TEST SERIES FOR GATE

BOOKLET SERIES D

Paper Code: PH

Test Type: TEST SERIES

Duration: 3:00 Hours

PHYSICS

Date: 24-01-2016

Maximum Marks: 100

Read the following instructions carefully:

1. Attempt all questions.
2. This question paper consists of **2 sections**, General Aptitude (GA) for **15 marks** and the subject specific GATE paper for **85 marks**. Both these sections are compulsory. The GA section consists of **10** questions. Question numbers 1 to 5 are of 1-mark each, while question numbers 6 to 10 are of 2-mark each. The subject specific GATE paper section consists of **55** questions, out of which question numbers 11 to 35 are of 1-mark each, while question numbers 36 to 65 are of 2-mark each.
3. The question paper may consist of questions of **multiple choice type** (MCQ) and **numerical answer type**.
4. Multiple choice type questions will have four choices against (a), (b), (c), (d), out of which only **ONE** is the correct answer.
5. For numerical answer type questions, each question will have a numerical answer and there will not be any choices.
6. All questions that are not attempted will result in zero marks. However, wrong answers for multiple choice type questions (MCQ) will result in **NEGATIVE** marks. For all MCQ questions a wrong answer will result in deduction of ⅓ marks for a **1-mark** question and ⅔ marks for a **2-mark** question.
7. There is **NO NEGATIVE MARKING** for questions of **NUMERICAL ANSWER TYPE**.
8. Non-programmable type Calculator is allowed.

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Q.1-Q. 5 carry ONE mark each.

1. Choose the most appropriate alternative from the options given below to complete the following sentence:
It is hard to _____ why people kept their weapons in the kitchen as revealed from the latest excavations.
(a) Decipher (b) Divulge (c) Deluge (d) Amplify

2. Which of the following options is closest in meaning to the word given below?
FAD:
(a) Apathetic (b) Expensive (c) Vogue (d) Benevolent

3. Oct 02, 2001 is a palindrome when written in the formaat of MMDDYYYY (a string that reads the same forwards as it does backwards, example 10/02/2001 ..... 10022001. When was the latest century before oct.02, 2001 that is also a palindrome.
(a) 13th century (b) 14th century (c) 17th century (d) 20th century

4. The difference between the squares of two consecutive odd integers is always divisible by which of the following numbers.
(a) 6 (b) 8 (c) 12 (d) 16

5. Consider the equation : $(7526)_8 - (Y)_8 = (4364)_8$, where $(X)_N$ stands for X to the base N. Find Y.
(a) 1634 (b) 1737 (c) 3142 (d) 3162

Q.6-Q. 10 carry TWO marks each.

6. Choose the word from the options that is most nearly same in meaning of **Ostensible**.
(a) Apparent (b) Acclaimed (c) Profound (d) Genuine.

7. Given below is a pair of words. Choose the most appropriate and related alternative from the options given below:
MENDACIOUS: TRUTHFUL
(a) Gelid: Icy (b) Scorching: Hot
(c) Cognisance: Recognition (d) Capricious: Constant

8. The grass domestic product (GDP) in rupees grew at 7% during 2012-2013. For international comparision, the GDP is compared in US dollars (USD) after conversion based on the market exchange rate. During the period 2012-13 the exchange rate for the USD increased from Rs. 50/USD to Rs. 60/USD. India's GDP in USD during the period 2012-13.
(a) increased by 5% (b) decreased by 13%
(c) decreased by 20% (d) decreased by 11%

9. What will come in place of ? mark?

5		8
	126	
9		6

4		9
	78	
6		7

4		12
	?	
11		5

(a) 240 (b) 336 (c) 180 (d) none of these

10. The table below has question wise data on the performance of students, in an examination. The mark for each questions are also listed. There is no negative or partial marking in the exam.

Q.No.	Marks	Answered correctly	Answered wrongly	Not attempted
1.	2	21	17	6
2.	3	15	27	2
3.	2	23	18	3

What is the average of the marks obtained by the class in the examination _____

Q.11-Q.35 carry one mark each.

11. Consider Maxwell's equation, $\vec{\nabla}\times\vec{E}=-\frac{\partial\vec{B}}{\partial t}$. Where, $\vec{E}=-\vec{\nabla}\phi-\frac{\partial\vec{A}}{\partial t}$ and $\vec{B}=\vec{\nabla}\times\vec{A}$. When transformation $\vec{A}'=\vec{A}+\vec{\nabla}\lambda,\ \phi'=\phi-\alpha\frac{\partial\lambda}{\partial t}$ is done. (λ is a scalar function) $\vec{E}$ and $\vec{B}$ remain unchanged. The value of constant 'α' is

(a) 0 (b) –1 (c) 1 (d) –1/2

12. A dielectric sphere of radius *R* has polarization, $\vec{P}=kr^3\vec{r}$. The volume charge density of the bound charges inside the sphere is

(a) $-6kr^3$ (b) $-3kr^2$ (c) $-5kr^3$ (d) $-4kr^3$

13. The cube fcc (100) of a rock salt crystal lattice constant *a* is 2.814Å. If the wave length of X-rays is 0.710Å then the glancing angle corresponding to second order reflection is

(a) 10º (b) 20º (c) 14.6º (d) 7º

14. The mobility of electron in Si at 300K is 0.130 m^2/V-s. The diffusion constant for electron is

(a) 0.0343 M^2/s (b) 0.00343 m^2/sec (c) 0.343 m^2/sec (d) 3.43 m^2/sec

15. A current I is flowing through a cable of radius R uniformly distributed over its cross-section. The value of $\left.\frac{\partial^2 B}{\partial r^2}\right|_{r=R}$ is

(a) 0 (b) $\frac{\mu_0 I}{\pi R^3}$ (c) $-\frac{\mu_0 I}{\pi R^3}$ (d) ∞

16. NaCl crystal has density, $\rho=2189\ kg/m^3$ and Avogadro's number N = 6.02×10^{26} /kg mole. The volume of the unit cell is

(a) 22.18 $Å^3$ (b) 2.81$Å^3$ (c) 5.62$Å^3$ (d) 30$Å^3$

17. Which of the following field is **NOT** conservative in nature?

(a) $x\,\hat{x}+y\,\hat{y}+z\,\hat{z}$ (b) $\left(2x^3y^4+x\right)\hat{x}+\left(2x^4y^3+y\right)\hat{y}$

(c) $yz\,\hat{x}+xz\,\hat{y}+xy\,\hat{z}$ (d) $\left(x^2-yx\right)\hat{x}+\left(y^2-xy\right)\hat{y}$

18. Consider the following differential equation:

$$3x\frac{dy}{dx}-y=\ln x+1\quad(x>0)$$

subjected to the conditions $y(x=1)=-2$. The value of *y* at *x* = 8 will be .....

19. A one-dimensional harmonic oscillator is in the superposition of number states $|n\rangle$, given by

$$|\psi\rangle=\frac{\sqrt{3}}{2}|1\rangle+\frac{1}{2}|3\rangle$$

The average energy of the oscillator in the given state is ..... $\hbar\omega$

20. Consider a particle of mass *m* which is occupying any one of the energy eigenstates of a one-dinesional box of length *L*. The force exerted by the particle on the boundary walls is proportional to

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

21. Consider the Bohr model of the hydrogen atom. If α is the fine structure constant, then the velocity of the electron in $n = 2$ orbit is

(a) $\frac{\alpha c}{2}$ (b) αc (c) $2\alpha c$ (d) $\frac{\alpha c}{4}$

22. The excited state of sodium atom $\left({}^{11}\text{Na}\right)$ is a ${}^{2}P_{3/2}$ state. The difference in energy levels arising in the presence of a weak external magnetic field B, is ..... $\mu_B B$.

23. The centre of mass of a uniform solid hemisphere of radius a is (assuming centre of the sphere is at origin)

(a) (0, 0, 0) (b) $\left(0, 0, \frac{3a}{4}\right)$ (c) $\left(a, a, \frac{a}{4}\right)$ (d) $\left(0, 0, \frac{3a}{8}\right)$

24. The Lagrangian of a particle is given by $L = \frac{1}{5}\dot{q}^2 + \alpha\left(q - q_0\right)^2$, where α is a constant, then the Hamiltonian of particle is

(a) $\frac{1}{5}\dot{q}^2 - \alpha\left(q + q_0\right)^2$ (b) $\frac{1}{5}\dot{q}^2 + \alpha\left(q + q_0\right)^2$ (c) $\frac{1}{5}\dot{q}^2 - \alpha\left(q - q_0\right)^2$ (d) $\frac{1}{5}\dot{q}^2 + \alpha\left(q - q_0\right)^2$

25. A cylinder has a mass M, length 'l' and radius r. If the moment of inertia about an axis through the centre and perpendicular to its length, is minimum, then the value of $\frac{\ell}{r}$ is

(a) $\sqrt{3} : \sqrt{2}$ (b) $\sqrt{5} : \sqrt{3}$ (c) $\sqrt{7} : \sqrt{3}$ (d) $\sqrt{3} : \sqrt{5}$

26. The threshold energy for the nuclear reaction, $14N\left(n, \alpha\right){}^{11}B$ is ..... MeV.

27. Four particle electron, proton, He^+ and Li^+ are projected in a circular orbit of same radius perpendicular to a given magnetic field. Then the velocity will be smallest for

(a) electron (b) proton (c) Li^+ (d) He^+

28. The activity of certain radio nuclide decreases to 15% of its original value in 10 days. Its half life time is

(a) 3.65 days (b) 5.5 days (c) 2.3 days (d) 8 days

29. The ground state angular momentum and parity of ${}^{41}\text{Ca}$ are

(a) $\left(\frac{7}{2}\right)^-$ (b) $\left(\frac{3}{2}\right)^+$ (c) $\left(\frac{5}{2}\right)^+$ (d) $\left(\frac{5}{2}\right)^-$

30. If the potential $\phi = r^3 \cos\theta$ due to some charge distribution, then the electric field $\bar{E}$ will be

(a) $-2r\cos\theta\hat{r} + r\sin\theta\hat{\theta}$ (b) $-3r^2\cos\theta\hat{r} + r^3\sin\theta\hat{\theta}$

(c) $-3r^2\cos\theta\hat{r} + r^2\sin\theta\hat{\theta}$ (d) $3r^2\cos\theta\hat{r} + r^2\sin\theta\hat{\theta}$

31. Magnetic field due to small circular loop at a large distance r varies as

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

32. If the electric field making the angel with normal $\theta = 30^\circ$ when it is incidened from vacuum to a dielectric medium having $\varepsilon = \sqrt{3}\,\varepsilon_0$. The value of angle that electric field make in the medium with normal is _____(degree).

33. The expression $-\frac{1}{V}\left(\frac{\partial^2 G}{\partial P^2}\right)_T$ represents which thermodynamics quantity?

(a) Isothermal susceptibility (b) Coefficient of volume expansion

(c) Isothermal compressibility and is also equal to $-\frac{1}{V}\left(\frac{\partial^2 E}{\partial P^2}\right)_T$

(d) Isothermal compressibility but not equal to $-\frac{1}{V}\left(\frac{\partial^2 E}{\partial P^2}\right)_T$

34. For vaporization among the following which option is correct?
(a) Entropy and specific heat at constant pressure are discontinuous at transition point.
(b) Entropy and isothermal compressibility are discontinuous at transition point.
(c) Entropy , specific heat at constant and isothermal compressibility are discontinuous at transition point.
(d) Specific heat at constant pressure , isothermal compressibility and coefficient of volume expansion at constant pressure all are infinite at transition point.

35. The specific heat at constant pressure of black body radiation inside a spherical cavity in n-dimensional space depends on the temperature as

(a) T^n (b) $T^{\left(\frac{n+3}{2}\right)}$ (c) $T^{\left(\frac{2n+3}{3}\right)}$ (d) T^{n+1}

Q.36-Q.65 carry TWO marks each.

36. For Nickel, the number density is 8×10^{23} atoms/cm^3 and electronic configuration is $1s^2\ 2s^2 2p^6 3s^2 3p^6 3d^8 4s^2$. The value of the saturation magnetization of Nickel in its ferromagnetic states is ..... $\times 10^9$ A/m. (Given the value of Bohr magneton $\mu_B = 9.21\times10^{-21}\ Am^2$)

37. A tennis ball falls freely from a height H on an inclined plane making an angle 45° with the horizon. After bouncing, the ball falls on the plane again. The distance between the two points of strking is

(a) $4\sqrt{2}\ H$ (b) $2\sqrt{2}\ H$ (c) $\sqrt{2}\ H$ (d) H

38. The electric potential of some configuration is given by the expression

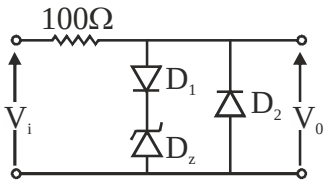
$$V(r) = A\frac{e^{-\lambda r}}{r}$$

where, A and λ are constants, the electric charge density corresponding this potential is

(a) $\in_0 A\left(4\pi\delta^3(\mathbf{r}) + \lambda^2 e^{-\lambda r}/r\right)$ (b) $\in_0 A\left(4\pi\delta^3(\mathbf{r}) - \lambda^2 e^{-\lambda r}/r\right)$

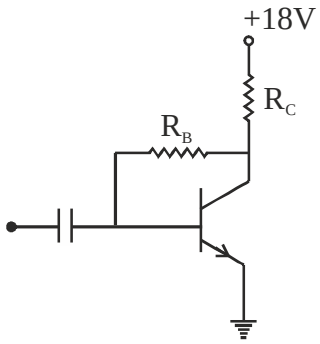
(c) $\in_0 A\left(4\pi\delta^3(\mathbf{r}) - \lambda^2 e^{+\lambda r}/r\right)$ (d) $\in_0 A\left(4\pi\delta^3(\mathbf{r}) + \lambda^2 e^{+\lambda r}/r\right)$

39. Consider the circuit shown in figure below. The diodes D1 and D2 are made of silicon and the voltage drop across each of them is 0.7V in the forward bias condition. D_z is Zener diode of breakdown voltage 6.8V. The maximum and minimum values of V_0 when $V_i = 10\sin 100\pi t V$ will be



(a) 7.5V, –0.7V (b) –7.5V, 0.7V (c) –0.7V, 7.5V (d) 0.7V, 7.5V

40. Consider the collector-base feedback bias circuit given below. (Given, $V_{CC} = 18V$, $R_C = 3.9\ k\Omega$, $R_B = 560\ k\Omega$. $\beta = 200$ and $I_B >> I_{CBO}$)
The Q value of the circuit is



(a) $I_C = 2.56$ mA, $V_{CE} = 6.87$ (b) $I_C = 2$ mA, $V_{CE} = 6.87$
(c) $I_C = 2.56$ mA, $V_{CE} = 7.87$ (d) $I_C = 3$ mA, $V_{CE} = 7.80$

41. A plane transmission grating produces an angular separation of 0.01 radian between two wavelengths observed at an angle of 30º. If the mean value of the wavelength is 5000Å and the spectrum is observed in the second order, the difference in the two wavelengths is .....Å.

42. Plane-polarised light is incident normally on a plate of doubly refracting uniaxial crystal with faces cut parallel to the optic axis. The ratio of intensities of extraordinary and ordinary rays ....., if the light is incident with vibrations making an angle of 30º with the optic axis. Given, $\lambda = 6000\mathring{A}$, $\mu_e = 1.5532$, $\mu_0 = 1.5442$.

43. An a.c. circuit containing a series-connected capacitor and inductor with certain resistance is connected to an an a.c. source whose frequency can be alterd. At frequencies 1.5 MHz and 6 MHz current amplitude is same. Resonance frequency of the circuit is ..... MHz.

44. Plane polarised light passes through a quartz plate with its axis parallel to the faces. The least thickness of the plate for which the emergent beam will be circularly polarised .....$\times 10^{-3}$ cm.

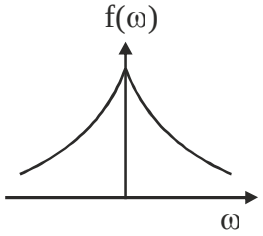
45. Consider the following matrix $A = \begin{bmatrix} 1 & 1 \\ 2 & 1 \end{bmatrix}$. Then $A^6 - 2A^5 - A^4 + A^3 - A^2 - 2A + I$ can be written as

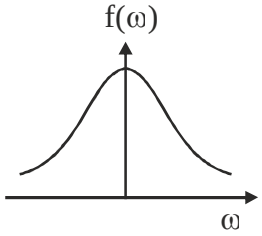
(a) $A^2 + A + I$ (b) $A^2 - A + I$ (c) $A^2 - 2A + I$ (d) $A^2 - 2A - I$

46. The fourier transform of the function

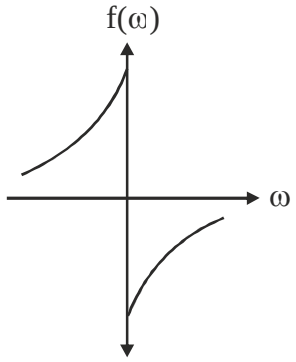
$$f(t) = \frac{a}{a^2 + t^2} \quad (\text{where } a \text{ is constant})$$

can be shown by which of the following graphs?

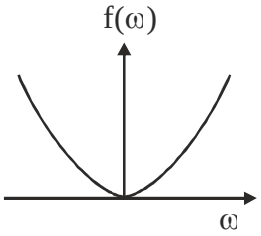
(a)


(b)


(c)



(d)



47. The real part of complex analytic function $f(z) = u(x, y) + i\, v(x, y)$ is given as $u(x, y) = x^3 - 3xy^2$. The corresponding imaginary part $v(x, y)$ will be

(a) $y^3 - 3x^2 y$ (b) $3x^2 y - y^3$ (c) $\frac{x^4}{4} - \frac{3}{2}x^2 y^2$ (d) $\frac{3}{2}x^2 y^2 - \frac{x^4}{4}$

48. The length element *ds* of an arc is given by

$$(ds)^2 = 3(dx^1)^2 + (dx^2)^2 + \sqrt{5}(dx^1)(dx^2)$$

The metric tensor g_{ij} is

(a) $\begin{bmatrix} 3 & \sqrt{5} \\ \sqrt{5} & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 3 & \sqrt{5/4} \\ \sqrt{5/4} & 1 \end{bmatrix}$ (c) $\begin{bmatrix} 3 & 0 \\ 0 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 3 & \sqrt{5/2} \\ \sqrt{5/2} & 1 \end{bmatrix}$

49. A hydrogen atom is prepared in the state

$$\psi = \frac{1}{\sqrt{5}}\psi_{210} + \sqrt{\frac{3}{10}}\psi_{321} + \frac{1}{\sqrt{2}}\psi_{310}$$

where *n*, *l*, *m* in ψ_{nlm} denotes the principal, orbital and magnetic quantum numbers, respectively. If L is the angular momentum operator, the average value of L^2 is ..... $\hbar^2$.

50. A particle is confined to a one-dimensional potential box with the following potential:

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

If the particle is subjected to the perturbation of the form $V_p(x) = \omega_0 L\, \delta\left(x - \frac{L}{2}\right)$, where ω_0 is small constant. The first order correction to the ground state energy of the particle will be

(a) 0 (b) ω_0 (c) $2\omega_0$ (d) $4\omega_0$

51. Consider a particle of mass *m* moving in 1-D potential $V(x) = V_0 + \beta x^2$, then the minimum energy of the particle will be

(a) $V_0 + \sqrt{\frac{\beta\hbar^2}{2m}}$ (b) $V_0 + \sqrt{\frac{2\beta\hbar^2}{m}}$ (c) $V_0 + \sqrt{\frac{\beta\hbar^2}{4m}}$ (d) $V_0 + \sqrt{\frac{3\beta\hbar^2}{4m}}$

52. There are only three anti-symmetric bound states for a particle of mass 'm' and energy 'E', in a 1-D finite potential well of the form given below:

$$V(x)=\begin{cases}0 & \text{for } |x|<\dfrac{3a}{4}\\ \dfrac{3}{2}V_0 & \text{for } |x|\geq\dfrac{3a}{4}\end{cases}$$

The range of the V_0 is

(a) $\dfrac{64\pi^2\hbar^2}{27ma^2}<V_0<\dfrac{16\pi^2\hbar^2}{3ma^2}$ (b) $\dfrac{100\pi^2\hbar^2}{27ma^2}<V_0<\dfrac{196\pi^2\hbar^2}{27ma^2}$

(c) $\dfrac{32\pi^2\hbar^2}{9ma^2}<V_0<\dfrac{8\pi^2\hbar^2}{3ma^2}$ (d) $\dfrac{4\pi^2\hbar^2}{3ma^2}<V_0<\dfrac{100\pi^2\hbar^2}{27ma^2}$

53. Suppose a spin 1/2 particle is in the state $|\phi\rangle=\dfrac{1}{\sqrt{5}}\begin{bmatrix}1-i\\ \sqrt{3}\end{bmatrix}$. The expectation value of *z*-component of spin angular momentum of the particle is

(a) $\dfrac{\hbar}{10}$ (b) $-\dfrac{\hbar}{10}$ (c) $-\dfrac{\hbar}{5}$ (d) $\dfrac{\hbar}{5}$

54. If the doublet splitting of the first excited state $2^2D_{5/2}-2^2D_{3/2}$ of *H* atom is 0.23 cm^{-1}, then the corresponding separation of He^+ is ..... cm^{-1}.

55. The wavelength of a photon emiited from a moving source is appeared to be 500.1 nm, whereas the actual wavelength is 500 nm. The speed and direction of the movement of the source w.r.t the observer is

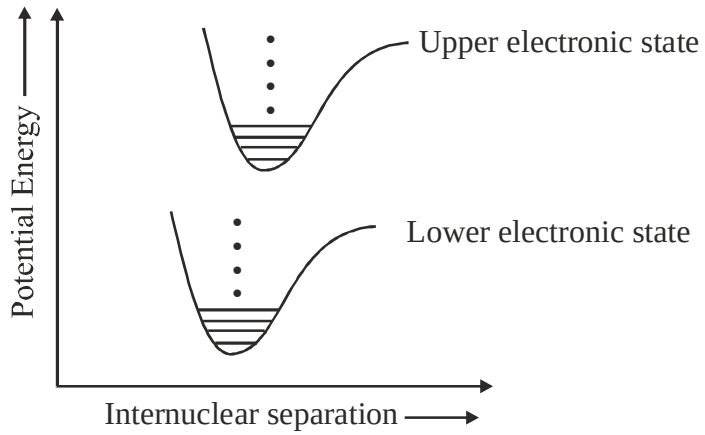
(a) 30 km/sec, away from the observer (b) 60 km/sec, away from the observer

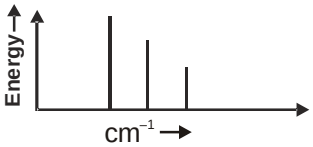
(c) 30 km/sec, towards the observer (d) 60 km/sec, towards the observer

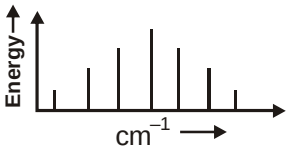
56. Given that the rotational constant and centrifugal distortion constant of IR active molecule are $10.593\,cm^{-1}$ and $5.3\times10^{-4}cm^{-1}$. The vibrational frequency of the IR active molecule will be

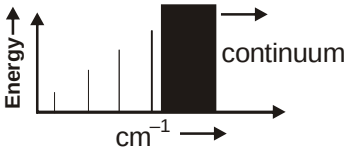
(a) $9\times10^{11}Hz$ (b) $9\times10^{12}Hz$ (c) $9\times10^{13}Hz$ (d) $9\times10^{14}Hz$

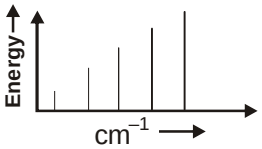
57. In a diatomic molecule, the internuclear separation of the ground and first excited electronic state are the same as shown in the figure. If the molecule is initially in the lowest vibrational state of the ground state, then the absorption spectrum will appear as



(a) 

(b) 

(c) 

(d) 

58. A planet is suddenly stopped in its orbit, supposedly circular if it will take time 't' to fall into the sun and the period of revolution of its is 'T', then the value of t/T is

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

59. Consider the four processes

(I) $\pi^+ + n \to \Lambda^0 + k^+$ (II) $\pi^+ + n \to \pi^- + p$

(III) $\pi^- + p \to \pi^0 + \Lambda^0$ (IV) $\pi^- + p \to \Lambda^0 + k^0$

Which of the above is/are allowed under the conservation of strangeness, conservation of baryon number and conservation of charge

(a) I and II (b) I and IV (c) III and IV (d) II and IV

60. A current distribution give rises to the magnetic vector potential $\bar{A}(r,\theta,z) = kr^{-r}\sin\theta\hat{z}$, where k is a constant. Corresponding magnetic field at any point (r,θ,z) will be

(a) $\vec{B}(r,\theta,z) = \hat{r}\frac{k}{r}e^{-r}\cos\theta + \hat{\theta}ke^{-r}\cos\theta$ (b) $\vec{B}(r,\theta,z) = \hat{r}\frac{k}{r}e^{-r}\cos\theta + \hat{\theta}ke^{-r}\sin\theta$

(c) $\vec{B}(r,\theta,z) = \hat{r}\frac{k}{r}e^{-r} + \hat{\theta}ke^{-r}\sin\theta$ (d) $\vec{B}(r,\theta,z) = \hat{r}\frac{k}{r}\sin\theta e^{-r} + \hat{\theta}ke^{-r}\sin\theta$

61. Consider a toroidal coil of N turns wound uniformly on a form of non-magnetic material with square cross-section of side 'a'. The mean radius of toroid is R. If magnetic field very over the cross-section area then self-induction is given by

(a) $L = \frac{\mu_0 N^2}{\pi}\left(R - \sqrt{R^2 - a^2}\right)$ (b) $L = \frac{\mu_0 N^2}{\pi}\left(R + \sqrt{R^2 + a^2}\right)$

(c) $L = \frac{\mu_0 N^2}{\pi}\ell n\left(\frac{R + a/2}{R - a/2}\right)$ (d) $L = \frac{\mu_0 a N^2}{2\pi}\ell n\left(\frac{R - a/2}{R + a/2}\right)$

62. A uniformly charged sphere of radius 'a' and total charge Q is centered at the origin and spinning at a constant angular velocity ω about z-axis. The current density at point (r,θ,ϕ) inside the sphere will be

(a) $\sigma\omega r\hat{\phi}$ (b) $\frac{3Q}{4\pi a^3}\omega r\cos\theta\hat{\phi}$ (c) $\frac{3Q}{4\pi a^3}\omega r\sin\theta\,\hat{\phi}$ (d) $\frac{3Q}{4\pi a^3}\omega r^2\sin\theta\,\hat{\phi}$

63. The excitations of a three –dimensional solid are bosonic in nature with their frequency ω and wave-number k are related by $\omega \propto k$. If the chemical potential is zero, the behaviour of the specific heat of the solid at low temperature is proportional to

(a) $T^{1/2}$ (b) $T^{3/2}$ (c) T^3 (d) T

64. N weakly coupled particles obeying Maxwell–Boltzmann statistics may each exizt in one of the 3 non-degenerate energy levels of energies –E, 0 ,+E. The system is in contact with a thermal reservoir at temperature T. The value of the maximum possible entropy of the system is

(a) $3NK\ell n2$ (b) $3NK$ (c) ∞ (d) $NK\ell n3$

65. A one –dimensional quantum harmonic oscillator (whose ground state energy is $\hbar\omega/2$) is in thermal equilibrium with a heat bath at temperature T. The value of root-mean square fluctuation in energy about ,is

(a) $\frac{1}{2\sinh\left(\frac{\hbar\omega}{2kT}\right)}$ (b) $\frac{\hbar\omega}{2\sinh\left(\frac{\hbar\omega}{2kT}\right)}$ (c) $\frac{\hbar\omega}{2}\coth\left(\frac{\hbar\omega}{2kT}\right)$ (d) $\hbar\omega e^{-\left(\frac{\hbar\omega}{2kT}\right)}$

Space for rough work

PHYSICS-PH

Date: 24-01-2016

GATE TEST SERIES-D

ANSWER SHEET

1. (a)	2. (c)	3. (a)	4. (b)	5. (c)	6. (a)	7. (d)
8. (d)	9. (b)	10. (3.02)				
11. (c)	12. (a)	13. (c)	14. (b)	15. (d)	16. (a)	17. (d)
18. (2.06 to 2.09)		19. (2)	20. (d)	21. (a)	22. (1.32 to 1.34)	
23. (d)	24. (c)	25. (a)	26. (0.15)	27. (d)	28. (3.65)	29. (a)
30. (d)	31. (c)	32. (45)	33. (d)	34. (d)	35. (a)	
36. (40 to 43)		37. (a)	38. (b)	39. (a)	40. (c)	41. (86.6)
42. (3)	43. (3)	44. (1.37)	45. (b)	46. (a)	47. (b)	48. (b)
49. (3.2)	50. (c)	51. (a)	52. (b)	53. (b)	54. (3.65 to 3.70)	
55. (b)	56. (c)	57. (b)	58. (c)	59. (b)	60. (b)	61. (c)
62. (c)	63. (c)	64. (d)	65. (b)			