TEST SERIES CSIR-UGC-NET/JRF Dec. 2016

BOOKLET SERIES E

Paper Code 05

Test Type: TEST SERIES

PHYSICAL SCIENCES

Duration: 3:00 Hours

Date: 09-12-2016

Maximum Marks: 200

Read the following instructions carefully:

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

Part - A: This part shall carry 20 questions. The candidate shall be required to answer any 15 questions. Each question shall be of **2 marks.**

Part - B: This part shall contain 25 questions covering the topics given in the Part 'B' of syllabus. The candidates are required to answer any 20 questions. Each question shall be of **3.5 Marks.**.

Part - C: This part shall contain **30** questions from Part - C of the syllabus. The candidates are required to answer any 20 questions. Each question shall be of **5 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. Each of the following pairs of words hides a number, based on which you can arrange them in ascending order. Pick the correct answer.

   I. Cloth reel

   J. Silent wonder

   K. Good tone

   L. Bronze rod

   (a) L, K, J, I (b) I, J, K, L (c) K, L, J, I (d) K, J, I, L

2. The maximum number of points formed by intersection of all pairs of diagonals of convex octagon is

   (a) 70 (b) 400 (c) 120 (d) 190

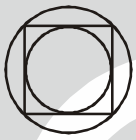
3. Let r be a positive number satisfying $r^{(1/1234)} + r^{(-1/1234)} = 2$. Then $r^{4321} + r^{-4321} = ?$

   (a) 2 (b) $2^{(4321/1234)}$ (c) 2^{3087} (d) 2^{1234}

4. "The clue is hidden in this statement", read the note handed to Sherlock by Moriarty, who hid the stolen treasure in one of the ten pillars. Which pillar is it?

   (a) X (b) II (c) III (d) IX

5. There is an inner circle and an outer circle around a square. What is the ratio of the area of the outer circle to that of the inner circle



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

6. Most Indian tropical fruit trees produce fruits in April-May. The best possible explanation for this is

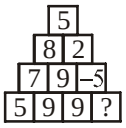
   (a) optimum water availability for fruit production

   (b) the heat allows quicker ripening of fruit

   (c) animals have no other source of food in summer

   (d) the impending monsoon provides optimum conditions for propagation

7. The missing number is



   (a) –19 (b) –5 (c) 9 (d) –9

8. It takes 2 hours for Tiwari and Deo to do a job. Tiwari and Hari take 3 hours to do the same job. Deo and Hari take 6 hours to do the same job. Which of the following statements is incorrect?

   (a) Tiwari alone can do the job in 3 hours (b) Deo alone can do the job in 6 hours

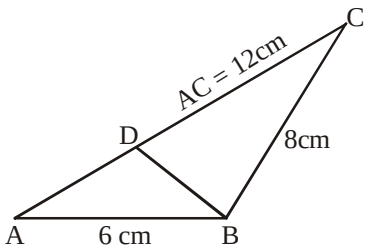
   (c) Hari does not work at all (d) Hari is the fastest worker

9. Abdul travels thrice the distance Catherine travels, which is also twice the distance that Binoy travels. Catherine's speed is 1/3 of Abdul's speed, which is also 1/2 of Binoy's speed. If they start at the same time then who reaches first?

   (a) Both Abdul and Catherine (b) Binoy

   (c) Catherine (d) All three together

10. D is a point on AC in the following triangle such that $\angle ADB = \angle ABC$. Then BD (in cm) is



(a) 8 (b) 6 (c) 3 (d) 4

11. A bicycle tube has a mean circumference of 200 cm and a circular cross-section of diameter 6cm. What is the approximate volume of water (in cc) required to completely fill the tube, assuming that it does not expand?

(a) 600π (b) 1200π (c) 3600π (d) 1800π

12. If 137 + 276 = 435 how much is 731 + 672?

(a) 534 (b) 1403 (c) 1623 (d) 1531

13. Abhishek is elder to Savar.
Savar is younger to Anshul
Which of the given conclusion is logically valid and is inferred from the above statements?

(a) Abhishek is elder to Anshul (b) Anshul is elder to Abhishek
(c) Abhishek and Anshul are of the same age (d) No conclusion follows

14. If $|-2X+9|=3$ then the possible value of $|-X|-X^2$ will be

(a) 30 (b) –30 (c) –42 (d) 42

15. All professors are researchers
Some scientists are professors.
Which of the given conclusion is logically valid and is inferred from the above arguments:

(a) All scientists are researchers (b) All professors are scientists
(c) Some researchers are scientists (d) No conclusion follows

16. A watch which gains uniformly is 2 minutes low at noon on Monday and is 4 min. 48 sec fast at 2 p.m. on the following Monday. When was it correct?

(a) 2 p.m. on Tuesday (b) 2 p.m. on Wednesday
(c) 3 p.m. on Thursday (d) 1 p.m. on Friday

17. If books bought at prices ranging from Rs. 200 to Rs. 350 are sold at prices ranging from Rs. 300 to Rs. 425, what is the greatest possible profit that might be made in selling eight books?

(a) Rs. 400 (b) Rs. 600
(c) Cannot be determined (d) None of these

18. In what ratio must water be mixed with milk to gain 20% by selling the mixture at cost price?

(a) 2 : 3 (b) 1 : 5
(c) 1 : 2 (d) 3 : 4

19. In how many ways can 21 books on English and 19 books on Hindi be placed in a row on a shelf so that two books on Hindi may not be together?

(a) 3990 (b) 1540 (c) 1995 (d) 3672

20. Probability than a man will be alive 25 years hence is 0.3 and the probability that his wife will be alive after 25 years hence is 0.4. Find the probability that 25 years hence if only the woman will be alive.

(a) 0.12 (b) 0.18 (c) 0.28 (d) 0.58

PART-B

21. The equation of state for adiabatic process performed on an ideal gas consisting of non-relativistic rigid triangular molecular in terms of pressure (P) and volume (V) is given by

(a) $PV^{9/7} = \text{constant}$ (b) $PV^{7/5} = \text{constant}$ (c) $PV^{5/3} = \text{constant}$ (d) $PV^{4/3} = \text{constant}$

22. Which of the following can exhibit Bose-Einstein condensation, even in principle?

(a) Hydrogen (b) Lithium (c) Helium (d) Photon

23. Two gases are separated by an impermeable but movable and conducting partition in an isolated container. Both gases are in which type of equilibrium?

(a) Thermal-chemical (b) Thermal-mechanical
(c) Chemical-mechanical (d) Thermodynamics

24. Consider a system of *N* non-interacting classical linear harmonic oscillates (each of mass *m* and angular frequency ω) in thermal equilibrium at temperature *T*. The enthalpy of the system is

(a) $NkT \ln\left(\frac{\hbar\omega}{kT}\right)$ (b) NkT (c) $2NkT$ (d) $\frac{5}{2}NkT$

25. If a polynomial $f(x) = 4x^3 - 9x^2 + 11x + 2$ is written in terms of Legendre Polynomials $P_n(x)$ [n = 0, 1, 2, ...]

i.e. $f(x) = \sum_{n=0}^{\infty} k_n P_n(x)$, then k_3 will be equal to

(a) 5/8 (b) 8/3 (c) 3/8 (d) 8/5

26. From a box containing 10 cards, numbered 1, 2, 3, ...10 four cards are drown together. What is the probability that their sum is even ?

(a) 13/18 (b) 11/21 (c) 7/16 (d) 8/25

27. The value of the integral $\oint_C \frac{z\,dz}{(9-z^2)(z+i)}$, where C is a circle |z| = 2 in the argand plane, described in the positive sense is equal to

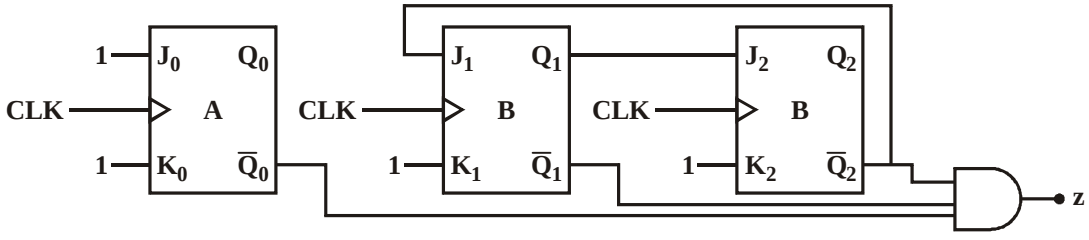
(a) $\pi/2$ (b) $\pi/4$ (c) $\pi/3$ (d) $\pi/5$

28. The eigenvalues of the matrix $P = \begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix}$ are

(a) $\frac{1}{2}(\sqrt{3} \pm i)$ When $\theta = 45^o$ (b) $\frac{1}{2}(1 \pm \sqrt{3}i)$ When $\theta = 60^o$

(c) $\frac{1}{2}(\sqrt{3} \pm i)$ When $\theta = 60^o$ (d) $\frac{1}{2}(1 \pm \sqrt{3}i)$ When $\theta = 30^o$

29. Consider a sequential circuit using three J-K flip-flops and one AND gate shown in figure. Output of the circuit becomes '1' after every N-clock cycles. The value of N is

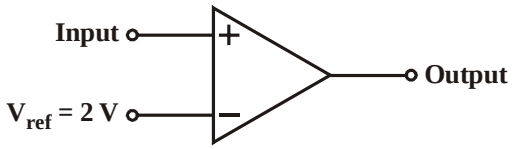


(a) 4 (b) 7 (c) 8 (d) 6

30. A 4-bit modulo-6 ripple counter uses JK flip-flop. If the propagation delay of each flip-flop is 50 ns, the maximum clock frequency that can be used is equal to

(a) 5 MHz (b) 10 MHz (c) 4 MHz (d) 20 MHz

31. If the input to the following ideal comparator is a sinusoidal signal of 8 V (peak to peak) without any DC componen., the output of the comparator has a duty cycle of



(a) 1/2 (b) 1/3 (c) 1/6 (d) 1/12

32. Suppose an electron is in a state described by the wavefunction

$$\psi = \frac{1}{\sqrt{4\pi}}\left(e^{i\phi}sin\theta + cos\theta\right)g(r)$$

The probability of finding the zero value of the z-component of the angular momentum is

(a) 1/2 (b) 1/3 (c) 2/3 (d) 0

33. A polar representation of the creation and annihilation operators for a simple harmonic oscillator can be introduced as $a = \sqrt{N+1}e^{i\phi}$ and $a^{\dagger} = e^{-i\phi}\sqrt{N+1}$

The operators N and are assumed to be Hermitian. Given $[a, a^{\dagger}] = 1$, the value of $\left[e^{i\phi}, N\right]$ is

(a) 0 (b) $-e^{-i\phi}$ (c) $e^{i\phi}$ (d) $\cos\phi$

34. Consider the following Hamiltonian:

$$\hat{H} = A\vec{S}.\hat{n}$$

where A is constant, $\vec{S}$ is the spin angular momentum of a spin-1/2 particle and $\hat{n}$ is a unit vector parametrized in terms of two angles as $\left(n_x, n_y, n_z\right) = \left(\sin\theta\cos\varphi, \sin\theta\sin\varphi, \cos\theta\right)$

The energy eigenvalues are

(a) $\pm\frac{1}{2}A\hbar\cos\theta$ (b) $\pm\frac{1}{2}A\hbar\sin\theta$ (c) $\pm\frac{1}{2}A\hbar$ (d) $\pm\frac{3}{2}A\hbar$

35. If $\vec{L}$ be angular momentum and $\hat{n}$ be a unit vector then value of Poisson bracket $\left[\vec{L}, \vec{L}.\hat{n}\right]$ is

(a) $\hat{n}\times\vec{L}$ (b) $\vec{L}\times\hat{n}$ (c) $\vec{L}.\hat{n}$ (d) zero

36. The ground state wave function of a hydrogen atom is given as the following:

$$\psi_{100} = \frac{1}{\sqrt{\pi}}\left(\frac{1}{a_0}\right)^{3/2} e^{-r/a_0}$$

The uncertainity in the measurement of the distance of the electron from the nucleus, will be

(a) $\frac{\sqrt{3}}{4}a_0$ (b) $\frac{\sqrt{3}}{2}a_0$ (c) $\frac{3}{4}a_0$ (d) $\frac{2}{\sqrt{3}}a_0$

37. Two dynamical variables *A* and *B* are defined as $A = \frac{1}{2}(p^2 + q^2),\ B = \tan^{-1}\left(\frac{q}{p}\right)$. Value of Poisson bracket [*A*, *B*] is

(a) 0 (b) 1 (c) –1 (d) *pq*

38. A particle of mass *m* and charge *q* is moving in electromagnetic potential $(\vec{A}, \phi)$. If $\vec{v}$ be velocity of the particle and $\vec{p}$ be canonical momentum then Hamiltonian for the particle can be written as

(a) $\frac{p^2}{2m} + q\vec{A}\cdot\vec{v} + q\phi$ (b) $\frac{p^2}{2m} - q\vec{A}\cdot\vec{v} + q\phi$

(c) $\frac{1}{2}mv^2 + q\phi$ (d) $\frac{1}{2}mv^2 - q\phi + q\vec{A}\cdot\vec{v}$

39. A satellite moves around the Earth in elliptical orbit. If ratio of maximum to minimum speed of satellite is 3 then eccentricity of orbit is

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

40. Lagrangian of a system is given as $L = \frac{1}{2}\dot{q}^T A\dot{q} - V(q)$, Hamiltonian of system can be written as:

(Here $\dot{q}$ is column matrix, $\dot{q}^T$ its transpose and *A* is square matrix and *p* is canonical momentum).

(a) $\frac{1}{2}p^T Ap + V$ (b) $\frac{1}{2}p^T A^{-1}p + V$

(c) $\frac{1}{2}p^T A^T p + V$ (d) $\frac{1}{2}p^T A^{\dagger}p + V$

41. The electric and magnetic fields of an electromagnetic wave in vacuum are given by $\vec{E} = \hat{i}E_0\sin(kz - \omega t)$ and $\vec{B} = \hat{j}B_0\sin(kz - \omega t)$, respectively. The total energy associated with the wave is:

(a) $\frac{\in_0 E_0^2}{4}$ (b) $\frac{\in_0 E_0^2}{2}$ (c) $\frac{B_0^2}{\mu_0}$ (d) $\frac{B_0^2}{4\mu_0}$

42. In a region of space, a time dependent magnetic field, $B(t) = 0.4t$ Tesla, points vertically upwards. Consider a horizontal circular loop of radius 2 cm in this region. The magnitude of the electric field (in mV/m) induced in the loop is

(a) 2.00 (b) 4.00 (c) 6.25 (d) 12.50

43. In heat transport, the rate of flow $\frac{dQ}{dt}$ through a solid slab is related to the temperature difference ΔT as, $\frac{dQ}{dt} = \frac{kA\Delta T}{L}$. Here k, A and L are thermal conductivity, cross-sectional area and thickness of the slab, respectively. In actual experiment, assume that the percentage errors in the measurement of heat flow rate, each length scale and temperature difference are 3%, 1% and 5% respectively. The percentage error in the measurement of thermal conductivity is

(a) 6% (b) 9% (c) 10% (d) 11%

44. A plane electromagnetic wave with

$$\vec{H} = 0.5\cos\left(4\times10^8 t - 2z\right)\hat{y}\ \text{A/m};\quad \vec{E} = 80\,\pi\cos\left(4\times10^8 t - 2z\right)\hat{x}\ \text{V/m}$$

travelling in an isotropic magnetic dielectric medium. The relative permeability (μ_r) of medium is:

(a) 4 (b) 2.25 (c) 1.25 (d) 2

45. A sphere of radius R has surface charge density $\sigma = \sigma_0 \sin\theta\cos\phi$. The electric dipole moment $(\vec{p})$ about the centre of sphere is

(a) $\frac{4}{3}\pi\sigma_0 R^3\,\hat{i}$ (b) $\pi\sigma_0 R^3\,\hat{i}$ (c) $\frac{4}{3}\pi\sigma_0 R^3\,\hat{j}$ (d) $\frac{\pi\sigma_0 R^3}{3}\,\hat{j}$

PART-C

46. The Helmholtz free energy (A) of a thermodynamics system in terms of volume (V) and temperature (T) is given by

$$A = a + bT\left(1 - \ell nT\right) - cT\ln V$$

where *a*, *b* and *c* are constants. The enthalpy (H) of the system is

(a) $a + (b+c)T$ (b) $b\ln T + c\ln V$ (c) $a + bT$ (d) $b\ln T - c\ln V$

47. A process is performed on 2 moles of an ideal mono-atomic gas in which its entropy depends on absolute temperature T as $S = \frac{\alpha}{T}$, where α is a constant. What is the work performed by the gas if its temperature varies from T_1 to T_2?

(a) $\alpha\ln\left(\frac{T_1}{T_2}\right)$ (b) $+\alpha\left[\frac{1}{T_2} - \frac{1}{T_1}\right]$

(c) $\alpha\ln\left(\frac{T_1}{T_2}\right) + 3R\left(T_1 - T_2\right)$ (b) $\alpha\left[\frac{1}{T_2} - \frac{1}{T_1}\right] + \frac{3}{2}R\left(T_1 - T_2\right)$

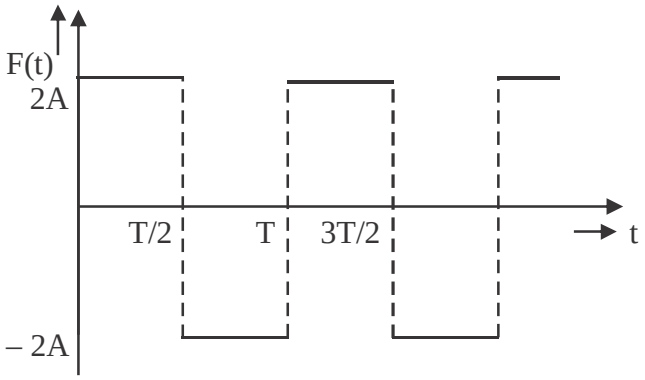
48. For a system of non-interacting one-dimensional quantum oscillators of angular frequency ω, the value of enthalpy in the limit per oscillator $T \to 0$, is

(a) 0 (b) $\frac{1}{2}\hbar\omega$ (c) $\frac{3}{2}\hbar\omega$ (d) $\hbar\omega\ln 2$

49. Consider an ideal gas of *N* Fermions inside a 3-D container of volume V. Assume that the dispersion relation $\in(k) \propto k$, the ratio of the ground state energy per particle to the Fermi energy at absolute zero of temperature is

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

50. The Laplace transform of the following square wave



is equal to

(a) $\frac{A}{S}\tanh\frac{ST}{4}$ (b) $\frac{A}{S}\coth\frac{ST}{4}$ (c) $\frac{2A}{S}\tanh\frac{ST}{4}$ (d) $\frac{2A}{S}\coth\frac{ST}{4}$

51. Consider the differential equation $\frac{dy}{dx} = ay - by^2$, where $a, b > 0$ and $y(0) = y_0$. As $x \to \infty$, the solution y(x) will tend to

(a) 0 (b) a/b (c) b/a (d) y_0

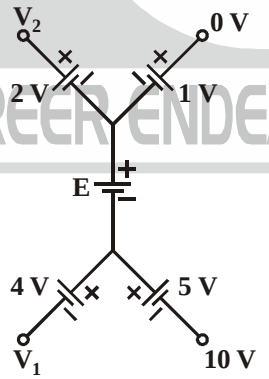
52. The work done by the force $\vec{F} = 4y\hat{i} - 3xy\hat{j} + z^2\hat{k}$ in moving the particle over the circular path $x^2 + y^2 = 1$ from (1,0,0) to (0,1,0) will be

(a) $\pi + 1$ (b) $\pi - 1$ (c) $-\pi - 1$ (d) $-\pi + 1$

53. Consider the function: $f(x) = \int_0^x \left(t^2 - 3t + 2\right) dt$. The function $f(x)$ has

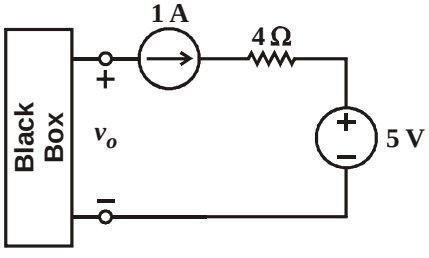
(a) maximum at x=1 and x=2. (b) minimum at x=1 and minimum at x=2.
(c) maximum at x=1 and minimum at x=2. (d) minimum at x=1 and x=2.

54. In the circuit of the figure, the value of the voltage source *E* is



(a) –16 V (b) 4 V (c) –6 V (d) 16 V

55. The voltage v_o in figure is always equal to



(a) 1 V (b) 5 V (c) 9 V (d) None of these

56. Generating function for a canonical transformation is $F(p,Q) = -Q\left[1+\ln\left(\frac{p^2}{4Q}\right)\right]$. The other generating function $F_1(p,P)$ for this canonical transformation is

(a) $-\frac{1}{2}p^2e^{-P}$ (b) $-pe^{-P}$ (c) $\frac{e^{-P}}{p^2}$ (d) $-\frac{3}{4}p^2e^{-P}$

57. Hamiltonian of a system is $H = qp^2 - qp + bp$. If at $t = 0,\ p = -1$, then $p(t)$ is given as

(a) $\frac{-2e^t}{e^t+1}$ (b) $\frac{e^t}{e^t-2}$ (c) $\frac{-(e^t+1)}{2}$ (d) $-e^t$

58. Generalised potential for a system is $U = \frac{1}{r}\left[1+\frac{\dot{r}^2}{c^2}\right]$ where c is a constant. Corresponding generalised force is

(a) $\frac{\dot{r}^2 - 2r\dot{r}}{r^2c^2}$ (b) $\frac{1}{r^2}\left[1-\frac{\dot{r}^2-2r\dot{r}}{c^2}\right]$

(c) $\frac{1}{r^2}\left[1+\frac{\dot{r}^2-2r\dot{r}}{c^2}\right]$ (d) $\frac{1}{r^2}\left[1+\frac{\dot{r}^2+2r\dot{r}}{c^2}\right]$

59. A bead of mass 'm' is constrained to move undergravity along a planer rigid wire that has parabolic shape $y = x^2/\ell$, where 'x' and 'y' are respectively horizontal and vertical. Lagrangian of system is

(a) $\frac{m\dot{x}^2}{2}\left(1+\frac{4x^2}{\ell^2}\right)-\frac{mgx^2}{\ell}$ (b) $\frac{m\dot{x}^2}{2}\left(1-\frac{4x^2}{\ell^2}\right)-\frac{mgx^2}{\ell}$

(c) $\frac{m\dot{x}^2}{2}\left(1+\frac{x^2}{\ell^2}\right)+\frac{mgx^2}{\ell}$ (d) $\frac{m\dot{x}^2}{2}\left(1-\frac{x^2}{\ell^2}\right)-\frac{mgx^2}{\ell}$

60. A measurement of the energy $\hat{H} = \hat{S}_x$, for a particle with spin 1/2 gives surely $H = 1/2$. In the above expression, $\hat{S}_x$ is the x component of the spin. Assuming $\hbar = 1$, The energy corrected to first order on this state induced by the perturbation $\hat{H}' = \varepsilon\hat{S}_+\hat{S}_-$, where $\hat{S}_\pm$ are the raising and lowering operators, is

(a) $\pm\frac{1}{2}$ (b) $\frac{1}{2}+\frac{\varepsilon}{2}$ (c) $\frac{1}{2}-\frac{\varepsilon}{2}$ (d) $\frac{1}{2}-\varepsilon$

61. Let us consider a system whose Hamiltonian is $\hat{H} = k\frac{L_+L_-}{\hbar}$

where $L_\pm$ are the raising and lowering operators for the z component of the orbital angular momentum and k is constant of suitable dimension. At time $t = 0$ the system is described by the following wave- function

$$\psi(\theta,\phi) = A\sin\theta\sin\phi$$

where θ, ϕ are usual spherical polar co-ordinates. The expectation value of energy of the system at $t = 0$, is

(a) $2\hbar$k (b) $3\hbar$k (c) $\hbar$k (d) $-\hbar$k

62. An atom with the orbital angular momentum l = 1 is subject to a constant magnetic field $\vec{B} = B(\sin\theta\cos\phi, \sin\theta\sin\phi, \cos\phi)$, where B is a constant parameter and θ, ϕ give the direction of magnetic field $\vec{B}$ in spherical polar co-ordinates. The atom is described by the following Hamiltonian $H = \mu\vec{L}.\vec{B}$, where μ is a constant magnetic moment. The possible values of the energies of the atom are given by

(a) $\mu B\sin\theta\cos\theta, \mu B\sin\theta\sin\phi, \mu B\cos\theta$ (b) $+\mu B\sin\theta, -\mu B\sin\theta, +\mu B\cos\theta$

(c) $+\mu B\sin\theta, -\mu B\sin\theta, +\mu B\cos\phi$ (d) $+\mu B\hbar, -\mu B\hbar$, and 0

63. The average value of the energy of a particle of mass m having wave-function $\Psi(\vec{r}) = C\exp\left[-2\alpha(\vec{r}-\vec{r}_0)^2\right]$ where $\alpha^2 = \frac{m\omega}{2\hbar}$ and Hamiltonian of the particle is given by $H = \frac{\vec{p}^2}{2m} + \frac{m\omega^2\vec{r}^2}{2}$, is

(a) $\frac{3}{2}\hbar\omega$ (b) $\left(\frac{2\alpha}{\pi}\right)^{\frac{3}{2}}\frac{3}{2}\hbar\omega$ (c) $\frac{3}{2}\hbar\omega + \frac{m\omega^2\vec{r}_0^{\,2}}{2}$ (d) 0

64. Iron (Fe) has fcc lattice with lattice parameter a = 1.0 Å. A beam of electrons 150 eV energy falls on powder Iron (Fe) sample. The angle of diffraction for Ist XRD peak is

(a) 30º (b) 60º (c) 90º (d) 120º

65. The dispersion relation between the vibrational frequency 'ω' and the wave vector 'k' of a monatomic linear lattice of lattice constant 'a' is given by $\omega^2 = \frac{2C}{M}(1-\cos ka)$, where C is the nearest neighbour coupling constnat and M is the mass of each atom.

Which of the following statement is INCORRECT?

(a) ω is a periodic function of k with a period of $2\pi/a$

(b) Maximum vibrational frequency is $2\sqrt{C/M}$

(c) The group velocity at centre of Brillouin zone is $2\sqrt{C/M}$

(d) In the limit $ka << 1$, the velocity of sound is independent of frequency.

66. In a cyclotron set up, a klystron radiation 2.4×10^{10} Hz is used for a sample, the resonance absorption occurs at a magnetic field of 9.4×10^{-2} T. The effective mass (m^*) of electron in the sample is

(a) 1.0×10^{-32} kg (b) 1.0×10^{-31} kg (c) 6.3×10^{-31} kg (d) 3.2×10^{-31} kg

67. Consider second line of Lyman series in Hydrogen atom. Under the application of weak magnetic field, the fine structure lines split into

(a) 4 components (b) 6 components (c) 10 components (d) 12 components

68. A sodium atom spontaneously decays into 3p state from 4s state with a life time of 10 ns. The wavelength of the emitted photon is 590 nm. The Einstein coefficient of spontaneous emission is

(a) $10^8\,Hz$ (b) $10^7\,Hz$ (c) $10^9\,Hz$ (d) $10^{12}\,Hz$

69. A He-Ne LASER operating at 632.8 nm consists of discharge tube of length 0.4 m with mirrors bonded to the ends. The gain band width of the laser medium is 1.5 GHz. The coherence length (l_c) of laser light is:

(a) 2.0 m (b) 0.2 m (c) 0.4 m (d) 4.0 m

70. A small particle having charge 'q' moves along a circle of radius 'r' with constant *v*. Power radiated by the charge is

(a) $\frac{2qv^4}{3\pi \in_0 c^3 r^2}$ (b) $\frac{2q^2v^4}{3\pi \in_0 c^3 r^2}$ (c) $\frac{q^2v^4}{6\pi \in_0 c^3 r^2}$ (d) $\frac{q^2v^2}{6\pi \in_0 c^3 r^2}$

71. In an inertial reference frame '*S*' there are two mutually perpendicular and uniform fields : an electric field of strength 40 kV/m and a magnetic field of strength 0.2 mT exist. In another inertia frame 'S'', no electric field is observed. The value of magnetic field in 'S'' frame is

(a) 0.15 mT (b) 0.25 mT (c) 0.3 mT (d) 0.4 mT

72. A dielectric sphere of radius 'R' has polarization $\vec{P} = \beta \hat{r}$. The electric potential at centre of sphere is

(a) $\frac{\beta R}{\in_0}$ (b) $-\frac{\beta R}{\in_0}$ (c) $\frac{\beta}{3\in_0}$ (d) $\frac{\beta}{\in_0}$

73. The maximum kinetic energy of the positron emitted in kaon decay at rest $K^+ \rightarrow e^+ + \pi^0 + \nu_e$ is
[Given that the rest mass energies of kaon, electron and π- meson are 494 MeV, 0.50 MeV and 135 MeV respectively].

(a) 358.5 MeV (b) 228 MeV (c) 282 MeV (d) 135 MeV

74. The kinetic energy of the α-particle emitted in the α-decay of $^{226}_{88}Ra$ according to reaction

$^{226}_{88}Ra \longrightarrow {}^{222}_{86}Rn + \alpha$ is

[Given that m(Ra) = 226.025403 a.m.u. ; m(Rn) = 222.017571 a.m.u. ; m(α) = 4.002603 a.m.u.]

(a) 2.34 MeV (b) 4.87 MeV (c) 4.78 MeV (d) 2.44 MeV

75. Choose the correct statement from the following :

(a) The reaction $\pi^- + p \rightarrow K^- + \Sigma^+$ is allowed via strong interaction.
(b) The Lepton number of the strange quark is 1/3.
(c) The reaction $\pi^+ \rightarrow \mu^+ + \nu_\mu$ proceeds via strong interaction.
(d) The isospin of the down quark is 1/2.

All the very Best for NET "18th Dec. 2016" Exam

Space for rough work

PHYSICAL SCIENCES
TEST SERIES-(E)

Date : 09-12-2016

PART-A

1. (a)	2. (a)	3. (a)	4. (d)	5. (b)	6. (d)	7. (a)
8. (d)	9. (b)	10. (d)	11. (d)	12. (a)	13. (d)	14. (b)
15. (c)	16. (b)	17. (d)	18. (b)	19. (b)	20. (c)	

PART-B

21. (d)	22. (d)	23. (b)	24. (b)	25. (d)	26. (b)	27. (d)
28. (b)	29. (d)	30. (a)	31. (b)	32. (b)	33. (d)	34. (c)
35. (a)	36. (b)	37. (b)	38. (c)	39. (b)	40. (b)	41. (b)
42. (b)	43. (a)	44. (d)	45. (a)			

PART-C

46. (a)	47. (c)	48. (b)	49. (c)	50. (c)	51. (b)	52. (c)
53. (a)	54. (d)	55. (d)	56. (d)	57. (b)	58. (b)	59. (a)
60. (b)	61. (c)	62. (d)	63. (c)	64. (d)	65. (c)	66. (b)
67. (c)	68. (a)	69. (b)	70. (c)	71. (a)	72. (b)	73. (b)
74. (c)	75. (d)					