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(PG–EE–2016)

Maths, Math with Computer Science

Code **A**

Sr. No. 11825

Time : 1¼ Hours	Max. Marks : 100	Total Questions : 100

Roll No. ____________ (in figure) ____________ (in words)

Name : ____________ Father's Name : ____________

Mother's Name : ____________ Date of Examination : ____________

(Signature of the candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/ INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. **All questions are compulsory.**
2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / misbehaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing within two hours after the test is over. No such complaint(s) will be entertained thereafter.
4. The candidate MUST NOT do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself. Answers MUST NOT be ticked in the Question book-let.
5. **There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
6. Use only Black or Blue <u>BALL POINT PEN</u> of good quality in the OMR Answer-Sheet.
7. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LETS. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

Question No.	Questions
1.	Every skew-symmetric matrix of odd order is (1) Symmetric (2) Singular (3) Non-singular (4) Hermitian
2.	If r is the rank of the matrix A, then the number of linearly independent solutions of the equation AX = 0 in n variables, is (1) $n-r$ (2) $n-r-1$ (3) $r-1$ (4) n/r
3.	For the equation $x^8+5x^3+2x-3=0$, least number of imaginary roots is (1) 4 (2) 5 (3) 6 (4) 2
4.	Characteristic roots of a Hermitian matrix are all (1) zero (2) imaginary (3) complex (4) real
5.	One root of the equation $ax^3+bx^2+cx+d=0$ is equal to the sum of the other two if (1) $b^3+4abc+8a^2d=0$ (2) $b^2+4abc-8a^2d=0$ (3) $b^3-4abc+8a^2d=0$ (4) $b^3-4abc-8a^2d=0$
6.	The roots of the equation $2x^3+6x^2+5x+k=0$ are in A. P. Then the value of K is (1) -1 (2) 1 (3) -2 (4) 2
7.	If $\frac{x^n-2^n}{x-2}=80$ and n is a positive integer, then the value of n is (1) 2 (2) 3 (3) 4 (4) 5

Question No.	Questions
8.	Let $f(x)=\begin{cases} ax+1 & , x\le 2 \\ 3ax+b & , 2<x<4 \\ 6 & , x\ge 4 \end{cases}$ Values of a and b such that f (x) is continuous everywhere, are (1) $\frac{-5}{8}, \frac{3}{2}$ (2) $\frac{5}{8}, \frac{-3}{2}$ (3) $\frac{5}{8}, \frac{3}{2}$ (4) $\frac{5}{3}, \frac{2}{3}$
9.	Derivative of $\cos^{-1}\sqrt{\frac{1+x}{2}}$, $0\le x<1$ is (1) $\frac{-2}{\sqrt{1-x^2}}$ (2) $\frac{-1}{2\sqrt{1-x^2}}$ (3) $-\frac{1}{\sqrt{1-x^2}}$ (4) $\frac{1}{2\sqrt{1-x^2}}$
10.	The radius of curvature P for the curve xy = c, c being constant, is (1) $\left(x^2+y^2\right)^{-3/2}$ (2) $\frac{\left(x^2+y^2\right)^{3/2}}{c}$ (3) $\frac{\left(x^2+y^2\right)^{2/3}}{2c}$ (4) $\frac{\left(x^2+y^2\right)^{3/2}}{2c}$
11.	Oblique asymptotes to the curve $y^2(x-2a)=x^3-a^3$ are (1) $y\pm x+2a=0$ (2) $x\pm y+2a=0$ (3) $x\pm y+a=0$ (4) $y\pm x+a=0$
12.	Area between the parabolas $x^2=4ay$ and $y^2=4ax$ is (1) $\frac{3}{8}a^2$ (2) $\frac{8}{3}a^2$ (3) $\frac{16}{3}a^2$ (4) $\frac{16}{5}a^2$

Question No.	Questions
13.	$\int_0^1 x^6 \sqrt{1-x^2}\, dx =$ (1) $5\pi/32$ (2) $5\pi/16$ (3) $3\pi/128$ (4) $3\pi/32$
14.	Co-ordinates of the centre of the conic $8x^2 - 24xy + 15y^2 + 48x - 48y = 0$, are (1) (4, 3) (2) (3, 4) (3) (3, 2) (4) (2, 3)
15.	Radius of the sphere $x^2 + y^2 + z^2 - 4x + 6y - 8z + 4 = 0$ is (1) 3 (2) 4 (3) $4/7$ (4) 5
16.	The condition that the plane $ax + by + cz = 0$ cuts the cone $xy + yz + zx = 0$ in perpendicular lines, is (1) $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=1$ (2) $\frac{1}{a}+\frac{2}{b}+\frac{3}{c}=0$ (3) $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=0$ (4) $a+b+c=0$
17.	Value of $\tan\left(i \log \frac{a-ib}{a+ib}\right)$ is (1) $\frac{ab}{a^2-b^2}$ (2) $\frac{2ab}{a^2-b^2}$ (3) $\frac{2ab}{(a^2-b^2)^2}$ (4) $\frac{4ab}{a^2-b^2}$

Question No.	Questions
18.	Which of the following congruences have solution (1) $x^2 \equiv 2 \pmod{59}$ (2) $x^2 \equiv -2 \pmod{59}$ (3) $x^2 \equiv 2 \pmod{61}$ (4) $x^2 \equiv -2 \pmod{61}$
19.	If $\tan^{-1} 2x + \tan^{-1} 3x = \frac{\pi}{4}$, then x = (1) $\frac{1}{2}$ (2) $\frac{1}{3}$ (3) $\frac{4}{7}$ (4) $\frac{1}{6}$
20.	If cosh x = 2, then x = (1) $\log\left(2-\sqrt{5}\right)$ (2) $\log\left(2-\sqrt{3}\right)$ (3) $\log\left(2+\sqrt{5}\right)$ (4) $\log\left(2+\sqrt{3}\right)$
21.	Sum of the series $\sinh x + \frac{\sinh 2x}{2} + \frac{\sinh 3x}{3} + \cdots\cdots \infty$, is (1) $\frac{1}{2}(i\pi - x)$ (2) $\frac{1}{2}(i\pi + x)$ (3) $i\pi - x$ (4) $i\pi + x$
22.	An integrating factor of $x\frac{dy}{dx} + (3x+1)y = xe^{-2x}$, is (1) xe^{x} (2) xe^{2x} (3) xe^{3x} (4) $\frac{1}{2}xe^{-3x}$

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23.	For the differential equation $\frac{d^2y}{dx^2}+ay=-4\sin 2x$, if $y = x\cos 2x$ is a particular solution, then the value of a is (1) 4 (2) −4 (3) $\frac{1}{4}$ (4) $-\frac{1}{4}$
24.	Orthogonal trajectories of the family of parabolas $y^2 = 4ax$ are (1) $2x^2+y^2=c$ (2) $x^2+2y^2=c$ (3) $x^2=4ay+c$ (4) $y^2=4x+\frac{c}{a}$
25.	The differential equation of the type $y = px + f(p)$ is known with the name (1) Euler (2) Lagrange (3) Clairaut (4) Cauchy
26.	The vector $(x+3y)\hat{i}+(y-2z)\hat{j}+(x+\lambda z)\hat{k}$ is solenoidal, then the value of λ is (1) 0 (2) −1 (3) 2 (4) −2
27.	Magnitude of maximum directional derivative of $\phi(x, y, z)=x^2-2y^2+4z^2$ at the point (1, 1, −1) is (1) $\sqrt{21}$ (2) $2\sqrt{21}$ (3) $3\sqrt{21}$ (4) $27/4$
28.	A particle moves along the curve $x=4\cos t$, $y=4\sin t$, $z=6t$, where t is time. Magnitude of acceleration at time t is (1) 3 (2) $7/2$ (3) $\sqrt{5}$ (4) 4

Question No.	Questions
29.	Using Stoke's theorem, value of the integral $\oint_c (yz\,dx + xz\,dy + xy\,dz)$, where c is the curve $x^2 + y^2 = 1$, $z = y^2$; is (1) 0 (2) 1 (3) 2 (4) $7/2$
30.	If $\vec{f} = 3xy\,\hat{i} - y^2\,\hat{j}$, then $\int_c \vec{f} \cdot dr$, where c is the curve $y = 2x^2$, from (0, 0) to (1, 2); is (1) $5/7$ (2) $7/5$ (3) $-7/6$ (4) $-8/3$
31.	If Lagrange's mean value theorem is used on the function $f(x) = x(x-1)$ in [1, 2], then the value of 'c' is (1) $1/2$ (2) $3/2$ (3) $2/3$ (4) $3/4$
32.	If $u = 2xy$, $v = x^2 - y^2$, $x = r\cos\theta$, $y = r\sin\theta$, then $\frac{\partial(u, v)}{\partial(r, \theta)} =$ (1) $-4r^3$ (2) $-4r^2$ (3) $-2r^3$ (4) $-3r^2$
33.	If $u = f(x + 2y) + g(x - 2y)$, then $4\frac{\partial^2 u}{\partial x^2} =$ (1) $-\frac{\partial^2 u}{\partial y^2}$ (2) $\frac{\partial^2 u}{\partial y^2}$ (3) $2\frac{\partial^2 u}{\partial y^2}$ (4) $-2\frac{\partial^2 u}{\partial y^2}$
34.	If $u = \log(x^2 + xy + y^2)$ then $u\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} =$ (1) 0 (2) -1 (3) 1 (4) 2

Question No.	Questions
35.	The envelope of the family of curves $(x - a)^2 + y^2 = 4a$, a being the parameter ; is (1) $x^2 = 4(y + 1)$ (2) $x^2 = 2(x + 1)$ (3) $y^2 = 4(x + 1)$ (4) $y^2 = -4(x + 1)$
36.	The locus of centre of curvature for a curve is called its (1) envelope (2) evolute (3) torsion (4) characteristic
37.	$\lim_{x \to 0} \frac{(\tan^{-1} x)^2}{\log(1 + x^2)} =$ (1) 0 (2) $\frac{1}{2}$ (3) 1 (4) $\frac{3}{2}$
38.	Partial differential equation obtained by eliminating the arbitrary constants a and b from the relation $2z = (ax + y)^2 + b$, is (1) $px + qy = q^2$ (2) $py + qx = q^2$ (3) $px + qy = p^2$ (4) $py + qx = p^2$
39.	Solution of $px + qy = 3z$ is (1) $f\left(\frac{y}{x}, \frac{x^2}{z}\right) = 0$ (2) $f\left(\frac{y}{x}, \frac{x^3}{z}\right) = 0$ (3) $f\left(\frac{x}{y}, \frac{x^2}{z}\right) = 0$ (4) $f\left(\frac{x}{y}, \frac{x^3}{z}\right) = 0$
40.	P.I. of the partial differential equation $(D^2 - 2DD' + D'^2)z = 12xy$, is (1) $2x^3y + x^4$ (2) $2x^3y + y^3$ (3) $2x^3y + 3x^2$ (4) $2x^3y + 3x^4$

Question No.	Questions
41.	The equation $\frac{\partial^2 u}{\partial x^2}+2\frac{\partial^2 u}{\partial y^2}+\frac{\partial^2 u}{\partial z^2}=2\frac{\partial^2 u}{\partial x \partial y +}+2\frac{\partial^2 u}{\partial y \partial z}$ is (1) Linear (2) Elliptic (3) Hyperbolic (4) Parabolic
42.	Every given system of forces acting on a rigid body can be reduced to a (1) Couple (2) Screw (3) Wrench (4) Null force
43.	Absolute units of moment in S.I. system is (1) Dyne centimeter (2) Gram centimeter (3) Kg. meter (4) Newton meter
44.	For two equal forces acting on a particle, if square of their resultant is three times their product, then the angle between these forces is (1) $\pi/2$ (2) $\pi/3$ (3) $\pi/4$ (4) $\pi/6$
45.	A body is slightly displaced and still remains in equilibrium in any position, then such equilibrium is known as (1) Perfect equilibrium (2) Stable equilibrium (3) Neutral equilibrium (4) Natural equilibrium
46.	A body of weight 4 kg. rests in equilibrium on an inclined plane whose slope is 30°. The co-efficient of friction is (1) $\sqrt{3}$ (2) $\frac{1}{\sqrt{2}}$ (3) $\frac{1}{\sqrt{3}}$ (4) $\frac{2}{\sqrt{3}}$

Question No.	Questions
47.	The series $\frac{2p}{1^q}+\frac{3p}{2^q}+\frac{4p}{3^q}+\text{-------}$, where p and q are positive real numbers, is convergent if (1) $p<q-2$ (2) $p<q-1$ (3) $p>q$ (4) $p=q$
48.	The series $\sum_{n=1}^{\infty}\frac{(-1)^{n-1}}{n^5}$ is (1) Absolutely convergent (2) Divergent (3) Conditionally convergent (4) Oscillatory
49.	The limit superior and limit inferior of $\left\{\frac{(-1)^n}{n^2}\right\}$ are respectively equal to (1) 0, 0 (2) 1, 0 (3) 1, –1 (4) –1, 0
50.	If the series $\sum_{n=1}^{\infty}a_n$ is convergent and the series $< b_n >$ is monotonic and bounded, then the series $\sum_{n=1}^{\infty}a_n b_n$ is convergent. This result is due to (1) Cauchy (2) Leibnitz (3) Dirichlet (4) Abel
51.	$\left\{J_{\frac{1}{2}}(x)\right\}^2+\left\{J_{-\frac{1}{2}}(x)\right\}^2=$ (1) $\frac{\pi x}{2}$ (2) $\frac{x}{2\pi}$ (3) $\frac{2}{\pi x}$ (4) $\frac{\pi}{2x}$

Question No.	Questions
52.	If the Hermite polynomial of degree n is denoted by $H_n(x)$, then $H_1(x) =$ (1) x (2) 2 x (3) − 2 x (4) $\frac{x}{2}$
53.	$\int_0^\infty t\,e^{-2t}\cos t\,dt =$ (1) $\frac{3}{16}$ (2) $\frac{9}{16}$ (3) $\frac{3}{25}$ (4) $\frac{9}{25}$
54.	$L^{-1}\left\{\frac{1}{(s-4)^3}\right\} =$ (1) $\frac{1}{4}te^{3t}$ (2) $\frac{1}{4}t^2e^{4t}$ (3) $\frac{1}{2}te^{4t}$ (4) $\frac{1}{2}t^2e^{4t}$
55.	Fourier transform of the function $f(t)=\begin{cases} e^{-at}, & t>0,\ a>0 \\ 0, & t<0 \end{cases}$ is (1) $\frac{1}{a+is}$ (2) $\frac{\pi}{a+is}$ (3) $\frac{a}{\pi+is}$ (4) $\frac{\pi a}{1+is}$
56.	Given that int x = 1, y = 4 ; x = + + x + − − y ; Then the value of x is (1) 4 (2) 5 (3) 6 (4) 7
57.	The continue statement cannot be used with (1) do (2) while (3) for (4) switch

Question No.	Questions
58.	The expression $(*p)\cdot x$ is equivalent to (1) $*p \to x$ (2) $p \to x$ (3) $p \to \cdot x$ (4) $p = x$
59.	The result of the expression (17 * 4) % (int) 9-3 is (1) 5 (2) 4 (3) 3.7 (4) 7.3
60.	The condition for covergence of the Newton - Raphson method to a root α is (1) $\frac{f'(\alpha)}{f''(\alpha)} < 0$ (2) $\frac{f'(\alpha)}{f''(\alpha)} < 1$ (3) $\frac{f'(\alpha)}{f''(\alpha)} > 1$ (4) $\frac{f'(\alpha)}{f''(\alpha)} < 2$
61.	The improper integral $\int_1^2 \frac{x}{\sqrt{x-1}}\,dx$ converges to (1) $5/3$ (2) $8/3$ (3) $3/8$ (4) $3/5$
62.	Which of the following statements is not true (1) Every singleton set is connected in any metric space (2) Empty set is connected in every metric space (3) Every subset having at least two points of a metric space is not connected (4) None of these
63.	$\int_1^\infty \frac{\sin x}{x^m}\,dx$ converges absolutely if (1) $m < 1$ (2) $m > 1$ (3) $m = 0$ (4) $m \leq 1$

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64.	A totally bounded metric space is (1) Compact (2) Complete (3) Separable (4) Everywhere dense
65.	If the set A is open and the set B is closed in R^n, then (1) B – A is closed (2) B – A is open (3) B – A is semi-open (4) B – A is null set
66.	For a Cantor's ternary set, which of the following is not correct (1) It is closed (2) It is uncountable (3) It is dense (4) It is perfect set
67.	Let f be a bounded function defined on the bounded interval [a, b]. Then f is Riemann integrable on [a, b] iff (1) $\int_a^b f \geq f_a^{\bar{b}} f$ (2) $\int_a^b f \leq f_a^{\bar{b}} f$ (3) $\int_a^b f < f_a^{\bar{b}} f$ (4) $\int_a^b f = f_a^{\bar{b}} f$
68.	If G is a non-abelian group of order 125, then $O(Z(G))$ is (1) 25 (2) 125 (3) 5 (4) 10
69.	The number of abelian groups upto isomorphism of order 10^5 is (1) 50 (2) 49 (3) 45 (4) 39
70.	The number of generators of a finite group of order 53 are (1) 53 (2) 52 (3) 54 (4) $\lfloor 52$

Question No.	Questions
71.	The number of prime ideals of Z_{10} is (1) 2 (2) 4 (3) 5 (4) 10
72.	If $f: G \rightarrow G'$ is group homomorphism, then f is one-one if Kernel f is (1) Empty (2) Singleton set (3) Any set (4) Set of identity element
73.	An ideal S of a commutative ring R with unity is maximal iff R/S is (1) An ideal (2) A vector space (3) A ring (4) A field
74.	Which of the following statements is false (1) Every field is a ring (2) Every finite integral domain is a field (3) Every field is an integral domain (4) Every integral domain is a field
75.	A person weighing 70 kg. is in a lift ascending with an acceleration of 1.4 m/sec². The thrust of his feet on the lift (in Newton) is (1) 784 N (2) 780 N (3) 692 N (4) 980 N
76.	The horizontal range of a projectile is three times the greatest height, the angle of projection is (1) $\tan^{-1}\frac{3}{2}$ (2) $\tan^{-1}\frac{2}{3}$ (3) $\tan^{-1}\frac{4}{3}$ (4) $\tan^{-1}\frac{3}{4}$

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77.	The law of force towards the pole under the curve $r^2 = 2\ ap$ is (1) $F \alpha \frac{1}{r^2}$ (2) $F \alpha \frac{1}{r^3}$ (3) $F \alpha \frac{1}{r^4}$ (4) $F \alpha \frac{1}{r^5}$
78.	If θ be the angle which the tangent at a point makes with the radius vector, then the relation between angular velocity w and linear velocity v is (1) $w = vr$ (2) $w = \frac{v\cos\theta}{r}$ (3) $w = \frac{v\sin\theta}{r}$ (4) $w = vr\sin\theta$
79.	Two particles of mass m and 4 m are moving with equal momentum. The ratio of their kinetic energies is (1) 1:2 (2) 2:1 (3) 1:4 (4) 4:1
80.	Kepler law of motion says that each planet describes an ellipse having the sum at its (1) Focus (2) Centre (3) Origin (4) Outer cover
81.	A particle describes the cycloid $s = 4\ a \sin\psi$ with uniform speed v. The acceleration at any point is (1) $\frac{v^2}{4a}$ (2) $\frac{v^2}{\sqrt{s^2 - 16\ a^2}}$ (3) $\frac{v^2}{\sqrt{16\ a^2 - s^2}}$ (4) $\frac{v^2}{\sqrt{a^2 - s^2}}$

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82.	$\int_0^2 (8-x^3)^{-\frac{1}{3}} dx =$ (1) $\frac{1}{3}\beta\left(\frac{1}{3}, \frac{3}{2}\right)$ (2) $\frac{1}{3}\beta\left(\frac{1}{3}, \frac{2}{3}\right)$ (3) $\frac{2}{3}\beta\left(\frac{1}{3}, \frac{2}{3}\right)$ (4) $\beta\left(\frac{1}{3}, \frac{2}{3}\right)$
83.	$\Gamma(n)\Gamma(1-n) =$ (1) $\frac{\pi}{\sin n\pi}$ (2) $\frac{\sin n\pi}{\pi}$ (3) $\frac{n\pi}{\sin n\pi}$ (4) $\frac{2\pi}{\sin n\pi}$
84.	If Fourier co-efficient of f (t) are Cn, then Fourier co-efficients of $\overline{f(t)}$ are (1) $\overline{C_n}$ (2) $\overline{C}_{-n}$ (3) $-\overline{C}_n$ (4) $-\overline{C}_{-n}$
85.	By changing the order of integration, the value of $\int_0^a \int_y^a \frac{x\,dx\,dy}{x^2+y^2} =$ (1) $\frac{3a}{4}$ (2) $\frac{3\pi a}{4}$ (3) $\frac{4\pi a}{3}$ (4) $\frac{\pi a}{4}$
86.	Given that $f(z) = 2x^2 + y + i(y^2 - x)$. C – R equations for this function are satisfied at (1) the line $x = 2y$ (2) the line $y = 2x$ (3) every point of z-plane (4) no point of z-plane

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87.	Image of $\|z-2i\|=2$ under the mapping $w=u+iv=\frac{1}{z}$ is (1) $4v+1=0$ (2) $4u+1=0$ (3) $4v-1=0$ (4) $4u-1=0$
88.	Fixed point of the transformation $w=\frac{3z-4}{z-1}$ is (1) $z=4$ (2) $z=3$ (3) $z=2$ (4) $z=1$
89.	If V and W are vector spaces, then a linear transformation T from V to W is isomorphism if it is (1) into (2) one-one (3) onto (4) orthogonal
90.	If $W=\{(a,b,c,d):b+c+d=0\}$ is a subspace of R^4, then dim W is (1) 4 (2) 3 (3) 2 (4) 1
91.	In an inner product space V (F), the inequality $\|(\alpha,\beta)\|\le\\|\alpha\\|\cdot\\|\beta\\|\ \forall\alpha,\beta\in V$, is called (1) Schwarz inequality (2) Triangle inequality (3) Bessel's inequality (4) Normal inequality
92.	If u and v are normal vectors in an inner product space V, then $\\|u-v\\|=$ (1) 0 (2) 1 (3) 2 (4) $\sqrt{2}$

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93.	Which of the following is a orthogonal set (1) $\{(1, 0, 1), (1, 0, -1), (0, 1, 0)\}$ (2) $\{(1, 0, 1), (1, 0, -1), (-1, 0, 1)\}$ (3) $\{(1, 0, 1), (1, 0, -1), (0, 2, 3)\}$ (4) None of these
94.	The missing term in the table <table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>y</td><td>1</td><td>3</td><td>9</td><td></td><td>81</td></tr></table> is (1) 27 (2) 31 (3) 32 (4) 34
95.	The sum of eigen values of a square matrix A of order n is equal to (1) $\frac{n}{2}$ (2) $\frac{n-1}{2}$ (3) trace (A) (4) $\|A\|$
96.	In Simpson's $\frac{3}{8}$ th rule, the interpolating polynomial is of degree (1) 2 (2) 1 (3) 4 (4) 3
97.	Root of the equation $x^4 - 12x + 7 = 0$ which is approximately equal to 2, is (1) 1.92 (2) 1.95 (3) 2.05 (4) 2.15
98.	Which of the following is not correct (1) $\Delta = (1-\nabla)^{-1}$ (2) $1 - E^{-1} = \nabla$ (3) $E = 1 + \Delta$ (4) $\delta = E^{1/2} - E^{-1/2}$

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99.	For a normal distribution having mean μ and standard deviation σ, the most probable limits are (1) $\mu \pm \sigma$ (2) $\mu \pm 2\sigma$ (3) $\mu \pm \frac{3}{2}\sigma$ (4) $\mu \pm 3\sigma$
100.	In Gauss quadrature formula, the range of integration is (1) [0, 1] (2) [–1, 1] (3) [0, n] (4) [–1, 0]

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Question No.	Questions
7.	The law of force towards the pole under the curve $r^2 = 2\,ap$ is (1) $F \alpha \frac{1}{r^2}$ (2) $F \alpha \frac{1}{r^3}$ (3) $F \alpha \frac{1}{r^4}$ (4) $F \alpha \frac{1}{r^5}$
8.	If θ be the angle which the tangent at a point makes with the radius vector, then the relation between angular velocity w and linear velocity v is (1) $w = vr$ (2) $w = \frac{v\cos\theta}{r}$ (3) $w = \frac{v\sin\theta}{r}$ (4) $w = vr\sin\theta$
9.	Two particles of mass m and 4 m are moving with equal momentum. The ratio of their kinetic energies is (1) 1:2 (2) 2:1 (3) 1:4 (4) 4:1
10.	Kepler law of motion says that each planet describes an ellipse having the sum at its (1) Focus (2) Centre (3) Origin (4) Outer cover
11.	$\left\{J_{\frac{1}{2}}(x)\right\}^2 + \left\{J_{-\frac{1}{2}}(x)\right\}^2 =$ (1) $\frac{\pi x}{2}$ (2) $\frac{x}{2\pi}$ (3) $\frac{2}{\pi x}$ (4) $\frac{\pi}{2x}$

Question No.	Questions
12.	If the Hermite polynomial of degree n is denoted by $H_n(x)$, then $H_1(x) =$ (1) x (2) 2 x (3) − 2 x (4) $\frac{x}{2}$
13.	$\int_0^\infty t\, e^{-2t} \cos t\, dt =$ (1) $\frac{3}{16}$ (2) $\frac{9}{16}$ (3) $\frac{3}{25}$ (4) $\frac{9}{25}$
14.	$L^{-1}\left\{\frac{1}{(s-4)^3}\right\} =$ (1) $\frac{1}{4}te^{3t}$ (2) $\frac{1}{4}t^2e^{4t}$ (3) $\frac{1}{2}te^{4t}$ (4) $\frac{1}{2}t^2e^{4t}$
15.	Fourier transform of the function $f(t) = \begin{cases} e^{-at}, & t > 0,\ a > 0 \\ 0, & t < 0 \end{cases}$ is (1) $\frac{1}{a+is}$ (2) $\frac{\pi}{a+is}$ (3) $\frac{a}{\pi+is}$ (4) $\frac{\pi a}{1+is}$
16.	Given that int x = 1, y = 4 ; x = + + x + − − y ; Then the value of x is (1) 4 (2) 5 (3) 6 (4) 7
17.	The continue statement cannot be used with (1) do (2) while (3) for (4) switch

Question No.	Questions
18.	The expression $(*p)\cdot x$ is equivalent to (1) $*p \rightarrow x$ (2) $p \rightarrow x$ (3) $p \rightarrow \cdot x$ (4) $p = x$
19.	The result of the expression (17 * 4) % (int) 9-3 is (1) 5 (2) 4 (3) 3.7 (4) 7.3
20.	The condition for covergence of the Newton - Raphson method to a root α is (1) $\frac{f'(\alpha)}{f''(\alpha)} < 0$ (2) $\frac{f'(\alpha)}{f''(\alpha)} < 1$ (3) $\frac{f'(\alpha)}{f''(\alpha)} > 1$ (4) $\frac{f'(\alpha)}{f''(\alpha)} < 2$
21.	If Lagrange's mean value theorem is used on the function $f(x) = x(x-1)$ in [1, 2], then the value of 'c' is (1) $\frac{1}{2}$ (2) $\frac{3}{2}$ (3) $\frac{2}{3}$ (4) $\frac{3}{4}$
22.	If $u = 2xy$, $v = x^2 - y^2$, $x = r\cos\theta$, $y = r\sin\theta$, then $\frac{\partial(u, v)}{\partial(r, \theta)} =$ (1) $-4r^3$ (2) $-4r^2$ (3) $-2r^3$ (4) $-3r^2$
23.	If $u = f(x + 2y) + g(x - 2y)$, then $4\frac{\partial^2 u}{\partial x^2} =$ (1) $-\frac{\partial^2 u}{\partial y^2}$ (2) $\frac{\partial^2 u}{\partial y^2}$ (3) $2\frac{\partial^2 u}{\partial y^2}$ (4) $-2\frac{\partial^2 u}{\partial y^2}$

Question No.	Questions
24.	If $u = \log(x^2 + xy + y^2)$ then $u\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} =$ (1) 0 (2) -1 (3) 1 (4) 2
25.	The envelope of the family of curves $(x - a)^2 + y^2 = 4a$, a being the parameter ; is (1) $x^2 = 4(y + 1)$ (2) $x^2 = 2(x + 1)$ (3) $y^2 = 4(x + 1)$ (4) $y^2 = -4(x + 1)$
26.	The locus of centre of curvature for a curve is called its (1) envelope (2) evolute (3) torsion (4) characteristic
27.	$\lim_{x \to 0} \frac{(\tan^{-1} x)^2}{\log(1 + x^2)} =$ (1) 0 (2) $\frac{1}{2}$ (3) 1 (4) $\frac{3}{2}$
28.	Partial differential equation obtained by eliminating the arbitrary constants a and b from the relation $2z = (ax + y)^2 + b$, is (1) $px + qy = q^2$ (2) $py + qx = q^2$ (3) $px + qy = p^2$ (4) $py + qx = p^2$
29.	Solution of $px + qy = 3z$ is (1) $f\left(\frac{y}{x}, \frac{x^2}{z}\right) = 0$ (2) $f\left(\frac{y}{x}, \frac{x^3}{z}\right) = 0$ (3) $f\left(\frac{x}{y}, \frac{x^2}{z}\right) = 0$ (4) $f\left(\frac{x}{y}, \frac{x^3}{z}\right) = 0$

Question No.	Questions
30.	P.I. of the partial differential equation $\left(D^2 - 2\,DD' + D'^2\right) z = 12\,xy$, is (1) $2\,x^3\,y + x^4$ (2) $2\,x^3\,y + y^3$ (3) $2\,x^3\,y + 3\,x^2$ (4) $2\,x^3\,y + 3\,x^4$
31.	Oblique asymptotes to the curve $y^2\,(x-2\,a) = x^3 - a^3$ are (1) $y \pm x + 2\,a = 0$ (2) $x \pm y + 2\,a = 0$ (3) $x \pm y + a = 0$ (4) $y \pm x + a = 0$
32.	Area between the parabolas $x^2 = 4\,ay$ and $y^2 = 4\,ax$ is (1) $\frac{3}{8}a^2$ (2) $\frac{8}{3}a^2$ (3) $\frac{16}{3}a^2$ (4) $\frac{16}{5}a^2$
33.	$\int_0^1 x^6 \sqrt{1-x^2}\,dx =$ (1) $5\pi/32$ (2) $5\pi/16$ (3) $3\pi/128$ (4) $3\pi/32$
34.	Co-ordinates of the centre of the conic $8\,x^2 - 24\,xy + 15\,y^2 + 48\,x - 48\,y = 0$, are (1) (4, 3) (2) (3, 4) (3) (3, 2) (4) (2, 3)
35.	Radius of the sphere $x^2 + y^2 + z^2 - 4\,x + 6\,y - 8\,z + 4 = 0$ is (1) 3 (2) 4 (3) $4/7$ (4) 5

Question No.	Questions
36.	The condition that the plane $ax + by + cz = 0$ cuts the cone $xy + yz + zx = 0$ in perpendicular lines, is (1) $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=1$ (2) $\frac{1}{a}+\frac{2}{b}+\frac{3}{c}=0$ (3) $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=0$ (4) $a+b+c=0$
37.	Value of $\tan\left(i \log \frac{a-ib}{a+ib}\right)$ is (1) $\frac{ab}{a^2-b^2}$ (2) $\frac{2\,ab}{a^2-b^2}$ (3) $\frac{2\,ab}{(a^2-b^2)^2}$ (4) $\frac{4\,ab}{a^2-b^2}$
38.	Which of the following congruences have solution (1) $x^2 \equiv 2 \pmod{59}$ (2) $x^2 \equiv -2 \pmod{59}$ (3) $x^2 \equiv 2 \pmod{61}$ (4) $x^2 \equiv -2 \pmod{61}$
39.	If $\tan^{-1} 2x + \tan^{-1} 3x = \frac{\pi}{4}$, then $x =$ (1) $\frac{1}{2}$ (2) $\frac{1}{3}$ (3) $\frac{4}{7}$ (4) $\frac{1}{6}$
40.	If $\cosh x = 2$, then $x =$ (1) $\log\left(2-\sqrt{5}\right)$ (2) $\log\left(2-\sqrt{3}\right)$ (3) $\log\left(2+\sqrt{5}\right)$ (4) $\log\left(2+\sqrt{3}\right)$

Question No.	Questions
41.	In an inner product space V (F), the inequality $\|(\alpha, \beta)\| \le \|\alpha\| \cdot \|\beta\| \; \forall \alpha, \beta \in V$, is called (1) Schwarz inequality (2) Triangle inequality (3) Bessel's inequality (4) Normal inequality
42.	If u and v are normal vectors in an inner product space V, then $\|u - v\| =$ (1) 0 (2) 1 (3) 2 (4) $\sqrt{2}$
43.	Which of the following is a orthogonal set (1) $\{(1, 0, 1), (1, 0, -1), (0, 1, 0)\}$ (2) $\{(1, 0, 1), (1, 0, -1), (-1, 0, 1)\}$ (3) $\{(1, 0, 1), (1, 0, -1), (0, 2, 3)\}$ (4) None of these
44.	The missing term in the table x: 0, 1, 2, 3, 4 y: 1, 3, 9, , 81 is (1) 27 (2) 31 (3) 32 (4) 34
45.	The sum of eigen values of a square matrix A of order n is equal to (1) $\frac{n}{2}$ (2) $\frac{n-1}{2}$ (3) trace (A) (4) $\|A\|$

Question No.	Questions
46.	In Simpson's $\frac{3}{8}$ th rule, the interpolating polynomial is of degree (1) 2 (2) 1 (3) 4 (4) 3
47.	Root of the equation $x^4 - 12x + 7 = 0$ which is approximately equal to 2, is (1) 1.92 (2) 1.95 (3) 2.05 (4) 2.15
48.	Which of the following is not correct (1) $\Delta = (1-\nabla)^{-1}$ (2) $1 - E^{-1} = \nabla$ (3) $E = 1 + \Delta$ (4) $\delta = E^{1/2} - E^{-1/2}$
49.	For a normal distribution having mean μ and standard deviation σ, the most probable limits are (1) $\mu \pm \sigma$ (2) $\mu \pm 2\sigma$ (3) $\mu \pm \frac{3}{2}\sigma$ (4) $\mu \pm 3\sigma$
50.	In Gauss quadrature formula, the range of integration is (1) [0, 1] (2) [–1, 1] (3) [0, n] (4) [–1, 0]
51.	The improper integral $\int_1^2 \frac{x}{\sqrt{x-1}}\,dx$ converges to (1) $5/3$ (2) $8/3$ (3) $3/8$ (4) $3/5$

Question No.	Questions
52.	Which of the following statements is not true (1) Every singleton set is connected in any metric space (2) Empty set is connected in every metric space (3) Every subset having at least two points of a metric space is not connected (4) None of these
53.	$\int_1^\infty \frac{\sin x}{x^m} dx$ converges absolutely if (1) $m < 1$ (2) $m > 1$ (3) $m = 0$ (4) $m \leq 1$
54.	A totally bounded metric space is (1) Compact (2) Complete (3) Separable (4) Everywhere dense
55.	If the set A is open and the set B is closed in R^n, then (1) B – A is closed (2) B – A is open (3) B – A is semi-open (4) B – A is null set
56.	For a Cantor's ternary set, which of the following is not correct (1) It is closed (2) It is uncountable (3) It is dense (4) It is perfect set
57.	Let f be a bounded function defined on the bounded interval [a, b]. Then f is Riemann integrable on [a, b] iff (1) $\int_a^b f \geq f_a^b f$ (2) $\int_a^b f \leq f_a^b f$ (3) $\int_a^b f < f_a^b f$ (4) $\int_a^b f = f_a^b f$

Question No.	Questions
58.	If G is a non-abelian group of order 125, then O (Z (G)) is (1) 25 (2) 125 (3) 5 (4) 10
59.	The number of abelian groups upto isomorphism of order 10^5 is (1) 50 (2) 49 (3) 45 (4) 39
60.	The number of generators of a finite group of order 53 are (1) 53 (2) 52 (3) 54 (4) $\lfloor 52$
61.	A particle describes the cycloid $s = 4\,a \sin\psi$ with uniform speed v. The acceleration at any point is (1) $\frac{v^2}{4a}$ (2) $\frac{v^2}{\sqrt{s^2-16\,a^2}}$ (3) $\frac{v^2}{\sqrt{16\,a^2-s^2}}$ (4) $\frac{v^2}{\sqrt{a^2-s^2}}$
62.	$\int_0^2 (8-x^3)^{-\frac{1}{3}}\,dx =$ (1) $\frac{1}{3}\beta\left(\frac{1}{3}, \frac{3}{2}\right)$ (2) $\frac{1}{3}\beta\left(\frac{1}{3}, \frac{2}{3}\right)$ (3) $\frac{2}{3}\beta\left(\frac{1}{3}, \frac{2}{3}\right)$ (4) $\beta\left(\frac{1}{3}, \frac{2}{3}\right)$
63.	$\Gamma(n)\Gamma(1-n) =$ (1) $\frac{\pi}{\sin n\pi}$ (2) $\frac{\sin n\pi}{\pi}$ (3) $\frac{n\pi}{\sin n\pi}$ (4) $\frac{2\pi}{\sin n\pi}$

Question No.	Questions
64.	If Fourier co-efficient of f (t) are Cn, then Fourier co-efficients of $\overline{f(t)}$ are (1) $\overline{C_n}$ (2) $\overline{C}_{-n}$ (3) $-\overline{C}_n$ (4) $-\overline{C}_{-n}$
65.	By changing the order of integration, the value of $\int_0^a \int_y^a \frac{x\,dx\,dy}{x^2+y^2} =$ (1) $\frac{3a}{4}$ (2) $\frac{3\pi a}{4}$ (3) $\frac{4\pi a}{3}$ (4) $\frac{\pi a}{4}$
66.	Given that $f(z) = 2x^2 + y + i(y^2 - x)$. C – R equations for this function are satisfied at (1) the line $x = 2y$ (2) the line $y = 2x$ (3) every point of z-plane (4) no point of z-plane
67.	Image of $\lvert z - 2i \rvert = 2$ under the mapping $w = u + iv = \frac{1}{z}$ is (1) $4v + 1 = 0$ (2) $4u + 1 = 0$ (3) $4v - 1 = 0$ (4) $4u - 1 = 0$
68.	Fixed point of the transformation $w = \frac{3z-4}{z-1}$ is (1) $z = 4$ (2) $z = 3$ (3) $z = 2$ (4) $z = 1$

Question No.	Questions
69.	If V and W are vector spaces, then a linear transformation T from V to W is isomorphism if it is (1) into (2) one-one (3) onto (4) orthogonal
70.	If $W = \{ (a, b, c, d) : b + c + d = 0 \}$ is a subspace of R^4, then dim W is (1) 4 (2) 3 (3) 2 (4) 1
71.	The equation $\frac{\partial^2 u}{\partial x^2} + 2\frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = 2\frac{\partial^2 u}{\partial x \partial y +} + 2\frac{\partial^2 u}{\partial y \partial z}$ is (1) Linear (2) Elliptic (3) Hyperbolic (4) Parabolic
72.	Every given system of forces acting on a rigid body can be reduced to a (1) Couple (2) Screw (3) Wrench (4) Null force
73.	Absolute units of moment in S.I. system is (1) Dyne centimeter (2) Gram centimeter (3) Kg. meter (4) Newton meter
74.	For two equal forces acting on a particle, if square of their resultant is three times their product, then the angle between these forces is (1) $\pi/2$ (2) $\pi/3$ (3) $\pi/4$ (4) $\pi/6$

Question No.	Questions
75.	A body is slightly displaced and still remains in equilibrium in any position, then such equilibrium is known as (1) Perfect equilibrium (2) Stable equilibrium (3) Neutral equilibrium (4) Natural equilibrium
76.	A body of weight 4 kg. rests in equilibrium on an inclined plane whose slope is 30°. The co-efficient of friction is (1) $\sqrt{3}$ (2) $\frac{1}{\sqrt{2}}$ (3) $\frac{1}{\sqrt{3}}$ (4) $\frac{2}{\sqrt{3}}$
77.	The series $\frac{2p}{1^q}+\frac{3p}{2^q}+\frac{4p}{3^q}+\cdots\cdots$, where p and q are positive real numbers, is convergent if (1) $p < q-2$ (2) $p < q-1$ (3) $p > q$ (4) $p = q$
78.	The series $\sum_{n=1}^{\infty}\frac{(-1)^{n-1}}{n^5}$ is (1) Absolutely convergent (2) Divergent (3) Conditionally convergent (4) Oscillatory
79.	The limit superior and limit inferior of $\left\{\frac{(-1)^n}{n^2}\right\}$ are respectively equal to (1) 0, 0 (2) 1, 0 (3) 1, –1 (4) –1, 0

Question No.	Questions
80.	If the series $\sum_{n=1}^{\infty} a_n$ is convergent and the series $< b_n >$ is monotonic and bounded, then the series $\sum_{n=1}^{\infty} a_n b_n$ is convergent. This result is due to (1) Cauchy (2) Leibnitz (3) Dirichlet (4) Abel
81.	Sum of the series $\sinh x + \frac{\sinh 2x}{2} + \frac{\sinh 3x}{3} + \cdots\cdots \infty$, is (1) $\frac{1}{2}(i\pi - x)$ (2) $\frac{1}{2}(i\pi + x)$ (3) $i\pi - x$ (4) $i\pi + x$
82.	An integrating factor of $x\frac{dy}{dx} + (3x+1)y = xe^{-2x}$, is (1) xe^{x} (2) xe^{2x} (3) xe^{3x} (4) $\frac{1}{2}xe^{-3x}$
83.	For the differential equation $\frac{d^2y}{dx^2} + ay = -4\sin 2x$, if $y = x\cos 2x$ is a particular solution, then the value of a is (1) 4 (2) -4 (3) $\frac{1}{4}$ (4) $-\frac{1}{4}$
84.	Orthogonal trajectories of the family of parabolas $y^2 = 4ax$ are (1) $2x^2 + y^2 = c$ (2) $x^2 + 2y^2 = c$ (3) $x^2 = 4ay + c$ (4) $y^2 = 4x + \frac{c}{a}$

Question No.	Questions
85.	The differential equation of the type y = px + f (p) is known with the name (1) Euler (2) Lagrange (3) Clairaut (4) Cauchy
86.	The vector $(x+3y)\hat{i}+(y-2z)\hat{j}+(x+\lambda z)\hat{k}$ is solenoidal, then the value of λ is (1) 0 (2) −1 (3) 2 (4) −2
87.	Magnitude of maximum directional derivative of $\phi(x, y, z) = x^2 - 2y^2 + 4z^2$ at the point (1, 1, −1) is (1) $\sqrt{21}$ (2) $2\sqrt{21}$ (3) $3\sqrt{21}$ (4) $27/4$
88.	A particle moves along the curve $x = 4\cos t, y = 4\sin t, z = 6t$, where t is time. Magnitude of acceleration at time t is (1) 3 (2) $7/2$ (3) $\sqrt{5}$ (4) 4
89.	Using Stoke's theorem, value of the integral $\oint_C (yz\,dx + xz\,dy + xy\,dz)$, where c is the curve $x^2 + y^2 = 1, z = y^2$; is (1) 0 (2) 1 (3) 2 (4) $7/2$
90.	If $\vec{f} = 3xy\,\hat{i} - y^2\,\hat{j}$, then $\int_C \vec{f}\cdot dr$, where c is the curve $y = 2x^2$, from (0, 0) to (1, 2); is (1) $5/7$ (2) $7/5$ (3) $-7/6$ (4) $-8/3$

Question No.	Questions
91.	Every skew-symmetric matrix of odd order is (1) Symmetric (2) Singular (3) Non-singular (4) Hermitian
92.	If r is the rank of the matrix A, then the number of linearly independent solutions of the equation $AX = 0$ in n variables, is (1) $n - r$ (2) $n - r - 1$ (3) $r - 1$ (4) n / r
93.	For the equation $x^8 + 5x^3 + 2x - 3 = 0$, least number of imaginary roots is (1) 4 (2) 5 (3) 6 (4) 2
94.	Characteristic roots of a Hermitian matrix are all (1) zero (2) imaginary (3) complex (4) real
95.	One root of the equation $ax^3 + bx^2 + cx + d = 0$ is equal to the sum of the other two if (1) $b^3 + 4abc + 8a^2d = 0$ (2) $b^2 + 4abc - 8a^2d = 0$ (3) $b^3 - 4abc + 8a^2d = 0$ (4) $b^3 - 4abc - 8a^2d = 0$
96.	The roots of the equation $2x^3 + 6x^2 + 5x + k = 0$ are in A. P. Then the value of K is (1) -1 (2) 1 (3) -2 (4) 2
97.	If $\frac{x^n - 2^n}{x - 2} = 80$ and n is a positive integer, then the value of n is (1) 2 (2) 3 (3) 4 (4) 5

Question No.	Questions
98.	Let $f(x) = \begin{cases} ax+1 & , x \le 2 \\ 3ax+b & , 2 < x < 4 \\ 6 & , x \ge 4 \end{cases}$ Values of a and b such that f (x) is continuous everywhere, are (1) $\frac{-5}{8}, \frac{3}{2}$ (2) $\frac{5}{8}, \frac{-3}{2}$ (3) $\frac{5}{8}, \frac{3}{2}$ (4) $\frac{5}{3}, \frac{2}{3}$
99.	Derivative of $\cos^{-1}\sqrt{\frac{1+x}{2}}, 0 \le x < 1$ is (1) $\frac{-2}{\sqrt{1-x^2}}$ (2) $\frac{-1}{2\sqrt{1-x^2}}$ (3) $-\frac{1}{\sqrt{1-x^2}}$ (4) $\frac{1}{2\sqrt{1-x^2}}$
100.	The radius of curvature P for the curve xy = c, c being constant, is (1) $(x^2+y^2)^{-3/2}$ (2) $\frac{(x^2+y^2)^{3/2}}{c}$ (3) $\frac{(x^2+y^2)^{2/3}}{2c}$ (4) $\frac{(x^2+y^2)^{3/2}}{2c}$

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(PG–EE–2016)

Maths, Math with Computer Science

Code **C**

Sr. No. 11827

Time : 1¼ Hours **Max. Marks : 100** **Total Questions : 100**

Roll No. ______________ (in figure) ______________ (in words)

Name : ______________ Father's Name : ______________

Mother's Name : ______________ Date of Examination : ______________

(Signature of the candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/ INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. **All questions are compulsory.**
2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / misbehaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing within two hours after the test is over. No such complaint(s) will be entertained thereafter.
4. The candidate MUST NOT do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself. Answers MUST NOT be ticked in the Question book-let.
5. **There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
6. Use only Black or Blue **BALL POINT PEN** of good quality in the OMR Answer-Sheet.
7. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LETS. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

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2.	Every given system of forces acting on a rigid body can be reduced to a (1) Couple (2) Screw (3) Wrench (4) Null force
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5.	A body is slightly displaced and still remains in equilibrium in any position, then such equilibrium is known as (1) Perfect equilibrium (2) Stable equilibrium (3) Neutral equilibrium (4) Natural equilibrium
6.	A body of weight 4 kg. rests in equilibrium on an inclined plane whose slope is 30°. The co-efficient of friction is (1) $\sqrt{3}$ (2) $\frac{1}{\sqrt{2}}$ (3) $\frac{1}{\sqrt{3}}$ (4) $\frac{2}{\sqrt{3}}$

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8.	The series $\sum_{n=1}^{\infty}\frac{(-1)^{n-1}}{n^5}$ is (1) Absolutely convergent (2) Divergent (3) Conditionally convergent (4) Oscillatory
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11.	Sum of the series $\sinh x+\frac{\sinh 2x}{2}+\frac{\sinh 3x}{3}+\cdots\cdots\infty$, is (1) $\frac{1}{2}(i\pi-x)$ (2) $\frac{1}{2}(i\pi+x)$ (3) $i\pi-x$ (4) $i\pi+x$

Question No.	Questions
12.	An integrating factor of $x\frac{dy}{dx}+(3x+1)\,y=xe^{-2x}$, is (1) xe^{x} (2) xe^{2x} (3) xe^{3x} (4) $\frac{1}{2}xe^{-3x}$
13.	For the differential equation $\frac{d^2y}{dx^2}+ay=-4\sin 2x$, if $y = x\cos 2x$ is a particular solution, then the value of a is (1) 4 (2) -4 (3) $\frac{1}{4}$ (4) $-\frac{1}{4}$
14.	Orthogonal trajectories of the family of parabolas $y^2 = 4ax$ are (1) $2x^2+y^2=c$ (2) $x^2+2y^2=c$ (3) $x^2=4ay+c$ (4) $y^2=4x+\frac{c}{a}$
15.	The differential equation of the type $y = px + f(p)$ is known with the name (1) Euler (2) Lagrange (3) Clairaut (4) Cauchy
16.	The vector $(x+3y)\,\hat{i}+(y-2z)\,\hat{j}+(x+\lambda z)\,\hat{k}$ is solenoidal, then the value of λ is (1) 0 (2) -1 (3) 2 (4) -2
17.	Magnitude of maximum directional derivative of $\phi(x, y, z)=x^2-2y^2+4z^2$ at the point $(1, 1, -1)$ is (1) $\sqrt{21}$ (2) $2\sqrt{21}$ (3) $3\sqrt{21}$ (4) $27/4$

Question No.	Questions
18.	A particle moves along the curve $x = 4\cos t$, $y = 4\sin t$, $z = 6t$, where t is time. Magnitude of acceleration at time t is (1) 3 (2) $7/2$ (3) $\sqrt{5}$ (4) 4
19.	Using Stoke's theorem, value of the integral $\oint_c (yz\,dx + xz\,dy + xy\,dz)$, where c is the curve $x^2 + y^2 = 1$, $z = y^2$; is (1) 0 (2) 1 (3) 2 (4) $7/2$
20.	If $\vec{f} = 3xy\,\hat{i} - y^2\,\hat{j}$, then $\int_c \vec{f} \cdot dr$, where c is the curve $y = 2x^2$, from (0, 0) to (1, 2); is (1) $5/7$ (2) $7/5$ (3) $-7/6$ (4) $-8/3$
21.	Every skew-symmetric matrix of odd order is (1) Symmetric (2) Singular (3) Non-singular (4) Hermitian
22.	If r is the rank of the matrix A, then the number of linearly independent solutions of the equation $AX = 0$ in n variables, is (1) $n - r$ (2) $n - r - 1$ (3) $r - 1$ (4) n / r
23.	For the equation $x^8 + 5x^3 + 2x - 3 = 0$, least number of imaginary roots is (1) 4 (2) 5 (3) 6 (4) 2

Question No.	Questions
24.	Characteristic roots of a Hermitian matrix are all (1) zero (2) imaginary (3) complex (4) real
25.	One root of the equation $ax^3 + bx^2 + cx + d = 0$ is equal to the sum of the other two if (1) $b^3 + 4\,abc + 8\,a^2d = 0$ (2) $b^2 + 4\,abc - 8\,a^2d = 0$ (3) $b^3 - 4\,abc + 8\,a^2d = 0$ (4) $b^3 - 4\,abc - 8\,a^2d = 0$
26.	The roots of the equation $2\,x^3 + 6\,x^2 + 5\,x + k = 0$ are in A. P. Then the value of K is (1) -1 (2) 1 (3) -2 (4) 2
27.	If $\frac{x^n - 2^n}{x-2} = 80$ and n is a positive integer, then the value of n is (1) 2 (2) 3 (3) 4 (4) 5
28.	Let $f(x) = \begin{cases} ax+1 & , x \le 2 \\ 3\,ax+b & , 2 < x < 4 \\ 6 & , x \ge 4 \end{cases}$ Values of a and b such that f (x) is continuous everywhere, are (1) $\frac{-5}{8}, \frac{3}{2}$ (2) $\frac{5}{8}, \frac{-3}{2}$ (3) $\frac{5}{8}, \frac{3}{2}$ (4) $\frac{5}{3}, \frac{2}{3}$

Question No.	Questions
29.	Derivative of $\cos^{-1}\sqrt{\frac{1+x}{2}}$, $0 \le x < 1$ is (1) $\frac{-2}{\sqrt{1-x^2}}$ (2) $\frac{-1}{2\sqrt{1-x^2}}$ (3) $-\frac{1}{\sqrt{1-x^2}}$ (4) $\frac{1}{2\sqrt{1-x^2}}$
30.	The radius of curvature P for the curve xy = c, c being constant, is (1) $(x^2+y^2)^{-3/2}$ (2) $\frac{(x^2+y^2)^{3/2}}{c}$ (3) $\frac{(x^2+y^2)^{2/3}}{2c}$ (4) $\frac{(x^2+y^2)^{3/2}}{2c}$
31.	In an inner product space V (F), the inequality $\lvert(\alpha, \beta)\rvert \le \lVert\alpha\rVert \cdot \lVert\beta\rVert \; \forall \alpha, \beta \in V$, is called (1) Schwarz inequality (2) Triangle inequality (3) Bessel's inequality (4) Normal inequality
32.	If u and v are normal vectors in an inner product space V, then $\lVert u - v \rVert =$ (1) 0 (2) 1 (3) 2 (4) $\sqrt{2}$
33.	Which of the following is a orthogonal set (1) $\{(1, 0, 1), (1, 0, -1), (0, 1, 0)\}$ (2) $\{(1, 0, 1), (1, 0, -1), (-1, 0, 1)\}$ (3) $\{(1, 0, 1), (1, 0, -1), (0, 2, 3)\}$ (4) None of these

Question No.	Questions
34.	The missing term in the table x: 0, 1, 2, 3, 4 / y: 1, 3, 9, , 81 — is (1) 27 (2) 31 (3) 32 (4) 34
35.	The sum of eigen values of a square matrix A of order n is equal to (1) $\frac{n}{2}$ (2) $\frac{n-1}{2}$ (3) trace (A) (4) $\|A\|$
36.	In Simpson's $\frac{3}{8}$th rule, the interpolating polynomial is of degree (1) 2 (2) 1 (3) 4 (4) 3
37.	Root of the equation $x^4 - 12x + 7 = 0$ which is approximately equal to 2, is (1) 1.92 (2) 1.95 (3) 2.05 (4) 2.15
38.	Which of the following is not correct (1) $\Delta = (1-\nabla)^{-1}$ (2) $1 - E^{-1} = \nabla$ (3) $E = 1 + \Delta$ (4) $\delta = E^{1/2} - E^{-1/2}$
39.	For a normal distribution having mean μ and standard deviation σ, the most probable limits are (1) $\mu \pm \sigma$ (2) $\mu \pm 2\sigma$ (3) $\mu \pm \frac{3}{2}\sigma$ (4) $\mu \pm 3\sigma$

Question No.	Questions
40.	In Gauss quadrature formula, the range of integration is (1) [0, 1] (2) [–1, 1] (3) [0, n] (4) [–1, 0]
41.	The improper integral $\int_1^2 \frac{x}{\sqrt{x-1}}\,dx$ converges to (1) $5/3$ (2) $8/3$ (3) $3/8$ (4) $3/5$
42.	Which of the following statements is not true (1) Every singleton set is connected in any metric space (2) Empty set is connected in every metric space (3) Every subset having at least two points of a metric space is not connected (4) None of these
43.	$\int_1^\infty \frac{\sin x}{x^m}\,dx$ converges absolutely if (1) $m<1$ (2) $m>1$ (3) $m=0$ (4) $m\le 1$
44.	A totally bounded metric space is (1) Compact (2) Complete (3) Separable (4) Everywhere dense
45.	If the set A is open and the set B is closed in R^n, then (1) $B-A$ is closed (2) $B-A$ is open (3) $B-A$ is semi-open (4) $B-A$ is null set

Question No.	Questions
46.	For a Cantor's ternary set, which of the following is not correct (1) It is closed (2) It is uncountable (3) It is dense (4) It is perfect set
47.	Let f be a bounded function defined on the bounded interval [a, b]. Then f is Riemann integrable on [a, b] iff (1) $\int_a^b f \geq \overline{\int_a^b} f$ (2) $\int_a^b f \leq \overline{\int_a^b} f$ (3) $\int_a^b f < \overline{\int_a^b} f$ (4) $\int_a^b f = \overline{\int_a^b} f$
48.	If G is a non-abelian group of order 125, then O (Z (G)) is (1) 25 (2) 125 (3) 5 (4) 10
49.	The number of abelian groups upto isomorphism of order 10^5 is (1) 50 (2) 49 (3) 45 (4) 39
50.	The number of generators of a finite group of order 53 are (1) 53 (2) 52 (3) 54 (4) $\lfloor 52$
51.	If Lagrange's mean value theorem is used on the function $f(x) = x(x-1)$ in [1, 2], then the value of 'c' is (1) $1/2$ (2) $3/2$ (3) $2/3$ (4) $3/4$
52.	If $u = 2xy$, $v = x^2 - y^2$, $x = r\cos\theta$, $y = r\sin\theta$, then $\frac{\partial(u, v)}{\partial(r, \theta)} =$ (1) $-4r^3$ (2) $-4r^2$ (3) $-2r^3$ (4) $-3r^2$

Question No.	Questions
53.	If $u = f(x + 2y) + g(x - 2y)$, then $4\frac{\partial^2 u}{\partial x^2} =$ (1) $-\frac{\partial^2 u}{\partial y^2}$ (2) $\frac{\partial^2 u}{\partial y^2}$ (3) $2\frac{\partial^2 u}{\partial y^2}$ (4) $-2\frac{\partial^2 u}{\partial y^2}$
54.	If $u = \log(x^2 + xy + y^2)$ then $u\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} =$ (1) 0 (2) -1 (3) 1 (4) 2
55.	The envelope of the family of curves $(x - a)^2 + y^2 = 4a$, a being the parameter ; is (1) $x^2 = 4(y + 1)$ (2) $x^2 = 2(x + 1)$ (3) $y^2 = 4(x + 1)$ (4) $y^2 = -4(x + 1)$
56.	The locus of centre of curvature for a curve is called its (1) envelope (2) evolute (3) torsion (4) characteristic
57.	$\lim_{x \to 0} \frac{(\tan^{-1} x)^2}{\log(1 + x^2)} =$ (1) 0 (2) $\frac{1}{2}$ (3) 1 (4) $\frac{3}{2}$

Question No.	Questions
58.	Partial differential equation obtained by eliminating the arbitrary constants a and b from the relation $2z = (ax + y)^2 + b$, is (1) $px + qy = q^2$ (2) $py + qx = q^2$ (3) $px + qy = p^2$ (4) $py + qx = p^2$
59.	Solution of $px + qy = 3z$ is (1) $f\left(\frac{y}{x}, \frac{x^2}{z}\right) = 0$ (2) $f\left(\frac{y}{x}, \frac{x^3}{z}\right) = 0$ (3) $f\left(\frac{x}{y}, \frac{x^2}{z}\right) = 0$ (4) $f\left(\frac{x}{y}, \frac{x^3}{z}\right) = 0$
60.	P.I. of the partial differential equation $\left(D^2 - 2DD' + D'^2\right) z = 12xy$, is (1) $2x^3y + x^4$ (2) $2x^3y + y^3$ (3) $2x^3y + 3x^2$ (4) $2x^3y + 3x^4$
61.	The number of prime ideals of Z_{10} is (1) 2 (2) 4 (3) 5 (4) 10
62.	If $f : G \to G'$ is group homomorphism, then f is one-one if Kernel f is (1) Empty (2) Singleton set (3) Any set (4) Set of identity element
63.	An ideal S of a commutative ring R with unity is maximal iff R/S is (1) An ideal (2) A vector space (3) A ring (4) A field

Question No.	Questions
64.	Which of the following statements is false (1) Every field is a ring (2) Every finite integral domain is a field (3) Every field is an integral domain (4) Every integral domain is a field
65.	A person weighing 70 kg. is in a lift ascending with an acceleration of 1.4 m/sec^2. The thrust of his feet on the lift (in Newton) is (1) 784 N (2) 780 N (3) 692 N (4) 980 N
66.	The horizontal range of a projectile is three times the greatest height, the angle of projection is (1) $\tan^{-1}\frac{3}{2}$ (2) $\tan^{-1}\frac{2}{3}$ (3) $\tan^{-1}\frac{4}{3}$ (4) $\tan^{-1}\frac{3}{4}$
67.	The law of force towards the pole under the curve $r^2 = 2\,ap$ is (1) $F \alpha \frac{1}{r^2}$ (2) $F \alpha \frac{1}{r^3}$ (3) $F \alpha \frac{1}{r^4}$ (4) $F \alpha \frac{1}{r^5}$
68.	If θ be the angle which the tangent at a point makes with the radius vector, then the relation between angular velocity w and linear velocity v is (1) $w = vr$ (2) $w = \frac{v\cos\theta}{r}$ (3) $w = \frac{v\sin\theta}{r}$ (4) $w = vr\sin\theta$

Question No.	Questions
69.	Two particles of mass m and 4 m are moving with equal momentum. The ratio of their kinetic energies is (1) 1:2 (2) 2:1 (3) 1:4 (4) 4:1
70.	Kepler law of motion says that each planet describes an ellipse having the sum at its (1) Focus (2) Centre (3) Origin (4) Outer cover
71.	A particle describes the cycloid $s = 4a \sin\psi$ with uniform speed v. The acceleration at any point is (1) $\frac{v^2}{4a}$ (2) $\frac{v^2}{\sqrt{s^2 - 16a^2}}$ (3) $\frac{v^2}{\sqrt{16a^2 - s^2}}$ (4) $\frac{v^2}{\sqrt{a^2 - s^2}}$
72.	$\int_0^2 (8 - x^3)^{-\frac{1}{3}} dx =$ (1) $\frac{1}{3}\beta\left(\frac{1}{3}, \frac{3}{2}\right)$ (2) $\frac{1}{3}\beta\left(\frac{1}{3}, \frac{2}{3}\right)$ (3) $\frac{2}{3}\beta\left(\frac{1}{3}, \frac{2}{3}\right)$ (4) $\beta\left(\frac{1}{3}, \frac{2}{3}\right)$
73.	$\Gamma(n)\Gamma(1-n) =$ (1) $\frac{\pi}{\sin n\pi}$ (2) $\frac{\sin n\pi}{\pi}$ (3) $\frac{n\pi}{\sin n\pi}$ (4) $\frac{2\pi}{\sin n\pi}$

Question No.	Questions
74.	If Fourier co-efficient of f (t) are Cn, then Fourier co-efficients of $\overline{f(t)}$ are (1) $\overline{C_n}$ (2) $\overline{C}_{-n}$ (3) $-\overline{C}_n$ (4) $-\overline{C}_{-n}$
75.	By changing the order of integration, the value of $\int_0^a \int_y^a \frac{x\,dx\,dy}{x^2+y^2} =$ (1) $\frac{3a}{4}$ (2) $\frac{3\pi a}{4}$ (3) $\frac{4\pi a}{3}$ (4) $\frac{\pi a}{4}$
76.	Given that $f(z) = 2x^2 + y + i(y^2 - x)$. C – R equations for this function are satisfied at (1) the line $x = 2y$ (2) the line $y = 2x$ (3) every point of z-plane (4) no point of z-plane
77.	Image of $\lvert z - 2i \rvert = 2$ under the mapping $w = u + iv = \frac{1}{z}$ is (1) $4v + 1 = 0$ (2) $4u + 1 = 0$ (3) $4v - 1 = 0$ (4) $4u - 1 = 0$
78.	Fixed point of the transformation $w = \frac{3z-4}{z-1}$ is (1) $z = 4$ (2) $z = 3$ (3) $z = 2$ (4) $z = 1$

Question No.	Questions
79.	If V and W are vector spaces, then a linear transformation T from V to W is isomorphism if it is (1) into (2) one-one (3) onto (4) orthogonal
80.	If $W = \{ (a, b, c, d) : b + c + d = 0 \}$ is a subspace of R^4, then dim W is (1) 4 (2) 3 (3) 2 (4) 1
81.	Oblique asymptotes to the curve $y^2 (x-2a) = x^3 - a^3$ are (1) $y \pm x + 2a = 0$ (2) $x \pm y + 2a = 0$ (3) $x \pm y + a = 0$ (4) $y \pm x + a = 0$
82.	Area between the parabolas $x^2 = 4ay$ and $y^2 = 4ax$ is (1) $\frac{3}{8} a^2$ (2) $\frac{8}{3} a^2$ (3) $\frac{16}{3} a^2$ (4) $\frac{16}{5} a^2$
83.	$\int_0^1 x^6 \sqrt{1-x^2}\, dx =$ (1) $5\pi/32$ (2) $5\pi/16$ (3) $3\pi/128$ (4) $3\pi/32$
84.	Co-ordinates of the centre of the conic $8x^2 - 24xy + 15y^2 + 48x - 48y = 0$, are (1) (4, 3) (2) (3, 4) (3) (3, 2) (4) (2, 3)

Question No.	Questions
85.	Radius of the sphere $x^2 + y^2 + z^2 - 4x + 6y - 8z + 4 = 0$ is (1) 3 (2) 4 (3) $4/7$ (4) 5
86.	The condition that the plane $ax + by + cz = 0$ cuts the cone $xy + yz + zx = 0$ in perpendicular lines, is (1) $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=1$ (2) $\frac{1}{a}+\frac{2}{b}+\frac{3}{c}=0$ (3) $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=0$ (4) $a+b+c=0$
87.	Value of $\tan\left(i \log \frac{a-ib}{a+ib}\right)$ is (1) $\frac{ab}{a^2-b^2}$ (2) $\frac{2ab}{a^2-b^2}$ (3) $\frac{2ab}{(a^2-b^2)^2}$ (4) $\frac{4ab}{a^2-b^2}$
88.	Which of the following congruences have solution (1) $x^2 \equiv 2 \pmod{59}$ (2) $x^2 \equiv -2 \pmod{59}$ (3) $x^2 \equiv 2 \pmod{61}$ (4) $x^2 \equiv -2 \pmod{61}$
89.	If $\tan^{-1} 2x + \tan^{-1} 3x = \frac{\pi}{4}$, then $x =$ (1) $\frac{1}{2}$ (2) $\frac{1}{3}$ (3) $\frac{4}{7}$ (4) $\frac{1}{6}$

Question No.	Questions
90.	If cosh x = 2, then x = (1) $\log\left(2-\sqrt{5}\right)$ (2) $\log\left(2-\sqrt{3}\right)$ (3) $\log\left(2+\sqrt{5}\right)$ (4) $\log\left(2+\sqrt{3}\right)$
91.	$\left\{J_{\frac{1}{2}}(x)\right\}^2 + \left\{J_{-\frac{1}{2}}(x)\right\}^2 =$ (1) $\frac{\pi x}{2}$ (2) $\frac{x}{2\pi}$ (3) $\frac{2}{\pi x}$ (4) $\frac{\pi}{2x}$
92.	If the Hermite polynomial of degree n is denoted by $H_n(x)$, then $H_1(x) =$ (1) x (2) 2 x (3) − 2 x (4) $\frac{x}{2}$
93.	$\int_0^\infty t\, e^{-2t} \cos t\, dt =$ (1) $\frac{3}{16}$ (2) $\frac{9}{16}$ (3) $\frac{3}{25}$ (4) $\frac{9}{25}$
94.	$L^{-1}\left\{\frac{1}{(s-4)^3}\right\} =$ (1) $\frac{1}{4} t e^{3t}$ (2) $\frac{1}{4} t^2 e^{4t}$ (3) $\frac{1}{2} t e^{4t}$ (4) $\frac{1}{2} t^2 e^{4t}$

Question No.	Questions
95.	Fourier transform of the function $f(t)=\begin{cases} e^{-at}, & t>0,\ a>0 \\ 0, & t<0 \end{cases}$ is (1) $\frac{1}{a+is}$ (2) $\frac{\pi}{a+is}$ (3) $\frac{a}{\pi+is}$ (4) $\frac{\pi a}{1+is}$
96.	Given that int x = 1, y = 4 ; x = + + x + − − y ; Then the value of x is (1) 4 (2) 5 (3) 6 (4) 7
97.	The continue statement cannot be used with (1) do (2) while (3) for (4) switch
98.	The expression $(*p)\cdot x$ is equivalent to (1) $*p \rightarrow x$ (2) $p \rightarrow x$ (3) $p \rightarrow \cdot x$ (4) $p = x$
99.	The result of the expression (17 * 4) % (int) 9-3 is (1) 5 (2) 4 (3) 3.7 (4) 7.3
100.	The condition for covergence of the Newton - Raphson method to a root α is (1) $\frac{f'(\alpha)}{f''(\alpha)}<0$ (2) $\frac{f'(\alpha)}{f''(\alpha)}<1$ (3) $\frac{f'(\alpha)}{f''(\alpha)}>1$ (4) $\frac{f'(\alpha)}{f''(\alpha)}<2$

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(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

(PG–EE–2016)

Maths, Math with Computer Science

Code **D**

Sr. No. 11828

Time : 1¼ Hours **Max. Marks : 100** **Total Questions : 100**

Roll No. ____________ (in figure) ____________ (in words)

Name : ____________ Father's Name : ____________

Mother's Name : ____________ Date of Examination : ____________

(Signature of the candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/ INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. **All questions are compulsory.**
2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / misbehaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing within two hours after the test is over. No such complaint(s) will be entertained thereafter.
4. The candidate MUST NOT do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself. Answers MUST NOT be ticked in the Question book-let.
5. **There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
6. Use only Black or Blue **BALL POINT PEN** of good quality in the OMR Answer-Sheet.
7. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LETS. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

Question No.	Questions
1.	Oblique asymptotes to the curve $y^2(x-2a) = x^3 - a^3$ are (1) $y \pm x + 2a = 0$ (2) $x \pm y + 2a = 0$ (3) $x \pm y + a = 0$ (4) $y \pm x + a = 0$
2.	Area between the parabolas $x^2 = 4ay$ and $y^2 = 4ax$ is (1) $\frac{3}{8}a^2$ (2) $\frac{8}{3}a^2$ (3) $\frac{16}{3}a^2$ (4) $\frac{16}{5}a^2$
3.	$\int_0^1 x^6 \sqrt{1-x^2}\, dx =$ (1) $5\pi/32$ (2) $5\pi/16$ (3) $3\pi/128$ (4) $3\pi/32$
4.	Co-ordinates of the centre of the conic $8x^2 - 24xy + 15y^2 + 48x - 48y = 0$, are (1) (4, 3) (2) (3, 4) (3) (3, 2) (4) (2, 3)
5.	Radius of the sphere $x^2 + y^2 + z^2 - 4x + 6y - 8z + 4 = 0$ is (1) 3 (2) 4 (3) $4/7$ (4) 5

Question No.	Questions
6.	The condition that the plane $ax + by + cz = 0$ cuts the cone $xy + yz + zx = 0$ in perpendicular lines, is
	(1) $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=1$ (2) $\frac{1}{a}+\frac{2}{b}+\frac{3}{c}=0$
	(3) $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=0$ (4) $a+b+c=0$
7.	Value of $\tan\left(i \log \frac{a-ib}{a+ib}\right)$ is
	(1) $\frac{ab}{a^2-b^2}$ (2) $\frac{2ab}{a^2-b^2}$
	(3) $\frac{2ab}{(a^2-b^2)^2}$ (4) $\frac{4ab}{a^2-b^2}$
8.	Which of the following congruences have solution
	(1) $x^2 \equiv 2 \pmod{59}$ (2) $x^2 \equiv -2 \pmod{59}$
	(3) $x^2 \equiv 2 \pmod{61}$ (4) $x^2 \equiv -2 \pmod{61}$
9.	If $\tan^{-1} 2x + \tan^{-1} 3x = \frac{\pi}{4}$, then $x =$
	(1) $\frac{1}{2}$ (2) $\frac{1}{3}$
	(3) $\frac{4}{7}$ (4) $\frac{1}{6}$
10.	If $\cosh x = 2$, then $x =$
	(1) $\log(2-\sqrt{5})$ (2) $\log(2-\sqrt{3})$
	(3) $\log(2+\sqrt{5})$ (4) $\log(2+\sqrt{3})$

Question No.	Questions
11.	In an inner product space V (F), the inequality $\lvert(\alpha, \beta)\rvert \le \lVert\alpha\rVert \cdot \lVert\beta\rVert \;\forall \alpha, \beta \in V$, is called (1) Schwarz inequality (2) Triangle inequality (3) Bessel's inequality (4) Normal inequality
12.	If u and v are normal vectors in an inner product space V, then $\lVert u - v\rVert =$ (1) 0 (2) 1 (3) 2 (4) $\sqrt{2}$
13.	Which of the following is a orthogonal set (1) $\{(1, 0, 1), (1, 0, -1), (0, 1, 0)\}$ (2) $\{(1, 0, 1), (1, 0, -1), (-1, 0, 1)\}$ (3) $\{(1, 0, 1), (1, 0, -1), (0, 2, 3)\}$ (4) None of these
14.	The missing term in the table x: 0, 1, 2, 3, 4 y: 1, 3, 9, , 81 is (1) 27 (2) 31 (3) 32 (4) 34
15.	The sum of eigen values of a square matrix A of order n is equal to (1) $\frac{n}{2}$ (2) $\frac{n-1}{2}$ (3) trace (A) (4) $\lvert A\rvert$

Question No.	Questions
16.	In Simpson's $\frac{3}{8}$ th rule, the interpolating polynomial is of degree (1) 2 (2) 1 (3) 4 (4) 3
17.	Root of the equation $x^4 - 12x + 7 = 0$ which is approximately equal to 2, is (1) 1.92 (2) 1.95 (3) 2.05 (4) 2.15
18.	Which of the following is not correct (1) $\Delta = (1-\nabla)^{-1}$ (2) $1 - E^{-1} = \nabla$ (3) $E = 1 + \Delta$ (4) $\delta = E^{1/2} - E^{-1/2}$
19.	For a normal distribution having mean μ and standard deviation σ, the most probable limits are (1) $\mu \pm \sigma$ (2) $\mu \pm 2\sigma$ (3) $\mu \pm \frac{3}{2}\sigma$ (4) $\mu \pm 3\sigma$
20.	In Gauss quadrature formula, the range of integration is (1) [0, 1] (2) [–1, 1] (3) [0, n] (4) [–1, 0]
21.	The number of prime ideals of Z_{10} is (1) 2 (2) 4 (3) 5 (4) 10
22.	If $f: G \to G'$ is group homomorphism, then f is one-one if Kernel f is (1) Empty (2) Singleton set (3) Any set (4) Set of identity element

Question No.	Questions
23.	An ideal S of a commutative ring R with unity is maximal iff R/S is (1) An ideal (2) A vector space (3) A ring (4) A field
24.	Which of the following statements is false (1) Every field is a ring (2) Every finite integral domain is a field (3) Every field is an integral domain (4) Every integral domain is a field
25.	A person weighing 70 kg. is in a lift ascending with an acceleration of 1.4 m/sec^2. The thrust of his feet on the lift (in Newton) is (1) 784 N (2) 780 N (3) 692 N (4) 980 N
26.	The horizontal range of a projectile is three times the greatest height, the angle of projection is (1) $\tan^{-1}\frac{3}{2}$ (2) $\tan^{-1}\frac{2}{3}$ (3) $\tan^{-1}\frac{4}{3}$ (4) $\tan^{-1}\frac{3}{4}$
27.	The law of force towards the pole under the curve $r^2 = 2\,ap$ is (1) $F \alpha \frac{1}{r^2}$ (2) $F \alpha \frac{1}{r^3}$ (3) $F \alpha \frac{1}{r^4}$ (4) $F \alpha \frac{1}{r^5}$

Question No.	Questions
28.	If θ be the angle which the tangent at a point makes with the radius vector, then the relation between angular velocity w and linear velocity v is (1) $w = vr$ (2) $w = \frac{v\cos\theta}{r}$ (3) $w = \frac{v\sin\theta}{r}$ (4) $w = vr\sin\theta$
29.	Two particles of mass m and 4 m are moving with equal momentum. The ratio of their kinetic energies is (1) 1:2 (2) 2:1 (3) 1:4 (4) 4:1
30.	Kepler law of motion says that each planet describes an ellipse having the sum at its (1) Focus (2) Centre (3) Origin (4) Outer cover
31.	$\left\{J_{\frac{1}{2}}(x)\right\}^2 + \left\{J_{-\frac{1}{2}}(x)\right\}^2 =$ (1) $\frac{\pi x}{2}$ (2) $\frac{x}{2\pi}$ (3) $\frac{2}{\pi x}$ (4) $\frac{\pi}{2x}$
32.	If the Hermite polynomial of degree n is denoted by $H_n(x)$, then $H_1(x) =$ (1) x (2) 2 x (3) − 2 x (4) $\frac{x}{2}$
33.	$\int_0^\infty t\, e^{-2t} \cos t\, dt =$ (1) $\frac{3}{16}$ (2) $\frac{9}{16}$ (3) $\frac{3}{25}$ (4) $\frac{9}{25}$

Question No.	Questions
34.	$L^{-1}\left\{\frac{1}{(s-4)^3}\right\}=$ (1) $\frac{1}{4}te^{3t}$ (2) $\frac{1}{4}t^2e^{4t}$ (3) $\frac{1}{2}te^{4t}$ (4) $\frac{1}{2}t^2e^{4t}$
35.	Fourier transform of the function $f(t)=\begin{cases} e^{-at}, & t>0,\ a>0 \\ 0, & t<0 \end{cases}$ is (1) $\frac{1}{a+is}$ (2) $\frac{\pi}{a+is}$ (3) $\frac{a}{\pi+is}$ (4) $\frac{\pi a}{1+is}$
36.	Given that int x = 1, y = 4 ; x = + + x + − − y ; Then the value of x is (1) 4 (2) 5 (3) 6 (4) 7
37.	The continue statement cannot be used with (1) do (2) while (3) for (4) switch
38.	The expression $(*p)\cdot x$ is equivalent to (1) $*p \rightarrow x$ (2) $p \rightarrow x$ (3) $p \rightarrow \cdot x$ (4) $p = x$
39.	The result of the expression $(17 * 4)$ % (int) 9-3 is (1) 5 (2) 4 (3) 3.7 (4) 7.3

Question No.	Questions
40.	The condition for covergence of the Newton - Raphson method to a root α is (1) $\frac{f'(\alpha)}{f''(\alpha)} < 0$ (2) $\frac{f'(\alpha)}{f''(\alpha)} < 1$ (3) $\frac{f'(\alpha)}{f''(\alpha)} > 1$ (4) $\frac{f'(\alpha)}{f''(\alpha)} < 2$
41.	If Lagrange's mean value theorem is used on the function $f(x) = x(x-1)$ in [1, 2], then the value of 'c' is (1) $1/2$ (2) $3/2$ (3) $2/3$ (4) $3/4$
42.	If $u = 2xy$, $v = x^2 - y^2$, $x = r\cos\theta$, $y = r\sin\theta$, then $\frac{\partial(u, v)}{\partial(r, \theta)} =$ (1) $-4r^3$ (2) $-4r^2$ (3) $-2r^3$ (4) $-3r^2$
43.	If $u = f(x + 2y) + g(x - 2y)$, then $4\frac{\partial^2 u}{\partial x^2} =$ (1) $-\frac{\partial^2 u}{\partial y^2}$ (2) $\frac{\partial^2 u}{\partial y^2}$ (3) $2\frac{\partial^2 u}{\partial y^2}$ (4) $-2\frac{\partial^2 u}{\partial y^2}$
44.	If $u = \log(x^2 + xy + y^2)$ then $u\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} =$ (1) 0 (2) −1 (3) 1 (4) 2

Question No.	Questions
45.	The envelope of the family of curves $(x-a)^2 + y^2 = 4a$, a being the parameter ; is (1) $x^2 = 4(y+1)$ (2) $x^2 = 2(x+1)$ (3) $y^2 = 4(x+1)$ (4) $y^2 = -4(x+1)$
46.	The locus of centre of curvature for a curve is called its (1) envelope (2) evolute (3) torsion (4) characteristic
47.	$\lim\limits_{x \to 0} \dfrac{(\tan^{-1} x)^2}{\log(1+x^2)} =$ (1) 0 (2) $\frac{1}{2}$ (3) 1 (4) $\frac{3}{2}$
48.	Partial differential equation obtained by eliminating the arbitrary constants a and b from the relation $2z = (ax+y)^2 + b$, is (1) $px + qy = q^2$ (2) $py + qx = q^2$ (3) $px + qy = p^2$ (4) $py + qx = p^2$
49.	Solution of $px + qy = 3z$ is (1) $f\left(\frac{y}{x}, \frac{x^2}{z}\right) = 0$ (2) $f\left(\frac{y}{x}, \frac{x^3}{z}\right) = 0$ (3) $f\left(\frac{x}{y}, \frac{x^2}{z}\right) = 0$ (4) $f\left(\frac{x}{y}, \frac{x^3}{z}\right) = 0$
50.	P.I. of the partial differential equation $(D^2 - 2DD' + D'^2)z = 12xy$, is (1) $2x^3y + x^4$ (2) $2x^3y + y^3$ (3) $2x^3y + 3x^2$ (4) $2x^3y + 3x^4$

Question No.	Questions
51.	Sum of the series $\sinh x + \frac{\sinh 2x}{2} + \frac{\sinh 3x}{3} + \cdots\cdots \infty$, is (1) $\frac{1}{2}(i\pi - x)$ (2) $\frac{1}{2}(i\pi + x)$ (3) $i\pi - x$ (4) $i\pi + x$
52.	An integrating factor of $x\frac{dy}{dx} + (3x+1)y = xe^{-2x}$, is (1) xe^{x} (2) xe^{2x} (3) xe^{3x} (4) $\frac{1}{2}xe^{-3x}$
53.	For the differential equation $\frac{d^2y}{dx^2} + ay = -4\sin 2x$, if $y = x\cos 2x$ is a particular solution, then the value of a is (1) 4 (2) -4 (3) $\frac{1}{4}$ (4) $-\frac{1}{4}$
54.	Orthogonal trajectories of the family of parabolas $y^2 = 4ax$ are (1) $2x^2 + y^2 = c$ (2) $x^2 + 2y^2 = c$ (3) $x^2 = 4ay + c$ (4) $y^2 = 4x + \frac{c}{a}$
55.	The differential equation of the type $y = px + f(p)$ is known with the name (1) Euler (2) Lagrange (3) Clairaut (4) Cauchy

Question No.	Questions
56.	The vector $(x+3y)\hat{i}+(y-2z)\hat{j}+(x+\lambda z)\hat{k}$ is solenoidal, then the value of λ is (1) 0 (2) -1 (3) 2 (4) -2
57.	Magnitude of maximum directional derivative of $\phi(x, y, z)=x^2-2y^2+4z^2$ at the point $(1, 1, -1)$ is (1) $\sqrt{21}$ (2) $2\sqrt{21}$ (3) $3\sqrt{21}$ (4) $27/4$
58.	A particle moves along the curve $x=4\cos t, y=4\sin t, z=6t$, where t is time. Magnitude of acceleration at time t is (1) 3 (2) $7/2$ (3) $\sqrt{5}$ (4) 4
59.	Using Stoke's theorem, value of the integral $\oint_c (yz\,dx+xz\,dy+xy\,dz)$, where c is the curve $x^2+y^2=1, z=y^2$; is (1) 0 (2) 1 (3) 2 (4) $7/2$
60.	If $\vec{f}=3xy\hat{i}-y^2\hat{j}$, then $\int_c \vec{f}\cdot dr$, where c is the curve $y=2x^2$, from $(0, 0)$ to $(1, 2)$; is (1) $5/7$ (2) $7/5$ (3) $-7/6$ (4) $-8/3$

Question No.	Questions
61.	The equation $\frac{\partial^2 u}{\partial x^2}+2\frac{\partial^2 u}{\partial y^2}+\frac{\partial^2 u}{\partial z^2}=2\frac{\partial^2 u}{\partial x\partial y+}+2\frac{\partial^2 u}{\partial y\partial z}$ is (1) Linear (2) Elliptic (3) Hyperbolic (4) Parabolic
62.	Every given system of forces acting on a rigid body can be reduced to a (1) Couple (2) Screw (3) Wrench (4) Null force
63.	Absolute units of moment in S.I. system is (1) Dyne centimeter (2) Gram centimeter (3) Kg. meter (4) Newton meter
64.	For two equal forces acting on a particle, if square of their resultant is three times their product, then the angle between these forces is (1) $\pi/2$ (2) $\pi/3$ (3) $\pi/4$ (4) $\pi/6$
65.	A body is slightly displaced and still remains in equilibrium in any position, then such equilibrium is known as (1) Perfect equilibrium (2) Stable equilibrium (3) Neutral equilibrium (4) Natural equilibrium
66.	A body of weight 4 kg. rests in equilibrium on an inclined plane whose slope is 30°. The co-efficient of friction is (1) $\sqrt{3}$ (2) $\frac{1}{\sqrt{2}}$ (3) $\frac{1}{\sqrt{3}}$ (4) $\frac{2}{\sqrt{3}}$

Question No.	Questions
67.	The series $\frac{2p}{1^q}+\frac{3p}{2^q}+\frac{4p}{3^q}+\text{-------}$, where p and q are positive real numbers, is convergent if (1) $p<q-2$ (2) $p<q-1$ (3) $p>q$ (4) $p=q$
68.	The series $\sum_{n=1}^{\infty}\frac{(-1)^{n-1}}{n^5}$ is (1) Absolutely convergent (2) Divergent (3) Conditionally convergent (4) Oscillatory
69.	The limit superior and limit inferior of $\left\{\frac{(-1)^n}{n^2}\right\}$ are respectively equal to (1) 0, 0 (2) 1, 0 (3) 1, –1 (4) –1, 0
70.	If the series $\sum_{n=1}^{\infty}a_n$ is convergent and the series $<b_n>$ is monotonic and bounded, then the series $\sum_{n=1}^{\infty}a_n b_n$ is convergent. This result is due to (1) Cauchy (2) Leibnitz (3) Dirichlet (4) Abel
71.	The improper integral $\int_1^2 \frac{x}{\sqrt{x-1}}\,dx$ converges to (1) $5/3$ (2) $8/3$ (3) $3/8$ (4) $3/5$

Question No.	Questions
72.	Which of the following statements is not true (1) Every singleton set is connected in any metric space (2) Empty set is connected in every metric space (3) Every subset having at least two points of a metric space is not connected (4) None of these
73.	$\int_1^\infty \frac{\sin x}{x^m} dx$ converges absolutely if (1) $m < 1$ (2) $m > 1$ (3) $m = 0$ (4) $m \leq 1$
74.	A totally bounded metric space is (1) Compact (2) Complete (3) Separable (4) Everywhere dense
75.	If the set A is open and the set B is closed in R^n, then (1) B – A is closed (2) B – A is open (3) B – A is semi-open (4) B – A is null set
76.	For a Cantor's ternary set, which of the following is not correct (1) It is closed (2) It is uncountable (3) It is dense (4) It is perfect set
77.	Let f be a bounded function defined on the bounded interval [a, b]. Then f is Riemann integrable on [a, b] iff (1) $\int_a^b f \geq f_a^{\bar{b}} f$ (2) $\int_a^b f \leq f_a^{\bar{b}} f$ (3) $\int_a^b f < f_a^{\bar{b}} f$ (4) $\int_a^b f = f_a^{\bar{b}} f$
78.	If G is a non-abelian group of order 125, then $O(Z(G))$ is (1) 25 (2) 125 (3) 5 (4) 10

Question No.	Questions
79.	The number of abelian groups upto isomorphism of order 10^5 is (1) 50 (2) 49 (3) 45 (4) 39
80.	The number of generators of a finite group of order 53 are (1) 53 (2) 52 (3) 54 (4) $\underline{|52}$
81.	Every skew-symmetric matrix of odd order is (1) Symmetric (2) Singular (3) Non-singular (4) Hermitian
82.	If r is the rank of the matrix A, then the number of linearly independent solutions of the equation $AX = 0$ in n variables, is (1) $n - r$ (2) $n - r - 1$ (3) $r - 1$ (4) n / r
83.	For the equation $x^8 + 5x^3 + 2x - 3 = 0$, least number of imaginary roots is (1) 4 (2) 5 (3) 6 (4) 2
84.	Characteristic roots of a Hermitian matrix are all (1) zero (2) imaginary (3) complex (4) real
85.	One root of the equation $ax^3 + bx^2 + cx + d = 0$ is equal to the sum of the other two if (1) $b^3 + 4abc + 8a^2d = 0$ (2) $b^2 + 4abc - 8a^2d = 0$ (3) $b^3 - 4abc + 8a^2d = 0$ (4) $b^3 - 4abc - 8a^2d = 0$

Question No.	Questions
86.	The roots of the equation $2x^3 + 6x^2 + 5x + k = 0$ are in A. P. Then the value of K is (1) -1 (2) 1 (3) -2 (4) 2
87.	If $\frac{x^n - 2^n}{x-2} = 80$ and n is a positive integer, then the value of n is (1) 2 (2) 3 (3) 4 (4) 5
88.	Let $f(x) = \begin{cases} ax+1 & , x \le 2 \\ 3ax+b & , 2 < x < 4 \\ 6 & , x \ge 4 \end{cases}$ Values of a and b such that f (x) is continuous everywhere, are (1) $\frac{-5}{8}, \frac{3}{2}$ (2) $\frac{5}{8}, \frac{-3}{2}$ (3) $\frac{5}{8}, \frac{3}{2}$ (4) $\frac{5}{3}, \frac{2}{3}$
89.	Derivative of $\cos^{-1}\sqrt{\frac{1+x}{2}}$, $0 \le x < 1$ is (1) $\frac{-2}{\sqrt{1-x^2}}$ (2) $\frac{-1}{2\sqrt{1-x^2}}$ (3) $-\frac{1}{\sqrt{1-x^2}}$ (4) $\frac{1}{2\sqrt{1-x^2}}$
90.	The radius of curvature P for the curve xy = c, c being constant, is (1) $(x^2+y^2)^{-3/2}$ (2) $\frac{(x^2+y^2)^{3/2}}{c}$ (3) $\frac{(x^2+y^2)^{2/3}}{2c}$ (4) $\frac{(x^2+y^2)^{3/2}}{2c}$

Question No.	Questions
91.	A particle describes the cycloid $s = 4\,a\sin\psi$ with uniform speed v. The acceleration at any point is (1) $\frac{v^2}{4a}$ (2) $\frac{v^2}{\sqrt{s^2-16\,a^2}}$ (3) $\frac{v^2}{\sqrt{16\,a^2-s^2}}$ (4) $\frac{v^2}{\sqrt{a^2-s^2}}$
92.	$\int_0^2 (8-x^3)^{-\frac{1}{3}}\,dx =$ (1) $\frac{1}{3}\beta\left(\frac{1}{3},\frac{3}{2}\right)$ (2) $\frac{1}{3}\beta\left(\frac{1}{3},\frac{2}{3}\right)$ (3) $\frac{2}{3}\beta\left(\frac{1}{3},\frac{2}{3}\right)$ (4) $\beta\left(\frac{1}{3},\frac{2}{3}\right)$
93.	$\Gamma(n)\Gamma(1-n) =$ (1) $\frac{\pi}{\sin n\pi}$ (2) $\frac{\sin n\pi}{\pi}$ (3) $\frac{n\pi}{\sin n\pi}$ (4) $\frac{2\pi}{\sin n\pi}$
94.	If Fourier co-efficient of f (t) are Cn, then Fourier co-efficients of $\overline{f(t)}$ are (1) $\overline{C_n}$ (2) $\overline{C}_{-n}$ (3) $-\overline{C}_n$ (4) $-\overline{C}_{-n}$

Question No.	Questions
95.	By changing the order of integration, the value of $\int_0^a \int_y^a \frac{x\,dx\,dy}{x^2+y^2} =$ (1) $\frac{3a}{4}$ (2) $\frac{3\pi a}{4}$ (3) $\frac{4\pi a}{3}$ (4) $\frac{\pi a}{4}$
96.	Given that $f(z) = 2x^2 + y + i(y^2 - x)$. C – R equations for this function are satisfied at (1) the line $x = 2y$ (2) the line $y = 2x$ (3) every point of z-plane (4) no point of z-plane
97.	Image of $\lvert z - 2i \rvert = 2$ under the mapping $w = u + iv = \frac{1}{z}$ is (1) $4v + 1 = 0$ (2) $4u + 1 = 0$ (3) $4v - 1 = 0$ (4) $4u - 1 = 0$
98.	Fixed point of the transformation $w = \frac{3z-4}{z-1}$ is (1) $z = 4$ (2) $z = 3$ (3) $z = 2$ (4) $z = 1$
99.	If V and W are vector spaces, then a linear transformation T from V to W is isomorphism if it is (1) into (2) one-one (3) onto (4) orthogonal
100.	If $W = \{(a, b, c, d) : b + c + d = 0\}$ is a subspace of R^4, then dim W is (1) 4 (2) 3 (3) 2 (4) 1

M.Sc. MATH GROUP PAGE: 1

SET : A

1. 2	16. 3	31. 2	46. 3	61. 2	76. 3	91. 1
2. 1	17. 2	32. 1	47. 2	62. 4	77. 4	92. 4
3. 3	18. 2	33. 2	48. 1	63. 2	78. 3	93. 1
4. 4	19. 4	34. 4	49. 1	64. 3	79. 4	94. 2
5. 3	20. 4	35. 3	50. 4	65. 1	80. 1	95. 3
6. 1	21. 1	36. 2	51. 3	66. 3	81. 3	96. 4
7. 4	22. 3	37. 3	52. 2	67. 4	82. 2	97. 3
8. 2	23. 1	38. 1	53. 3	68. 3	83. 1	98. 1
9. 2	24. 1	39. 4	54. 4	69. 2	84. 2	99. 4
10. 4	25. 3	40. 1	55. 1	70. 2	85. 4	100. 2
11. 3	26. 4	41. 4	56. 2	71. 1	86. 2	
12. 3	27. 2	42. 3	57. 4	72. 1	87. 1	
13. 1	28. 4	43. 4	58. 2	73. 4	88. 3	
14. 2	29. 1	44. 2	59. 1	74. 4	89. 3	
15. 4	30. 3	45. 3	60. 3	75. 1	90. 2	

05/7/16

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SET : B

1. 1	16. 2	31. 3	46. 4	61. 3	76. 3	91. 2
2. 1	17. 4	32. 3	47. 3	62. 2	77. 2	92. 1
3. 4	18. 2	33. 1	48. 1	63. 1	78. 1	93. 3
4. 4	19. 1	34. 2	49. 4	64. 2	79. 1	94. 4
5. 1	20. 3	35. 4	50. 2	65. 4	80. 4	95. 3
6. 3	21. 2	36. 3	51. 2	66. 2	81. 1	96. 1
7. 4	22. 1	37. 2	52. 4	67. 1	82. 3	97. 4
8. 3	23. 2	38. 2	53. 2	68. 3	83. 1	98. 2
9. 4	24. 4	39. 4	54. 3	69. 3	84. 1	99. 2
10. 1	25. 3	40. 4	55. 1	70. 2	85. 3	100. 4
11. 3	26. 2	41. 1	56. 3	71. 4	86. 4	
12. 2	27. 3	42. 4	57. 4	72. 3	87. 2	
13. 3	28. 1	43. 1	58. 3	73. 4	88. 4	
14. 4	29. 4	44. 2	59. 2	74. 2	89. 1	
15. 1	30. 1	45. 3	60. 2	75. 3	90. 3	

05/7/16

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1. 4	16. 4	31. 1	46. 3	61. 1	76. 2	91. 3
2. 3	17. 2	32. 4	47. 4	62. 1	77. 1	92. 2
3. 4	18. 4	33. 1	48. 3	63. 4	78. 3	93. 3
4. 2	19. 1	34. 2	49. 2	64. 4	79. 3	94. 4
5. 3	20. 3	35. 3	50. 2	65. 1	80. 2	95. 1
6. 3	21. 2	36. 4	51. 2	66. 3	81. 3	96. 2
7. 2	22. 1	37. 3	52. 1	67. 4	82. 3	97. 4
8. 1	23. 3	38. 1	53. 2	68. 3	83. 1	98. 2
9. 1	24. 4	39. 4	54. 4	69. 4	84. 2	99. 1
10. 4	25. 3	40. 2	55. 3	70. 1	85. 4	100. 3
11. 1	26. 1	41. 2	56. 2	71. 3	86. 3	
12. 3	27. 4	42. 4	57. 3	72. 2	87. 2	
13. 1	28. 2	43. 2	58. 1	73. 1	88. 2	
14. 1	29. 2	44. 3	59. 4	74. 2	89. 4	
15. 3	30. 4	45. 1	60. 1	75. 4	90. 4	

05/7/16

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SET : D

1. 3	16. 4	31. 3	46. 2	61. 4	76. 3	91. 3
2. 3	17. 3	32. 2	47. 3	62. 3	77. 4	92. 2
3. 1	18. 1	33. 3	48. 1	63. 4	78. 3	93. 1
4. 2	19. 4	34. 4	49. 4	64. 2	79. 2	94. 2
5. 4	20. 2	35. 1	50. 1	65. 3	80. 2	95. 4
6. 3	21. 1	36. 2	51. 1	66. 3	81. 2	96. 2
7. 2	22. 1	37. 4	52. 3	67. 2	82. 1	97. 1
8. 2	23. 4	38. 2	53. 1	68. 1	83. 3	98. 3
9. 4	24. 4	39. 1	54. 1	69. 1	84. 4	99. 3
10. 4	25. 1	40. 3	55. 3	70. 4	85. 3	100. 2
11. 1	26. 3	41. 2	56. 4	71. 2	86. 1	
12. 4	27. 4	42. 1	57. 2	72. 4	87. 4	
13. 1	28. 3	43. 2	58. 4	73. 2	88. 2	
14. 2	29. 4	44. 4	59. 1	74. 3	89. 2	
15. 3	30. 1	45. 3	60. 3	75. 1	90. 4	

05/7/16

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