GEOPHYSICS (BHU) 2017

Q1. If the matrix $\begin{bmatrix} 6 & 8 & 5 \\ 4 & 2 & 3 \\ 9 & 7 & 1 \end{bmatrix}$ is expressed as $A+B$. Where A is Symmetric and B is skew-symmetric, then B is equal to:

(a) $\begin{bmatrix} 6 & 6 & 7 \\ 6 & 2 & 5 \\ 1 & 5 & 7 \end{bmatrix}$ (b) $\begin{bmatrix} 6 & 6 & 7 \\ 6 & 2 & 5 \\ 7 & 5 & 1 \end{bmatrix}$ (c) $\begin{bmatrix} 0 & 2 & -2 \\ -2 & 0 & -2 \\ 2 & 2 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 0 & -2 & 2 \\ 2 & 0 & 2 \\ -2 & -2 & 0 \end{bmatrix}$

Q2. If A is a square matrix of order n, then $|adjA|$ is equal to:

(a) $|A|^{n-2}$ (b) $|A|^{n-1}$ (c) $|A|^{n}$ (d) $|A|^{n+1}$

Q3. If $A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$, then A^{-2} is:

(a) $\begin{bmatrix} \frac{1}{5} & 0 & 0 \\ 0 & \frac{1}{5} & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & \frac{1}{5} & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (c) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & \frac{1}{5} & 0 \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$ (d) $\begin{bmatrix} \frac{1}{5} & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$

Q4. The characteristic roots of a Skew-Hermitian matrix are:

(a) Always all zero (b) Always all imaginary

(c) All real (d) Either all zero or purely imaginary

Q5. The characteristic roots of the matrix $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ are:

(a) $0,5,12$ (b) $0,3,12$ (c) $0,3,15$ (d) $0,5,15$

Q6. The system of equations $x+y+z=-3,\ 3x+y-2z=-2,\ 2x+4y+7z=7$ has:

(a) Zero solution (b) No solution

(c) Unique non zero solution (d) infinitely many solutions

Q7. The equation which has roots $-3,-1,\frac{5}{3}$, is:

(a) $3x^3+7x^2-11x-15=0$ (b) $-3x^3+7x^2+15x-11=0$

(c) $-3x^3+11x^2-15x+7=0$ (d) $3x^3-7x^2+11x-15=0$

Q8. If the sum of two roots of equation $2x^3-3x^2+kx-1=0$ is 1, then the value of k is:

(a) 2 (b) 1 (c) 3 (d) -2

Q9. If the sum of two roots is equal to the third root of equation $x^2+px^2+qx+r=0$, then the following is true:

(a) $p^3+4pq-8r=0$ (b) $p^3-4pq+8r=0$

(c) $p^3-8pq+4r=0$ (d) $p^3+8pq-4r=0$

Q10. If the roots of equation $x^3+px^2+qx+r=0$ are in G.P. then which of the following relation is true:

(a) $q^3=p^3r$ (b) $p^3=q^3r$ (c) $q^3=p^2r^2$ (d) $p^3=q^2r^2$

Q11. If the roots of the equation $x^3+3px^2+3qx+r=0$ are in A.P. then:

(a) $2q^3-3pq+r=0$ (b) $3q^3-2pq+r=0$

(c) $2p^3-3pq+r=0$ (d) $3p^3-2pq+r=0$

Q12. If the roots of the equation $x^3+3px^2+3qx+r=0$ are in H.P. then. Which of the following relation is true.

(a) $2p^3=r(3pq-r)$ (b) $3p^3=r(2pq-r)$

(c) $3q^3=r(2pq-r)$ (d) $2q^3=r(3pq-r)$

Q13. For which values of λ and μ the system of equations $x+y+z=6$, $x+2y+3z=10$, $x+2y+\lambda z=\mu$ has infinity of solutions?

(a) $\lambda=10,\ \mu=3$ (b) $\lambda=3,\ \mu=10$ (c) $\lambda=1,\ \mu=10$ (d) $\lambda=10,\ \mu=1$

Q14. The eigen values of matrix $A=\begin{bmatrix}\cos\theta & \sin\theta\\ \sin\theta & -\cos\theta\end{bmatrix}$ are:

(a) ±1 (b) $\pm\cos\theta$ (c) $\pm\sin\theta$ (d) $\cos\theta,\ \sin\theta$

Q15. The equation whose roots are $-3, -1, \frac{5}{3}$ is

(a) $3x^3 - 7x^2 + 11x - 15 = 0$ (b) $3x^3 - 7x^2 - 11x + 15 = 0$

(c) $-3x^3 + 7x^2 - 11x + 15 = 0$ (d) $3x^3 + 7x^2 - 11x - 15 = 0$

Q16. If $x + \frac{1}{x} = 2\cos\theta$ then $x^n + \frac{1}{x^n}$ is:

(a) $\cos n\theta$ (b) $2\cos n\theta$ (c) $2\sin n\theta$ (d) $2i\cos n\theta$

Q17. If n is a positive integer then value of $(1+i)^n + (1-i)^n$ is:

(a) $2^{(n/2)}\cos\frac{n\pi}{4}$ (b) $2^{(n/2)-1}\cos\frac{n\pi}{4}$ (c) $2^{(n/2)+1}\cos\frac{n\pi}{4}$ (d) $2^{(n/2)+1}\sin\frac{n\pi}{4}$

Q18. All values of $(-1)^{\frac{1}{3}}$ are:

(a) $-1, \frac{1}{2}\left(1 \pm i\sqrt{3}\right)$ (b) $-1, \frac{1}{3}\left(1 \pm \sqrt{3}\right)$

(c) $1, \frac{1}{2}\left(1 \pm \sqrt{3}\right)$ (d) $1, \frac{1}{3}\left(1 \pm i\sqrt{3}\right)$

Q19. If $\frac{\sin\theta}{\theta} = \frac{2165}{2166}$, then approximate value of θ is:

(a) 1° (b) 2° (c) 3° (d) None of these

Q20. The value of $\cos ec10^\circ - \sqrt{3}\sec 10^\circ$ is:

(a) 2^2 (b) 3^2 (c) 2^3 (d) None of these

Q21. The value of $\log(-1)$ is:

(a) π (b) 2π (c) $-\pi$ (d) $i\pi$

Q22. The expression $tan\left(i\log\frac{a-ib}{a+ib}\right)$ has the value:

(a) $\frac{ab}{a^2+b^2}$ (b) $\frac{2ab}{a^2+b^2}$ (c) $\frac{ab}{a^2-b^2}$ (d) $\frac{2ab}{a^2-b^2}$

Q23. The value of $\log\left(\frac{a+bi}{a-bi}\right)$ is:

(a) $2i\cot^{-1}\left(\frac{b}{a}\right)$ (b) $2i\cot^{-1}\left(\frac{a}{b}\right)$ (c) $2i\tan^{-1}\left(\frac{b}{a}\right)$ (d) $2i\tan^{-1}\left(\frac{a}{b}\right)$

Q24. If $y=x^4\log x$, then the value of $\frac{d^6y}{dx^6}$ is:

(a) $\frac{24}{x^2}$ (b) $-\frac{24}{x^2}$ (c) $\frac{12}{x^2}$ (d) $-\frac{12}{x^2}$

Q25. If $y=\left(X^2-1\right)^n$, then $\left(x^2-1\right)y_{n+2}$ is:

(a) $2xy_{n+1}-n(n+1)y_n$ (b) $2xy_{n+1}+n(n-1)y_n$

(c) $-2xy_{n+1}+n(n+1)y_n$ (d) $-2xy_{n+1}+n(n-1)y_n$

Q26. If $y=\sin\left(a\sin^{-1}x\right)$, then which of the following is true?

(a) $\left(1-x^2\right)y_2+xy_1+a^2y=0$ (b) $\left(1-x^2\right)y_2-xy_1+2a^2y=0$

(c) $\left(1-x^2\right)y_2+xy_1-2a^2y=0$ (d) $\left(1-x^2\right)y_2-xy_1+a^2y=0$

Q27. Which curve has no asyhmptotes?

(a) $\frac{a^2}{x^2}-\frac{b^2}{y^2}=1$ (b) $y^2=x$

(c) $y=mx+c+\frac{A}{x}+\frac{B}{x^2}$ (d) $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$

Q28. The greatest and least values of the function $f(x)=3x^4-2x^3-6x^2+6x+1$ in the interval $(0,\,2)$ are:

(a) 1 and 21 (b) 1 and 2 (c) 1 and 20 (d) None of thoese

Q29. The function $f(x)=\sqrt{3}\sin x+\cos x$ will be maximum when x is equal to:

(a) $30°$ (b) $45°$ (c) $60°$ (d) $90°$

Q30. The radius of curvature at any point on the cardioids $r=a(1-\cos\theta)$ is:

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

Q31. For the function $f(x) = x + \frac{1}{x} in \left[\frac{1}{2}, 3\right]$, the value if c of Lagrange's mean value theorem is:

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

Q32. The value of $I = \int_0^{\pi/8} \cos^3 4\theta d\theta$ is:

(a) $\frac{1}{8}$ (b) $\frac{1}{4}$ (c) $\frac{1}{6}$ (d) $\frac{1}{2}$

Q33. The value of integral $I = \int \frac{dx}{\sqrt{x^2+9}}$ is:

(a) $\sin^{-1}\left(\frac{x}{3}\right)$ (b) $\cos^{-1}\left(\frac{x}{3}\right)$ (c) $\sinh^{-1}\left(\frac{x}{3}\right)$ (d) $\cosh^{-1}\left(\frac{x}{3}\right)$

Q34. The whole area of the asteroid $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ is:

(a) $\frac{3}{8}\pi a^2$ (b) $\frac{3}{32}\pi a^2$ (c) $\frac{3}{8}\pi a^3$ (d) $\frac{3}{32}\pi a^3$

Q35. The perimeter of the loop of the curve $3ay^2 = x^2(a-x)$ is:

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

Q36. The volume of the solid generated by revolving the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ about the x-axis is:

(a) $\frac{4}{3}\pi ab^2$ (b) $\frac{4}{3}\pi a^2 b$ (c) $\frac{2}{3}\pi ab^2$ (d) $\frac{2}{3}\pi a^2 b$

Q37. The curved surface of a sphere of radius a is:

(a) $2\pi a^2$ (b) πa^2 (c) $3\pi a^2$ (d) $4\pi a^2$

Q38. Which conic is represented by the curve $4x^2 - 4xy + y^2 - 8x + 6y + 5 = 0$?

(a) Ellipse (b) Parabola

(c) Hyperbola (d) rectangular hyperbola

Q39. If PSP' is the focal chord of a conic $\frac{\ell}{r}=1+e\cos\theta$, whose focus is S, then $\frac{1}{SP}+\frac{1}{SP'}$ is:

(a) ℓ (b) 2ℓ (c) $\frac{1}{\ell}$ (d) $\frac{2}{\ell}$

Q40. The condition that the line $\frac{\ell}{r}=A\cos\theta+B\sin\theta$ may touch the conic $\frac{\ell}{r}=1+e\cos_\theta$ is:

(a) $(e-B)^2+A^2=1$
(b) $(A-e)^2+B^2=1$
(c) $(B+e)^2+A^2=1$
(d) $(A+e)^2+B^2=1$

Q41. The equation of a cone whose vertex is the origin and direction cosines of its generator satisfy the relation $4\ell^2+7m^2-8n^2=0$ is:

(a) $4x+7y-8z=0$
(b) $4yz+7zx-8xy=0$
(c) $4x^2+7y^2-8z^2=0$
(d) $16yz+49zx-64xy=0$

Q42. The equation of the right circular cylinder of radius $5cm$ and whose axis is y-axis is:

(a) $x^2+y^2=25$
(b) $y^2+z^2=25$
(c) $z^2+x^2=25$
(d) $x^2+y^2+z^2=25$

Q43. The equation $\frac{x^2}{a^2}+\frac{y^2}{b^2}=\frac{2z}{c}$ represents:

(a) An ellipsoid
(b) A hyperboloid
(c) An elliptic paraboloid
(d) A hyperbolic paraboloid

Q44. If $\phi(x,y,z)=2x^2y^3-3y^2z^3$, then gradient of ϕ at the point $(1,-1,1)$ is:

(a) $-4i+12j+9k$
(b) $4i-12j+9k$
(c) $12i+4j-9k$
(d) $-12i+4j+9k$

Q45. Gradient $\nabla\phi$ in polar coordinates is given by:

(a) $\frac{\partial\phi}{\partial r}\hat{e}_r-\frac{1}{r}\frac{\partial\phi}{\partial\theta}\hat{e}_\theta$
(b) $\frac{\partial\phi}{\partial r}\hat{e}_r+\frac{1}{r}\frac{\partial\phi}{\partial\theta}\hat{e}_\theta$
(c) $\frac{\partial\phi}{\partial r}\hat{e}_\theta-\frac{1}{r}\frac{\partial\phi}{\partial\theta}\hat{e}_r$
(d) $\frac{\partial\phi}{\partial r}\hat{e}_\theta+\frac{1}{r}\frac{\partial\phi}{\partial\theta}\hat{e}_r$

Q46. The equation of the tangent plane to the surface $x^2+y^2+z^2=25$ at the point $(4,\,0,\,3)$ is:

(a) $4x+3y=25$ (b) $3x+4z=25$ (c) $4y+3z=25$ (d) $4x+3z=25$

Q47. The value of curl $(a\times b)$ is:

(a) $b\,\text{curl}\,a-a\,\text{curl}\,b$

(b) $a\,\text{div}\,b-(b\cdot\nabla)a+b\,\text{div}\,a+(a\cdot\nabla)$

(c) $a\,\text{div}\,b-b\,\text{div}\,a+(b\cdot\nabla)a-(a\cdot\nabla)b$

(d) $(b\cdot\nabla)a-(a\cdot\nabla)b$

Q48. If $f=x^2yi+xzj+2yzk$ then value of div curl f is:

(a) 4 (b) 3 (c) 2 (d) 0

Q49. If ϕ is differentiable vector function then value of curl grad ϕ is:

(a) 1 (b) 0 (c) -1 (d) ϕ

Q50. If S is any closed surface enclosing a volume V and $F=xi+2yj+3zk$ then $\iint_s F\cdot\hat{n}ds$ is:

(a) $3V$ (b) $2V$ (c) V (d) $6V$

Q51. Let $F=F_1i+F_2j+F_3k$ the Cartesian representation of stoke's theorem is:

(a) $\iint_s\left[\left(\frac{\partial F_2}{\partial y}-\frac{\partial F_3}{\partial z}\right)dydz+\left(\frac{\partial F_1}{\partial x}-\frac{\partial F_2}{\partial y}\right)dxdy+\left(\frac{\partial F_3}{\partial z}-\frac{\partial F_1}{\partial x}\right)dzdx\right]$

(b) $\iint_s\left[\left(\frac{\partial F_3}{\partial y}-\frac{\partial F_2}{\partial z}\right)dydz+\left(\frac{\partial F_1}{\partial z}-\frac{\partial F_3}{\partial x}\right)dzdx+\left(\frac{\partial F_2}{\partial x}-\frac{\partial F_1}{\partial y}\right)dxdy\right]$

(c) $\iint_s\left[\left(\frac{\partial F_3}{\partial z}-\frac{\partial F_2}{\partial y}\right)dydz+\left(\frac{\partial F_1}{\partial x}-\frac{\partial F_3}{\partial z}\right)dxdz+\left(\frac{\partial F_2}{\partial y}-\frac{\partial F_1}{\partial x}\right)dydx\right]$

(d) $\iint_s\left[\left(\frac{\partial F_2}{\partial z}-\frac{\partial F_3}{\partial y}\right)dydz+\left(\frac{\partial F_1}{\partial y}-\frac{\partial F_2}{\partial x}\right)dxdy+\left(\frac{\partial F_3}{\partial x}-\frac{\partial F_1}{\partial z}\right)dxdz\right]$

Q52. If C is the rectangle with vertices $(0,0),(\pi,0),(\pi,\pi/2),(0,\pi/2)$ then value of $\int_C \left(e^{-x}\sin y dx + e^{-x}\cos y dy\right)$ by Green's theorem is:

(a) $\left(e^{-\pi}-1\right)$ (b) $\left(e^{\pi/2}-1\right)$ (c) $2\left(e^{\pi/2}-1\right)$ (d) $2\left(e^{\pi}-1\right)$

Q53. Which is not the solution of the differential equation $\frac{d^2y}{dx^2}-y=0$?

(a) e^x (b) e^{-x} (c) ae^x+be^{-x} (d) e^x+c

Q54. Particular integral of the differential equation $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+5y=e^x\cos 2x$ is:

(a) $\frac{e^x}{4}\sin 2x$ (b) $\frac{2e^x}{3}\sin 2x$ (c) $\frac{xe^x}{4}\sin 2x$ (d) $\frac{2xe^x}{3}\sin 2x$

Q55. The complementary function of the differential equation $x^3\frac{d^3y}{dx^3}+2x^2\frac{d^2y}{dx^2}+2y=10\left(x+\frac{1}{x}\right)$ is:

(a) $Y_c=c_1x^{-1}+x\left[c_2\cos(\log x)+c_3\sin(\log x)\right]$

(b) $Y_c=c_1x^{-1}+x\left[c_2\cos\left(e^x\right)+c_3\sin\left(e^x\right)\right]$

(c) $Y_c=c_1x+x\left[c_2\cos\left(e^{-x}\right)+c_3\sin\left(e^{-x}\right)\right]$

(d) $Y_c=c_1x+x^{-1}\left[c_2\cos(\log x)+c_3\sin(\log x)\right]$

Q56. Solution of integral equation $\int_0^1 \frac{y(u)}{\sqrt{t-u}}du=\sqrt{t}$ is:

(a) $y(t)=1$ (b) $y(t)=\frac{1}{3}$ (c) $y(t)=\frac{1}{2}$ (d) $y(t)=2$

Q57. Solution of integral equation $F(t)=a\sin t-2\int_0^1 F(u)\cos(t-u)du$ is:

(a) $F(t)=ate^{-t}$ (b) $F(t)=ate^{t}$ (c) $F(t)=2ate^{-t}$ (d) $F(t)=2ate^{t}$

Q58. Which relation is not true for a common catenary?

(a) $y = c\cosh\left(\frac{x}{c}\right)$ (b) $x = c\log(\sec\psi + \tan\psi)$

(c) $y = c\sec\psi$ (d) $s = c\sin\psi$

Q59. The equation of the resultant of a system of forces in one plane is:

(a) $xY - yX = 0$ (b) $xY - yX = G$ (c) $yX - \frac{x}{Y} = G$ (d) $xY - \frac{y}{X} = G$

Q60. A heavy uniform rod of length $2a$ rests with its ends in contact with two smooth inclined planes of inclinations α and β to the horizon. If θ be the inclination of the rod the horizon, then by the principle of virtual work:

(a) $\tan\theta = \frac{1}{3}(\cot\alpha - \cot\beta)$ (b) $\tan\theta = \frac{1}{3}(\cot\beta - \cot\alpha)$

(c) $\tan\theta = \frac{1}{2}(\cot\alpha - \cot\beta)$ (d) $\tan\theta = \frac{1}{2}(\cot\beta - \cot\alpha)$

Q61. According to Kepler's second law of the planetary motion the line drawn from the sun to the planet sweeps equal area in equal time intervals. This is due to conservation of:

(a) Linear momentum (b) Angular momentum

(c) Kinetic energy (d) Potential energy

Q62. Which one of the following is not a Maxwell's equation of electromagnetic theory?

(a) $\oint \vec{D}\cdot\overline{ds} = q$ (b) $\oint \vec{H}\cdot\overline{dI} = \int_a\left(\vec{J} + \frac{\partial\vec{D}}{\partial t}\right)\cdot\overline{ds}$

(c) $\oint \vec{B}\cdot\overline{d\ell} = \mu, I$ (d) $\oint \vec{E}\cdot\overline{d\ell} = -\frac{\partial}{\partial t}\int_a \vec{B}\cdot ds$

Where I is the current in the circuit.

Q63. The value of $\vec{\nabla}\times\vec{\nabla}\times\vec{A}$ is given by:

(a) $\vec{\nabla}\cdot\vec{A} + \nabla^2\cdot\vec{A}$ (b) $\vec{\nabla}\times\vec{A} - \nabla^2\cdot\vec{A}$

(c) $\vec{\nabla}\cdot(\vec{\nabla}\cdot\vec{A}) - \nabla^2\cdot\vec{A}$ (d) $\vec{\nabla}\cdot(\vec{\nabla}\cdot\vec{A}) + \nabla^2\cdot\vec{A}$

Q64. We have two spheres of same mass one of which is a spherical shell and another is a solid. They have same moment of inertia about their respective diameters. The ratio of their radii is given by:

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

Q65. If the earth is suddenly contracted so that its radius becomes half without any change in its mass and its shape the duration of the day instead of 24 hours shall be:

(a) 6 hours (b) 12 hours (c) 48 hours (d) 18 hours

Q66. A particle is performing uniform circular motion with angular momentum L. If the time period of the motion of the particle and its kinetic energy both are valued then its angular momentum will be:

(a) $2L$ (b) $4L$ (c) $L/2$ (d) $L/4$

Q67. Which one of the following is the correct Maxwell's Thermodynamical relation?

(a) $\left(\frac{\partial S}{\partial P}\right)_T=-\left(\frac{\partial T}{\partial V}\right)_P$ (b) $\left(\frac{\partial T}{\partial V}\right)_S=-\left(\frac{\partial P}{\partial S}\right)_V$

(c) $\left(\frac{\partial T}{\partial P}\right)_S=\left(\frac{\partial S}{\partial V}\right)_P$ (d) $\left(\frac{\partial S}{\partial T}\right)_P=\left(\frac{\partial P}{\partial V}\right)_S$

Q68. The temperature of inversion of a gas is:

(a) $\frac{2b}{Ra}$ (b) $\frac{2a}{Rb}$ (c) $\frac{a}{Rb}$ (d) $\frac{b}{Ra}$

Q69. Two simple harmonic motions in the perpendicular directions to each other are superimposed. If both have the same frequency, amplitude and phase, then the resultant motion is along:

(a) A circle

(b) An ellipse

(c) A straight line inclined at $45°$ to the X-axis

(d) A parabola

Q70. An organ pipe opened at both ends resonated with another organ pipe closed at one end, if their lengths are in the ratio:

(a) $1:2$ (b) $1:4$ (c) $4:1$ (d) $2:1$

Q71. A particle is executing simple harmonic motion in a straight line along X-axis. When the distances of the particle from the equilibrium position are x_1 and x_2 its velocities are u_1 and u_2 respectively. The time period T of the particle execting S.H.M. shall be:

(a) $T = 2\pi\left(\frac{x_2^2 - x_1^2}{u_1^2 - u_2^2}\right)^{1/2}$

(c) $T = 2\pi\left(\frac{x_2^2 - x_1^2}{u_2^2 + u_1^2}\right)^{1/2}$

(c) $T = 2\pi\left(\frac{u_1^2 - u_2^2}{x_2^2 - x_1^2}\right)^{1/2}$

(d) $T = 2\pi\left(\frac{u_1^2 - u_2^2}{x_1^2 + x_2^2}\right)^{1/2}$

Q72. In one complete rotation of Nical prism, no variation in the intensity of transmitted light is observed, the incident light is:

(a) Plane polarized

(b) Elliptically polarized

(c) Mixture of unpolarized and plane polarized

(d) Circularly polarized

Q73. Tlae Breuster angle for a glass slab $(\mu = 1.5)$ immersed in water $\left(\mu = \frac{4}{3}\right)$ is:

(a) $56.31°$ (b) $33.69°$ (c) $48.4°$ (d) $41.2°$

Q74. When a narrow pin is placed in front of a sodium light source the fringes observed on the screen are due to the phenomenon of:

(a) Diffraction only

(b) Both interference and diffraction

(c) Interference only

(d) Both interference and dispersion

Q75. The expression for the resolving power of telescope is:

(a) $\frac{1.22\lambda}{d}$ (b) $\frac{\lambda}{d}$ (c) $\frac{d}{\lambda}$ (d) $\frac{d}{1.22\lambda}$

Q76. Three charges $2q$, $-q$ and $-q$ are located at the vertical of an equilateral triangle. At the center of the triangle:

(a) The field is zero but the potential is non zero

(b) The field is non zero but the potential is zero

(c) Both the field and potential are zero

(d) Both the field and potential are non zero

Q77. Which one of the following Maxwell's equation of electromagnetic theory represents the absence of magnetic monopoles:

(a) $\vec{\nabla}\cdot\vec{D}=\rho$ (b) $\vec{\nabla}\cdot\vec{B}=0$ (c) $\vec{\nabla}\times\vec{E}=\frac{-\partial\bar{B}}{\partial t}$ (d) $\vec{\nabla}\times\vec{H}=\bar{J}+\frac{\partial\bar{D}}{\partial t}$

Q78. A very very long solenoid has n turns/meter and a current I ampere is flowing through it. The magnetic field at the ends of the solenoid is:

(a) $\mu_0 nI/2$ (b) $\mu_0 nI$ (c) $2\mu_0 nI$ (d) Zero

Q79. The magnetic flux linked with an electrical circuit of resistance $100\,ohm$ charges by 500 webers in 10 seconds. The amount of induced charge that flows in the circuit is:

(a) 0.5 coulomb (b) 5 coulomb (c) 50 coulomb (d) 500 coulomb

Q80. The energy flux density (pointing vector) transported by the electromagnetic fields in free space is given by:

(a) $\in_0\left(\vec{E}\times\vec{B}\right)$ (b) $\in_0\left(\vec{E}\cdot\vec{B}\right)$ (c) $\frac{1}{\mu_0}\left(\vec{E}\times\vec{B}\right)$ (d) $\frac{1}{\mu_0}\left(\vec{E}\cdot\vec{B}\right)$

Q81. In a semiconductor diode p side is earthed and n side is applied -2 volt, the diode shall:

(a) Not conduct (b) Breaks down

(c) Conduct partially (d) Conduct

Q82. The current gain a of a transistor is 0.9. The transistor is connected in CE configuration. What would be the change in collector current when the base current changes by $4\,mA$? I_{co} may be assumed to beglglled:

(a) $40\,mA$ (b) $18\,mA$ (c) $20\,mA$ (d) $36\,mA$

Q83. The peak sinusoidal voltage to the input of a half wave diode rectifier with out filter is $10V$. The DC component of the output voltage is:

(a) $\frac{10}{\sqrt{2}}V$ (b) $\frac{20}{\pi}V$ (c) $\frac{10}{\pi}V$ (d) $\frac{20}{\sqrt{2}}V$

Q84. The depletion layer of P.N. Junction diode contains:

(a) Only electrons (b) Only holes

(c) Neither electrons non holes (d) Electrons and holes both

Q85. A turning fork of frequency $260 Hz$ is vibrating with a sonometer wire and 5 beats are heard. If the tension in the wire is slightly increased the beat frequency also increases. The original frequency of the sonometer wire is:

(a) $265 Hz$ (b) $255 Hz$ (c) $270 Hz$ (d) $250 Hz$

Q86. The value of the acceleration "a" of a moving particle at any instant is given by $a = -bx$ where x is the displacement of the particle from the equilibrium position and b is a constant. The period of ascillation of the particle will be:

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

Q87. Two waves of wavelength 2 meter and 2.02 meter respectively and moving with the same velocity superpose to produce 2 beats per second. The velocity of the final wave is:

(a) 404 meter/sec (b) 402 meter/sec

(c) 404 meter/sec (d) 406 meter/sec

Q88. The intensity of the diffraction pattern due to a double slit is expressed as:

(a) $I = I_0 \frac{\sin^2 \alpha}{\alpha^2} \sin^2 \beta$ (b) $I = I_0 \frac{\cos^2 \alpha}{\alpha^2} \cos^2 \beta$

(c) $I = I_0 \frac{\cos^2 \alpha}{\alpha^2} \sin^2 \beta$ (d) $I = I_0 \frac{\sin^2 \alpha}{\alpha^2} \cos^2 \beta$

Where α and β have their usual meaning used in diffraction of light.

Q89. If μ_r and $\in_r$ are respectively the relative permeability and relative permeability (dielectric constant) of a medium then its refractive index is given by:

(a) $\frac{1}{\sqrt{\mu_r \in_r}}$ (b) $\frac{1}{\mu_r \in_r}$ (c) $\sqrt{\mu_r \in_r}$ (d) $\mu_r \in_r$

Q90. Two waves of intensities in the ratio $9:1$ interfere to form the fringes. The ratio of maximum to minimum intensities of the fringes is:

(a) $10:8$ (b) $4:1$ (c) $2:1$ (d) $8:1$

Q91. A convex lens made of glass $(\mu = 1.5)$ has radius of curvature R for its both surface. If the lens is dipped in water $\left(\mu = \frac{4}{3}\right)$, then the focal length of the lens will be:

(a) $4R$ (b) R (c) $2R$ (d) $R/2$

Q92. A convergent lens of focal length $40cm$ is kept in contact with a divergent lens of focal length $25cm$. The power of the combination is:

(a) $+1.5$ diopter (b) -6.5 diopter (c) $+6.5$ diopter (d) -1.5 diopter

Q93. The area of the Fresnel half period zone in diffraction due to an straight edge is:

(a) $\pi^2 b^2 \lambda^2$ (b) $\pi b \lambda^2$ (c) $\pi b \lambda$ (d) $\pi b^2 \lambda$

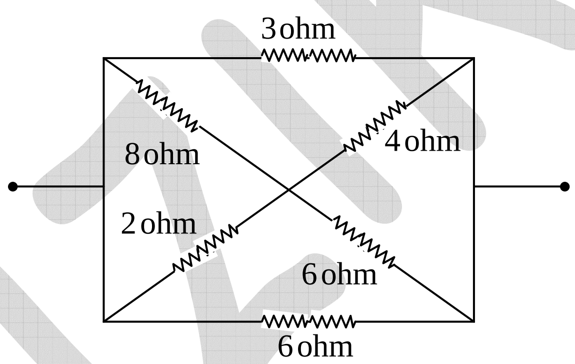
Q94. Which of the following phenomenon supports the transverse nature of electromagnetic waves:

(a) Reflection (b) Polarization (c) Interference (d) Diffraction

Q95. In Newton's ring experiment the diameter of 4^{th} and 12^{th} dark ring are $0.400cm$ and $0.700cm$ respectively. The diameter of the 20^{th} dark ring will be:

(a) $0.996cm$ (b) $0.976cm$ (c) $0.906cm$ (d) $0.796cm$

Q96. The value of effective resistance, in the network shown below, between points A and B is given by:



(a) $\frac{4}{3}$ ohm (b) $\frac{3}{4}$ ohm (c) $\frac{24}{17}$ ohm (d) $\frac{5}{7}$ ohm

Q97. The magnetic field $d\vec{B}$ due to small current element $\overline{d\ell}$, which is carrying current i, at a distance $\bar{r}$ is given by:

(a) $d\bar{B} = \frac{\mu_0 i}{4\pi}\left(\frac{\vec{dl}\times\bar{r}}{r^2}\right)$ (b) $d\bar{B} = \frac{\mu_0 i}{4\pi}\left(\frac{\vec{dl}\times\bar{r}}{r^3}\right)$

(c) $d\vec{B} = \frac{\mu_0 i}{4\pi}\left(\frac{\vec{dl}\times\bar{r}}{r}\right)$ (d) $d\vec{B} = \frac{\mu_0 i^2}{4\pi}\left(\frac{\vec{dl}\times\bar{r}}{r^2}\right)$

Q98. Two point charges Q and $-2Q$ are placed at some distance apart, of the electric field at the location of Q is $\vec{E}$ then the electric field at the location of $-2Q$ will be:

(a) $-2\overline{E}$ (b) $-\frac{\overline{E}}{2}$ (c) $-\frac{3\overline{E}}{2}$ (d) $-\overline{E}$

Q99. By mistake a voltmeter is connected in series and an ammeter is connected in parallel with a resistance in an electrical circuit. What will happen to the voltmeter and ammeter:

(a) Voltmeter will be damaged (b) Ammeter will be damaged

(c) Both will be damaged (d) None of these will be damaged

Q100. In an intrinsic semiconductor the density of either carrier is proportional to:

(a) $T^3 e^{-Eg/2kt}$ (b) $T^{3/2} e^{-Eg/2kt}$ (c) $T^{3/2} e^{-Eg/2kt}$ (d) $T^3 e^{-Eg/kt}$

Q101. The knee voltage (cut in voltage) of a semiconductor diode is nearly:

(a) 0.3 V for Silicon and 0.7 volt for Germanium

(b) 0.7 V for Silicon and 0.3 volt for Germanium

(c) 0.7 volt for Silicon and Germanium both

(d) 0.3 volt for Silicon and Germanium both

Q102. In Zener diode when it is used as a voltage regulator, the acurent flow is due to the flow of:

(a) Minority carriers (b) Majority carriers

(c) Both majority and minority carriers (d) None of the above

Q103. Rydberg constant for Hydrogen atom is 1.097×10^{-3} per Å. The maximum wavelength limit of Lyman series will be:

(a) 2430 Å (b) 1215 Å (c) 608 Å (d) 1825 Å

Q104. Total energy of electron in Hydrogen atom in the orbit of radius r is:

(a) $\frac{1}{4\pi\epsilon_0}\frac{e^2}{r}$ (b) $-\frac{1}{4\pi\epsilon_0}\frac{e^2}{r}$ (c) $\frac{1}{4\pi\epsilon_0}\frac{e^2}{2r}$ (d) $-\frac{1}{4\pi\epsilon_0}\frac{e^2}{2r}$

Q105. Raman effect is due to:

(a) Coherent scattering (b) Elastic scattering

(c) Incoherent scattering (d) Inelastic scattering

Q106. For Compton scattering at 90° the effective shift in wavelength is:

(a) $0.242\,\text{Å}$ (b) $2.42\,\text{Å}$ (c) $0.0242\,\text{Å}$ (d) $0.121\,\text{Å}$

Q107. If at room temperature Ge has intrinsic carrier concentration $n_1 = p_1 = 10^{13}/cm^3$. When it is doped with Antimony the hole density p is decreased to $10^{11}/cm^3$ at room temperature. The majority carrier density is:

(a) $10^{15}/cm^3$ (b) $10^{16}/cm^3$ (c) $10^{12}/cm^3$ (d) $10^{14}/cm^3$

Q108. A gas is compressed at a constant pressure of $50\,N/m^2$ with a change of volume as $6m^3$ then $100\,J$ of energy is added to the gas. What is the change in the internal energy of the gas:

(a) $400\,J$ (b) $500\,J$ (c) $200\,J$ (d) $300\,J$

Q109. A reversible heat engine converts $\frac{1}{6}th$ heat which it absorbs from source into useful work. When the temperature of the sink is reduced by $62^{\circ}C$ the efficiency of the engine is doubled. The temperature of the source is:

(a) $172\,K$ (b) $262\,K$ (c) $562\,K$ (d) $372\,K$

Q110. The electric field of a plane electromagnet wave traveling along Z axis is given by $\vec{E} = \left(E_{ax}x + E_{ay}y\right)\sin\left(\omega t - kz + \phi\right)$ then the magnetic field $\vec{B}$ is given by:

(a) $\vec{B} = \left(-E_{ax}\hat{x} + E_{ay}\hat{y}\right)/c \times \cos\left(\omega t - kz + \phi\right)$

(b) $\vec{B} = \left(-E_{ax}\hat{x} + E_{ay}\hat{y}\right)/c \times \sin\left(\omega t - kz + \phi\right)$

(c) $\vec{B} = \left(E_{ax}\hat{x} + E_{ay}\hat{y}\right)/c \times \cos\left(\omega t - kz + \phi\right)$

(d) $\vec{B} = \left(E_{ax}\hat{x} - E_{ay}\hat{y}\right)/c \times \sin\left(\omega t - kz + \phi\right)$

Where $\hat{x}$ and $\hat{y}$ are unit vectors along x and y directions respectively.

Q111. On increasing the angular velocity of an object by 10% the kinetic energy of the object increases by:

(a) 20% (b) 41% (c) 21% (d) 46%

Q112. Two bodies are placed in an evacuated vessel maintained at a temperature of $27°C$. The temperature of first body is $327°C$ and that of the second body is $227°C$. The ratio of respective heat losses from two bodies is about:

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

Q113. In the throttling process through a porous plug which of the following thermodynamical variable remains constant:

(a) Temperature (b) Internal energy (c) Entropy (d) Enthalpy

Q114. Two transverse sinusoidal waves travel in opposite direction along a string. The speed of each wave is $0.5 m/\sec$. Each has the amplitude 0.03 meter and wave length of 0.06 meter. The equation of the resultant wave is:

(a) $y = 3\sin\frac{\pi t}{3}\cos\frac{10\pi x}{6}$ (b) $y = 3\sin\frac{\pi x}{3}\cos\frac{10\pi t}{6}$

(c) $y = 6\sin\frac{\pi^3 x}{3}\cos\frac{10\pi t}{6}$ (d) $y = 6\sin\frac{10\pi t}{6}\cos\frac{\pi x}{3}$

Q115. The minimum wavelength of X rays produced by X ray tube operated on 50 kilovolt will be:

(a) $0.248\,Å$ (b) $2.48\,Å$ (c) $4.96\,Å$ (d) $0.496\,Å$

Q116. In Ruby LASER the population inversion is achieved through a:

(a) Vaccum pump (b) Helical Xenon discharge tube

(c) Helium Lamp (d) Mercury Lamp

Q117. $10\,gm$ of water at $0°C$ is heated and transformed to $10\,gm$ steam at $100°C$. If the latent heat of evaporation of water at $100°C$ is $538\,Cal/gm$ then the change in entropy in the entire process is:

(a) $14.46\,Cal/°K$ (b) $15.74\,Cal/°K$ (c) $17.54\,Cal/°K$ (d) $16.44\,Cal/°K$

Q118. "The ratio of the emissive power to the absorptive power for radiation of a given wavelength is the same for all bodies at the same temperature". This statement is known as:

(a) Kirchhoff's Law (b) Stefan's law

(c) Newton's law (d) Rayleighzetion's law

Q119. A metal surface is illuminated by light of two different wavelengths $\lambda_1 = 248\,nm$ and $\lambda_2 = 310\,nm$. The maximum speeds of the photo electrons corresponding to these wavelengths are u_1 and u_2 respectively. If the ratio $u_1 : u_2$ is $2:1$ and $\mu c = 1240\,eV\,nm$ the work function of the metal is nearly:

(a) $3.7\,eV$ (b) $3.2\,eV$ (c) $2.8\,eV$ (d) $2.5\,eV$

Q120. A galvanometer gives full scale deflection with $0.006\,A$ current. By connecting it to $4999\,\Omega$ resistance in series it can be converted to a voltmeter of range $0-30$ volt if connected to a $\frac{2n}{249}\Omega$ resistance in parallel to at it becomes an ammeter of range $0-1.5\,A$. The value of n is:

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