00736

Set No. 1 **Question Booklet No.**

17P/204/29(i)

(To be filled up by the candidate by blue/black ball-point pen)

Roll No. | | | | | | | | | | |

Serial No. of OMR Answer Sheet ..... 2017 .....

Day and Date ....

(Signature of Invigilator)

INSTRUCTIONS TO CANDIDATES

(Use only ***blue/black ball-point pen*** in the space above and on both sides of the **Answer Sheet**)

1. Within 30 minutes of the issue of the Question Booklet, check the Question Booklet to ensure that it contains all the pages in correct sequence and that no page/question is missing. In case of faulty Question Booklet bring it to the notice of the Superintendent/Invigilators immediately to obtain a fresh Question Booklet.
2. Do not bring any loose paper, written or blank, inside the Examination Hall ***except the Admit Card without its envelope.***
3. ***A separate Answer Sheet is given. It should not be folded or mutilated. A second Answer Sheet shall not be provided. Only the Answer Sheet will be evaluated.***
4. Write your Roll Number and Serial Number of the Answer Sheet by pen in the space provided above.
5. ***On the front page of the Answer Sheet, write by pen your Roll Number in the space provided at the top and by darkening the circles at the bottom. Also, wherever applicable, write the Question Booklet Number and the Set Number in appropriate places.***
6. ***No overwriting is allowed in the entries of Roll No., Question Booklet no. and Set no. (if any) on OMR sheet and Roll No. and OMR sheet no. on the Question Booklet.***
7. ***Any change in the aforesaid entries is to be verified by the invigilator, otherwise it will be taken as unfairmeans.***
8. ***Each question in this Booklet is followed by four alternative answers. For each question, you are to record the correct option on the Answer Sheet by darkening the appropriate circle in the corresponding row of the Answer Sheet, by pen as mentioned in the guidelines given on the first page of the Answer Sheet.***
9. For each question, darken only one circle on the Answer Sheet. If you darken more than one circle or darken a circle partially, the answer will be treated as incorrect.
10. *Note that the answer once filled in ink cannot be changed. If you do not wish to attempt a question, leave all the circles in the corresponding row blank (such question will be awarded zero marks).*
11. For rough work, use the inner back page of the title cover and the blank page at the end of this Booklet.
12. Deposit only **OMR *Answer Sheet*** at the end of the Test.
13. You are not permitted to leave the Examination Hall until the end of the Test.
14. If a candidate attempts to use any form of unfair means, he/she shall be liable to such punishment as the University may determine and impose on him/her.

Total No. of Printed Pages : 32

[उपर्युक्त निर्देश हिन्दी में अन्तिम आवरण पृष्ठ पर दिये गए हैं।]

10

ROUGH WORK
रफ़ कार्य

No. of Questions : 120

Time : 2 Hours ***Full Marks : 360***

Note : (1) Attempt as many questions as you can. Each question carries **3 (Three)** marks. ***One mark will be deducted for each incorrect answer.*** **Zero** mark will be awarded for each unattempted question.

(2) If more than one alternative answers seem to be approximate to the correct answer, choose the closest one.

01. 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 :

(1) $\begin{bmatrix} 6 & 6 & 7 \\ 6 & 2 & 5 \\ 1 & 5 & 7 \end{bmatrix}$ (2) $\begin{bmatrix} 6 & 6 & 7 \\ 6 & 2 & 5 \\ 7 & 5 & 1 \end{bmatrix}$

(3) $\begin{bmatrix} 0 & 2 & -2 \\ -2 & 0 & -2 \\ 2 & 2 & 0 \end{bmatrix}$ (4) $\begin{bmatrix} 0 & -2 & 2 \\ 2 & 0 & 2 \\ -2 & -2 & 0 \end{bmatrix}$

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

(1) $|A|^{n-2}$ (2) $|A|^{n-1}$ (3) $|A|^{n}$ (4) $|A|^{n+1}$

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

(1) $\begin{bmatrix}\frac{1}{5} & 0 & 0\\ 0 & \frac{1}{5} & 0\\ 0 & 0 & 1\end{bmatrix}$ (2) $\begin{bmatrix}1 & 0 & 0\\ 0 & \frac{1}{5} & 0\\ 0 & 0 & 1\end{bmatrix}$

(3) $\begin{bmatrix}1 & 0 & 0\\ 0 & \frac{1}{5} & 0\\ 0 & 0 & \frac{1}{5}\end{bmatrix}$ (4) $\begin{bmatrix}\frac{1}{5} & 0 & 0\\ 0 & 1 & 0\\ 0 & 0 & \frac{1}{5}\end{bmatrix}$

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

(1) Always all zero

(2) Always all imaginary

(3) All real

(4) Either all zero or purely imaginary

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

(1) 0, 5, 12 (2) 0, 3, 12

(3) 0, 3, 15 (4) 0, 5, 15

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

(1) Zero solution (2) No solution

(3) Unique non zero solution (4) Infinitely many solutions

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

(1) $3x^3 + 7x^2 - 11x - 15 = 0$ (2) $-3x^3 + 7x^2 + 15x - 11 = 0$

(3) $-3x^3 + 11x^2 - 15x + 7 = 0$ (4) $3x^3 - 7x^2 + 11x - 15 = 0$

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

(1) 2 (2) 1 (3) 3 (4) -2

09. If the sum of two roots is equal to the third root of equation $x^3 + px^2 + qx + r = 0$, then the following is **true** :

(1) $p^3 + 4pq - 8r = 0$ (2) $p^3 - 4pq + 8r = 0$

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

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

(1) $q^3 = p^3 r$ (2) $p^3 = q^3 r$ (3) $q^3 = p^2 r^2$ (4) $p^3 = q^2 r^2$

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

(1) $2q^3 - 3pq + r = 0$ (2) $3q^3 - 2pq + r = 0$

(3) $2p^3 - 3pq + r = 0$ (4) $3p^3 - 2pq + r = 0$

12. 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** :

(1) $2p^3 = r(3pq - r)$ (2) $3p^3 = r(2pq - r)$

(3) $3q^3 = r(2pq - r)$ (4) $2q^3 = r(3pq - r)$

13. 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 ?

(1) $\lambda = 10, \mu = 3$ (2) $\lambda = 3, \mu = 10$

(3) $\lambda = 1, \mu = 10$ (4) $\lambda = 10, \mu = 1$

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

(1) ± 1 (2) $\pm \cos\theta$

(3) $\pm \sin\theta$ (4) $\cos\theta, \sin\theta$

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

(1) $3x^3 - 7x^2 + 11x - 15 = 0$ (2) $3x^3 - 7x^2 - 11x + 15 = 0$

(3) $-3x^3 + 7x^2 - 11x + 15 = 0$ (4) $3x^3 + 7x^2 - 11x - 15 = 0$

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

(1) $\cos n\theta$ (2) $2\cos n\theta$ (3) $2\sin n\theta$ (4) $2i\cos n\theta$

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

(1) $2^{(n/2)}\cos\frac{n\pi}{4}$ (2) $2^{(n/2)-1}\cos\frac{n\pi}{4}$

(3) $2^{(n/2)+1}\cos\frac{n\pi}{4}$ (4) $2^{(n/2)+1}\sin\frac{n\pi}{4}$

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

(1) $-1, \frac{1}{2}(1 \pm i\sqrt{3})$ (2) $-1, \frac{1}{3}(1 \pm \sqrt{3})$

(3) $1, \frac{1}{2}(1 \pm \sqrt{3})$ (4) $1, \frac{1}{3}(1 \pm i\sqrt{3})$

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

(1) 1^0 (2) 2^0

(3) 3^0 (4) None of these

20. The value of $\text{cosec } 10^0 - \sqrt{3} \sec 10^0$ is :

(1) 2^2 (2) 3^2

(3) 2^3 (4) None of these

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

(1) π (2) 2π (3) $-\pi$ (4) $i\pi$

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

(1) $\frac{ab}{a^2+b^2}$ (2) $\frac{2ab}{a^2+b^2}$ (3) $\frac{ab}{a^2-b^2}$ (4) $\frac{2ab}{a^2-b^2}$

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

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

(3) $2i\tan^{-1}\left(\frac{b}{a}\right)$ (4) $2i\tan^{-1}\left(\frac{a}{b}\right)$

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

(1) $\frac{24}{x^2}$ (2) $-\frac{24}{x^2}$ (3) $\frac{12}{x^2}$ (4) $-\frac{12}{x^2}$

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

(1) $2xy_{n+1} - n(n+1)\, y_n$ (2) $2xy_{n+1} + n(n-1)\, y_n$

(3) $-2xy_{n+1} + n(n+1)\, y_n$ (4) $-2xy_{n+1} + n(n-1)\, y_n$

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

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

(3) $(1-x^2)\, y_2 + xy_1 - 2a^2y = 0$ (4) $(1-x^2)\, y_2 - xy_1 + a^2y = 0$

27. Which curve has no asymptotes ?

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

(3) $y = mx + c + \frac{A}{x} + \frac{B}{x^2}$ (4) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

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

(1) 1 and 21 (2) 1 and 2

(3) 1 and 20 (4) None of these

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

(1) 30° (2) 45° (3) 60° (4) 90°

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

(1) $\frac{1}{3}\sqrt{2ar}$ (2) $\frac{1}{2}\sqrt{3ar}$ (3) $\frac{2}{3}\sqrt{3ar}$ (4) $\frac{2}{3}\sqrt{2ar}$

31. 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 :

(1) $\sqrt{\frac{2}{3}}$ (2) $\sqrt{\frac{3}{2}}$ (3) $\frac{3}{2}$ (4) $\frac{2}{3}$

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

(1) $\frac{1}{8}$ (2) $\frac{1}{4}$ (3) $\frac{1}{6}$ (4) $\frac{1}{2}$

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

(1) $\sin^{-1}\left(\frac{x}{3}\right)$ (2) $\cos^{-1}\left(\frac{x}{3}\right)$

(3) $\sinh^{-1}\left(\frac{x}{3}\right)$ (4) $\cosh^{-1}\left(\frac{x}{3}\right)$

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

(1) $\frac{3}{8}\pi a^2$ (2) $\frac{3}{32}\pi a^2$ (3) $\frac{3}{8}\pi a^3$ (4) $\frac{3}{32}\pi a^3$

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

(1) $4\sqrt{3}\,a$ (2) $\frac{4a}{\sqrt{3}}$ (3) $2\sqrt{3}\,a$ (4) $\frac{2a}{\sqrt{3}}$

36. 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 :

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

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

(1) $2\pi a^2$ (2) πa^2 (3) $3\pi a^2$ (4) $4\pi a^2$

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

(1) Ellipse (2) Parabola

(3) Hyperbola (4) Rectangular hyperbola

39. 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 :

(1) ℓ (2) 2ℓ (3) $\frac{1}{\ell}$ (4) $\frac{2}{\ell}$

40. 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 :

(1) $(e - B)^2 + A^2 = 1$ (2) $(A - e)^2 + B^2 = 1$

(3) $(B + e)^2 + A^2 = 1$ (4) $(A + e)^2 + B^2 = 1$

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

(1) $4x + 7y - 8z = 0$ (2) $4yz + 7zx - 8xy = 0$

(3) $4x^2 + 7y^2 - 8z^2 = 0$ (4) $16yz + 49zx - 64xy = 0$

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

(1) $x^2 + y^2 = 25$ (2) $y^2 + z^2 = 25$

(3) $z^2 + x^2 = 25$ (4) $x^2 + y^2 + z^2 = 25$

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

(1) An ellipsoid
(2) A hyperboloid
(3) An elliptic paraboloid
(4) A hyperbolic paraboloid

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

(1) $-4i + 12j + 9k$
(2) $4i - 12j + 9k$
(3) $12i + 4j - 9k$
(4) $-12i + 4j + 9k$

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

(1) $\frac{\partial\phi}{\partial r}\hat{e}_r - \frac{1}{r}\frac{\partial\phi}{\partial\theta}\hat{e}_\theta$
(2) $\frac{\partial\phi}{\partial r}\hat{e}_r + \frac{1}{r}\frac{\partial\phi}{\partial\theta}\hat{e}_\theta$
(3) $\frac{\partial\phi}{\partial r}\hat{e}_\theta - \frac{1}{r}\frac{\partial\phi}{\partial\theta}\hat{e}_r$
(4) $\frac{\partial\phi}{\partial r}\hat{e}_\theta + \frac{1}{r}\frac{\partial\phi}{\partial\theta}\hat{e}_r$

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

(1) $4x + 3y = 25$
(2) $3x + 4z = 25$
(3) $4y + 3z = 25$
(4) $4x + 3z = 25$

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

(1) b curl a – a curl b
(2) a div b – $(b \cdot \nabla)$ a + b div a + $(a \cdot \nabla)$
(3) a div b – b div a + $(b \cdot \nabla)$ a – $(a \cdot \nabla)$b
(4) $(b \cdot \nabla)$ a – $(a \cdot \nabla)$ b

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

(1) 4 (2) 3 (3) 2 (4) 0

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

(1) 1 (2) 0 (3) -1 (4) ϕ

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

(1) 3V (2) 2V (3) V (4) 6V

51. Let $F = F_1 i + F_2 j + F_3 k$ the cartesian representation of stoke's theorem is :

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

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

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

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

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

(1) $(e^{-\pi} - 1)$ (2) $\left(e^{-\pi/2} - 1\right)$ (3) $2\left(e^{-\pi/2} - 1\right)$ (4) $2(e^{-\pi} - 1)$

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

(1) e^x (2) e^{-x}

(3) $ae^x + be^{-x}$ (4) $e^x + c$

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

(1) $\frac{e^x}{4} \sin 2x$ (2) $\frac{2e^x}{3} \sin 2x$

(3) $\frac{xe^x}{4} \sin 2x$ (4) $\frac{2xe^x}{3} \sin 2x$

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

(1) $Y_c = c_1 x^{-1} + x\,[c_2 \cos(\log x) + c_3 \sin(\log x)]$

(2) $Y_c = c_1 x^{-1} + x\,[c_2 \cos(e^x) + c_3 \sin(e^x)]$

(3) $Y_c = c_1 x + x\,[c_2 \cos(e^{-x}) + c_3 \sin(e^{-x})]$

(4) $Y_c = c_1 x + x^{-1}\,[c_2 \cos(\log x) + c_3 \sin(\log x)]$

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

(1) $y(t) = 1$ (2) $y(t) = \frac{1}{3}$ (3) $y(t) = \frac{1}{2}$ (4) $y(t) = 2$

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

(1) $F(t) = ate^{-t}$ (2) $F(t) = ate^{t}$

(3) $F(t) = 2ate^{-t}$ (4) $F(t) = 2ate^{t}$

58. Which relation is **not true** for a common catenary ?

(1) $y = c \cos h\left(\frac{x}{c}\right)$ (2) $x = c \log(\sec \psi + \tan \psi)$

(3) $y = c \sec \psi$ (4) $s = c \sin \psi$

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

(1) $xY - yX = 0$ (2) $xY - yX = G$

(3) $yX - \frac{x}{Y} = G$ (4) $xY - \frac{y}{X} = G$

60. 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 :

(1) $\tan\theta = \frac{1}{3}(\cot\alpha - \cot\beta)$ (2) $\tan\theta = \frac{1}{3}(\cot\beta - \cot\alpha)$

(3) $\tan\theta = \frac{1}{2}(\cot\alpha - \cot\beta)$ (4) $\tan\theta = \frac{1}{2}(\cot\beta - \cot\alpha)$

61. 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 :

(1) Linear momentum (2) Angular momentum

(3) Kinetic energy (4) Potential energy

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

(1) $\oint \vec{D}.\overline{ds} = q$ (2) $\oint \vec{H}.\overline{dl} = \int_s \left(\vec{J} + \frac{\partial \vec{D}}{\partial t}\right).\overline{ds}$

(3) $\oint \vec{B}.\overline{d\ell} = \mu, I$ (4) $\oint \vec{E}.\overline{d\ell} = -\frac{\partial}{\partial t}\int_s \vec{B}.ds$

Where I is the current in the circuit.

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

(1) $\vec{\nabla}.\vec{A} + \nabla^2 \vec{A}$ (2) $\vec{\nabla} \times \vec{A} - \nabla^2 \vec{A}$

(3) $\vec{\nabla}.(\vec{\nabla} \cdot \vec{A}) - \nabla^2 \vec{A}$ (4) $\vec{\nabla}.(\vec{\nabla}.\vec{A}) + \nabla^2 \cdot \vec{A}$

64. 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 :

(1) $\sqrt{3} : \sqrt{5}$ (2) $\sqrt{3} : \sqrt{7}$ (3) 3 : 7 (4) 3 : 5

65. 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 :

(1) 6 hours (2) 12 hours (3) 48 hours (4) 18 hours

66. 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 :

(1) 2L (2) 4L (3) L/2 (4) L/4

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

(1) $\left(\frac{\partial S}{\partial P}\right)_T = -\left(\frac{\partial T}{\partial V}\right)_P$ (2) $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$

(3) $\left(\frac{\partial T}{\partial P}\right)_S = \left(\frac{\partial S}{\partial V}\right)_P$ (4) $\left(\frac{\partial S}{\partial T}\right)_P = \left(\frac{\partial P}{\partial V}\right)_S$

68. The temperature of inversion of a gas is :

(1) $\frac{2b}{Ra}$ (2) $\frac{2a}{Rb}$ (3) $\frac{a}{Rb}$ (4) $\frac{b}{Ra}$

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

(1) A circle

(2) An ellipse

(3) A straight line inclined at 45° to the X– axis

(4) A parabola

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

(1) 1 : 2 (2) 1 : 4 (3) 4 : 1 (4) 2 : 1

71. 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 respectevely. The time period T of the particle executing S.H.M. stall be :

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

(3) $T = 2\pi \left(\frac{u_1^2 - u_2^2}{x_2^2 - x_1^2}\right)^{1/2}$ (4) $T = 2\pi \left(\frac{u_1^2 - u_2^2}{x_1^2 + x_1^2}\right)^{1/2}$

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

(1) Plane polarized

(2) Elliptically polarized

(3) Mixture of unpolarized and plane polarized

(4) Circularly polarized

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

(1) 56.31^o (2) 33.69^0 (3) 48.4^0 (4) 41.2^0

74. When a narraw pin is placed infront of a sodium light source the fringes observed on the screen are due to the phenomenon of :

(1) Diffraction only

(2) Both interference and diffraction

(3) Interference only

(4) Both intereference and dispersion

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

(1) $\frac{1.22\lambda}{d}$ (2) $\frac{\lambda}{d}$ (3) $\frac{d}{\lambda}$ (4) $\frac{d}{1.22\lambda}$

76. Three charges 2q, – q and – q are located at the vertical of an equilatral triangle. At the center of the triangle :

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

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

(3) Both the field and potential are zero

(4) Both the field and potential are non zero

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

(1) $\vec{\nabla}.\vec{D}=\rho$ (2) $\vec{\nabla}.\vec{B}=0$

(3) $\vec{\nabla}\times\vec{E}=\frac{-\partial\vec{B}}{\partial t}$ (4) $\vec{\nabla}\times\vec{H}=\vec{J}+\frac{\partial\vec{D}}{\partial t}$

78. 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 :

(1) $\mu_0 nI/2$ (2) $\mu_0 nI$ (3) $2\mu_0 nI$ (4) Zero

79. 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 :

(1) 0.5 coulomb (2) 5 coulomb

(3) 50 coulomb (4) 500 coulomb

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

(1) $\epsilon_0 (\vec{E} \times \vec{B})$ (2) $\epsilon_0 (\vec{E}.\vec{B})$

(3) $\frac{1}{\mu_0}(\vec{E} \times \vec{B})$ (4) $\frac{1}{\mu_0}(\vec{E}.\vec{B})$

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

(1) Not conduct (2) Breaks down

(3) Conduct partially (4) Conduct

82. The current gain α 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 :

(1) 40 mA (2) 18 mA (3) 20 mA (4) 36 mA

83. 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 :

(1) $\frac{10}{\sqrt{2}}$ V (2) $\frac{20}{\pi}$ V (3) $\frac{10}{\pi}$ V (4) $\frac{20}{\sqrt{2}}$ V

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

(1) Only electrons

(2) Only holes

(3) Neither electrons non holes

(4) Electrons and holes both

85. A tuning 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 :

(1) 265 Hz (2) 255 Hz (3) 270 Hz (4) 250 Hz

86. 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 :

(1) $2\pi\sqrt{b}$ (2) $\frac{2\pi}{\sqrt{b}}$ (3) $\frac{2\pi}{b}$ (4) $2\sqrt{\frac{\pi}{b}}$

87. 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 :

(1) 400 meter/sec (2) 402 meter/sec

(3) 404 meter/sec (4) 406 meter/sec

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

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

(3) $I = I_0 \frac{\cos^2 \alpha}{\alpha^2} \sin^2 \beta$ (4) $I = I_0 \frac{\sin^2 \alpha}{\alpha^2} \cos^2 \beta$

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

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

(1) $\frac{1}{\sqrt{\mu_r \epsilon_r}}$ (2) $\frac{1}{\mu_r \epsilon_r}$ (3) $\sqrt{\mu_r \epsilon_r}$ (4) $\mu_r \epsilon_r$

90. Two waves of intensities in the ratio 9 : 1 interfer to form the fringes. The ratio of maximum to minimum intensities of the fringes is :

(1) 10 : 8 (2) 4 : 1 (3) 2 : 1 (4) 8 : 1

91. 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 :

(1) 4 R (2) R (3) 2 R (4) R/2

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

(1) + 1.5 diopter (2) – 6.5 diopter

(3) + 6.5 diopter (4) – 1.5 diopter

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

(1) $\pi^2 b^2 \lambda^2$ (2) $\pi b \lambda^2$ (3) $\pi b \lambda$ (4) $\pi b^2 \lambda$

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

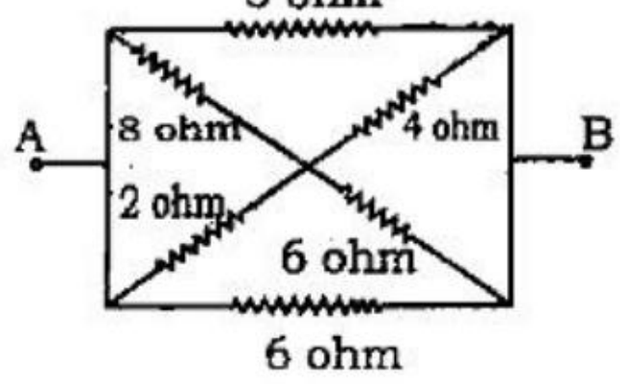
(1) Reflection (2) Polarization

(3) Interference (4) Diffraction

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

(1) 0.996 cm (2) 0.976 cm (3) 0.906 cm (4) 0.796 cm

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



(1) $\frac{4}{3}$ ohm (2) $\frac{3}{4}$ ohm (3) $\frac{24}{17}$ ohm (4) $\frac{5}{7}$ ohm

97. 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 :

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

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

98. 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 :

(1) $-2\bar{E}$ (2) $-\frac{\bar{E}}{2}$ (3) $-\frac{3\bar{E}}{2}$ (4) $-\bar{E}$

99. 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 :

(1) Voltmeter will be damaged

(2) Ammeter will be damaged

(3) Both will be damaged

(4) None of these will be damaged

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

(1) $T^3e^{-Eg/2kt}$ (2) $T^{3/2}e^{-Eg/kt}$ (3) $T^{3/2}e^{-Eg/2kt}$ (4) $T^3e^{-Eg/kt}$

Where T is temperature and Eg is the band gap.

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

(1) 0.3 V for Silicon and 0.7 volt for Germanium

(2) 0.7 V for Silicon and 0.3 volt for Germanium

(3) 0.7 volt for Silicon and Germanium both

(4) 0.3 volt for Silicon and Germanium both

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

(1) Minority carriers

(2) Majority carriers

(3) Both majorty and minority carriers

(4) None of the above

103. Rydberg constant for Hydrogen atom is 1.097×10^{-3} per $\mathring{A}$. The maximum wavelength limit of Lyman series will be :

(1) $2430\ \mathring{A}$ (2) $1215\ \mathring{A}$

(3) $608\ \mathring{A}$ (4) $1825\ \mathring{A}$

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

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

(3) $\frac{1}{4\pi\epsilon_0}\frac{e^2}{2r}$ (4) $-\frac{1}{4\pi\epsilon_0}\frac{e^2}{2r}$

105. Raman effect is due to :

(1) Coherent scattering (2) Elastic scattering

(3) Incoherent scattering (4) Inelastic scattering

106. For compton scattering at 90^0 the effective shift in wavelength is :

(1) $0.242\ \mathring{A}$ (2) $2.42\ \mathring{A}$

(3) $0.0242\ \mathring{A}$ (4) $0.121\ \mathring{A}$

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

(1) $10^{15}/cm^3$ (2) $10^{16}/cm^3$

(3) $10^{12}/cm^3$ (4) $10^{14}/cm^3$

108. 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 :

(1) 400 J (2) 500 J (3) 200 J (4) 300 J

109. A reversible heat engine converts $\frac{1}{6}$th heat which it obsorbes from source into useful work. When the temperature of the sink is reduced by 62^0 C the efficiency of the engine is daubled. The temperature of the source is :

(1) 172 K (2) 262 K (3) 562 K (4) 372 K

110. The electric field of a plane electromagnet wave travelling along Z axis is given by $\vec{E} = (E_{ox}x + E_{oy}y)\sin(\omega t - kz + \phi)$ then the magnetic field $\vec{B}$ is given by :

(1) $\vec{B} = (-E_{ox}x + E_{oy}\hat{y})/c \times \cos(\omega t - kz + \phi)$

(2) $\vec{B} = (-E_{oy}\hat{x} + E_{ox}\hat{y})/c \times \sin(\omega t - kz + \phi)$

(3) $\vec{B} = (E_{ox}\hat{x} + E_{oy}\hat{y})/c \times \cos(\omega t - kz + \phi)$

(4) $\vec{B} = (E_{ox}\hat{x} - E_{ox}\hat{y})/c \times \sin(\omega t - kz + \phi)$

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

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

(1) 20% (2) 41% (3) 21% (4) 46%

112. 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 :

(1) 2 : 1 (2) 1 : 2 (3) 4 : 1 (4) 1 : 3

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

(1) Temperature (2) Internal energy

(3) Entropy (4) Enthalpy

114. 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 :

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

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

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

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

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

(1) $0.248\,\mathring{A}$ (2) $2.48\,\mathring{A}$

(3) $4.96\,\mathring{A}$ (4) $0.496\,\mathring{A}$

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

(1) Vaccum pump

(2) Helical Xenon discharge tube

(3) Helium Lamp

(4) Mercury Lamp

117. 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 :

(1) 14.46 Cal/°K (2) 15.74 Cal/°K

(3) 17.54 Cal/°K (4) 16.44 Cal/°K

118. "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 :

(1) Kirchhoff's law (2) Stefan's law

(3) Newton's law (4) Rayleighzetion's law

119. A metal surface is illuminated by light of two different wavelenghts $\lambda_1 = 248$ 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 :

(1) 3.7 eV (2) 3.2 eV

(3) 2.8 eV (4) 2.5 eV

120. A galvanometer gives full scale deflection with 0.006 A current. By connecting it to 4999 Ω resistance in series it can be converted to a voltmeter of range 0 – 30 volt if conneted 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 :

(1) 4 (2) 3 (3) 2 (4) 5

ROUGH WORK
रफ़ कार्य

अभ्यर्थियों के लिए निर्देश

(इस पुस्तिका के प्रथम आवरण पृष्ठ पर तथा उत्तर-पत्र के दोनों पृष्ठों पर केवल नीली-काली बाल-प्वाइंट पेन से ही लिखें)

1. प्रश्न पुस्तिका मिलने के 30 मिनट के अन्दर ही देख लें कि प्रश्नपत्र में सभी पृष्ठ मौजूद हैं और कोई प्रश्न छूटा नहीं है। पुस्तिका दोषयुक्त पाये जाने पर इसकी सूचना तत्काल कक्ष-निरीक्षक को देकर सम्पूर्ण प्रश्नपत्र की दूसरी पुस्तिका प्राप्त कर लें।
2. परीक्षा भवन में ***लिफाफा रहित प्रवेश-पत्र के अतिरिक्त,*** लिखा या सादा कोई भी खुला कागज साथ में न लायें।
3. ***उत्तर-पत्र अलग से दिया गया है। इसे न तो मोड़ें और न ही विकृत करें। दूसरा उत्तर-पत्र नहीं दिया जायेगा। केवल उत्तर-पत्र का ही मूल्यांकन किया जायेगा।***
4. अपना अनुक्रमांक तथा उत्तर-पत्र का क्रमांक प्रथम आवरण-पृष्ठ पर पेन से निर्धारित स्थान पर लिखें।
5. ***उत्तर-पत्र के प्रथम पृष्ठ पर पेन से अपना अनुक्रमांक निर्धारित स्थान पर लिखें तथा नीचे दिये वृत्तों को गाढ़ा कर दें। जहाँ-जहाँ आवश्यक हो वहाँ प्रश्न-पुस्तिका का क्रमांक तथा सेट का नम्बर उचित स्थानों पर लिखें।***
6. ***ओ० एम० आर० पत्र पर अनुक्रमांक संख्या, प्रश्नपुस्तिका संख्या व सेट संख्या (यदि कोई हो) तथा प्रश्नपुस्तिका पर अनुक्रमांक और ओ० एम० आर० पत्र संख्या की प्रविष्टियों में उपरिलेखन की अनुमति नहीं है।***
7. ***उपर्युक्त प्रविष्टियों में कोई भी परिवर्तन कक्ष निरीक्षक द्वारा प्रमाणित होना चाहिये अन्यथा यह एक अनुचित साधन का प्रयोग माना जायेगा।***
8. ***प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार वैकल्पिक उत्तर दिये गये हैं। प्रत्येक प्रश्न के वैकल्पिक उत्तर के लिए आपको उत्तर-पत्र की सम्बन्धित पंक्ति के सामने दिये गये वृत्त को उत्तर-पत्र के प्रथम पृष्ठ पर दिये गये निर्देशों के अनुसार पेन से गाढ़ा करना है।***
9. प्रत्येक प्रश्न के उत्तर के लिए केवल एक ही वृत्त को गाढ़ा करें। एक से अधिक वृत्तों को गाढ़ा करने पर अथवा एक वृत्त को अपूर्ण भरने पर वह उत्तर गलत माना जायेगा।
10. ***ध्यान दें कि एक बार स्याही द्वारा अंकित उत्तर बदला नहीं जा सकता है। यदि आप किसी प्रश्न का उत्तर नहीं देना चाहते हैं, तो संबंधित पंक्ति के सामने दिये गये सभी वृत्तों को खाली छोड़ दें। ऐसे प्रश्नों पर शून्य अंक दिये जायेंगे।***
11. रफ कार्य के लिए प्रश्न-पुस्तिका के मुखपृष्ठ के अंदर वाला पृष्ठ तथा उत्तर-पुस्तिका के अंतिम पृष्ठ का प्रयोग करें।
12. परीक्षा के उपरान्त केवल ***ओ एम आर उत्तर-पत्र*** परीक्षा भवन में जमा कर दें।
13. परीक्षा समाप्त होने से पहले परीक्षा भवन से बाहर जाने की अनुमति नहीं होगी।
14. यदि कोई अभ्यर्थी परीक्षा में अनुचित साधनों का प्रयोग करता है, तो वह विश्वविद्यालय द्वारा निर्धारित दंड का/की, भागी होगा/होगी।