BHU GEOPHYSICS 2016

Q1. If $(\bar{x}, \bar{y})$ are the coordinates of the centre of gravity of the arc of the astroid $x^{2/3} + y^{2/3} = a^{2/3}$ lying in the first quadrant, then:

(a) $\bar{x} = \bar{y} = \frac{2a}{5}$ (b) $\bar{x} = \bar{y} = \frac{a}{5}$

(c) $\bar{x} = \bar{y} = \frac{3a}{5}$ (d) $\bar{x} = \bar{y} = \frac{a}{3}$

Q2. A uniform ladder rests in limiting equilibrium with its lower end on a rough horizontal plane and its upper end against a smooth wall. If μ is the coefficient of friction and θ is the inclination of the ladder to the vertical, then:

(a) $\tan\theta = \mu$ (b) $\tan\theta = 2\mu$ (c) $2\tan\theta = \mu$ (d) $\tan\mu = \theta$

Q3. In the case of a catenary, the relation between c, s and x is given by:

(a) $s = c\sec\frac{x}{c}$ (b) $s = c\cos h\frac{x}{c}$

(c) $s = c\sin\frac{x}{c}$ (d) $s = c\sin\text{h}\frac{x}{c}$

Q4. A uniform chain of length l is suspended from two points A and B in the same horizontal line in the form of a catenary. If the tension at A is twice the tension at lowest point, then span AB is:

(a) $\frac{1}{\sqrt{3}}\log\left(1+\sqrt{3}\right)$ (b) $\frac{1}{\sqrt{3}}\log\left(2-\sqrt{3}\right)$

(c) $\frac{1}{\sqrt{3}}\log\left(2+\sqrt{3}\right)$ (d) $\frac{1}{\sqrt{2}}\log\left(2+\sqrt{3}\right)$

Q5. A uniform rod of length $2a$ rests in equilibrium against a smooth peg distance b from the wall. In the position of equilibrium, the rod is inclined to the vertical wall at an angle:

(a) $\sin^{-1}\left(\frac{b}{a}\right)$ (b) $\sin^{-1}\left(\frac{b}{a}\right)^{1/2}$

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

Q6. Six equal rods AB, BC, CD, DE, EF and FA are each of weight W and are freely joined at their extremities so as form a hexagon. The rod AB is fixed in a horizontal position and the middle points of AB and DE are joined by a string. The tension of the string is:

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

Q7. Forces P, Q, R act along the sides BC, CA, AB of a triangle ABC. If their resultant passes through the centre of the circumscribing circle of the triangle, then:

(a) $P+Q+R=0$ (b) $P\sin A+Q\sin B+R\sin C=0$

(c) $P+Q-R=0$ (d) $P\cos A+Q\cos B+R\cos C=0$

Q8. If a system of coplanar forces $(1,0),(0,2),(-3,0)$ and $(0,-4)$ act at the points $(0,0),(1,0),(1,1)$ and $(0,1)$, then the equation of the line of action of their resultant is:

(a) $x-y=\frac{5}{2}$ (b) $y-x=\frac{5}{2}$ (c) $y-x=5$ (d) $y+x=\frac{5}{2}$

Q9. If particle describes the curve $r=ae^{\theta}$ with constant angular velocity w, the radial component of the acceleration of the particle is:

(a) 0 (b) rw^2 (c) $2rw^2$ (d) $-rw^2$

Q10. In a simple harmonic motion of amplitude a and period T, the velocity v at a distance x from the centre is given by the relation:

(a) $V^2T^2=\left(a^2-x^2\right)$ (b) $V^2T^2=4\pi^2\left(a^2-x^2\right)$

(c) $VT=2\pi\left(a^2-x^2\right)$ (d) $V^2T^2=4\pi^2\left(a^2+x^2\right)$

Q11. A heavy particle hangs from 0 by a string of length a. It is projected horizontally with a velocity $u^2=\frac{7ag}{2}$. The string becomes slack when it has described an angle:

(a) $\cos^{-1}\left(-\frac{1}{\sqrt{2}}\right)$ (b) $\cos^{-1}\left(-\frac{1}{\sqrt{3}}\right)$ b

(c) $\cos^{-1}\left(-\frac{1}{2}\right)$ (d) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

Q12. The momentum of inertia of a uniform cube of side $2a$ and mass M about axis through its centre is:

(a) $\frac{1}{3}Ma^2$ (b) $\frac{2}{3}Ma^2$ (c) $\frac{5}{3}Ma^2$ (d) $\frac{11}{3}Ma^2$

Q13. A solid sphere of radius a oscillates about a tangent at the heightest point as a horizontal axis. The length of the simple equivalent pendulum is:

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

Q14. A circular plate rotates about an axis through its centre perpendicular to its plane with angular velocity w. If the axis is set free and a point in the circumference of the plate is fixed, then the resulting angular velocity is:

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

Q15. A square lamina of side a is vertically immersed in a liquid with one side in the free surface of the liquid. The depth of centre of pressure from the free surface is:

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

Q16. The n^{th} differential coefficient at $\log\{(ax+b)(cx+d)\}$ is:

(a) $(-1)^{n-1}(n-1)!\left[a^n(ax+b)^{-n}+c^n(cx+d)^{-n}\right]$

(b) $(-1)^n n!\left[a^n(ax+b)^{-n}+c^n(cx+d)^{-n}\right]$

(c) $(-1)^n n!\left[a^n(ax+b)^{-(n+1)}+c^n(cx+d)^{-(n+1)}\right]$

(d) $(-1)^{n-1}(n-1)!\left[a^n(ax+b)^{n}+c^n(cx+d)^{n}\right]$

Q17. If $y=e^{a\sin^{-1}x}$ and $y_1=\frac{dy}{dx}, y_2=\frac{d^2y}{dx^2}$, then

(a) $(1-x^2)y_2-xy_1=ay$ (b) $(1-x^2)y_2+xy_1=a^2y$

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

Q18. $\lim_{n\to\infty}\sum_{r=1}^{n-1}\frac{1}{\sqrt{n^2-r^2}}$ is equal to:

(a) 0 (b) $\frac{\pi}{2}$ (c) π (d) $\frac{\pi}{4}$

Q19. The number of asymptotes of the curve $y^2\left(x^2-a^2\right)=x^2\left(x^2-4a^2\right)$ parallel to x-axis:

(a) 2 (b) 4 (c) 1 (d) none of these

Q20. If the equation of curve $r=f\left(\theta\right)$ remains unaltered on replacing θ by $\pi-\theta$, then the curve is symmetrical about the line:

(a) $\theta=\frac{\pi}{4}$ (b) $\theta=\pi$ (c) $\theta=\frac{\pi}{2}$ (d) none of these

Q21. The number of loops in the curve $r=\sin 5\theta$ is

(a) 10 (b) 5 (c) 4 (d) none of these

Q22. The radius of curvature at (x, y) for the curve $a^2y=x^3-a^3$ is:

(a) $\frac{\left(a^4+9x^4\right)^{\frac{3}{2}}}{6a^4x}$ (b) $\frac{\left(a^4+3x^4\right)^{\frac{3}{2}}}{3a^4x}$

(c) $\frac{\left(a^4+9x^4\right)^{\frac{3}{2}}}{3a^4x}$ (d) $\frac{\left(a^4+9x^4\right)^{\frac{3}{2}}}{6a^4x^2}$

Q23. The radius of curvature for the pedal equation $r=f\left(p\right)$ is:

(a) $\rho=r\frac{dp}{dr}$ (b) $\rho=r\frac{dr}{dp}$

(c) $\rho=\frac{dp}{dr}$ (d) $\rho=\frac{1}{r}\frac{dr}{dp}$

Q24. $\int_0^{\frac{x}{2}}\log\tan x\,dx$ is equal to:

(a) $-\frac{\pi}{2}\log 2$ (b) $\frac{\pi}{2}\log 2$

(c) $\frac{\pi}{4}\log 2$ (d) none of these

Q25. If u, v are functions of r, θ and r, θ are functions of x, y, then $\frac{\partial(u,v)}{\partial(x,y)} =$

(a) $\frac{\partial(u,v)}{\partial(r,\theta)} \times \frac{\partial(r,\theta)}{\partial(x,y)}$ (b) $\frac{\partial(u,v)}{\partial(r,\theta)} \times \frac{\partial(x,y)}{\partial(r,\theta)}$

(c) $\frac{\partial(u,v)}{\partial(x,y)} \times \frac{\partial(x,y)}{\partial(r,\theta)}$ (d) None of these

Q26. If $x = r\cos\theta$ and $y = r\sin\theta$, then $\frac{\partial(x,y)}{\partial(r,\theta)}$ -

(a) $\frac{1}{r}$ (b) 1 (c) r (d) none of these

Q27. The value of $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dx\, dy$ is:

(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{3}$ (d) none of these

Q28. The value of $\int_0^1 \int_0^1 (x^2+y^2) dx\, dy =$ is:

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

Q29. Length of complete cycloid $x = a(\theta + \sin\theta), y = a(1-\cos\theta)$ is equal to:

(a) $2a$ (b) $4a$ (c) $8a$ (d) $16a$

Q30. The value of $\int_0^a \frac{x^4}{\sqrt{a^2-x^2}} dx =$

(a) $\frac{3a^4}{16}$ (b) $\frac{3\pi a^2}{16}$ (c) $\frac{3\pi a^4}{16}$ (d) none of these

Q31. The value of $\frac{(\cos\theta + \sin\theta)^{100}}{(\cos\theta - i\sin\theta)^{-100}}, 0 < \theta < \frac{\pi}{2}, i = \sqrt{-1}$ is

(a) 1 (b) $(\cos\theta + i\sin\theta)^{200}$

(c) $(\cos\theta - i\sin\theta)^{200}$ (d) $(\cos\theta - i\sin\theta)^{100}$

Q32. If $2\cos\theta = x + \frac{1}{x}, 0 < \theta < \frac{\pi}{2}$ and $2\cos\phi = y + \frac{1}{y}, 0 < \phi < \frac{\pi}{2}$, then the value of $x^{100}y^{50} + \frac{1}{x^{100} + y^{50}}$ is:

(a) $2\cos(100\theta - 50\phi)$ (b) $2\cos(100\theta + 50\phi)$

(c) $2\sin(100\theta + 50\phi)$ (d) $2\sin(100\theta - 50\phi)$

Q33. If $\cos\alpha + \cos\beta + \cos\gamma = 0$ and $\sin\alpha + \sin\beta + \sin\gamma = 0,\ 0 \le \alpha, \beta, \gamma \le \pi$, then the value of $\cos 3\alpha + \cos 3\beta + \cos 3\gamma$ is:

(a) $3\sin(\alpha + \beta + \gamma)$ (b) $\cos(\alpha + \beta + \gamma)$

(c) $2\cos(\alpha + \beta + \gamma)$ (d) $3\cos(\alpha + \beta + \gamma)$

Q34. If $\cos\alpha + \cos\beta + \cos\gamma = 0$ and $\sin\alpha + \sin\beta + \sin\gamma = 0,\ 0 \le \alpha, \beta, \gamma \le \pi$, then the value of $\sin 3\alpha + \sin 3\beta + \sin 3\gamma$ is:

(a) $3\sin(\alpha + \beta + \gamma)$ (b) $2\sin(\alpha + \beta + \gamma)$

(c) $\sin(\alpha + \beta + \gamma)$ (d) $4\sin(\alpha + \beta + \gamma)$

Q35. If $(a_1 + ib_1)(a_2 + ib_2)(a_3 + ib_3) = A + iB$ then value of

$$\tan^{-1}\left(\frac{b_1}{a_1}\right) + \tan^{-1}\left(\frac{b_2}{a_2}\right) + \tan^{-1}\left(\frac{b_3}{a_3}\right)$$ is:

(a) $\tan^{-1}(B)$ (b) $\tan^{-1}\left(\frac{B}{A}\right)$

(c) $\tan^{-1}(A)$ (d) $\tan^{-1}(A + B)$

Q36. If $(c_1 + id_1)(c_2 + id_2)(c_3 + id_3) = C + iD$ then the value of $(c_1^2 + d_1^2)(c_2^2 + d_2^2)(c_3^2 + d_3^2)$ is:

(a) D^2 (b) C^2 (c) $C^2 - D^2$ (d) $C^2 + D^2$

Q37. Let n be a positive integer. By the use of De-Moiver's theorem, the roots of the equation $(x-1)^n = x^n$ are

(a) $\frac{1}{2}\left(1+i\cot\frac{r\pi}{n}\right), 0 \le r \le n-1$ (b) $\frac{1}{2}\left(1-i\cot\frac{r\pi}{n}\right), 0 \le r \le n-1$

(c) $\frac{1}{2}\left(1+i\tan\frac{r\pi}{n}\right), 0 \le r \le n-1$ (d) $\frac{1}{2}\left(1-i\tan\frac{r\pi}{n}\right), 0 \le r \le n-1$

Q38. The value of $\left(\sqrt{3}+i\right)^{600} + \left(\sqrt{3}-i\right)^{600}$ is

(a) 2^{603} (b) 2^{601} (c) 2^{602} (d) 2^{600}

Q39. The value of $(1+i)^4 + (1-i)^4$ is:

(a) 4 (b) −4 (c) 8 (d) −8

Q40. Let N be the set of all natural numbers. The general value of $\log_e(-5)$ is given by:

(a) $\log_e 5.(2n+1)\pi i, n \in N$ (b) $\log_e 5 - 2n\pi i, n \in N$

(c) $\log_e 5 + 2n\pi i, n \in N$ (d) $\log_e 5 + (2n+1)\pi i, n \in N$

Q41. Let IR be the set of all real numbers. The value of $\tan\left(i\log\left(\frac{a-ib}{a+ib}\right)\right), a, b \in IR, a \ne b$, is:

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

Q42. If $x \in 1R$ then the value of $i\log\left(\frac{x-i}{x+i}\right)$ is:

(a) $\pi - \tan^{-1}x$ (b) $\pi + 2\tan^{-1}x$

(c) $\pi - 2\tan^{-1}x$ (d) $\pi + \tan^{-1}x$

Q43. If α, β, γ are the roots of the equation $x^3 + 2x^2 + 7x + 2 = 0$ then the value of $\tan^{-1}\alpha + \tan^{-1}\beta + \tan^{-1}\gamma$ is:

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

Q44. The expansion of $2^6\cos^7\theta, \theta \in 1R$, is

(a) $\cos 7\theta + 7\cos 5\theta + 21\cos 3\theta + 35\cos\theta$

(b) $\cos 7\theta + 7\cos 5\theta + 21\cos 3\theta - 35\cos\theta$

(c) $\cos 7\theta + 7\cos 5\theta - 21\cos 3\theta + 35\cos\theta$

(d) $\cos 7\theta - 7\cos 5\theta + 21\cos 3\theta + 35\cos\theta$

Q45. The expression of $2^7\sin^8\theta, \theta \in IR$, is:

(a) $\cos 8\theta - 8\cos 6\theta + 28\cos 4\theta + 56\cos 2\theta + 35$

(b) $\cos 8\theta - 8\cos 6\theta + 28\cos 4\theta - 56\cos 2\theta + 35$

(c) $\cos 8\theta + 8\cos 6\theta + 28\cos 4\theta - 56\cos 2\theta + 35$

(d) $\cos 8\theta - 8\cos 6\theta - 28\cos 4\theta - 56\cos 2\theta + 35$

Q46. $\dfrac{mx+n}{(x-a)(x+b)}$ is equal to:

(a) $\dfrac{1}{a+b}\left(\dfrac{ma+n}{x-a}+\dfrac{mb-n}{x+b}\right)$

(b) $\dfrac{1}{a-b}.\dfrac{(ma+n)}{(x-a)}+\dfrac{1}{a+b}\dfrac{(mb-n)}{(x+b)}$

(c) $\dfrac{1}{a^2-b^2}\left(\dfrac{m+na}{x-a}+\dfrac{m-nb}{x+b}\right)$

(d) none of these

Q47. The general term of $\dfrac{3x^2+x-2}{(x-2)^2(1-2x)}$, when expanded ascending powers of x is:

(a) $\left(-\dfrac{1}{3}+\dfrac{5}{6}.\dfrac{1}{2^r}-\dfrac{r-1}{2^r}\right)x^r$

(b) $\left(-\dfrac{2^r}{3}+\dfrac{5}{6}.\dfrac{1}{2^r}-\dfrac{r-1}{2^r}\right)x^r$

(c) $\left(-\dfrac{2^r}{3}+\dfrac{5}{6}.\dfrac{1}{2^r}+\dfrac{r+1}{2^r}\right)x^r$

(d) none of the above

Q48. If p,q and r are any real numbers then

(a) $\max(p,q) < \max(p,q,r)$

(b) $\min(p,q) = \dfrac{1}{2}(p+q-|p-q|)$

(c) $\min(p,q) < \min(p,q,r)$

(d) none of above

Q49. If p, q, r be three positive numbers, then the value of $(p+q)(q+r)(r+p)$ is:

(a) $< 4pqr$ (b) $< 8pqr$

(c) $\geq 8pqr$ (d) $> 4pqr$ but $< 8pqr$

Q50. If a, b, c are real numbers such that $a^2+b^2+c^2=1$, then $ab+bc+ca > ....$

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

Q51. If $\frac{x^2-bx}{ax-c}=\frac{k-1}{k+1}$ has roots where magnitudes are equal but signs are opposite the value of k must be:

(a) $\frac{a-b}{a+b}$ (b) $\frac{a+b}{a-b}$ (c) c (d) $1/C$

Q52. The number of solutions to the equation $x^2-5|x|+6$ is:

(a) 2 (b) 4 (c) 6 (d) None of these

Q53. If α, β are the roots of $ax^2+bx+c=0$, $\alpha+h$, $\beta+h$ are roots of $px^2+qx+\gamma=0$ and D_1, D_2 are respective discriminants of these equations then $D_1 : D_2$ is equal to:

(a) a^2/p^2 (b) b^2/q^2 (c) c^2/r^2 (d) None of these

Q54. If the roots of the quadratic equation $x^2-4x-\log_3 a=0$ are real, then the least value of a is equal to:

(a) 81 (b) $1/81$ (c) $1/64$ (d) None of these

Q55. The condition that $x^3-px^2+qx-r=0$ may have two of its roots equal to each other but of opposite sign is:

(a) $r=pq$ (b) $r=2p^3+pq$ (c) $r=p^2q$ (d) None of these

Q56. The difference between the larger root and smaller root of $x^2-px+\frac{p^2-1}{4}=0$:

(a) 0 (b) 1 (c) 2 (d) $-p+1$

Q57. Which is not possible? The number of real roots of the equation $ax^4+bx^3+cx^2+dx+e=0$, where a,b,c,d and e are real coefficients, may be:

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

Q58. If $\alpha_1,\alpha_2,.....\alpha_n$ are roots of the equation $x^n+nax-b=0$, then $(\alpha_1-\alpha_2)(\alpha_1-\alpha_3)......(\alpha_1-\alpha_n)$ is equal to:

(a) $n\left(\alpha_1^{n-1}+a\right)$ (b) α_1^n+a (c) $n\alpha_1^{n-1}+a$ (d) $\alpha_1^{n-1}+na$

Q59. If we square either of the imaginary cube roots of unity, we obtain:

(a) A 6^{th} root of unity (b) Its real root

(c) The other imaginary root (d) None of these

Q60. If the roots of the equation $x^3-12x^2+39x-28=0$ are in A.P. then the difference between its two roots is:

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

Q61. The least possible number of positive roots of the equation $2x^7-x^4+4x^3-5=0$ is

(a) 2 (b) 4 (c) 6 (d) None of the above

Q62. If $f(a)$ and $f(b)$ are of opposite signs, then the number of roots of $f(x)=0$ lying between a and b is:

(a) Odd (b) Even

(c) Either even or odd (d) None of the above

Q63. The system of equations

$\alpha x+y+z=a-1$

$x+\alpha y+z=\alpha-1$

$x+y+\alpha z=\alpha-1$

has no solution if α is

(a) 1 (b) not (-2) (c) either -2 or 1 (d) -2

Q64. If a square matrix A is such that $AA^T=I=A^TA$, then $|A|$ is equal to:

(a) 0 (b) ±1 (c) ±2 (d) None of these

Q65. If $x=\begin{bmatrix}3 & -4\\ 1 & -1\end{bmatrix}$, the value of x^n is equal to:

(a) $\begin{bmatrix}3n & -4n\\ n & n\end{bmatrix}$ (b) $\begin{bmatrix}2+n & 5-n\\ n & n\end{bmatrix}$

(c) $\begin{bmatrix}3^n & (-4)^n\\ 7^n & (-7)^n\end{bmatrix}$ (d) None of these

Q66. If $A=\begin{bmatrix}1 & 0 & 0\\ 0 & 1 & 1\\ 0 & -2 & 4\end{bmatrix}, 6A^{-1}=A^2+CA+dI$, then (C,d) is:

(a) $(-6, 11)$ (b) $(-11, 6)$ (c) $(11, 6)$ (d) $(6, 11)$

Q67. If $\begin{vmatrix}6i & -3i & 1\\ 4 & 3i & -1\\ 20 & 3 & i\end{vmatrix}=x+iy$, then

(a) $x=3,\ y=1$ (b) $x=1,\ y=3$

(c) $x=0,\ y=3$ (d) $x=0,\ y=0$

Q68. If $A=\begin{bmatrix}1 & 0\\ 1 & 1\end{bmatrix}, I=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$, then which of the following holds for $n\geq 1$ by the principle of mathematical induction:

(a) $A^n=2^{n-1}A+(n-1)I$ (b) $A^n=nA+(n-1)I$

(c) $A^n=2^{n-1}A-(n-1)I$ (d) $A^n=nA-(n-1)I$

Q69. Let a, b, c be positive real numbers. Then the following system of equation in x, y and z:

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{c^2}=1,\ \frac{x^2}{a^2}-\frac{y^2}{b^2}+\frac{z^2}{c^2}=1,\ -\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1 \text{ has}$$

(a) no solution (b) unique solution

(c) infinitely many solution (d) none of these

Q70. If the value of the determinant $\begin{vmatrix} a & 1 & 1 \\ 1 & b & 1 \\ 1 & 1 & c \end{vmatrix} > 0$, then

(a) $abc > 1$ (b) $abc > -8$ (c) $abc < -8$ (d) $abc > -2$

Q71. The maximum number of different possible non-zero entries in a skew-symmetric matrix of order n is:

(a) $\frac{1}{2}\left(n^2 - n\right)$ (b) $\frac{1}{2}\left(n^2 + n\right)$

(c) n^2 (d) None of the above

Q72. Mark the incorrect statement: If A^* and B^* are transpore of conjugates of A and B respectively, then:

(a) $\left(A^*\right)^* = A$

(b) $\left(AB\right)^* = A^*B^*$, A and B are being conformable to multiplication

(c) $\left(A+B\right)^* = A^* + B^*$, A and B are being comparable

(d) $kA^* = kA^*$, k being complex number and $\bar{k}$ denotes the conjugate of K

Q73. The system of equations

$$x + 2y + 3z = 0$$

$$3x + 4y + 4z = 0$$

$$7x + 10y + 12z = 0$$

(a) possesses a trivial solution only

(b) possesses a unique non-trivial solution

(c) has infinitely many solution

(d) none of these

Q74. The two eign values of matrix $\begin{bmatrix} 1 & 0 & 0 & -a/2 \\ 0 & 1 & 0 & -a/2 \\ 0 & 0 & 1 & -a/2 \\ 0 & 0 & 0 & a \end{bmatrix}$ are

(a) 1 and a (b) 1 and $-a$

(c) $\frac{1}{2}$ and $-\frac{a}{2}$ (d) $-\frac{1}{2}$ and $-\frac{a}{2}$

Q75. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, then $A^2 - 5A + 71$ is

(a) $\begin{bmatrix} 0 & 0 \\ 1 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

(c) $\begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$ (d) None of the above

Q76. The half life of certain particle in its own frame of reference, which is at rest, is $36\mu\text{sec}$. Its half life for an observer moving with constant velocity $0.8c$ with respect to the particle will be:

(a) $21.6\,\mu\text{sec}$ (b) $40\,\mu\text{sec}$ (c) $60\,\mu\text{sec}$ (d) $50.4\,\mu\text{sec}$

Q77. A space ship launched from the earth at the speed of $0.5c$ fires from its nose a rocket which travels at a speed of $0.5c$ relative to the space ship. The speed of the rocket with reference to the earth will be:

(a) $1.0c$ (b) $0.8c$ (c) $0.6c$ (d) $0.4c$

Q78. A certain particle in motion has a kinetic energy equal to its rest energy. The velocity of this particle is:

(a) $0.866c$ (b) $0.433c$ (c) $0.334c$ (d) $0.668c$

Q79. If the escape velocity on the surface of the earth is v_0 then the escape velocity on another planet whose mass is twice that of earth and radius is half of the radius of the earth, will be:

(a) $4v_0$ (b) $2v_0$ (c) v_0 (d) $v_0/2$

Q80. Imagine a light planet revolving round a very massive star in a circular orbit of radius R with a period of revolution T. If T^2 is proportional to $R^{7/2}$ then the gravitational force of attraction between the planet and star is proportional to:

(a) $R^{-11/2}$ (b) $R^{-9/2}$ (c) $R^{-7/2}$ (d) $R^{-5/2}$

Q81. If the proper mean life time of π^+ meson is $\tau = 2.5\,\mu\text{sec}$ then the distance travelled by a burst of π^+ mesons travelling with speed $0.8c$ will be:

(a) 1000 meter (b) 800 meter (c) 600 meter (d) 400 meter

Q82. A $50\,gm$ bullet moving with velocity $10\,m/\sec$ strikes a block of $950\,gm$ at rest and gets embedded in it. The loss in kinetic energy will be:

(a) 5% (b) 20% (c) 95% (d) 80%

Q83. If $\vec{F}$ is conservative force then:

(a) $\vec{\nabla} \cdot \vec{F} = 0$ (b) $\vec{\nabla} \times \vec{F} = 0$

(c) $\vec{\nabla} \times \vec{\nabla} \times \vec{F} = 0$ (d) $\vec{\nabla}\left(\vec{\nabla} \cdot \vec{F}\right) = 0$

Q84. A body is rotating with a constant angular velocity $\vec{\omega}$ about an axis passing through the origin of the coordinate system. If $\vec{r}$ is the position vector of a point fixed in the rotating body then the linear velocity $\vec{v}$ of that point is given by

(a) $\vec{v} = \vec{\omega} \times \vec{r}$ (b) $\vec{\omega} = \vec{v} \times \vec{r}$ (c) $\vec{v} = \vec{r} \times \vec{\omega}$ (d) $\vec{\omega} = \vec{r} \times \vec{v}$

Q85. A cylinder of mass M and radius R is rolling down an inclined plane without slipping. If the height of the inclined plane from the surface of the earth is h then find the speed of the center of mass of the cylinder when it reaches the bottom of inclined plane:

(a) $2\sqrt{gh}$ (b) $\sqrt{2gh}$ (c) $\sqrt{gh}$ (d) $\sqrt{\dfrac{gh}{2}}$

Q86. The bandwidth of a series LCR resonant circuit is given by:

(a) $\dfrac{R}{2\pi L}$ (b) $\dfrac{R}{4\pi L}$ (c) $\dfrac{1}{2\pi RC}$ (d) $\dfrac{1}{4\pi RC}$

Q87. If a battery of emf 10 volt is connected in series with an inductance of 10 milihenry and a capacitor of 0.05 microfarad and a resistance of 100 ohms. The charging current in the circuit is:

(a) non-oscillatory (b) critical damped

(c) damped oscillatory (d) undamped oscillatory

Q88. A tuning fork of frequency $512\,Hz$ is vibrated with a sonometer wire and 6 beats per second are heard. The beat frequency reduces when the tension in the string of sonometer is slightly increased. The original frequency of vibration of sonometer is:

(a) 506 (b) 500 (c) 542 (d) 518

Q89. If the input to the full wave rectifier is $v(t)=V_p\sin\omega t$ then the fourier series for the output $f(t)$ of the full wave rectifier is given by:

(a) $f(t)=\frac{2Vp}{\pi}=\frac{4Vp}{\pi}\sum_{n=2,4,6}^{\infty}\frac{\sin nwt}{(n^2-1)}$ (b) $f(t)=\frac{2Vp}{\pi}-\frac{4Vp}{\pi}\sum_{n=2,4,6}^{\infty}\frac{\cos nwt}{(n^2-1)}$

(c) $f(t)=\frac{2Vp}{\pi}-\frac{4Vp}{\pi}\sum_{n=1,3,5}^{\infty}\frac{\sin nwt}{(n^2+1)}$ (d) $f(t)=\frac{2Vp}{\pi}-\frac{4Vp}{\pi}\sum_{n=1,3,5}^{\infty}\frac{\cos nwt}{(n^2+1)}$

Q90. In a playground there is a small merry go round of radius $4\,m$ and mass $12\,kg$. The radius of gyration of merry go round is $3\,m$. A child of mass $3\,kg$ runs at a speed of $10\,m/\sec$ tangent to the rim of the merry go round, which is at rest and then jumps on it. Find the angular velouty of the merry go round and the child together neglecting the friction:

(a) 0.58 rad/sec (b) 0.69 rad/sec (c) 0.77 rad/sec (d) 0.83 rad/sec

Q91. Indicate the false statement about the coriolis force:

(a) It is a fictitious force acting on a moving particle in a aniformly rotating frame of reference

(b) It is in the direction perpendicular to the direction of motion of the particle

(c) It is a along the direction of rotation of the frame of reference

(d) Its magnitude is equal to twice the product of magnitude of velocity of the particle and magnet rotational velocity of frame of reference

Q92. Two identical straight wires are stretched so as to produce 6 beats per see when vibrating simultaneously. On changing the tension slightly in one of them the beat frequency remain unchanged. Denoting by $T_1 T_2$ the higher and the lower tensions in the strings it could be said that while making above changes in the tensions

(a) T_2 was decreased

(b) T_1 was decreased

(c) T_1 was increased

(d) Beat frequency will change unless both T_1 and T_2 are changed

Q93. On placing a thin sheet of mica of thickness 12×10^{-5} cm in the path of one of the two interfering beams in Fresnel's biprism experiment it is found that the central fringe was shifted by a distance equal to the width of the bright fringe. If $\lambda = 6\times10^{-5}$ cm then find the refractive index of the mica:

(a) 1.35 (b) 1.40 (c) 1.45 (d) 1.50

Q94. In Newton's ring experiment if we use a source of light emitting two wavelength $\lambda_1 = 6000\,\overset{0}{\text{A}}$ and $\lambda_1 = 4500\,\overset{0}{\text{A}}$ then it is found that the n^{th} dark ring due to λ_1 coincides with $(n+1)^{th}$ dark ring due to λ_2. Find the value of n:

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

Q95. We wish to use a plate of glass $(\mu = 1.5)$ as a polarizer. What must be the angle of incidence so that the reflected light is completely polarized.

(a) 56.3^0 (b) 65.4^0 (c) 36.5^0 (d) 45.6^0

Q96. The sodium source of light has a doublet whose components are $5890A^0$ and $5896A^0$. Find the minimum number of lines in a grating to resolve this doublet in the first order grating spectrum:

(a) 490 (b) 796 (c) 982 (d) 856

Q97. A beam of light is analysed by a Nical prism after passing through a quarter wave plate. Two positions of maximum intensity and two positions of zero intensity are found on one complete rotation of Nical prism. The light is:

(a) unpolarized (b) plane polarized

(c) elliptically polarized (d) circularly polarized

Q98. indicate the false statement about the dispersive power of a diffraction grating:

(a) It increases with the order of the spectrum

(b) It increases with the grating element

(c) It increases with the number of lines per unit length on the grating

(d) decreases with grating element.

Q99. If the width of the transparent portion is equal to half the width of opaque portion in a diffraction grating then the missing orders of spectrum will be:

(a) 1^{st}, 3^{rd} ,5^{th} etc (b) 2^{nd}, 4^{th}, 6^{th} etc

(c) 3^{rd}, 6^{th}, 9^{th} etc (d) 5^{th}, 10^{th}, 15^{th} etc

Q100. In Michelson interferrometer light fringes are formed. It is found that on introducting a glass plate $(\mu = 1.5)$ of thickness $0.5\,mm$ the central fring shifts. By what distance the mirror M_1 must be moved to bring the central dark fringe to its initial position on the cross wires:

(a) $0.125\,mm$ (b) $0.25\,mm$ (c) $0.50\,mm$ (d) $0.08\,mm$

Q101. If two signals $V_1 = a\sin\omega t$ and $V_2 = b\cos 2\omega t$ are applied acrass the horizontal and vertical plates of a C.R.O then the lissaguous figure obtained on the CRO screen will be:

(a) circle (b) ellepse

(c) parabola (d) hyperbala

Q102. The value of $\vec{\nabla}\times\vec{\nabla}\times\vec{A}$ is given by:

(a) $\vec{\nabla}.\vec{A} - \nabla^2\vec{A}$ (b) $\vec{\nabla}\left(\vec{\nabla}.\vec{A}\right)\nabla^2\vec{A}$

(c) $\vec{\nabla}.\vec{A} + \nabla^2\vec{A}$ (d) $\vec{\nabla}\left(\vec{\nabla}.\vec{A}\right) + \nabla^2\vec{A}$

Q103. The average value of the Poynting vector for a plane polarized electromagnetic wave in free space is given by:

(a) $\frac{1}{2}\in_0 E_0^2$ (b) $\frac{1}{2}C\in_0 E_0^2$

(c) $\frac{1}{2}\mu_0 B_0^2$ (d) $\frac{1}{2}\mu_0 B_0^2/C$

Q104. The Maxwell's equation derived from Gauss's law of electrostatics is

(a) $\vec{\nabla}.\vec{E}=\frac{\rho}{\in_0}$ (b) $\vec{\nabla}\times\vec{E}=\frac{-\partial\vec{B}}{\partial t}$

(c) $\vec{\nabla}.\vec{B}=0$ (d) $\vec{\nabla}\times\vec{B}=\mu_0\left(\vec{J}+\in_0\frac{\partial\vec{E}}{\partial t}\right)$

Q105. Indicate the false statement about the high frequency $\left(w>w_p\right)$ electromagnetic wave propagation through low pressure ionized gases.

(a) phase velocity is greater than the velocity of light in free space

(b) $\vec{E}$ and $\vec{H}$ vectors are in same phase

(c) $\frac{\vec{E}}{\vec{H}}$ in ionized gases is larger than that in free space

(d) wave are attenuated in passing through the ionized gas.

Q106. If V is the scalar potential and $\vec{A}$ is the vector potential then indicate the relation which is not true:

(a) $\vec{E}=-\vec{\nabla}V-\frac{\partial\vec{A}}{\partial t}$ (b) $\vec{B}=\vec{\nabla}\times\bar{A}$

(c) $\vec{E}=-\vec{\nabla}V$ (d) $\bar{\nabla}.\bar{A}+\mu_0\in_0\frac{\partial\vec{A}}{\partial t}=0$

Q107. In metals the skin depth for electromagnetic waves:

(a) increases with increase in frequency

(b) increases with increase in conductivity

(c) decreases with increase in frequency

(d) does not dpend on frequency

Q108. The dominant mode in a rectangular wave guide is:

(a) TE_{01} (b) TE_{10} (c) TM_{01} (d) TM_{10}

Q109. A lossless transmission line has characteristic impedance $70\,\Omega$ and phase constant 3rad/m at frequency of $100\,\text{MH}_3$. Find the capacitance per meter:

(a) $68.2\,pF/M$ (b) $82.6\,pF/M$ (c) $56.3\,pF/M$ (d) $47.8\,pF/M$

Q110. Indicate the false statement about the displacement current density:

(a) Its concept was given by Maxwell

(b) Its value is given by $\frac{\partial D}{\partial t} = Ja$

(c) It can flow even in free space where charge density is zero

(d) Its concept was derived from the through that the changing electric field should produce magnetic field

Q111. In a certain medium the electric field of an electromagnetic wave is given by $\vec{E} = 10\sin\left(10^8 t - 3y\right)^n \hat{a}_x$ volt/meter, where $\hat{a}_x$ is the unit vector along x direction, what type of medium is it?

(a) Free space (b) conductor

(c) Dielectric (d) Lossless dielectric

Q112. For a plane polarized wave passing through a medium it is found that the electric vector $\vec{E}$ leads the magnetic vector $\vec{H}$ by $\frac{\pi}{4}$. The medium is:

(a) Free space (b) Dielectric

(c) Low pressure ionized gas (plasma) (d) Metal

Q113. For a transistor the value of $h_{fe} = 49$ then value of h_{fb} will be:

(a) 0.50 (b) 0.96 (c) 0.98 (d) 0.2

Q114. If a silicon chip doped with Arsenic is heated and its temperature starts increasing from room temperature then its resistance:

(a) increases (b) first increases then decreases

(c) remains unchanged (d) decreases

Q115. If a P.N junction diode is reverse then its depletion width:

(a) increases (b) decreases

(c) remains unchanged (d) first increases then decreases

Q116. In the frequency response of R.C. Coupled C.E. amplifier the upper cutoff frequency is obtained due to:

(a) blocking capacitance (b) bypass capacitance

(c) junction capacitance (d) decoupling capacitance

Q117. Indicate the false statement about the advantages of full wave rectifier over half wave rectifier

(a) ripple factor is small (b) peak inverse voltage is large

(c) rectification efficiency is large (d) transformer loss is small

Q118. Find the concentration of donor atoms in N type silicon whose conductivity is $480\ \text{simons/meter}$. It is given that the mobility of electrons in N type silicon is $0.38\,\text{m}^2/\text{volt}-\text{sec}$ and electronic charge is 1.6×10^{-19} coulomb.

(a) $7.9\times10^{21}/\text{m}^3$ (b) $8.7\times10^{20}/\text{m}^3$

(c) $5.7\times10^{21}/\text{m}^3$ (d) $6.3\times10^{20}/\text{m}^3$

Q119. What guide wavelength does $3GH_3$ radiation exhibit for dominant mode in rectangular waveguide whose width is $6\,cm$

(a) $12\,cm$ (b) $15\,cm$ (c) $18\,cm$ (d) $10\,cm$

Q120. An observer is at a very large distance r from anmonocharomatic point light source whose power output is P_0 and which radiates uniformly in all directions. Find the magnetic of electric field assuming that at large distances it behaves like plane electromagnetic wave.

(a) $\frac{1}{r}\sqrt{\frac{\mu_0 P_0}{2\pi C}}$ (b) $\frac{1}{r}\sqrt{\frac{\mu_0 P_0}{4\pi C}}$

(c) $\frac{1}{r}\sqrt{\frac{P_0\mu_0 C}{2\pi}}$ (d) $\frac{1}{r}\sqrt{\frac{P_0\mu_0 C}{4\pi}}$

Q121. Indicate the wrong relation among the four Maxwell's relations given below:

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

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

Q122. In thermodynamics the Gebb's function G is defined as:

(a) $G = u + PV + TS$ (b) $G = u + PV - TS$

(c) $G = u - PV + TS$ (d) $G - u + PV - TS$

Q123. Indicate the false conclusion drawn directly from the third law of thermodynamics:

(a) At absolute zero specific heats at constant pressure and constant volume are equal.

(b) Heat capacity vanishes at absolute zero

(c) Coefficent of volume expansion vanishes at absolute zero

(d) Absolute temperature is unattainable by a finite change of parameters.

Q124. If $1kg$ of water at 0^0C is mixed with $1kg$ of water at 100^0C. The change in the entropy of the system is:

(a) 24 Cal/Ok (b) 48 Cal/Ok

(c) 36 Cal/Ok (d) 144 Cal/Ok

Q125. The statement that 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" is known as:

(a) Stefan's law (b) Newton's law

(c) Kirchhaff's law (d) Wien's law

Q126. The change in the boiling point of water when the pressure is increased by 10^6 dynes/cm^2, on assuming, that normal boiling point of water is 100^0C, specific volume of steam is $1677\,CC/gm$ and latent heat of vaporization is 540 Cal/gm, will be about:

(a) 28^0C (b) 7.5^0C (c) 15^0C (d) 42^0C

Q127. S-T diagram can be plotted for:

(a) irreversible process only

(b) reversible processes only

(c) Both for reversible and irreversible processes

(d) Throttling processes only

Q128. At what angle of incidence should a beam of sodium light be incident on the surface of diamond to produce completely polarized reflected light? The critical angle for diamond is 24.5^0:

(a) 36.5^0 (b) 54.5^0 (c) 67.5^0 (d) 45.5^0

Q129. The work function of tungsten is $5.4eV$ when its surface is illuminated by he light of $175nm$ the maximum energy of the photoelectrons will be (given $h = 6.63\times10^{-34}$ Joule – sec):

(a) $1.4eV$ (b) $1.3eV$ (c) $1.5eV$ (d) $1.7eV$

Q130. Find the shortest wavelength present in the radiation from an X ray machine whose operating potential is 50 kilo volt $\left(e = 1.6\times10^{-19}\text{ coulomb}\right)$:

(a) $0.05nm$ (b) $0.0156nm$ (c) $0.0248nm$ (d) $0.03nm$

Q131. X rays of wavelength $10.0\,pm$ are scattered from a target. Find the maximum kinetic energy of the recoil electrons:

(a) 6.54×10^{-15} Joule (b) 3.27×10^{-15} Joule

(c) 8.54×10^{-12} Joule (d) $4..27\times10^{-12}$ Joule

Q132. The de-Broglie wavelength of an electron moving with a velocity of $v = 10^5\, m/\sec$ is (given mass of the electron $= 9.1\times10^{-31}\,kg$ and $h = 6.63\times10^{-34}$ Joule-sec)

(a) $5.3\times10^{-9}\,m$ (b) $7.3\times10^{-9}\,m$

(c) $3.65\times10^{-11}\,m$ (d) $6.9\times10^{-11}\,m$

Q133. Some of the conclusions drawn from Michelson-Marley experiment are given below. Indicate the conclusion which is not correct:

(a) The ether does not exist

(b) The light waves does not require a material medium for its propagation

(c) A fixed frame of refrence does not exist

(d) All motion is relative to a universal frame of refrence

Q134. Indicate the wrong statement about the Raman effect:

(a) It is due to the exchange of energy between the incident light photon and molecules of the medium

(b) In the scattered light extra frequencies are $v \pm v_1, v \pm v_2, v \pm v_3 ...$ where v is the original frequency:

(c) Shift in frequency $v_1, v_2, v_3 .....$ depends on the original frequency v

(d) Shift in frequency depends on the nature of the scattering material.

Q135. Which element has a $K_\alpha X$ ray line whose wavelength is $0.180\, nm$ (Rydberg constant $R = 1.097 \times 10^{-7}\, m^{-1}$)

(a) Cobalt (b) Nickel (c) Magnese (d) Iron

Q136. Indicate the false statement about the Ruby Laser:

(a) It consists of ruby rod, with ends made precisely flat

(b) Ruby rod is a long ruby crystal doped with chromium

(c) It is surrounded by a cylindrical reflector and a coolant

(d) It is also surrounded by a spiral neon flash lamp acting as a pump.

Q137. Find the thickness of a quarter wave plate for light of wavelength $6000\, \overset{0}{A}$ (given that $\mu_0 = 1.544$, and $\mu_e = 1.553$)

(a) $8.33 \times 10^{-4}\, cm$ (b) $16.67 \times 10^{-4}\, cm$

(c) $33.24 \times 10^{-4}\, cm$ (d) $4.17 \times 10^{-4}\, cm$

Q138. A plane polarized light is incident on a thin uniaxial crystal cut parallel to optic axis such that the plane of vibration of the incident light makes an angle of 45^0 with the principal plane and the crystal is of thickness which produces a phase difference of $\frac{\pi}{2}$ between ordinary and extra ordinary beams the emergent light will be:

(a) elliptically polarized

(b) plane polarized with sameplane of vibration

(c) circularly polarized

(d) plane polarized with plane of vibration rotated by 90^0

Q139. A piece of coaxial cable has a characteristic impedance of 75 ohms and a nominal capacitance of $40\, pF/m$. Find the inductance perimeter.

(a) $0.225\,\mu H$ (b) $0.525\,\mu H$ (c) $0.125\,\mu H$ (d) $0.500\,\mu H$

Q140. N -type semiconductor is formed by doping Si or Ge with:

(a) Gallium and Arsenic (b) Phosphorous and Arsenic

(c) Aluminium and Antimoney (d) Phosphorous and Boron

Q141. Common emitter amplifier is used as an amplifier in intermediate stages in multistage amplifier because:

(a) its voltage gain is high

(b) its current gain is high

(c) its input impedance and output impedance both are medium value (kilo ohms)

(d) its input impedance is very high and output impedance is very low.

Q142. If an electron is injected into a uniform magnetic field $\vec{B}$ with velocity $\vec{V}$ making an angle 45^0 with the direction of $\vec{B}$ then its path would be:

(a) circle (b) parabola (c) hyperbola (d) helix

Q143. A slab of glass placed in air:

(a) radiates more heat than it receives from surrounding

(b) radiates as much as it receives from surrounding

(c) radiates less than it receives from surrounding

(d) does not radiate at all

Q144. When white light source is used in the Young's double slet experiment the colour of bright fringes on both sides of the central fring is:

(a) violet (b) green (c) yellow (d) red

Q145. If two electric heaters rated P_1 and P_2 watts at 220 volt are connected in parallel across an electric supply of $220V$ then the total power drawn would be:

(a) $\frac{P_1P_2}{P_1+P_2}$ (b) $\frac{P_1+P_2}{P_1P_2}$ (c) P_1+P_2 (d) $\frac{P_1+P_2}{2}$

Q146. The series of spectral lines in the spectrum of hydrogen atom that lies partly in the ultraviolet and partly in the visible region is called:

(a) Lyman Series (b) Brackett Series

(c) Paschen Series (d) Balmer Series

Q147. The largest and the smallest distances of a satellite from the center of earth in its orbit r_1 and r_2 respectively. Its distance from the center of earth in its orbit will be:

(a) $\frac{r_1+r_2}{2}$ (b) $\frac{r_1+r_2}{4}$ (c) $\frac{2r_1r_2}{r_1+r_2}$ (d) $\frac{r_1r_2}{r_1+r_2}$

Q148. Laser cooling of atoms is produced due to:

(a) absorption of photons by atoms

(b) scattering of photons by atoms

(c) transfer of momentum from photons to atoms

(d) transfer of energy from photons to atoms

Q149. In a transistor the dopent concentration is:

(a) least in the emitter (b) least in the base

(c) least in the collector (d) same in the base and collector

Q150. The magnification of the image formed by a concave mirror of focal length f is m. If the image is real the distance of the object from the mirror should be:

(a) mf (b) $(m+1)f$ (c) $\frac{m-1}{m}f$ (d) $\frac{m+1}{m}f$