta}$

(d) $\frac{2A}{c}\frac{\cos\theta}{r^2}\sin(kr - \omega t)\hat{r} + \frac{A\sin\theta}{rc}\cos(kr - \omega t)\hat{\theta}$

34. The cut-off frequency corresponding to the lowest TM mode of rectangular wave guide (4×2 cm) is ω_0. The cut-off frequency corresponding to the lowest TE mode of this wave guide is

(a) $\frac{\omega_0}{2}$ (b) $\frac{\omega_0}{\sqrt{3}}$ (c) $\frac{2}{\sqrt{5}}\omega_0$ (d) $\frac{1}{\sqrt{5}}\omega_0$

35. The electric field associated with an electromagnetic wave in free space is described by

$$\vec{E} = 3\cos(kz - \omega t)\hat{x} + 4\sin(kz - \omega t)\hat{y}\, V.m^{-1}$$

The wave is incident normally on the surface of a dielectric of refractive index n = 1.5. The state of the polarization of the transmitted wave is

(a) Linear polarized (b) Elliptical polarized
(c) Circular polarized (d) Unpolarized

36. A circular loop of radius a carries sinusoidally varying current of frequency of ω and amplitude I_0. The average power radius by the loop per cycle is

(a) $\frac{I_0^2\pi a^4\omega^4}{12\varepsilon_0 c^5}$ (b) $\frac{I_0^2\pi a^4\omega^2}{12\varepsilon_0 c^3}$ (c) $\frac{I_0^2\pi^2 a^2\omega^4}{12\varepsilon_0 c^3}$ (d) $\frac{I_0^2\pi a^2\omega}{6\varepsilon_0 c^5}$

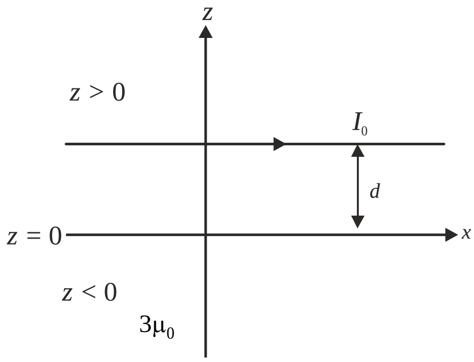
37. $z = 0$ plane separates free space and magnetic material $(3\mu_0)$. An infinite wire passing through (0, 0, d) carries a current I_0 parallel to x-axis. The force per unit length experienced by wire is

(a) $\frac{\mu_0 I_0^2}{2\pi d}$(attractive)

(b) $\frac{\mu_0 I_0^2}{4\pi d}$(attractive)

(c) $\frac{\mu_0 I_0^2}{4\pi d}$(repulsive)

(d) $\frac{\mu_0 I_0^2}{8\pi d}$(repulsive)



38. An infinitely long wire carries linear charge density λ_0 in rest frame. If the wire moves with velocity $v = \frac{c}{2}$ along its length with respect to rest frame. The magnitude of electric field in rest frame at perpendicular distance ρ from the wire will be

(a) $\frac{\lambda_0}{2\pi\varepsilon_0\rho}$ (b) $\frac{\lambda_0}{\sqrt{3}\pi\varepsilon_0\rho}$ (c) $\frac{\lambda_0}{4\pi\varepsilon_0\rho}$ (d) $\frac{\lambda_0}{2\sqrt{3}\pi\varepsilon_0\rho}$

39. To implement y = ABCD using only two-input NAND gates, minimum number of requirement of gate is

(a) 3 (b) 4 (c) 5 (d) 6

40. $\hat{S}_1$ is the component of spin along $\hat{a} = \frac{1}{\sqrt{6}}\left(\hat{i} + 2\hat{j} - \hat{k}\right)$ and $\hat{S}_2$ is the component along $\hat{b} = \frac{1}{3}\left(2\hat{i} - \hat{j} + 2\hat{k}\right)$.

The value of $\left[\hat{S}_1, \hat{S}_2\right]$ is

(a) $\frac{i\hbar}{3\sqrt{6}}\left(3\hat{S}_x - 4\hat{S}_y - 5\hat{S}_z\right)$ (b) $\frac{i\hbar}{3\sqrt{6}}\left(3\hat{S}_x + 4\hat{S}_y - 5\hat{S}_z\right)$

(c) $\frac{i\hbar}{3\sqrt{6}}\left(3\hat{S}_x + 4\hat{S}_y + 5\hat{S}_z\right)$ (d) None of these

41. A particle of mass 'm' is in the ground state of a 1-D harmonic oscillator of frequency 'ω'. If the frequency suddenly changes to '$a\omega$' where a is a constant, the probability of finding it in the ground state of the new oscillator is

(a) $\frac{1}{\sqrt{a} + \frac{1}{\sqrt{a}}}$ (b) $\frac{2}{\sqrt{a} + \frac{1}{\sqrt{a}}}$ (c) $\frac{2}{a + \frac{1}{a}}$ (d) $\frac{1}{a}$

42. The matrix representation of Hamiltonian of a system in a given basis is, (assuming $\hbar = 1$),

$$\hat{H} = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$$

If the initial state of the particle is $\left|\psi(0)\right\rangle = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$, its state at time t will be

(a) $\begin{pmatrix} \cos t \\ -i\sin t \end{pmatrix}$ (b) $\begin{pmatrix} \cos t \\ \sin t \end{pmatrix}$ (c) $\begin{pmatrix} \cos(t/2) \\ \sin(t/2) \end{pmatrix}$ (d) $\begin{pmatrix} i\cos(t/2) \\ \sin(t/2) \end{pmatrix}$

43. A three-dimensional rigid rotator of moment of inertia I has Hamiltonian, $\hat{H}_0 = \frac{\hat{L}^2}{2I}$. If a perturbation of the form, $\hat{H}' = \lambda\sqrt{\frac{3}{4\pi}}\cos\theta$ {λ is a small constant} is applied to it, the second order correction to the ground state energy will be $\left[\text{Given: } Y_1^0(\theta,\phi) = \sqrt{\frac{3}{4\pi}}\cos\theta;\ Y_0^0(\theta,\phi) = \frac{1}{\sqrt{4\pi}}\right]$

(a) $\frac{I\lambda^2}{4\pi\hbar^2}$ (b) $-\frac{I\lambda^2}{4\pi\hbar^2}$ (c) $\frac{I\lambda^2}{2\pi\hbar^2}$ (d) $-\frac{I\lambda^2}{2\pi\hbar^2}$

44. A particle is in the potential

$$V(x) = \begin{cases} 0 & for\ 0 < x < a \\ \infty & otherwise \end{cases}$$

The ground state energy of the particle with trial wave function

$$\psi(x) = \begin{cases} Ax & for\ 0 < x < \frac{a}{2} \\ A(a-x) & for\ \frac{a}{2} < x < a \\ 0 & otherwise \end{cases}$$

is

(a) $\frac{\hbar^2\pi^2}{2ma^2}$ (b) $\frac{\hbar^2}{ma^2}$ (c) $\frac{6\hbar^2}{ma^2}$ (d) $\frac{3\hbar^2}{2ma^2}$

45. Six electrons of mass m each are placed in a 3-D infinite potential well of length L, width $\frac{L}{2}$ and height $2L$. The ground state energy of the system will be

(a) $\frac{37\pi^2\hbar^2}{2mL^2}$ (b) $\frac{27\pi^2\hbar^2}{2mL^2}$ (c) $\frac{17\pi^2\hbar^2}{2mL^2}$ (d) None of these

46. The spin state of an electron is unknown. Upon measuring $\hat{S}_z$, $+\frac{\hbar}{2}$ is found. A subsequent measurement of $\hat{S}_y$ gives $-\frac{\hbar}{2}$. If $\hat{S}_x$ is immediately measured on the electron after this, the probability of finding $+\frac{\hbar}{2}$ is,

(a) 0 (b) $\frac{1}{4}$ (c) $\frac{1}{2}$ (d) $\frac{3}{4}$

47. Consider a quantum system with two stationary eigenstates $|1\rangle$ and $|2\rangle$. The difference between their energy eigenvalues is given by $E_2 - E_1 = \hbar\omega_{21}$. At time $t = 0$ when the system is in state $|1\rangle$, a small perturbation H' that does not change with time is applied. The following matrix elements are given,

$$\langle 1|H'|1\rangle = 0,\ \langle 2|H'|1\rangle = h\omega_0,\ \langle 2|H'|2\rangle = -\hbar\omega$$

The probability of finding the system at time *t* in state $|2\rangle$ given by

(a) $\omega_0^2\left|\frac{\sin(\omega_0 t/2)}{\omega_0/2}\right|^2$ (b) $\omega^2\left|\frac{\sin(\omega t/2)}{\omega/2}\right|^2$ (c) $\omega_0^2\left|\frac{\sin(\omega_{21}t/2)}{\omega_{21}/2}\right|^2$ (d) $\omega_{21}^2\left|\frac{\sin(\omega_{21}t/2)}{\omega_{21}/2}\right|^2$

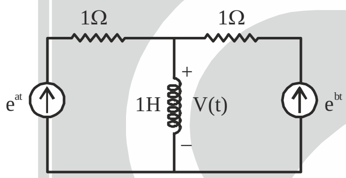
48. Consider a physical system with a three dimensional state space. The Hamiltonian of this system is represented by a matrix in some orthonormal basis

$$\hat{H}=\begin{pmatrix}2 & 1 & 0\\ 1 & 2 & 0\\ 0 & 0 & 3\end{pmatrix}$$

A particle is in the state $|\psi\rangle$, represented in this basis as $\frac{1}{\sqrt{3}}\begin{pmatrix}i\\ -i\\ i\end{pmatrix}$. The value of ΔH is

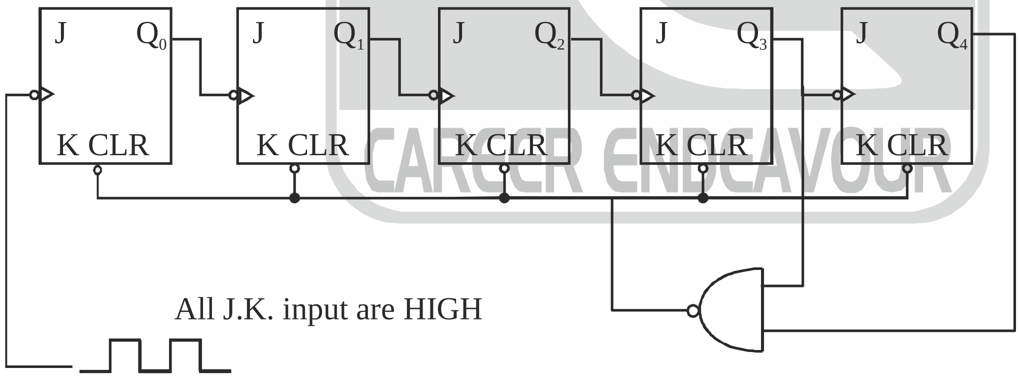
(a) $\sqrt{2}$ (b) $\frac{2\sqrt{2}}{3}$ (c) $\frac{1}{3}$ (d) $\frac{1}{\sqrt{3}}$

49. In the circuit shown below, the voltage $v(t)$ is



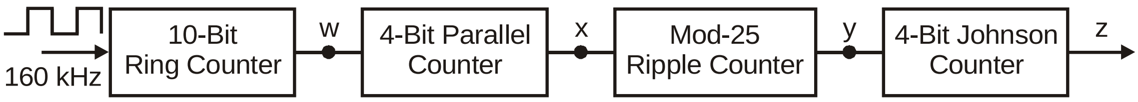
(a) $e^{at}-e^{bt}$ (b) $e^{at}+e^{bt}$ (c) $ae^{at}-be^{bt}$ (d) $ae^{at}+be^{bt}$

50. The mod-number of the asynchronous counter shown in figure below is



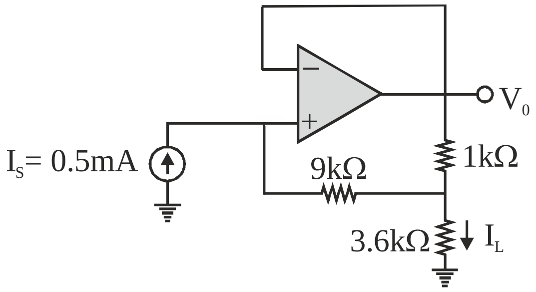
(a) 24 (b) 48 (c) 25 (d) 36

51. The frequency of the pulse at z in the network shown in figure below is



(a) 10 Hz (b) 160 Hz (c) 40 Hz (d) 5 Hz

52. An ideal op-amp circuit is shown in figure.



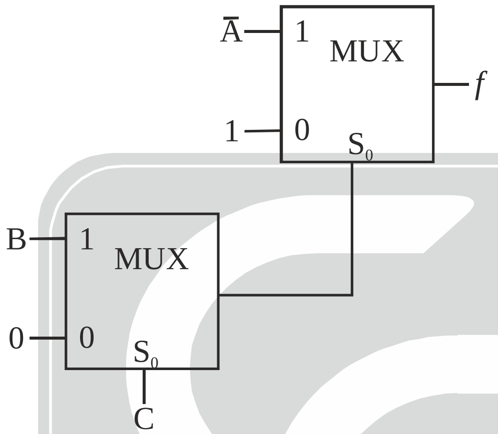
Current I_L is

(a) 4.5 mA (b) 0 mA (c) 4 mA (d) 5 mA

53. The simplified form of a logic function $Y = A(B + C\overline{(AB + AC)})$ is

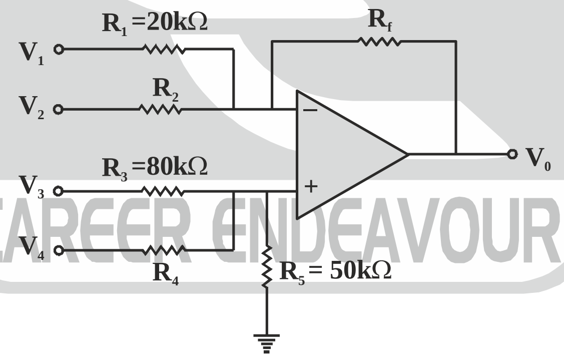
(a) $\bar{A}\bar{B}$ (b) AB (c) $\bar{A}B$ (d) $A\bar{B}$

54. The network shown below implements



(a) NOR gate (b) NAND gate (c) XOR gate (d) XNOR gate

55. In following circuit output is given as



$V_0 = -10V_1 - 4V_2 + 5V_3 + 2V_4$

The resistane R_2, R_4 and R_f respectively are

(a) $50\ k\Omega$, $200\ k\Omega$, $500\ k\Omega$ (b) $50\ k\Omega$, $100\ k\Omega$, $80\ k\Omega$

(c) $50\ k\Omega$, $200\ k\Omega$, $200\ k\Omega$ (d) $50\ k\Omega$, $80\ k\Omega$, $100\ k\Omega$

Space for rough work

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PHYSICAL SCIENCES
TEST SERIES-A

Date : 22-05-2019

ANSWER KEY

PART-A

1. (b)	**2. (c)**	**3. (b)**	**4. (a)**	**5. (d)**	**6. (c)**	**7. (a)**
8. (d)	**9. (d)**	**10. (b)**				

PART-B

11. (c)	**12. (a)**	**13. (c)**	**14. (c)**	**15. (b)**	**16. (b)**	**17. (c)**
18. (c)	**19. (a)**	**20. (d)**	21. (b)	22. (b)	23. (d)	24. (c)
25. (d)	26. (c)	27. (a)	28. (a)	29. (b)	30. (b)	

PART-C

31. (b)	**32. (a)**	**33. (c)**	**34. (d)**	**35. (b)**	**36. (a)**	**37. (d)**
38. (b)	**39. (d)**	**40. (a)**	**41. (b)**	**42. (a)**	**43. (b)**	**44. (c)**
45. (a)	**46. (c)**	**47. (c)**	**48. (b)**	**49. (d)**	**50. (a)**	**51. (d)**
52. (d)	**53. (b)**	**54. (b)**	**55. (c)**			