BHU- Geophysics Question Paper 2019

Q1. Decomposition of $\frac{5x-11}{2x^2+x+6}$ into partial fractions gives:

(a) $\frac{3}{x+2}+\frac{1}{2x-3}$ (b) $\frac{3}{x-2}+\frac{1}{2x-3}$ (c) $\frac{2}{x+2}-\frac{1}{2x-3}$ (d) $\frac{3}{x+2}+\frac{1}{2x-3}$

Q2. The $(n+1)^{\text{th}}$ term of the expression $\frac{5x+6}{(2+x)(1-x)}, x<1$ when expanded in the ascending powers of x is

(a) $\frac{1}{3}\left(11+\frac{(-1)^{n-1}}{2^{n-1}}\right)x^n$ (b) $\frac{3}{11}x^n$

(c) $\frac{(-1)^{n-1}}{2^{n-1}}x^n$ (d) $\frac{1}{2}\left(11+\frac{(-1)^{n-1}}{2^{n-1}}\right)x^n$

Q3. Consider the inequality:

$$\frac{x+y}{2}\geq\sqrt{xy}$$

The above inequality holds if:

(a) x is any real number and y is any positive real number

(b) x is any positive real number and y is any positive real number

(c) Both x and y are non-negative real numbers

(d) Both x and y are negative real numbers

Q4. Let x take real values. Then $x^3+1\leq x^2+1$ if and only if:

(a) $x\leq -1$ (b) $x\geq -1$ (c) $x\leq 0$ (d) $x\leq 1$

Q5. If equations $x^2+px+q=0$ and $x^2+bx+c=0, (p\neq b$ and $q\neq c)$ have a common root then it must be equal to:

(a) $\frac{pc+bq}{q-c}$ (b) $\frac{q-c}{p-b}$ (c) $\frac{c-q}{p-b}$ (d) $\frac{b-p}{q-c}$

Q6. The sum of the fourth powers of the roots of equation $x^3-2x^2+x-1=0$ is:

(a) 2 (b) −1 (c) 0 (d) 10

Q7. If a,b,c are roots of the equation $x^3+2x^2-3x-1=0$, then the value of $a^{-3}+b^{-3}+c^{-3}$ is:

(a) -3 (b) 13 (c) 0 (d) -42

Q8. If points $P(3,2,-4), Q(5,4,-6)$ and $R(9,8,-10)$ are collinear, then the ratio in which point Q divisible the line PR is:

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

Q9. If α,β,γ are angles which a line makes with positive direction of axes, then $\sin^2\alpha+\sin^2\beta+\sin^2\gamma$ has value:

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

Q10. Distance between planes $x+2y-2z=-1$ and $2x+4y-4z=-5$ is:

(a) $\frac{1}{3}$ (b) $\frac{5}{6}$ (c) $\frac{1}{2}$ (d) $\frac{1}{4}$

Q11. The system of equations $3x-y+4z=3$, $x+2y-3z=-2$, $6x+5y+\lambda z=-3$ has unique solution if:

(a) $\lambda\neq 5$ (b) $\lambda\neq 7$ (c) $\lambda\neq -5$ (d) $\lambda\neq -7$

Q12. The determinant of the matrix:

$$\begin{bmatrix} 1 & \lambda & \lambda^2 \\ 1 & \mu & \mu^2 \\ 1 & \nu & \nu^2 \end{bmatrix}$$ is zero if:

(a) $\lambda\neq\mu$ (b) $\mu\neq\nu$ (c) $\nu\neq\lambda$ (d) $\lambda=\mu$

Q13. If A is a square matrix such that $A^2+I=0$, then

(a) A^{-1} does not exist

(b) A^{-1} exist and $A^{-1}=A$

(c) A^{-1} exist and $A^{-1}=-A$

(d) determinant of A is 1

Q14. Let $A=\begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$. Then rank (A) is:

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

Q15. Let $AX = b$ is the matrix representation of a system of linear equations. Then the given system has infinitely many solutions if:

(a) $\text{rank}(A,b) = \text{rank}(A)$ (b) $\text{rank}(A,b) > \text{rank}(A)$

(c) $\text{rank}(A,b) \le \text{rank}(A)$ (d) $\text{rank}(A,b) = \text{rank}(A) <$ number of variables

Q16. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 2 & 0 \\ 1 & 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 0 & 0 \\ 2 & 2 & 0 \\ 2 & 2 & 2 \end{bmatrix}$. Then the determinant of BA is:

(a) 8 (b) 4 (c) 16 (d) 32

Q17. Modulus of the complex number $Z = (1+i)^6$ is:

(a) 8 (b) 16 (c) 32 (d) 64

Q18. If $z = \cos\frac{2\pi}{n} + i\sin\frac{2\pi}{n}$ for some integer $n \ge 2$, then the value of $z + z^2 + \ldots\ldots + z^{n-1}$ is:

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

Q19. If z is a complex number such that real part of z^n is positive for every positive integer n, then z is:

(a) 0 (b) 1

(c) A positive real number (d) None of the three

Q20. Let $f(x) = \frac{e^{1/x} - 1}{e^{1/x} + 1}$, when $x \ne 0$. Then $\lim_{x \to 0} f(x)$:

(a) 0 (b) 1 (c) -1 (d) does not exist

Q21. The function $f(x) = |x||x-1||x-2|$ is not differentiable only at points:

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

Q22. Let $f(x) = \begin{cases} 1, & \text{when } x \text{ is rotaional} \\ -1, & \text{when } x \text{ is irrational} \end{cases}$. Now consider following statements:

(i) f is nowhere differentiable (ii) f is nowhere continuous

(a) Both (i) and (ii) is true (b) (i) is true but (ii) is false

(c) (i) is false but (ii) is true (d) Both (i) and (ii) are false

Q23. Let $f(x)=\begin{cases} x^2\sin\left(\frac{1}{x}\right) & \text{where } x\neq 0 \\ 0, & \text{other wise} \end{cases}$. Then :

(a) $f'(0)$ does not exist (b) $f'(0)=0$

(c) $f'(0)=-1$ (d) $f'(0)=\frac{1}{2}$

Q24. The angle that the tangent to the hyperbola $y=\frac{1}{x}$ makes at the point $(1,1)$ with the x-axis is:

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

Q25. $f(x)=\begin{vmatrix} x^3 & \sin x & \cos x \\ 6 & -1 & 0 \\ 2 & 4 & 6 \end{vmatrix}$. Then $f^{(3)}(0)$ is:

(a) 6 (b) 4 (c) 0 (d) 1

Q26. If $y=\sin x+\cos x$, then the nth derivative of y with respect to x is:

(a) $\sqrt{1+\sin 2x}$ (b) $\sqrt{1-\sin 2x}$

(c) $\sqrt{1+(-1)^n\sin 2x}$ (d) $1+(-1)^n\sin 2x$

Q27. The coefficient of x^3 in the Maclaurin's series expansion of $f(x)=\log(1+x)$ is:

(a) $1/3$ (b) 1 (c) $-1/3$ (d) 0

Q28. The asymptotes to the curve $x^2y^2=a^2(x^2+y^2)$, which are parallel to x-axis, are:

(a) $x=\pm a$ (b) $x=a$ (c) $x=-a$ (d) $y=\pm a$

Q29. The curve $y^2+|x|=1$ is symmetric about:

(a) x-axis but not about y-axis (b) both x-axis and y-axis

(c) y-axis but not about x-axis (d) neither x-axis nor y-axis

Q30. The curvature of a circle at any point on it is:

(a) Zero (b) 1

(c) Radius of the circle (d) Inverse of radius

Q31. Let $f(x)\begin{cases}\frac{1}{x}, & x\neq 0\\ 0, & x=0\end{cases}$, then:

(a) f satisfies Rolle's theorem in $[0,1]$.

(b) f satisfies Lagrange's mean value theorem in $[0,1]$.

(c) f satisfies Cauchy mean value theorem in $[0,1]$.

(d) f does not satisfy Rolle's Theorem in $[0,1]$.

Q32. If f is real valued differentiable function on the interval $[0,1]$ and $f'(x)>0$ for all $x\in[0,1]$, then f is:

(a) Monotonically increasing in $[0,1]$ (b) Monotonically decreasing in $[0,1]$

(c) f is constant in $[0,1]$ (d) f is the exponential function

Q33. The greatest and least values of the function $f(x)=3x^4-2x^3-6x^2+6x+1$ in the interval $[0,2]$ are respectively:

(a) 30 and 20 (b) 21 and 1 (c) 21 and -1 (d) 20 and -1

Q34. The maximum value of the function $f(x)=x^p(1-x)^q$, where p and $q(>1)$ are positive integers, is attained at the point:

(a) $x=0$ (b) $x=1$ (c) $x=\frac{p}{p+q}$ (d) $x=\frac{q}{p+q}$

Q35. The focus and the directrix of the parabola $y^2=10x$ are, respectively:

(a) $(5,0)$ and $x=5$ (b) $(5/2,0)$ and $x=\frac{5}{2}$

(c) $(5/2,0)$ and $x=-\frac{5}{2}$ (d) $(0,5/2)$ and $x=-\frac{5}{2}$

Q36. The asymptotes of the hyperbola $\frac{x^2}{5}-\frac{y^2}{6}=1$, are:

(a) $y=\pm x$ (b) $y=\pm\frac{5}{6}x$ (c) $y=\pm\sqrt{\frac{6}{5}x}$ (d) $y=\pm\sqrt{\frac{5}{6}x}$

Q37. The equation $3x^2-6xy+3y^2+2x-7=0$ represents:

(a) a parabola (b) an ellipse

(c) a hyperbola (d) a pair of straight lines

Q38. The vertices of an ellipse whose eccentricity is 0.8 and whose foci lie at points $(0,\pm 7)$ are:

(a) $(0,\pm 8)$ (b) $(\pm 8.75,0)$ (c) $(0,\pm 8.75)$ (d) $(0,9)$

Q39. The parametric equation of the cycloid generated by the circle of radius a is:

(a) $x=a(t-\cos t), y=a(1-\sin t)$ (b) $x=a(t-\sin t), y=a(1-\cos t)$

(c) $x=a(t+\sin t), y=a(1-\cos t)$ (d) $x=a(t-\sin t), y=a(1+\cos t)$

Q40. The polar equation of the circle $x^2+(y-3)^2=9$ is:

(a) $r=2\sin\theta$ (b) $r=3\cos\theta$ (c) $r=6\cos\theta$ (d) $r=6\sin\theta$

Q41. The unit vector normal to the curve $y=\frac{x^3}{2}+\frac{1}{2}$ at the point $(1,1)$ is :

(a) $\frac{2}{\sqrt{13}}\vec{i}+\frac{2}{\sqrt{13}}\vec{j}$ (b) $\frac{-3}{\sqrt{13}}\vec{i}+\frac{2}{\sqrt{13}}\vec{j}$

(c) $\frac{-2}{\sqrt{13}}\vec{i}+\frac{3}{\sqrt{13}}\vec{j}$ (d) $2\vec{i}-3\vec{j}$

Q42.The centre and the radius of the sphere $x^2+y^2+z^2+3x-4z+1=0$ are :

(a) $\left(-\frac{3}{2},0,2\right)$ and $\sqrt{\frac{21}{2}}$ (b) $(2,0,-3)$ and $\sqrt{21}$

(c) $\left(-\frac{3}{2},0,2\right)$ and 21 (d) $(0,3,-2)$ and 5

Q43. The equation of the plane passing through points $(0,0,1)$, $(2,0,0)$ and $(0,3,0)$ is :

(a) $3x+2y+6z=6$ (b) $2x+3y+6z=6$

(c) $6x+3y+2z=6$ (d) $3x+2y+6z=-6$

Q44. The length of the smooth curve $r(t)=\cos t\vec{i}+\sin t\vec{j}+t\vec{k}\,(0\le t\le 2\pi)$ is :

(a) 2π (b) 4π (c) $2\pi\sqrt{2}$ (d) 6π

Q45. The curvature of the helix $r(t)=(a\cos t)\vec{i}\,(a\sin t)\,\vec{j}+bt\vec{k}, a,b\ge 0$ and $a^2+b^2\neq 0$, is :

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

Q46. The point closest to the origin on the plane $2x+y-z=5$ is :

(a) $\left(\frac{5}{2},0,0\right)$ (b) $(0,5,0)$ (c) $\left(\frac{5}{3},\frac{5}{6},\frac{-5}{6}\right)$ (d) $(0,0,-5)$

Q47. The area of the region bounded by $y=x$ and $y=x^2$ in the first quadrant is :

(a) $\frac{1}{3}$ (b) $\frac{1}{6}$ (c) $\frac{1}{8}$ (d) $\frac{1}{4}$

Q48. The differential equation of all circles touching y-axis at the origin and centre at the x-axis is :

(a) $2x\frac{dy}{dx}+y^2-x^2=0$ (b) $2xy\frac{dy}{dx}+x^2-y^2=0$

(c) $2y\frac{dy}{dx}+x^2-y^2=0$ (d) $2xy\frac{dy}{dx}+x^2+y^2=0$

Q49. The orthogonal trajectory of the cardioids $r=a(1-\cos\theta)$ is :

(a) $r=c(1+\cos\theta)$ (b) $r=c(1-\cos\theta)$

(c) $r=c(1+\sin\theta)$ (d) $r=c(1-\sin\theta)$

Q50. The complementary function of the differential equation

$$\left(D^3-6D^2+11D-6\right)y=e^{-2x} \text{ is :}$$

(a) $c_1e^{-x}+c_2e^{-2x}+c_3e^{-3x}$ (b) $c_1e^{x}+c_2e^{2x}-c_3e^{-3x}$

(c) $\left(c_1x+c_2\right)e^{x}+c_3e^{2x}$ (d) $c_1e^{x}+c_2e^{2x}+c_3e^{3x}$

Q51. Solution of the inequality $-2<\dfrac{6-2x}{3}<4$ is :

(a) $-3<x<6$ (b) $3<x<6$ (c) $-6<x<-3$ (d) $-6<x<3$

Q52. The rank of a matrix A is equal to the maximum number of linearly independent column vectors of A then :

(a) rank of $A>$ rank of A^T (b) rank of $A^T=0$

(c) rank of $A<$ rank of A^T (d) rank of $A=$ rank of A^T

Q53. The eigen vectors of $\begin{bmatrix}0 & 1\\ -1 & 0\end{bmatrix}$ are

(a) $\begin{bmatrix}1\\ i\end{bmatrix}$ and $\begin{bmatrix}1\\ -i\end{bmatrix}$ (b) $\begin{bmatrix}1\\ 1\end{bmatrix}$ and $\begin{bmatrix}1\\ -i\end{bmatrix}$ (c) $\begin{bmatrix}1\\ i\end{bmatrix}$ and $\begin{bmatrix}1\\ 1\end{bmatrix}$ (d) $\begin{bmatrix}1\\ i\end{bmatrix}$ and $\begin{bmatrix}-1\\ i\end{bmatrix}$

Q54. The determinant of an orthogonal matrix has the value:

(a) +1 or −1 (b) +2 or −2 (c) 0 or +2 (d) 0 or −2

Q55. The square root of $(1+i)$ is

(a) $2^{1/4}\left[\cos\pi/8+i\sin\left(\pi/8\right)\right]$ (b) $2^{1/4}\left[\cos\pi/8-i\sin\left(\pi/8\right)\right]$

(c) $2^{1/4}\left[\sin\pi/8+i\cos\left(\pi/8\right)\right]$ (d) $2^{1/4}\left[\sin\pi/8-i\sin\left(\pi/8\right)\right]$

Q56. If $u=\log\left\{\dfrac{x^2+y^2}{x+y}\right\}$, then $x\dfrac{\partial u}{\partial x}+y\dfrac{\partial u}{\partial y}$ is equal to:

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

Q57. If $u=f\left(x-y,y-z,z-x\right)$, then the value of $\dfrac{\partial u}{\partial x}+\dfrac{\partial u}{\partial y}+\dfrac{\partial u}{\partial z}$ is:

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

Q58. The whole area of the astroid $x^{2/3}+y^{2/3}=a^{2/3}$ is:

(a) πa^2 (b) $\frac{\pi a^2}{8}$ (c) $12\pi a^2$ (d) $\frac{3\pi a^2}{8}$

Q59. The volume in the positive octant of the ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$ is

(a) $\frac{1}{6}\pi abc$ (b) πabc (c) $\pi a^2b^2c^2$ (d) $\pi a^3b^3c^3$

Q60. The condition for a cone $ax^2+by^2+cz^2+2fyz+2gzx+2hxy=0$ to have three mutually perpendicular generator is:

(a) $a^2+b^2+c^2=0$ (b) $a+b+c=0$

(c) $a^3+b^3+c^3=0$ (d) $b^2-4ac=0$

Q61. Consider an inertial frame S and another frame S' moving with constant velocity $\vec{v}$ relative to S. If the origins of two frames coincide, the position vector of any particle P at any instant in the two frames are related by:

(a) $\vec{r}'=\vec{r}-\vec{v}t$ (b) $\vec{r}'=\vec{r}+\vec{v}t$ (c) $\vec{r}'=\vec{r}$ (d) $\vec{r}'=\vec{r}-\frac{\vec{v}}{2}t$

Q62. Total angular momentum in terms of kinetic energy K of an earth's satellite of mass m in a circular orbit of radius r is:

(a) $J=\left(2mr^2K\right)^{1/2}$ (b) $J=\left(2mrK\right)^{1/2}$

(c) $J=\left(mr^2K\right)^{1/2}$ (d) $J=\left(2m^2rK\right)^{1/2}$

Q63. The moment of inertia of a solid cylinder about its own axis is

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

Q64. In a LCR circuit $L=10mH, C=1\mu F$ and $R=0.1\text{ohm}$. The quality factor for the circuit is:

(a) 1000 (b) 200 (c) 500 (d) 400

Q65. Fourier series is given as:

$$y = \frac{a}{T} \text{ for } 0 < t < T$$

The coefficient A_0 is:

(a) $a/2$ (b) 0 (c) a (d) $a/4$

Q66. Maxwell's equation $\vec{\nabla} \cdot \vec{D} = \rho$ is a statement of:

(a) Faraday's law of induction (b) Modified Ampere's law

(c) Gauss law electricity (d) Gauss law of magnetism

Q67. An electromagnetic wave travels along z-axis. Which of the following pairs of space and time varying fields would generate such a wave?

(a) E_x, B_y (b) E_y, B_x (c) E_z, B_x (d) E_y, B_z

Q68. The vector Helmholtz equation in conducting medium is given by:

(a) $\nabla^2 \vec{E} + \omega^2 \mu \vec{E} = 0$

(b) $\nabla^2 \vec{E} + \left(\omega^2 \mu \in - j\omega\mu\sigma\right)\vec{E} = 0$

(c) $\nabla^2 \vec{E} + \left(\omega^2 \mu \in + j\omega\mu\sigma\right)\vec{E} = 0$

(d) $\nabla^2 \vec{E} + \left(j\omega\mu\sigma - \omega^2 \mu \in\right)\vec{E} = 0$

Q69. At absolute zero a semiconductor behaves like:

(a) An insulator (b) A super conductor

(c) A good conductor (d) A variable resistor

Q70. Which of the following is donor impurity element ?

(a) Aluminum (b) Boron (c) Phosphorus (d) Germanium

Q71. If the reverse bias voltage applied to a $p-n$ junction is increased, its barrier capacitance will:

(a) Increase (b) Decrease

(c) Remain constant (d) First increase then decrease

Q72. The intensity of the principal maxima for a grating of N slits is proportional to:

(a) $1/N$ (b) N (c) N^2 (d) $1/N^2$

Q73. The first diffraction minima due to a single slit diffraction is at $\theta = 30^0$ for a light of wavelength $500\overset{0}{\text{A}}$. The width of the slit is:

(a) $5\times10^{-5}cm$ (b) $10\times10^{-5}cm$ (c) $2.5\times10^{-5}cm$ (d) $1.25\times10^{-5}cm$

Q74. The coherence length for sodium light of wavelength $5890\overset{0}{\text{A}}$ is $2.945\times10^{-2}m$, the coherence time is:

(a) $9.82\times10^{-11}s$ (b) $9.28\times10^{-11}s$ (c) $8.92\times10^{-11}s$ (d) $8.29\times10^{-11}s$

Q75. In a doubly refracting crystal, optic axis is a direction along which:

(a) A plane polarized beam does not suffer deviation

(b) Any beam of light does not suffer deviation

(c) Double refraction does not take place

(d) Ordinary and extraordinary rays undergo maximum deviation

Q76. The state of polarization of the emerging light when a beam of circularly polarized light is passed through a quarter wave plate is:

(a) Unpolarized (b) Circularly polarized

(c) Plane polarized (d) Elliptically polarized

Q77. A black body emits:

(a) No radiations (b) Radiation of all wavelengths

(c) Radiation of only one wavelength (d) Radiations of selected wavelengths

Q78. If the temperature of the sun is doubled, the rate of energy received on earth will be increased by a factor of:

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

Q79. A tungsten cathode having threshold of $230nm$ is irradiated by ultraviolet light of wavelength $180\,nm$. The maximum energy of emitted photoelectrons is:

(a) $1.485\,eV$ (b) $1.548\,eV$ (c) $1.854eV$ (d) $4.185eV$

Q80. Antistokes lines in Raman effect have wavelength:

(a) Shorter as compared to original wavelength

(b) Longer as compared to original wavelength

(c) Equal to original wavelength

(d) Both shorter and longer as compared to original wavelength

Q81.Which of the following can be considered to be the best option for an inertial frame :

(a) a frame of reference fixed on the surface of the earth

(b) A frame of reference located on the sun

(c) A frame of reference fixed on stars

(d) A frame of reference which is moving with a uniform speed relative to an inertial frame.

Q82. At what speed a rod should move relative to an observer so that the ratio of the change in the length of the rod to its original length is $\frac{1}{2}$

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

Q83. If an electron move with a velocity such that its mass doubles its rest mass, the ratio of its kinetic energy to the rest mass energy becomes:

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

Q84. Which of the following quantities remains invariant under Galilean transformation?

(a) Velocity (b) Acceleration

(c) Position coordinate (d) None of the there

Q85. The radius of gyration of a ring of mass M and radius R about its tangent is :

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

Q86. If the distance of a satellite from the earth is doubled , its time period will become :

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

Q87. For a planet around the sun:

(a) Angular momentum of planet remains constant

(b) Linear momentum of planet remains constant

(c) Velocity of the planet remains constant

(d) None of the three

Q88. If a particle of mass m collides inelastically with another particle of mass $2m$ at rest. The ratio of kinetic energies after and before collisions will be:

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

Q89. The velocity of sound in a gas, in which two waves of length $1m$ and $1.02m$ produce 10 beats in two seconds will be:

(a) $510m/\sec$ (b) $255m/\sec$ (c) $500m/\sec$ (d) $450m/\sec$

Q90. When two simple harmonic motions at right angles to each other having periods in the ratio $1:1$ and equal amplitudes with phase difference $\frac{\pi}{2}$ superpose, the resultant is:

(a) Oblique ellipse (b) A pair of coincident straight lines

(c) A circle (d) Double ellipse overlapping on each other

Q91. Which of the following can not be expanded in the form of Fourier series?

(a) A saw-tooth wave (b) A triangular wave

(c) A square wave (d) A wave which is aperiodic

Q92. The fictions force acting on a body of mass $5kg$ in a frame of reference moving vertically upwards with an acceleration $4m/\sec^2$ will be:

(a) $49N$ downwards (b) $20N$ downwards

(c) $69N$ upwards (d) $20N$ upwards

Q93. The ratio of magnetic field vector H and electric field vector E has the dimension of

(a) Conductance (b) Inductance

(c) Capacitance (d) Product of inductance and capacitance

Q94. A plane electromagnetic wave is traveling in an unbounded lossless dielectric medium having $\mu_r = 1$ and $\varepsilon_r = 3$, the velocity of the wave in the medium is:

Where the terms have their usual meanings.

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

Q95. The permittivity of a medium is twice that of free space while its permeability may be assumed equal to that of free space, the intrinsic impedance of the medium is:

(a) 533Ω (b) 266.6Ω (c) 377Ω (d) 188.5Ω

Q96. Zener breakdown voltage depends on:

(a) Velocity of the carries (b) Number of donor atoms

(c) Number of acceptor atoms (d) Electric field created across the depletion region

Q97. The phase difference between the input and output currents in common collector configuration is:

(a) 180^0 (b) 0^0 (c) 90^0 (d) 45^0

Q98. The peak value of half-wave rectifier output voltage V_P (out) for rectifier having silicon diode is give by:

Where V_P (in) is the peak value of input voltage

(a) $V_p(in)-0.7V$ (b) $V_p(in)+0.7V$

(c) $V_p(in)-0.2V$ (d) $\frac{V_p(in)}{2}$

Q99. If the diameter of nth dark ring in reflected light system in Newton's ring experiment is $0.5cm$, when a film of air in enclosed between the glass plate and the plane-convex lens. What will be the diameter of nth dark ring in reflected light system if a liquid of refractive index 1.5 is present between glass plate and plano-convex lens?

(a) $0.75cm$ (b) $0.40cm$ (c) $0.86cm$ (d) $0.61cm$

Q100. A shift of 100 fringes is observed when the movable Mirror of Michelson mirror moves a distance of 0.002945cm. The wavelength of light used is:

(a) $5890\,\overset{0}{\text{A}}$ (b) $6000\,\overset{0}{\text{A}}$ (c) $6500\,\overset{0}{\text{A}}$ (d) $7000\,\overset{0}{\text{A}}$

Q101. If a light beam is incident on a slit of width d and distance between the screen and the slit in D. The width of principle maxima and the width of slit will be equal if D is:

(a) $\frac{d^2}{\lambda}$ (b) $\frac{2d}{\lambda}$ (c) $\frac{2d^2}{\lambda}$ (d) $\frac{d^2}{2\lambda}$

Q102. If a light beam is incident on a transparent glass sheet at Brewster's angle, the reflected and refracted beams are:

(a) At 90^0 to each other (b) At 45^0 to each other

(c) At 57^0 (d) At 180^0

Q103. In Fresnel's biprism, coherent sources are formed due to:

(a) Division of amplitude (b) Multiple reflection

(c) Division of wavefront (d) Scattering

Q104. Diffraction of light can be exhibited by an obstacle having dimension of the order of:

(a) $100\,cm$ (b) $10\,cm$ (c) $10^{-5}\,cm$ (d) $10\,m$

Q105. If in Fresnel's biprism experiment, the distance, d between two slits producing coherent beam is zero, the width of region of illumination on the screen will be

(Where the terms have their usual meaning)

(a) Infinite (b) $\frac{\lambda D}{d}$ (c) $\frac{d}{\lambda D}$ (d) Zero

Q106. A polarizer and an analyzer are oriented so that the maximum light is transmitted. What is the fraction of maximum light transmitted when analyzer is rotated through 60^0?

(a) 0.75 (b) 0.25 (c) 0.50 (d) 1

Q107. Van der Walls equation of state of a gas takes into account:

(a) The effect of intermolecular

(b) The effect of size of the molecules only

(c) Both the effect of intermolecular forces and the size of molecules

(d) The velocity of molecule only

Q108. Which of the following properties of a thermodynamics system remains constant during a reversible adiabatic process?

(a) Enthalpy (b) Temperature (c) Specific heat (d) Entropy

Q109. For solids, which contract on melting, slope of the P vs T curve is:

(a) Positive (b) Negative (c) Zero (d) Infinite

Q110. When a liquid film is stretched adiabatically:

(a) Its temperature falls (b) Its temperature remains same

(c) Its temperature increases (d) Its temperature becomes zero

Q111. In isothermal isobaric equilibrium:

(a) The entropy is maximum (b) Helmholtz free energy is minimum

(c) Gibb's free energy is minimum (d) Internal energy is minimum

Q112. A gas will be cooled as a result of Joule-Thomson expansion if temperature of the gas undergoing expansions is:

Where the terms have their usual meaning.

(a) Less than $\frac{2a}{Rb}$ (b) Greater than $\frac{2a}{Rb}$

(c) Equal to $\frac{2a}{Rb}$ (d) None of the above

Q113. At a constant temperature, the internal energy of a Van der Walls gas:

(a) Decreases as the volume increases

(b) Increases as the volume increases

(c) Remains constant irrespective of change in volume

(d) None of the three

Q114. The de-Broglie wavelength associated with $1MeV$ electron is approximately:

(a) $3.9\,nm$ (b) $8.7\times10^{-4}\,nm$ (c) $87nm$ (d) $38.9\,nm$

Q115. If the energy density from a star is maximum at $4000A$ its temperature will be nearly:

(a) $15000K$ (b) $7230\,K$ (c) $5000K$ (d) $6000K$

Q116. Rest mass of a photon is:

Where terms have their usual meaning.

(a) $\frac{h\nu}{c^2}$ (b) $h\nu$ (c) $\frac{h\nu}{c}$ (d) Zero

Q117. In Compton scattering the incident photon loses maximum energy to the electron, when photon is scattered at:

(a) 0^0 (b) 90^0 (c) 45^0 (d) 180^0

Q118. A Carnot's reversible heat engine has efficiency 0.4 when heat extracted from source is 1000 calories. What will be the change in efficiency if heat rejected to the sink is increased by 100 calories?

(a) 0.1 (b) 0.5 (c) 0.2 (d) 0.4

Q119. What of these properties must change for a mode to be Raman active?

(a) Volume (b) Dipole moment (c) Polarisability (d) Surface area

Q120. Which type of scattering is the strongest?

(a) Rayleigh (b) Stokes (c) Antistokes (d) None of the above