HIMACHAL PRADESH
PUBLIC SERVICE COMMISSION

SCREENING TEST FOR THE POST OF LECTURER APPLIED SCIENCES AND HUMANITIES (POLYTECHNIC) PHYSICS (CLASS-I GAZETTED) IN THE DEPARTMENT OF TECHNICAL EDUCATION, H.P.

TIME ALLOWED: 2.00 HOURS. **MAXIMUM MARKS: 100**

Write your Roll. No.

Note: All questions carry equal marks. Out of four options given at the end of each question, please indicate the correct option.

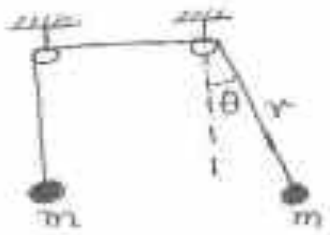
Q. 1. Two equal masses are connected by a string that hangs over two pulleys, as shown. The left mass moves in a vertical line, but the right mass is free to swing back and forth. The equations of motion for r and θ are:

(a) $2\ddot{r} = r\dot{\theta}^2 - g(1-\cos\theta)$, $\ddot{\theta} = -\frac{2\dot{r}\dot{\theta}}{r} - \frac{g\sin\theta}{r}$

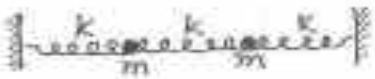
(b) $\ddot{r} = 2r\dot{\theta}^2 - g(1-\cos\theta)$, $\ddot{\theta} = \frac{2\dot{r}\dot{\theta}}{r} + \frac{g\sin\theta}{r}$

(c) $\ddot{r} = r\dot{\theta}^2 - 2g(1-\cos\theta)$, $\ddot{\theta} = -\frac{2\dot{r}\dot{\theta}}{r} - \frac{g\cos\theta}{r}$

(d) $\ddot{r} = \frac{1}{2}r\dot{\theta}^2 - g(1-\cos\theta)$, $\ddot{\theta} = -\frac{\dot{r}\dot{\theta}}{2r} - \frac{g\sin\theta}{r}$



Q. 2. Consider two masses m, connected to each other by three springs, as shown. The springs have the same spring constant K. What are the normal modes and the corresponding frequencies?



(a) (1,1), ω; (1,-1), $\sqrt{3}\,\omega$ (b) (1,2), ω; (1,-1), $\sqrt{2}\,\omega$

(c) (2,1), ω; (1,1), $\sqrt{3}\,\omega$ (d) (1/2,1/2), ω; (-1,-1), $\sqrt{2}\,\omega$

Q. 3. For the Lagrangian, $L = \frac{m}{2}(5\dot{x}^2 - 2\dot{x}\dot{y} + 2\dot{y}^2) - c(2x - y)$, the conserved momentum is

(a) $m(\dot{x} + 3\dot{y})$ (b) $m(3\dot{x} + 3\dot{y})$ (c) $m(3\dot{x} - 3\dot{y})$ (d) $m(3\dot{x} + 2\dot{y})$

Q. 4. A particle P of mass m_1 collides with another particle Q of mass m_2 at rest. The particle P and Q travel at angles θ and φ, respectively, after the collision with respect to the initial direction of P. The maximum value of θ is given by

(a) $\theta_{max} = \cos^{-1}\left(\sqrt{1 - m_2^2/m_1^2}\right)$ (b) $\theta_{max} = \cos^{-1}\left(\sqrt{1 + m_2^2/m_1^2}\right)$

(c) $\theta_{max} = \sin^{-1}\left(\sqrt{1 - m_2^2/m_1^2}\right)$ (d) $\theta_{max} = \sin^{-1}\left(\sqrt{1 + m_2^2/m_1^2}\right)$

Q. 5. A particle is constrained to move along a circle lying in the vertical xy-plane. According to D'Alembert's principle, its equation of motion is

(a) $\ddot{x}\dot{y} - y\dot{x} - g\dot{x} = 0$ (b) $\ddot{x} - y\dot{x} - g\dot{x} = 0$

(c) $\ddot{x}\dot{y} - \dot{y}\dot{x} - g\dot{x} = 0$ (d) $\ddot{x}y - \dot{y}\dot{x} - g\dot{x} = 0$

Q. 6. The Lagrangian for a certain system is given by,

$L = \frac{1}{2}m(\dot{r}^2 + r^2\dot{\theta}^2) - V(r)$.

The Lagrangian equations of motion are:

(a) $\frac{d}{dt}(m\dot{r}) - mr\dot{\theta}^2 + \frac{\partial V}{\partial r} = 0$, $\frac{d}{dt}(mr^2\dot{\theta}) = 0$

(b) $\frac{d}{dt}(mr^2\dot{\theta}) - mr\dot{\theta}^2 - \frac{\partial V}{\partial r} = 0$, $\frac{d}{dt}(r^2\dot{\theta}) = 0$

(c) $\frac{d}{dt}(m\dot{r}) = 0$, $\frac{d}{dt}(mr^2\dot{\theta}) = 0$

(d) $\frac{d}{dt}(m\dot{r}) - r\dot{\theta}^2 - \frac{\partial V}{\partial r} = 0$, $\frac{d}{dt}(mr\dot{\theta}) = 0$

Q. 7. Which of the following transformationsis canonical?

(a) $Q = q \tan p$, $P = \ln(\sin p)$ (b) $Q = p$, $P = q$

(c) $Q = q^{\alpha} \sin \beta p$; $P = q^{\beta} \sin \alpha p$ (d) none of these

Q. 8. Which of the following corresponds to the required transformation equation for the generating function, $F = \frac{1}{2}m\omega q^2 \cot Q$:

(a) $Q = \sin^{-1}\left[m\omega q / \sqrt{m^2\omega^2 q^2 + p^2}\right]$

(b) $Q = \cos^{-1}\left[m\omega q^2 / \sqrt{m^2\omega^2 q^2 + p^2}\right]$

(c) $P = \frac{1}{2}m\dot{\omega}q^2 + \frac{p^2}{2m\omega}$

(d) $P = \frac{1}{2}m\omega q + \frac{p}{2m\omega}$

Q. 9. For the Hamiltonian, $H = \frac{p^2}{2} - \frac{1}{2q^2}$, which of the following quantities is a constant o motion:

(a) $\frac{pq}{2} - Ht$ (b) $\frac{pq^2}{2} - H$ (c) $\frac{pq}{2} - H$ (d) $\frac{p^2q}{2} - Ht$

Q. 10. For the canonical transformations, $Q = \frac{1}{2}(p^2 + q^2)$, $P = -\tan^{-1}(q/p)$, find $[Q, P]$.

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

Q. 11. Which of the following objects in the solar system has largest semi-major axis of the orbit in astronomical units)?

(a) Pluto (b) Venus (c) Neptune (d) Saturn

Q. 12. Which of the following represents the centrifugal force?

(a) $m\vec{\omega}\times\vec{r}$ (b) $-m\vec{\omega}\times(\vec{\omega}\times\vec{r})$

(c) $-2m\vec{\omega}\times\vec{v}$ (d) $m\vec{\omega}\times(\dot{\vec{\omega}}\times\vec{r})$

Q. 13. The moment of inertia tensor for a homogeneous cube of sides b, density ρ and mass M is ($\beta = M\,b^2$)

(a) $\beta\begin{vmatrix} 2/3 & -1/4 & -1/4 \\ -1/4 & 2/3 & -1/4 \\ -1/4 & -1/4 & 2/3 \end{vmatrix}$ (b) $\beta\begin{vmatrix} 1/3 & -1/4 & -1/3 \\ -1/4 & 1/3 & -1/4 \\ -1/3 & -1/4 & 1/3 \end{vmatrix}$

(c) $\beta\begin{vmatrix} 2/3 & -1/3 & -1/3 \\ -1/3 & 2/3 & -1/3 \\ -1/3 & -1/3 & 2/3 \end{vmatrix}$ (d) $\beta\begin{vmatrix} 4/3 & -1/4 & -1/4 \\ -1/4 & 4/3 & -1/4 \\ -1/4 & -1/4 & 4/3 \end{vmatrix}$

Q. 14. A typical element of a group of all orthogonal matrices of order 2 with determinant −1 is:

$$\begin{pmatrix} \cos\varphi & \sin\varphi \\ \sin\varphi & \cos\varphi \end{pmatrix}.$$

Its generator is a

(a) Pauli spin matrix, σ_y

(b) Pauli spin matrix, σ_x

(c) Pauli spin matrix, σ_z

(d) None of the above

Q. 15. Which of the following commutation relations is correct?

(a) $[J_x, J_y] = J_z$ (b) $[L_x, L_y] = L_z$ (c) $[x, p_x] = 0$ (d) $[L^2, L_z] \neq 0$

Q. 16. At a quark level, which of the following decays corresponds to decay of Λ ?

(a) $(udd) \rightarrow (d\bar{u}) + (uud)$ (b) $(udd) \rightarrow (d\bar{u}) + (uud)$

(c) $(udd) \rightarrow (du) + (uud)$ (d) $(ud\bar{d}) \rightarrow (du) + (uud)$

Q. 17. Which of the following property (properties) is (are) true for nuclear forces?

(i) charge independent (ii) repulsive at very short distances

(iii) saturated (iv) central (v) velocity-dependent

(a) (i), (ii), (iii), and (v) (b) (i) only (c) (i), (iii), (iv),and (v) (d) all of the above

Q. 18. In the first experiment, Bainbridge analyzed germanium vapours using a strong magnetic field across the analyzing chamber and the semicircular path of the ions was about 40 cm. What was the order of magnetic field ?

(a) 0.5 KG (b) 15 KG (c) 150 KG (d) 1500 KG

Q. 19. A photon of energy 3 KeV collides elastically with an electron initially at rest. If the photon emerges at an angle of 60^0, find the kinetic energy of the recoiling electron.

(a) 0.9 eV (b) 3.9 eV (c) 1.6 eV (d) 8.6 eV

Q. 20. If the energy of the α-particle emitted by ^{241}Am is 5.48 MeV, find the closest distance it can approach a Au nucleus.

(a) 2.6×10^{-19}m (b) 3.2×10^{-10}m (c) 4.1×10^{-14}m (d) 1.6×10^{-8}m

Q. 21. Find the energy required (in Joules) to break ^{12}C nucleus into 3 α-particles. Given, $m_{12_C} = 12$ amu and $m_\alpha = 4.0026$ amu.

(a) 1.16×10^{-12} (b) 3.94×10^{-10} (c) 1.93×10^{-8} (d) 3.24×10^{-6}

Q. 22. Which of the following terms in semiempirical mass formula reflects the stability of nuclei?

(a) surface energy term (b) Coulomb energy term

(c) asymmetry energy term (d) pairing energy term

Q. 23. According to the nuclear shell model, the ground state spin and parity of $^{33}_{16}S$ nucleus is

(a) $3/2^-$ (b) $1/2^+$ (c) $5/2^+$ (d) $3/2^+$

Q. 24. Find the height of potential barrier faced by an α-particle inside the $^{226}_{88}Ra$ nucleus.

(a) 31.2 MeV (b) 16.9 MeV (c) 8.6 MeV (d) 52.9 MeV

Q. 25. The straggling of heavy ions at low energy is mostly a consequence of

(a) finite momentum (b) finite angular momentum

(c) fluctuating state of ionization (d) multiple scattering

Q. 26. A 0.01 mm thick $^{7}_{3}Li$ target is bombarded with a beam of flux of 10^{13} particles/cm^2-s. If 10^8 neutrons are produced in one second, the total cross section for this reaction is (Given, density of lithium = 500 Kg/m^3)

(a) 0.232 b (b) 1.345 b (c) 1.94 mb (d) 19.4 mb

Q. 27. Linear absorption coefficient of Pb for 1.0 MeV γ-rays is 0.75 cm^{-1}. Calculate the thickness of lead required to reduce the intensity of γ-rays to $\frac{1}{100}$ times.

(a) 6.6 cm (b) 10.2 cm (c) 1.3 cm (d) 2.4 cm

Q. 28. In a drift tube portion of a linear accelerator, protons are accelerated from 0.75 MeV to 100.0 MeV. If an AC voltage of frequency 200 MHz is applied, find the length of the first drift tube.

(a) 0.003 m (b) 0.03 m (c) 0.005 m (d) 0.05 m

Q. 29. The maximum magnetic field in a betatron is 1.0 T. If the radius of doughnut is 1.0 m and the frequency of variation of magnetic field is 60 Hz, find the energy gained by electron per turn.

(a) 560 eV (b) 920 eV (c) 1230 eV (d) 1508 eV

Q. 30. The radius of the central wire of a proportional counter is 0.1 mm and the radius of the cylindrical tube is 2.0 cm. Calculate the electric field developed at the surface of the wire, when the potential difference of 1500 Volts is applied between the two.

(a) 2.8×10^6 V/m (b) 7.3×10^5 V/m (c) 1.6×10^4 V/m (d) 3.9×10^3 V/m

Q. 31. Which of the following is (are) dominant decay mode (modes) for charged pions?

(i) $\pi^+ \longrightarrow \mu^+ + \nu_\mu$ (ii) $\pi^- \longrightarrow \mu^- + \bar{\nu}_\mu$

(iii) $\pi^\pm \longrightarrow \pi^0 + e^\pm + \nu_e$ (iv) $\pi^- \longrightarrow e^- + \bar{\nu}_e$

(a) (i) and (iii) (b) (i) and (ii) (c) (i), (ii) and (iii) (d) (i) only

Q. 32. Using Green's theorem, evaluate $\oint_c (x^2y\,dx + x^2\,dy)$, where c is the boundary described counter clockwise of the triangle with vertices (0,0), (1,0), and (1,1).

(a) 1/12 (b) 3/14 (c) 5/12 (d) 7/15

Q. 33. Find the value of B, so that $f(x,y) = x^2 + Axy - By^2$ is harmonic.

(a) 0 (b) -1 (c) 1 (d) -2

Q. 34. Find the residue of $\frac{1}{(z^2+1)^3}$ at $Z = i$.

(a) -3i/16 (b) -2i/8 (c) i/16 (d) -i/8

Q. 35. Find the value of $J_{-1}(x) + J_1(x)$, where J's are the Bessel functions.

(a) zero (b) $2J_0(x)/x$ (c) $2/x$ (d) $J_0(x)/x$

Q. 36. Which of the following properties of deuteron suggests that the ground state of deuteron is a mixture of s- and d- states?

(a) small binding energy (b) ground state spin

(c) finite value of electric quadrupole moment (d) non existence of bound state for $\ell = 0$

Q. 37. What is the value of a projection operator $P = \frac{3}{4} - \vec{S_n} \cdot \vec{S_p}$ for triplet state, where $\vec{S_n}$ and $\vec{S_p}$ are the spin angular momenta of neutron and proton, respectively.

(a) 1 (b) zero (c) ¾ (d) ¼

Q. 38. Which of the following statement is <u>not</u> correct in nuclear shell model?

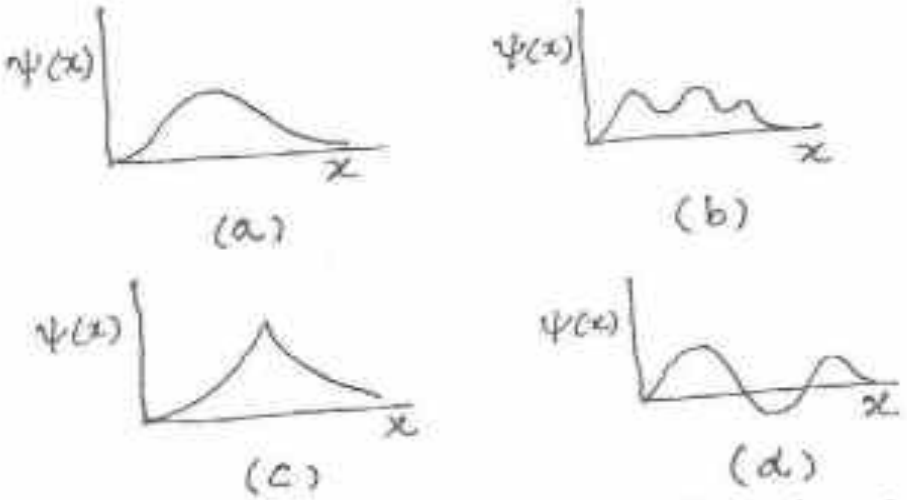
(a) the nucleons are assumed to move in a common (mean) potential

(b) spin-orbit interaction predicts correct values of quadrupole moments of odd-A nuclei

(c) the predicted spin of even-even nuclei is zero

(d) the predicted magnetic moment of odd-A nuclei is non-zero

Q. 39. Which of the following wave functions is not quantum mechanically acceptable?



Q. 40. If the radiation emitted by the star has a maximum intensity at a wave length of 446 nm, the surface temperature of star is

(a) 3200 K (b) 4300 K (c) 6500 K (d) 7200 K

Q. 41. Which of the following experiments confirms the wave nature of particles?

(a) Davisson-Germer experiment (b) Rutherford experiment

(c) Franck-Hertz experiment (d) Stern-Gerlach experiment

Q. 42. Estimate the uncertainty in the position of a 50 Kg person moving at 2.0 m/s.

(a) $0.5\times 10^{-36}m$ (b) $1.5\times 10^{-33}m$ (c) $3.2\times 10^{-28}m$ (d) $1.9\times 10^{-26}m$

Q. 43. Which of the following uncertainty relations corresponds to Gaussian wave packet?

(a) $\Delta x\,.\,\Delta p_x > h/4\pi$ (b) $\Delta x\,.\,\Delta p_x \geq h/4\pi$ (c) $\Delta x\,.\,\Delta p_x = 0$ (d) $\Delta x\,.\,\Delta p_x = h/4\pi$

Q. 44. The phase velocity for the wave packet corresponding to a relativistic particle moving with velocity v is

(a) c^2/v (b) v^2/c (c) v (d) $3v^2/c$

Q. 45. Consider a state $|\Psi\rangle = \frac{1}{\sqrt{2}}|\varphi_1\rangle + \frac{1}{\sqrt{5}}|\varphi_2\rangle + \frac{1}{\sqrt{10}}|\varphi_3\rangle$ which is given in terms of three orthonormal eigen states $|\varphi_1\rangle$, $|\varphi_2\rangle$ and $|\varphi_3\rangle$ of an operator B such that $B|\varphi_n\rangle = n^2|\varphi_n\rangle$. Find the expectation value of B for the state $|\Psi\rangle$.

(a) 11/14 (b) 21/10 (c) 8/11 (d) 11/4

Q. 46. Find the energy levels of a spin 3/2 particle whose Hamiltonian is given by

$$H = \frac{\alpha}{\hbar^2}\left(\hat{S}_x^2 + \hat{S}_y^2 - 2\hat{S}_z^2\right) - \frac{\beta}{\hbar}\hat{S}_z,$$

where α and β are positive constants.

(a) $\frac{15}{4}\alpha - m(3\alpha m + \beta)$ (b) $\frac{5}{4}\alpha - (3\alpha m + \beta)$

(c) $\frac{15}{4}\alpha - m(\alpha m + \beta)$ (d) $\frac{5}{4}\alpha - m(\alpha m + \beta)$

Q. 47. The $l = 0$ energy levels of a particle of mass m that is subject to the potential,

$$V(r) = \begin{cases} 0, & a < r < b \\ \infty, & \text{elsewhere} \end{cases}$$

are given by

(a) $\frac{n^2\pi^2\hbar^2}{2m(b-a)^2}$; $n = 1, 2, 3, \cdots$ (b) $\frac{n^2\pi^2\hbar^2}{2m(b+a)^2}$; $n = 1, 2, 3, \cdots$

(c) $\frac{n^2\pi^2\hbar^2}{2m(b-a)}$; $n = 0, 1, 2, \cdots$ (d) $\frac{n^2\pi^2\hbar^2}{2m(a-b)}$; $n = 0, 1, 2, \cdots$

Q. 48. Consider the scattering of an α-particle from a gold nucleus (Z=79, A=197). If the scattering angle of the α-particle in the lab. Frame is 60^0, find its angle in the CM frame.

(a) $< 60^0$ (b) $> 60^0$ (c) $30^0 \leq \theta \leq 45^0$ (d) $< 30^0$

Q. 49. Consider the elastic scattering of 50 MeV neutron from a nucleus. The phase shifts measured in this experiment are $\delta_0 = 90^0$, $\delta_1 = 60^0$, $\delta_2 = 30^0$; all other phase shifts are negligible. Find the total cross section.

(a) 0.743 b (b) 0.56 b (c) 0.63 b (d) 0.23 b

Q. 50. When a normal conductor becomes superconductor, its

(a) entropy increases and thermal conductivity decreases

(b) both entropy and thermal conductivity decrease

(c) both entropy and thermal energy increase

(d) entropy decreases and thermal conductivity increases

Q. 51. The common condition for superconductivity and high resistance to occur is

(a) a weak electron-phonon interaction (b) a strong electron-phonon interaction

(c) a weak phonon-phonon interaction (d) a weak electron-electron interaction

Q. 52. According to Einstein theory, the specific heat at lower temperature

(a) drops linearly with increase of temperature (b) drops linearly with decrease of temperature

(c) drops exponentially with decrease of temperature (d) becomes constant

Q. 53. The structure of thin films or thin surface layers can be investigated conveniently using

(a) X-ray diffraction (b) electron diffraction

(c) neutron diffraction (d) hole diffraction

Q. 54. The concept of Brillouin zones is used in

(a) direct lattice (b) reciprocal lattice (c) f.c.c. lattice (d) b.c.c. lattice

Q. 55. A monatomic linear lattice acts as a

(a) band pass filter (b) high pass filter (c) low pass filter (d) T-type filter

Q. 56. At a particular temperature the ratio of thermal conductivity and electrical conductivity is costant for

(a) all metals (b) the same metal (c) different metals (d) all alloys

Q. 57. The concept of the negative effective mass of an electron gave rise to the idea of the

(a) free electrons (b) hole (c) phonon (d) photon

Q. 58. For a one dimensional periodic chain of oppositely charged ions, the Medelung constant is

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

Q. 59. In a simple square lattice of two dimensions, the ratio of the kinetic energy of a free electron at a corner of the first zone to that at the mid point of a side face of the zone is

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

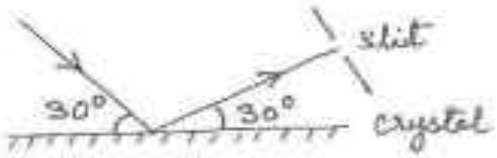
Q. 60. Air molecules present in the earth's atmosphere scatter blue light of wave length 0.42 μm 'y' times more than the red light of wave length 0.65 μm. The value of 'y' will be about-

(a) 2.3 (b) 5.7 (c) 10.2 (d) 20.6

Q. 61. Assuming dry air near the earth surface, if the atmospheric temperature decreases with height at the rate of 10 K/km, the specific heat capacity at constant pressure of the air will be

(a) 1000 J $Kg^{-1}K^{-1}$ (b) 2000 J $Kg^{-1}K^{-1}$ (c) 5000 J $Kg^{-1}K^{-1}$ (d) 10000 J $Kg^{-1}K^{-1}$

Q. 62. The electrons of a beam incident on a crystal at an angle of 30^0 have kinetic energies ranging from zero to a maximum value of 5500 eV. The crystal has a grating space d = 0.05 nm and the reflected electrons are passed through a slit, as shown. Find the minimum velocity of the electrons passing through the slit.



(a) $3.67\times 10^6 m/s$) (b) $1.46\times 10^7 m/s$

(c) $1.46\times 10^9 m/s$ (d) $1.76\times 10^8 m/s$

Q. 63. Find the maximum radius of the sphere that can just fit into the void at the body centre of fcc structure coordinated by the facial atoms (Take r as the radius of the atom).

(a) 1.63 r (b) 0.99 r (c) 0.78 r (d) 0.41 r

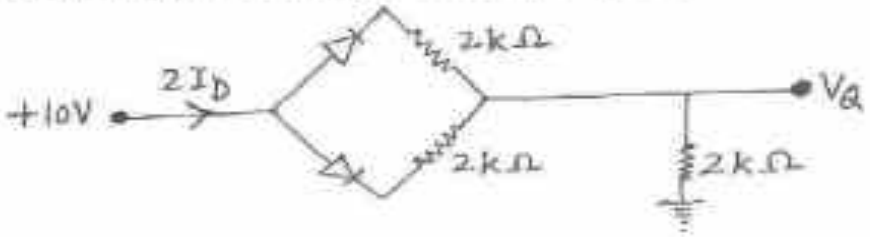
Q. 64. Obtain the Miller indices of a plane which intercepts at a, b/2, 3c in a simple cubic unit cell.

(a) 3, 6, 1 (b) 6,3,1 (c) 1,3,6 (d) 6,1,3

Q. 65. A cyclotron has an oscillator frequency of $12.0\times 10^6 Hz$ and dee radius of 0.53 m. Find the value of the magnetic field (in Tesla) needed to accelerate deuterons in it.

(a) 3.93 (b) 2.45 (c) 1.57 (d) 0.92

Q. 66. Find V_Q and I_D in the following network:
(Take potential barrier for each diode, $V_0 = 0.7$ V)



(a) 1.3 V, 1.55 mA (b) 3.2 V, 1.99 mA (c) 4.1 V, 2.33 mA (d) 6.2 V, 1.55 mA

Q. 67. A half-wave rectifier is used to supply 50 V d.c. to a resistive load of 800 Ω. The diode has a resistance of 25 Ω. Find the maximum value of a.c. voltage required.

(a) 162 V (b) 104 V (c) 93 V (d) 28 V

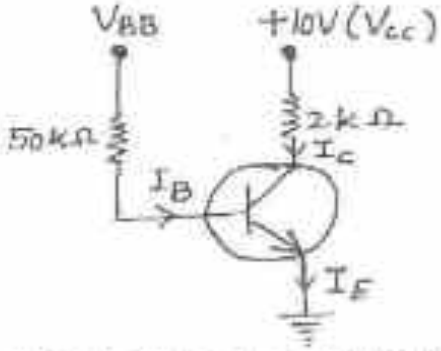
Q. 68. An n-p-n transistor at room temperature has its emitter disconnected. A voltage of 5.0 V is applied between collector and base. With collector positive, a current of 0.2 μA flows. When the base is disconnected and the same voltage is applied between collector and emitter, the current is found to be 20 μA. Find I_B when collector current is 1.0 mA.

(a) 2.0 μA (b) 3.7 μA (c) 10 μA (d) 12.9 μA

Q. 69. For the circuit, as shown, find the base supply voltage (V_{BB}) that just puts the transistor into saturation. Take $\beta = 200$.

(a) $V_{BB} \geq 1.95$ (b) $V_{BB} = 0.95$

(c) $V_{BB} < 0.95$ (d) $V_{BB} - 1.34$



Q. 70. A class B push-pull amplifier has an efficiency of 60% and each transistor has a rating of 2.5 W. Find the a.c. output power (P_{ac}) and d.c. input power (P_{dc}).

(a) $P_{ac} = 9.5$ W, $P_{dc} = 10.5$ W (b) $P_{ac} = 7.5$ W, $P_{dc} = 12.5$ W

(c) $P_{ac} = 5.5$ W, $P_{dc} = 8.5$ W (d) $P_{ac} = 3.5$ W, $P_{dc} = 16.5$ W

Q. 71. An amplifier has a voltage gain of 500 without feedback. If a negative feedback is applied, the gain is reduced to 100. If, due to excessive use of the components, the gain without feedback falls by 20%, find the percentage fall in gain with feedback.

(a) 4.7% (b) 5.2% (c) 6.7% (d) 7.2%

Q. 72. The load current in the transmitting antenna of an unmodulated AM transmitter is 8.0 A. What will be the antenna current when modulation is 40% ?

(a) 8.31 A (b) 10.37 A (c) 6.73 A (d) 3.67 A

Q. 73. In a differentiating circuit, R = 10 KΩ and C = 2.2 μF. If the input voltage goes from 0 V to 10 V at a constant rate in 0.4 s, find the output voltage.

(a) 1.23 V (b) 0.93 V (c) 0.55 V (d) 0.23 V

Q. 74. In a Silicon Controlled Rectifier (SCR) half-wave rectifier circuit, what peak-load current will occur if we measure an average (d.c.) load current of 1.0 A at a firing angle of 30°?

(a) 3.36 A (b) 4.43 A (c) 5.67 A (d) none of these

Q. 75. The hyperfine structure components of $^2D_{3/2}$ level of Bi (I = 9/2) is

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

Q. 76. The transition J = 2 to J = 3 in a diatomic molecule is observed at 30 cm^{-1}. Its rotational constant is

(a) 5 cm^{-1} (b) 10 cm^{-1} (c) 15 cm^{-1} (d) 30 cm^{-1}

Q. 77. Fourier transform infrared (FTIR) spectrophotometer is a

(a) prism spectrograph (b) grating spectrograph

(c) combination of prism and grating spectrographs (d) Michelson interferometer

Q. 78. A strong band is observed at 3200 cm^{-1} in infrared spectrum of a diatomic molecule. The energy of lowest vibrational level of the molecule is

(a) 0.0198 eV (b) 0.198 eV (c) 1.98 eV (d) 19.8 eV

Q. 79. A triatomic molecule shows two strong infrared bands neither of which coincides with the Raman bands of the molecule. The molecule is

(a) SO_2 (b) NO_2 (c) CO_2 (d) H_2O

Q. 80. Which of the following molecules exhibits pure rotational spectra?

(a) H_2 (b) O_2 (c) N_2 (d) CO

81. Mahmood Ghazni attacked Kangra fort in _____

(a) 1009
(b) 1365
(c) 1265
(d) 1620

82. Jutogh Revolt of 1857 was led by _____

(a) Maharaja Ranjit Singh
(b) Bhim Singh
(c) Guru Govind Singh
(d) Raja Sansar Chand

83. Himachal Pradesh Subordinate Services Selection Board was set up in 1998 at ____

(a) Mandi
(b) Solan
(c) Hamirpur
(d) Shimla

84. Sundernagar was founded by _____

(a) Alam Chand
(b) Hamir Chand
(c) Abhay Chand
(d) Garur Sen

85. The State of Himachal Pradesh constituted its first Finance Commission in _____

(a) 1993
(b) 1994
(c) 1995
(d) 1996

86. Which of the following does not belong to the tribal community in Himachal Pradesh ___

(a) Pangawals
(b) Gaddis
(c) Kolis
(d) Gujjars

87. Pt. Deen Dayal Bagwan Samriddhi Yojna is not concerned with _____

(a) Improvement of agrarian economy
(b) Construction of village drainage
(c) Construction of Poly Houses
(d) Increase in farm income

88. Barley is largely cultivated in _____

(a) Kangra district
(b) Shimla district
(c) Mandi district
(d) Sirmaur district

89. Himachal Pradesh enacted its industrial Policy recently in _____

(a) 2000
(b) 2001
(c) 2003
(d) 2004

90. Which of the following percentage of seats are reserved for woman in PRIs in H.P. ____

(a) 33%
(b) 30%
(c) 45%
(d) 50%

91. 2012 Olympics were held at _____

(a) Washington
(b) London
(c) Munich
(d) Islamabad

92. 73rd Constitution amendment Act deals with _____

(a) Constitution of District Planning Committee
(b) Constitution of Metropolitan Area Planning Committee
(c) Rural Local Government
(d) Urban Local Government

93. Who of the following appoints the Comptroller and Auditor General of India ?

(a) The Prime Minister
(b) The Finance Minister
(c) The President
(d) The Home Minister

94. Who was the first Martyr of India against the British ?

(a) Jayee Rajguru
(b) Bakshi Jagbandhu
(c) Mangal Pandey
(d) Bhagat Singh

95. Aligarh Muslim University was known before 1920 as _____

(a) Muslim – oriental College
(b) Mohamdan Anglo – oriental College
(c) Mohamdan oriental College
(d) Muslim Minority oriental College

96. Partition of the Bengal Province in 1905 was caused by _____

(a) Lord Hastings
(b) Lord Cornwallis
(c) Lord Dalhausie
(d) Lord Curzon

97. Mahakavi Subramanya Bharathi belonged to _____

(a) Hydrabad
(b) Lucknow
(c) Banglore
(d) Tamilnadu

98. Gandhi Irwin pact was signed in _____

(a) 1930
(b) 1931
(c) 1933
(d) 1935

99. Indian National Congress was founded in 1885 by _____

(a) A.O. Hume
(b) Annie Besant
(c) Gopal Krishna Gokhale
(d) Dadabhai Naoroji

100. Which of the following is not the creation / part of the Constitution?

(a) National Commission for Scheduled Castes
(b) Finance Commission
(c) National Human Rights Commission
(d) Election Commission.